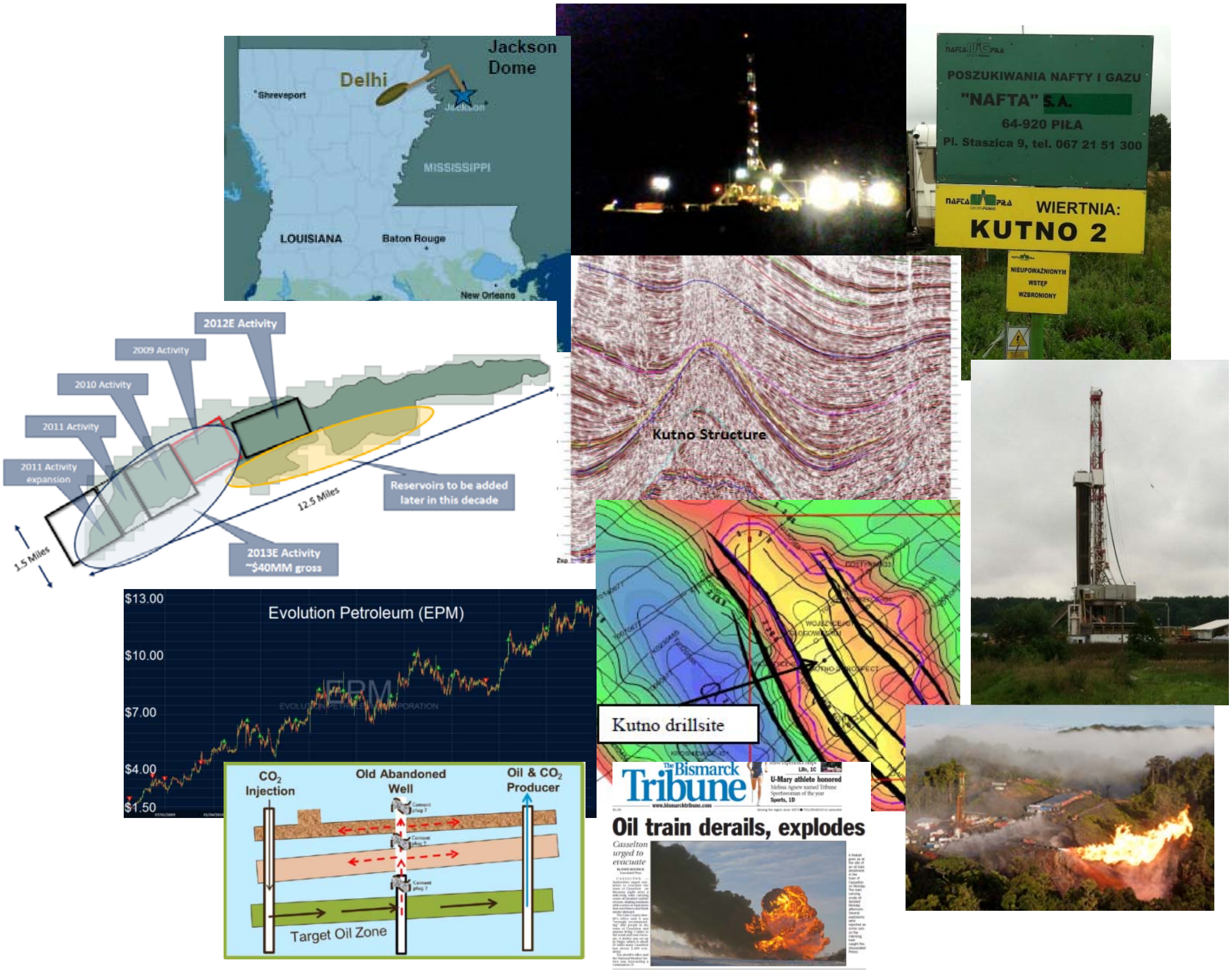
Energy & Environmental Law – Spring 2014

Regulation, Economics, and Investment of the Energy Sector



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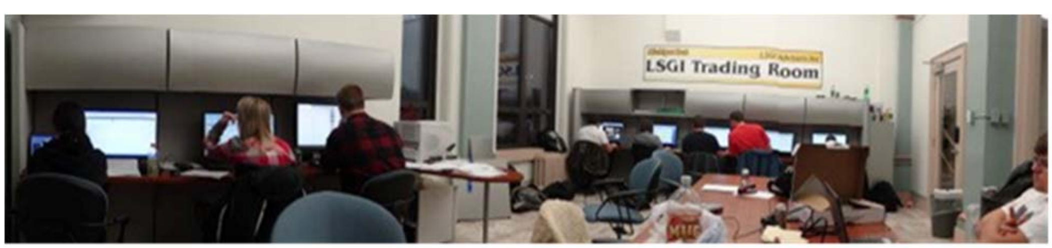

Adjunct Professor Joseph Dancy
LSGI Technology Venture Fund L.P.
Email: JDancy@smu.edu

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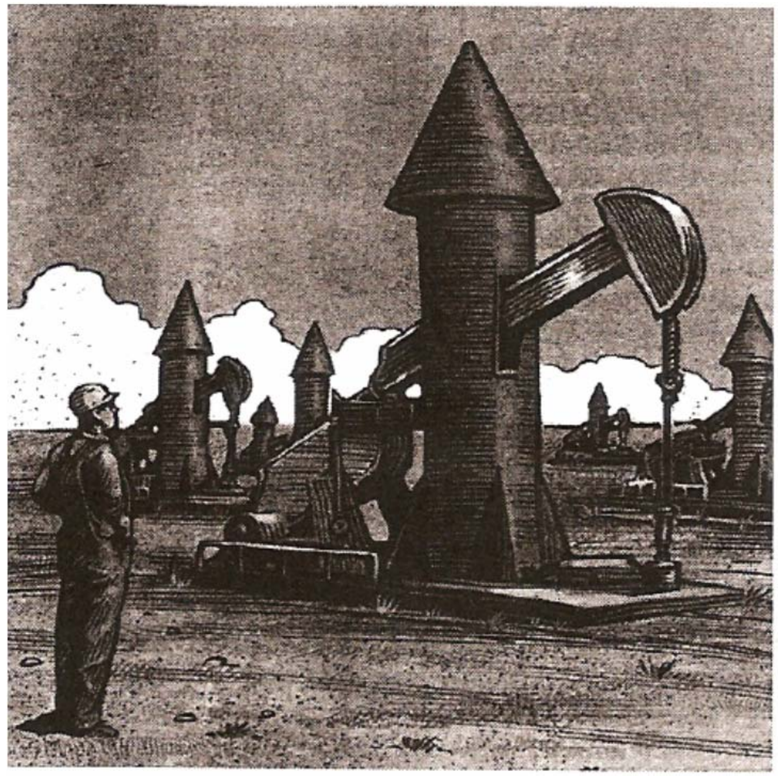
The Energy Boom Is Just Starting

"No less an expert than Charlie Munger, the vice chairman of Berkshire Hathaway who is Warren Buffett's investment partner, advises that good investments are difficult to find. An investor must be patient. But when a situation finally arise where the probabilities are heavily weighted in favor of an investment, he adds, the patient investor should act decisively. . .

Global energy trends are creating opportunities where, to paraphrase Munger, probabilities strongly tilt in favor of the investor. And the patient investors should act decisively."

Joseph Dancy, June 4, 2007 Barron's Financial

JOSEPH DANCY, an adjunct professor of energy law at Southern Methodist University, runs the LSGI Venture Fund (LsgiFund.com). He placed second in the professors' section of the past two *Barron's* Challenge stock-picking contests. His fund owns all the stocks mentioned.



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P.O. Box 750116
Dallas, Texas 75275-0116

Introductory Comments & Statement of Purpose

The energy business is one where success turns on making good decisions. It is a business that has generated tremendous wealth for landowners, employees, and company shareholders, especially here in Texas - but it is also one that has driven many to bankruptcy.

The key to the energy business, and ultimately your career and success in life, will turn on how well you make decisions and weigh the risks and rewards and consequences therein.

This class will focus on energy and environmental law and regulations, the framework which is needed to evaluate investment and career opportunities in the sector. But we will also examine how these laws and regulations impact operations, decision-making, financial analysis, and potential liabilities.

You are incredibly lucky to be examining the industry while it is on the cusp of implementing new technology, mainly utilizing directional drilling and hydraulic fracturing to develop reserves that a decade ago would be considered uneconomic. But, as we will see, technology is almost always a major driver of exploration and development in the sector. The long-term trends in the energy sector are very positive, and are driven by global developments.

The ability to analyze and assess risk is a critical component for the energy lawyer and manager, and while we focus on the legal and regulatory framework we will also have supplemental material and appendices which will include materials dealing with decision-making, risk, financial modeling, management, and investing.

In a slow growth global environment, and a lukewarm US economy, the energy sector is one of the few areas providing robust growth in revenues, profits, and employment.

The goal of this course is to provide you with tools to analyze risk and reward in making decisions in the energy sector, and how to make decisions based on that analysis, all done under the appropriate legal and regulatory framework.

I personally cannot think of a more dynamic, interesting, and lucrative sector of the economy that I would rather be involved with. Best of luck in this course, in your studies at SMU, and ultimately with your career decisions.

Joseph R. Dancy
Jdancy@smu.edu
Spring 2014

Legal, Regulatory & Career Implications of Long Term Global Trends in the Energy Sector

Bloomberg Radio's Charlie Rose recently interviewed Bill Gates about opportunities in the U.S. and global economy. Discussing what fields Gates would enter if he could re-start his career, Gates mentioned that he would look at a career in the medical field – or the energy sector. Long term global trends in both sectors are very positive he explained.

Because of the increasing global demand, and restraints on energy supply, the economic environment should in general remain attractive for firms and employees in the energy sector for decades to come. Some of the more interesting trends are illustrated by the charts below.

Energy Demand & Supply Trends

- The most valuable product as measured in the value of market traded in our global economy is crude oil

- Economic growth is, and has been historically, strongly correlated with increasing energy use. Economies can become more energy efficient, usually as a result of price increases, but generally economic growth and energy use correlate closely – rising gross domestic products (GDP's) require the use of more energy.

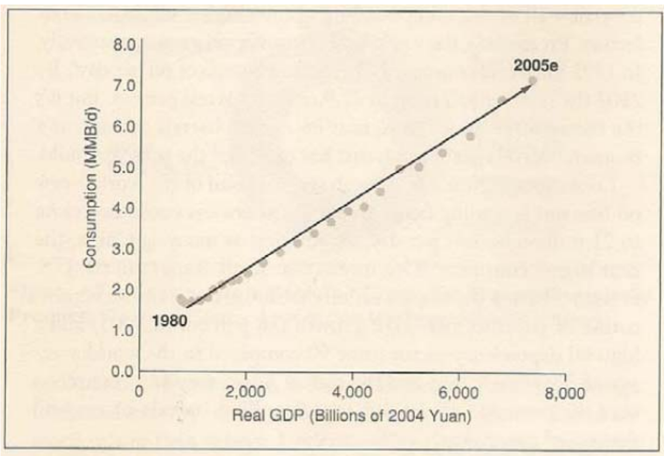


Figure 4.5 Accelerating Growth, Dependency, and Industrialization: China's Oil Consumption Cross Plotted Real GDP, 1980-2005e *(Source: Adapted from IMF World Economic Outlook Database and BP Statistical Review 2005)*

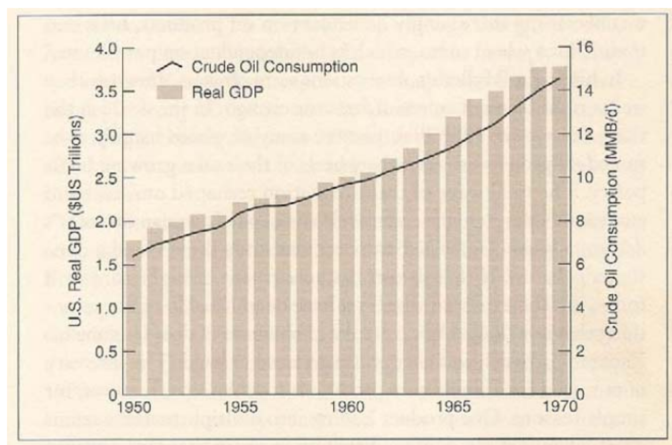
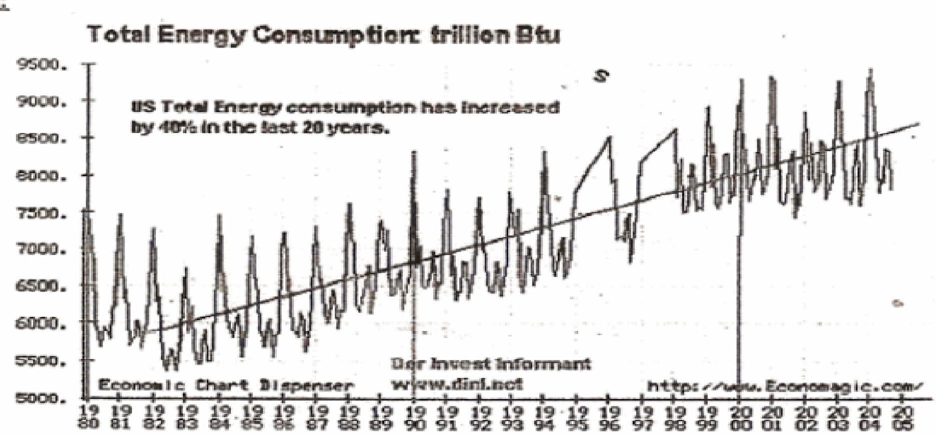
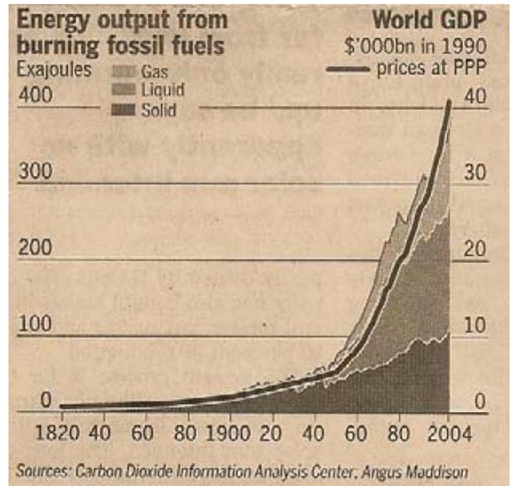


Figure 3.1 U.S. Oil Consumption and Real Gross Domestic Product, 1950-1970: GDP Inflation Adjusted to 2004 Dollars *(Source: Adapted from U.S. Energy Information Agency data)*

U.S. Consumption:

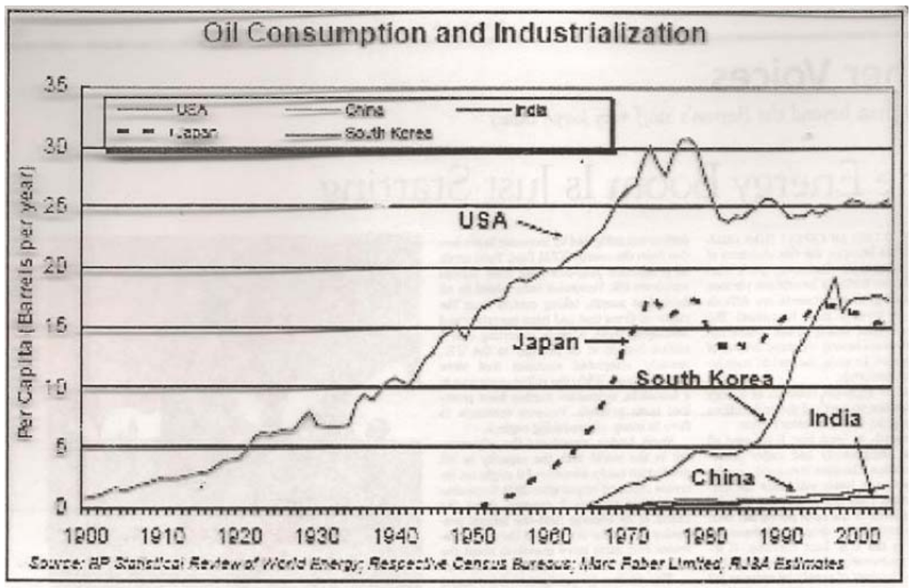


- Historically, on a global basis, energy use – coal, crude oil, and natural gas, have correlated with global economic output and growth. The statistical relationship between economic output and energy consumption is statistically significant and pervasive across different economies and time periods. Note however that with increasing energy use we generally have increased emissions of greenhouse gases – so economic development and increasing energy use has an unwanted side effect. Such emissions can be addressed with technological advances in many cases. How to control such emissions while growing our economy remains a major challenge.

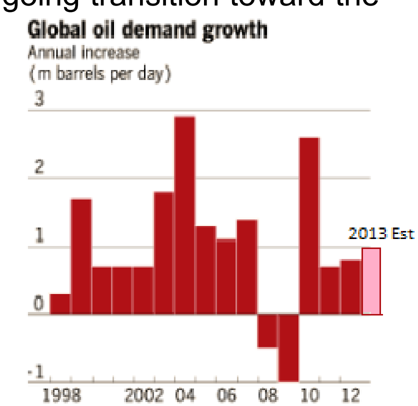


- Per capita income and per capita energy use are strongly correlated. The statistical relationship is statistically significant and globally pervasive. As economies expand the amount of oil (and energy) used by each citizen on average tends to increase rapidly during early industrialization then tends to flatten.

  Notice two of the largest global economies – and two of the fastest growing – are India and China. Note also on the chart the per capita consumption of oil in these countries is only a fraction of that seen in the U.S. If China or India industrializes to the extent seen in the U.S. or Japan, following the "Western Model" of development, global demand for crude oil will continue to increase for decades.

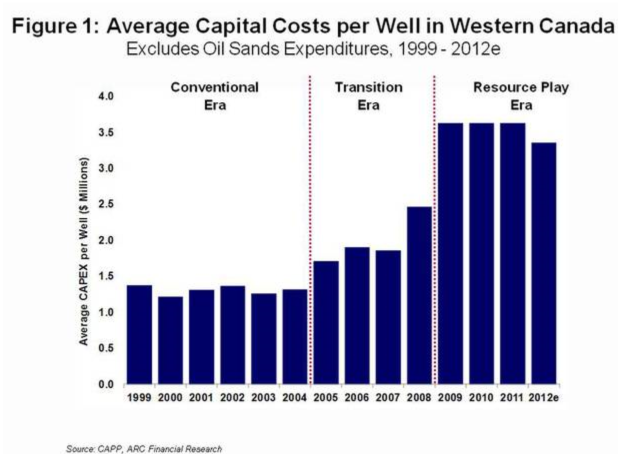


- Global demand for oil is increasing relentlessly, and is forecast to continue to grow for years to come. The developing world, primarily China and India, are in an ongoing transition toward the developed world's high-consumption lifestyle. North Americans only represent a small percentage of the global population yet we consume a huge percentage of the oil that is produced. The rest of the world is striving to have our comfortable lifestyle.



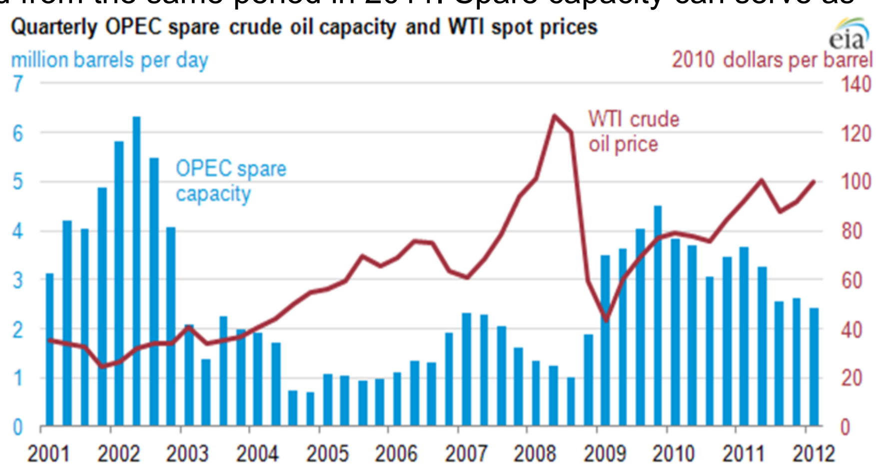
  The IEA projects a 1.0 million barrel per day increase in crude oil demand in 2013 (to 90.9 million barrels per day - a record level). This compares to an increase of 0.8 million barrels per day estimated for 2012 and 0.7 million barrels per day seen in 2011. Demand growth is driven by developing economies such as China, India, and the Middle East. The U.S., Europe, and Japan are expected to see stagnant or declining consumption. Chart courtesy The Financial Times. Note that only during the "Great Recession" of 2008-9 did we see global demand decrease.

- Developmental costs for energy resources are skyrocketing. Whether the costs involve oil sands, drilling and fracing, or coal mining they generally are increasing at a pace well in excess of inflation. As an example, a well in western Canada today, on average, costs three times as much to drill and complete as it did six years ago (chart courtesy National Post). The reason is that horizonal wells require larger and more powerful rigs, more casing, and massive hydraulic fracturing programs.



  Well costs in the U.S. are increasing in a similar manner. The result is that many of the ‘new’ higher cost energy resources require much higher crude oil and natural gas prices to support developmental activity. Tar sands and other alternative enery sources also require elevated prices to be economic, many times oil must be at $80 a barrel or above for these projects to meet financial projections.

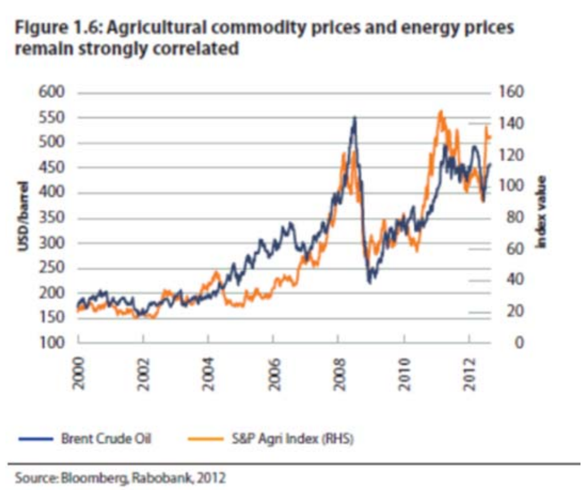
- The U.S. Energy Information Administration (EIA) estimated that global spare crude oil production capacity averaged about 2.4 million barrels per day during the first quarter of 2012, down about 1.3 million b/d from the same period in 2011. Spare capacity can serve as a buffer against oil market disruptions. There is little or no spare capacity outside of the OPEC member countries.



  Spare crude oil production capacity was less than 3% of total world crude oil consumption, the lowest proportion since the fourth quarter of 2008.

  Low spare oil production capacity tends to be associated with elevated oil prices, oil price volatility, and price spikes. The trend in global spare capacity has been downward for the last several years (see chart, courtesy EIA).

- The price of energy and agricultural products have correlated very closely over the last decade. The increasing production of biofuels has been one reason for this high degree of correlation, as well as the upgrading of diets and lifestyles in China and other developing countries.

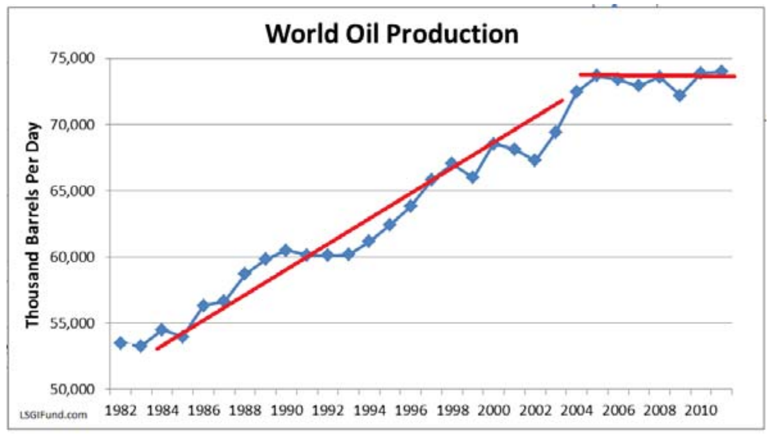


  In the U.S. around 42% of the corn crop in 2012 was used for ethanol feedstock, and non-corn alternative fuels are mandated to be introduced over the next decade under federal laws and regulations.

- In mid-2012 ago the EIA released a new set of international oil production data with revised figures going back to 1985. This is one of the most comprehensive revisions in several years. It now includes full year data for 2011. The data covers only crude oil ("black oil"), not total liquid hydrocarbons, which includes natural gas liquids (NGLs). Dan Steffens with the Energy Prospectus Group summarized the revisions, and his conclusions as to what the data indicates:

  "Since 2005, despite a significant transition in the price of crude oil, global oil production has been trapped below a ceiling of 74 million barrels per day. Obviously, new production is coming on line from new discoveries and new technology being applied to oil fields, but it has not been at a rate fast enough to overcome the declines from existing fields. If you are a student of Peak Oil, you know this is exactly the scenario that King Hubbert said would happen right before the world's oil production began to decline with nothing we could do about it.

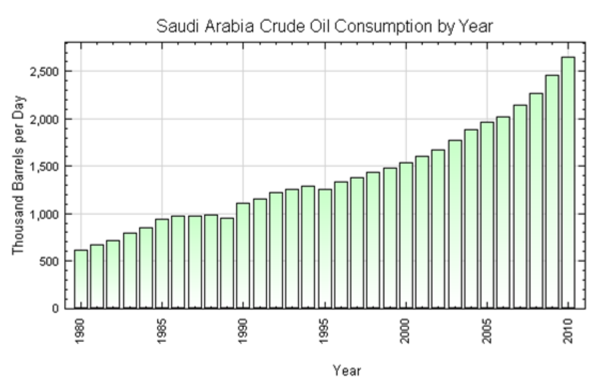
  The world now consumes almost 90 million barrels per day of liquid fuels. The difference between the global production of crude oil [of around 74 million b/d] is made up by natural gas liquids that are blended in during the refining process. Keep in mind that there are some fuels and lots of materials that can only be made from black oil.



  Overall, global decline in production from existing fields is estimated at a minimum of 4% per year and as high as 6+% a year. Given that new oil resources are developed and flow at much slower rates, the existing declines present a formidable challenge to the task of increasing supply.

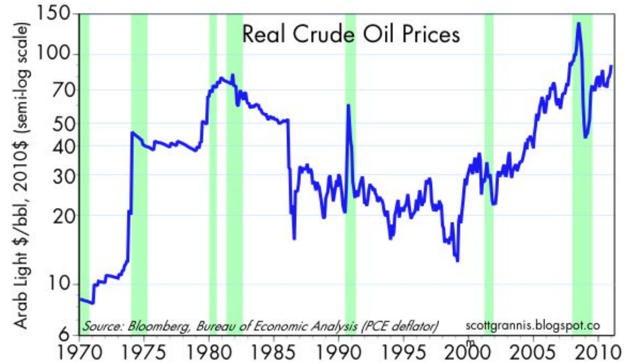
  When Saudi Arabian production peaks (and that may be happening very soon), I doubt even the massive amounts of capital being invested to develop North American shale oil reserves will be enough to take global production of crude oil higher."

- Chatham House, a consulting think-tank based in Great Britain, issued a report in mid-20112 on the increasing domestic energy use in Saudi Arabia and the future impact on global markets. The study concluded that energy consumption has been climbing since the early 1970s in Saudi Arabia and shows no hint of a slowdown (energy prices are subsidized).



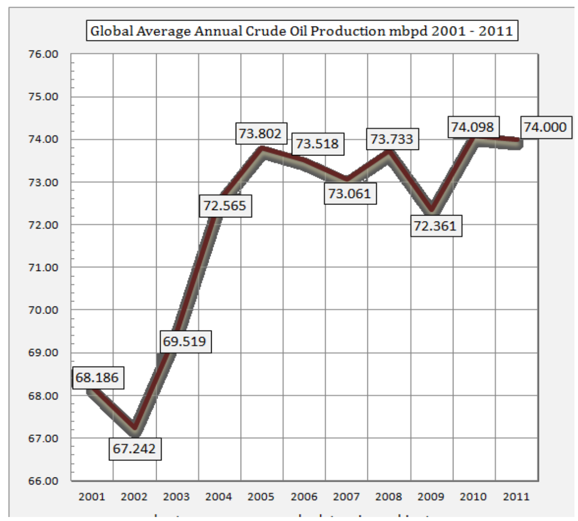
  If domestic Saudi Arabian demand continues to grow along the long term trend the amount of oil available for export would fall. The report concludes the amount of spare production capacity available to meet unexpected shortfalls would also decline, and would impact the ability of the Saudis to stabilize global energy markets. (Chart courtesy Chatham House)

- A study published in 2012 by University of California energy economist James Hamilton shows that except for brief periods in the late 1970s, early 1980s and in 2008, oil is far costlier in constant dollars today (2012) than at any time in the last century. The revenues generated by the higher prices is one reason the energy sector is so attractive. You would expect global oil production to be surging in such a high-priced environment as the producers take advantage of the favorable economics, but this has not been the case when we look at global production volumes.



- James Murray of the University of Washington and David King, former chief scientific adviser to the British government, published an article in the scientific journal Nature in 2012 discussing how productive oil capacity largely reached a plateau in 2005 and has not increased over the last seven years.

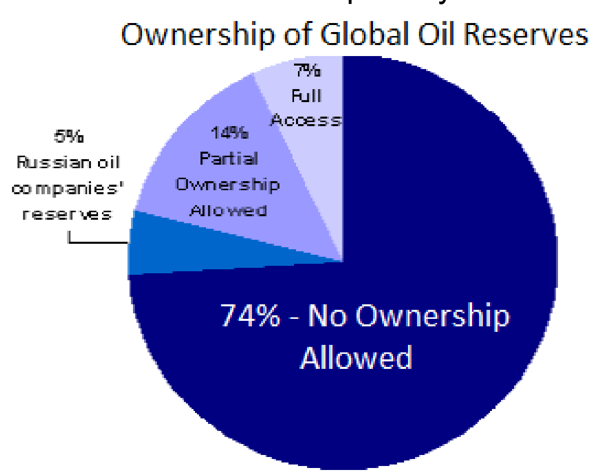
  They found that since 2005, when oil was priced about $50 a barrel, global conventional crude production rates have stayed roughly constant at around 74 million barrels a day despite average annual gains of 15 per cent in price. The chart at right, courtesy gregor.com, illustrates the situation.



  "For each extra barrel of oil produced over the past seven years from Russia, and Canada, there has been a loss of production from the North Sea, from Mexico, from Indonesia and elsewhere."

  'Conventional' crude oil production provides around 80 per cent of total crude oil liquids supply. 'Unconventional' sources of oil like that from Canada's oil sands, U.S. shale oil, oil from biofuels, and liquids from natural gas production, boosted total liquids output to about 89 million barrels a day in 2011. Murray and King claim these unconventional sources are very expensive to develop, averaging between $50 and $90 a barrel.

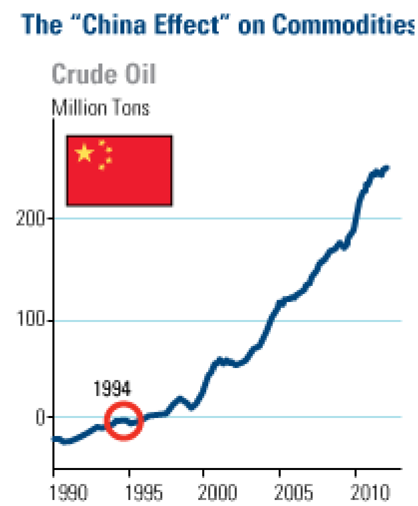
- Why can't global crude oil production increase above the 74 million barrel per day level? One reason is that each year the world's mature conventional fields produce about four million barrels a day less oil than the previous year as production capacity declines, a function of field depletion. This decline has to be addressed to keep global output constant.



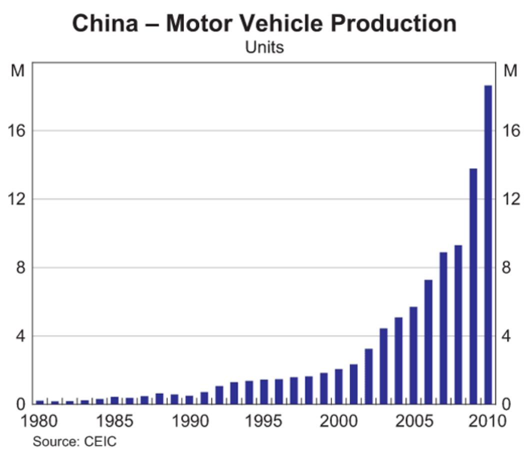
  Analysts also point to the fact that the world's cheap and easy-to-get oil is disappearing. On average each additional barrel requires more energy inputs, more complex technology, and more environmental risk to produce and refine. Access to attractive areas to explore is also an issue. It has been estimated that more than 74% of the global crude oil reserves are controlled by foreign governments or by national oil companies, reducing exploration and developmental opportunities.

Depletion, increasing demand, ownership issues, means that “humankind will have to invest staggering resources – many trillions of dollars – to find and produce new oil if global output is to grow steadily for decades into the future.”

- Frank Holmes of US Global Investors discussed the rocketing demand for energy and commodity resources from China in a note in 2012. He notes that “China’s rapid growth and increasing reliance on other countries for key resources has made a powerful case for commodities over the past several years”.



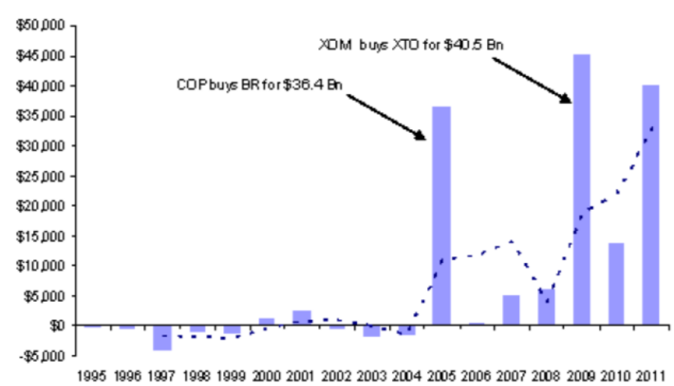
Charts from BCA Research illustrate that China became a net importer of crude oil in 1994 and demand continues to expand. Today China is the second-largest oil importer in the world and will soon surpass the U.S. as the largest. It boasts the largest automobile market and is the largest consumer of steel, copper, mobile phones, and energy.



China’s urban population just surpassed the 50-percent mark in 2011, and analysts claim this will dramatically shift buying patterns in the economy “driving an enormous demand for housing, consumer staples and durable goods”. China’s net crude-oil imports are expected to grow 5% over year earlier periods in 2013 according to Chinese government sources.

- Oil and gas companies set a record number of exploration and production merger and acquisition deal values and counts in the U.S. in 2011 according to a Houston-based consulting firm.

  Much of the focus was on domestic shale resources. The report noted 369 oil and gas deals with a total value of $86 billion in 2011. In 2010, 313 deals had a total value of $75 billion.



Value of E & P transactions by year
2011 through 3rd quarter only

  Most of the 2011 deals were for unconventional resources like shale resources, with 70% of the total focused on this sector. Five years ago these unconventional resources were a small share of acquisition activity.

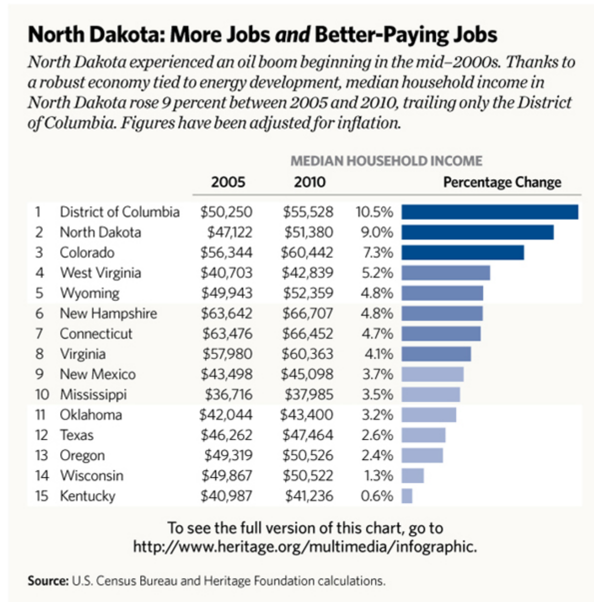
<u>Legal, Regulatory & Career Implications</u>

If we assume that global economic growth will continue over the next several decades the demand for energy will also increase. Historical correlations indicate economic growth and energy use track closely. Supplies of energy will become more and more challenging to recover as easy to produce and cheap reserves are depleted. Technology should be able to provide adequate energy supplies to markets if prices are high enough to support development.

Few realize the extent of the demand for energy professionals. Landmen check title and negotiate leases, pipeline right of way agents negotiate damages, attorneys and executives negotiate contracts, and each well has numerous permits and approvals that are required before drilling.

The product is refined or processed, with environmental implications and requirements, and shipped via pipeline/barge/railcar/tanker truck to market. Each step requires a professional. To say nothing of the drilling, construction, and related jobs associated with development and support. Merger and acquisitions are common, both property and total corporate acquisitions. The industry is cyclical, but long term trends are much more positive and lasting than other sectors of the economy.

As a result of the recent developments in technology and drilling, states such as North Dakota have seen a boom in employment and wages. Likewise Texas and the Barnett and Eagle Ford fields have driven developmental activity and employment well above what it would have been otherwise (see graphics below).


North Dakota: More Jobs *and* Better-Paying Jobs

North Dakota experienced an oil boom beginning in the mid–2000s. Thanks to a robust economy tied to energy development, median household income in North Dakota rose 9 percent between 2005 and 2010, trailing only the District of Columbia. Figures have been adjusted for inflation.

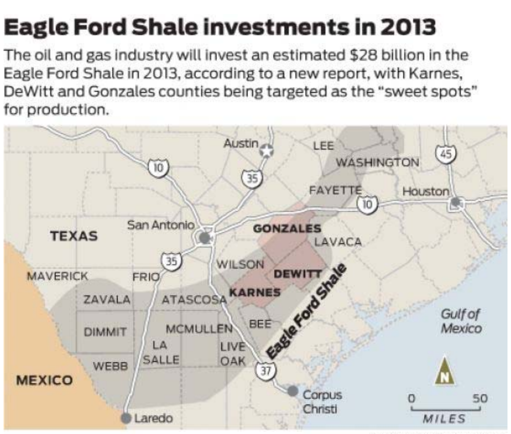
		MEDIAN HOUSEHOLD INCOME		
		2005	2010	Percentage Change
1	District of Columbia	$50,250	$55,528	10.5%
2	North Dakota	$47,122	$51,380	9.0%
3	Colorado	$56,344	$60,442	7.3%
4	West Virginia	$40,703	$42,839	5.2%
5	Wyoming	$49,943	$52,359	4.8%
6	New Hampshire	$63,642	$66,707	4.8%
7	Connecticut	$63,476	$66,452	4.7%
8	Virginia	$57,980	$60,363	4.1%
9	New Mexico	$43,498	$45,098	3.7%
10	Mississippi	$36,716	$37,985	3.5%
11	Oklahoma	$42,044	$43,400	3.2%
12	Texas	$46,262	$47,464	2.6%
13	Oregon	$49,319	$50,526	2.4%
14	Wisconsin	$49,867	$50,522	1.3%
15	Kentucky	$40,987	$41,236	0.6%

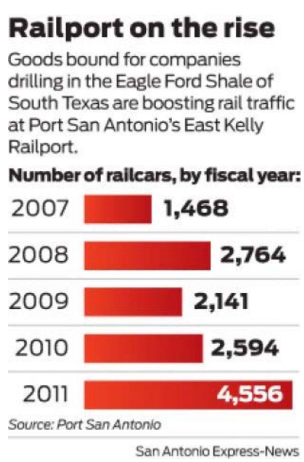
To see the full version of this chart, go to http://www.heritage.org/multimedia/infographic.

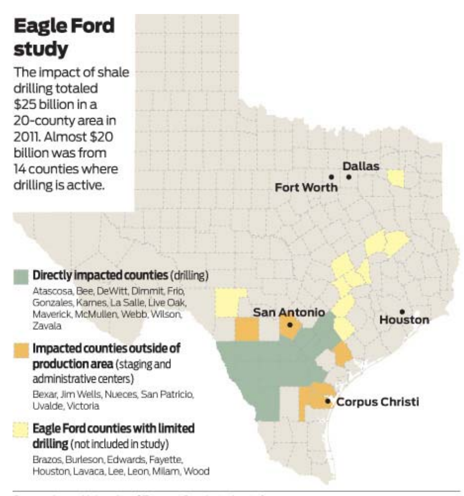
Source: U.S. Census Bureau and Heritage Foundation calculations.

Energy & Environment heritage.org

With a basic understanding of the legal, regulatory, and business environment surrounding the energy sector we expect the business and employment opportunities to remain robust and attractive. This course, and the associated materials, have been prepared to assist in establishing this basic foundation.







(Charts courtesy San Antonio Express News)

Did Energy Development Drive Democracy? Life in 1860 v. 2010

Prior to 1800 the global economy was more or less in a no-growth mode. A person living in Europe at the time would have a life not unlike their ancestors who lived two centuries earlier. Because growth was so low few could improve their standing in life.

Governments responded to this non-growth environment by focusing on domestic repression and by exploiting resources abroad, benefiting a few elites while leaving the majority of the population essentially destitute, or close to it.

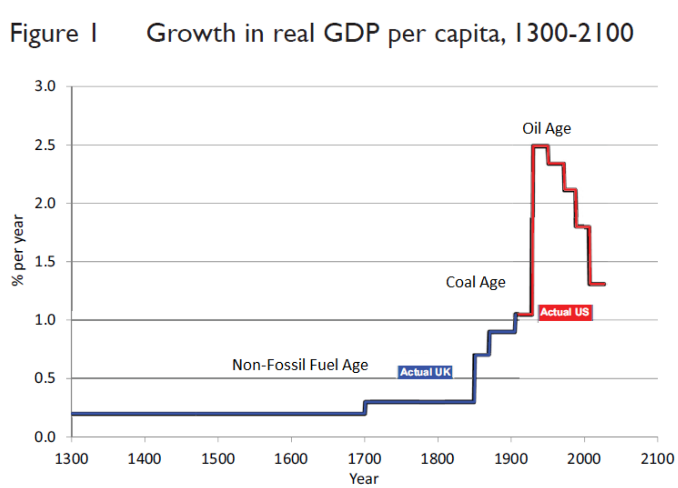
After 1800 the economy began to grow at an impressive rate. According to the late Angus Maddison, an economic historian, average real income has increased 10-fold since 1820. This is an astonishing story, with hugely positive impacts for mankind.

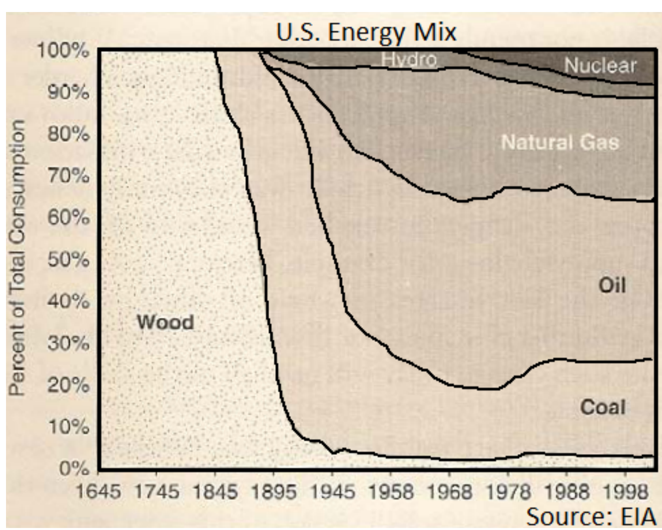
The 'clever use of commercial energy has immeasurable increased the range of goods and services available' according to economist Martin Wolf, and this has 'substantially reduced both our own drudgery and our dependence on that of others'. He continues 'serfs and slaves need no longer satisfy the appetites of narrow elites.'

In this environment everyone gains, which Wolf claims was a major reason we have seen democracy evolve on a global basis. Without energy, and economic growth, the preferred system of government might be much different according to his argument, with a strong tendency toward repression and military rule.

Few people today realize the role energy plays in our economy and the role it played in the development of our governmental structure. When the first explorers came to North America the attribute that impressed them most was the massive amount of timber – something that Europe had depleted for use as a fuel and for building. Since wood was the primary energy source of the world at the time this was a massive store of wealth for those who might settle.

Two charts, one from the US EIA, the other by Dr. Robert Gordon of Northwestern University, illustrate the situation:





If we compare life in 1860 versus 2010 it gives a great picture as to what economic growth has accomplished for the average global citizen.

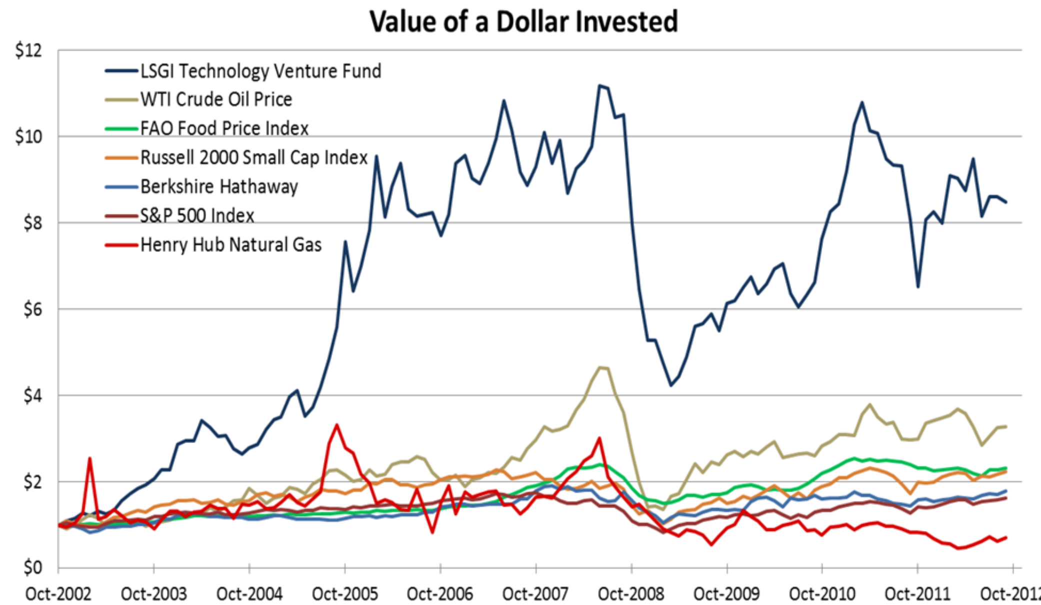
	1860	2010
Source of energy:		
Animals & people	90%	5%
Fuels	10%	95%
Primary fuel:	wood	coal / crude oil /nat gas
Economic growth over the previous 150 years	0.3% (annual)	2.2%
Global population	1.5 billion	6.8 billion
Cities > 1 million population	3	415
People met in lifetime	2,000	??
Occupation	rural agriculture	--
Agriculture method and max. capacity to feed	organic / 3 billion	inorganic / 7+ billion
Major means of transportation	walk	car / bus / train
Houses with indoor plumbing	5%	98%
Average lifespan (U.S.)	45	75+
Average IQ (US)	65 - 70	105 - 115
Average height (male US)	5’ 6”	5’ 10”
Form of Illumination	candle / lantern	electric light

The bottom line is that the energy sector has made a significant contribution to economic growth, and has played a large role in the evolution toward a democratic style of government on a global basis.

Commodities Super-Cycle Remains in Place

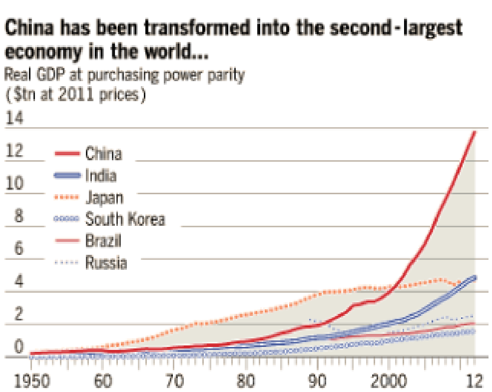
The last decade has been a difficult one for the stock market. We asked one of our students to use Bloomberg data to prepare a chart of the return an individual would have received investing in the equity market or in commodities over the last decade. They found that an investment of $1 in October of 2002 would yield the following returns a decade later:

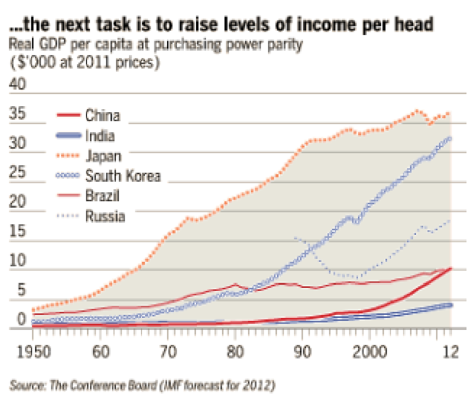
- $3.28 if invested in WTI crude oil
- $2.31 if invested in the FAO Food Index
- $2.24 if invested in the Russell 2000 Small Cap Index (includes dividends)
- $1.79 if invested in Warren Buffett's Berkshire Hathaway
- $1.63 if invested in the S&P 500 Index (includes dividends)
- $0.70 if invested in Henry Hub spot natural gas

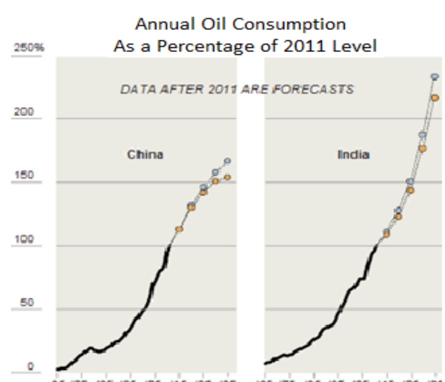


The story is that commodities in general have substantially outperformed the major stock market indexes. Even investing in a company run by one of the world's best investors over the last decade – Warren Buffett's Berkshire Hathaway – would have underperformed WTI crude oil prices, the FAO Food Index, and the Russell 2000 small cap stock index.

In the last decade we have seen (1) rapid globalization (2) impressive growth in China, India, and other developing economies, (3) robust global economic growth and (4) a rapidly expanding middle class – all of which have driven demand for commodities upward. We expect these long term trends to continue, driven by the following trends illustrated in charts recently published in the New York Times and The Financial Times:







While volatile, we expect public shares of small companies in the energy, agricultural, and basic material sectors to substantially outperform the major market indexes over time.

PART I

OWNERSHIP RIGHTS AND OBLIGATIONS

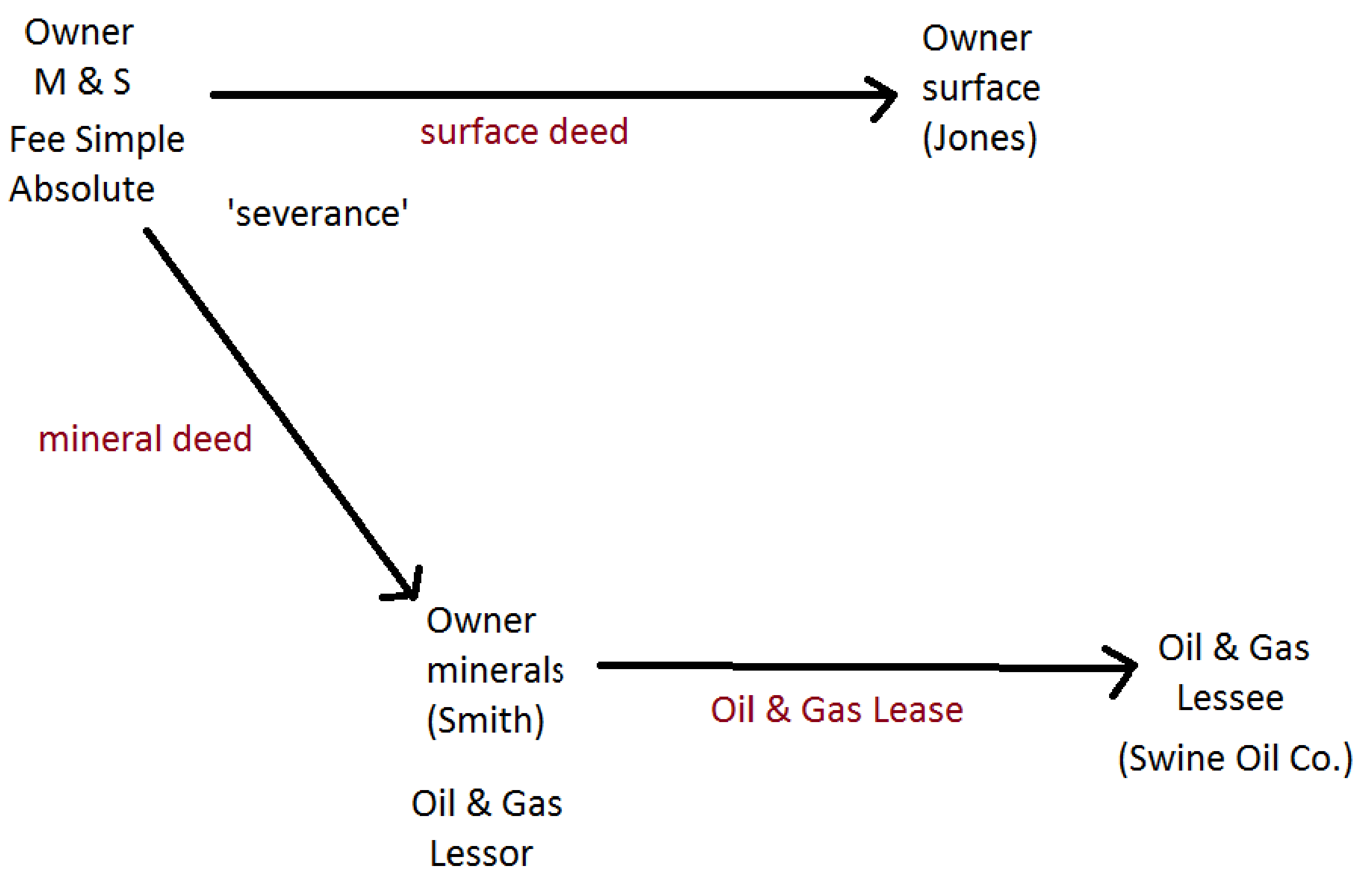
Fee Simple, Mineral Severance & Conveyances

In most of the world the practice of oil and gas law is much simpler than in the U.S. due to the fact that the right to explore and produce the minerals has in many countries been retained by the state. In the U.S. private ownership of the minerals is more common, although the federal and state governments have retained ownership of minerals in certain areas (for example, the minerals underlying the Gulf of Mexico).

Early mining law, which we will explore in the next few cases, provided that a landowner in the U.S. held the right to use the surface and the right to develop all the minerals that might lay underground. This concept is referred to as the "ad coelum" doctrine – the owner had the rights "from heaven to hell" and could exercise those rights as they saw fit.

Because mining activities were instituted in the U.S. before oil and natural gas development became more commonplace early mineral law was heavily influenced by early mining decisions. In the application of mining law and concepts to oil and natural gas development the courts quickly recognized that oil and natural gas are much different physically, and how they are mined, than the coal, copper, gold and silver mines that pre-dated the oil and gas industry.

Before we visit some of the early decisions that establish the ground rules with regard to ownership rights, we need to address some of the common concepts we encounter with regard to property rights. The following diagram might help clarify some of the concepts.



Questions:

1. What is ‘fee simple’ ownership? What are the attributes of ‘fee simple’?

2. What do we mean when we say the minerals have been ‘severed’?

3. When we have two separate owners of the same property, in this case Smith and Jones, do you think that conflicts will arise between the parties with regard to its use and development?

4. What rights does Jones have as surface owner?

5. What rights does Smith have as mineral owner?

6. Note that the conveyance to Jones is by Surface Deed and to Smith is by Mineral deed. What is the difference?

7. Is the conveyance to Jones and Smith a conveyance of real property? If so, what are the legal implications and requirements?

8. Note that the Smiths may not want to develop the minerals even though they know oil is beneath their lands. Why might they decide to grant an oil and gas lease to a company like Swine Oil Co. instead?

9. In an oil and gas leasing situation you have a ‘lessor’ and ‘lessee’. Many times the courts will use this terminology, as well as those in industry settings. Who is the lessee and who is the lessor in this situation?

10. What does the surface owner actually own? What does the mineral owner actually own?

11. What rights are transferred or granted by the oil and gas lease from Smith to Swine Oil?

12. How do we tell the difference between a mineral deed, surface deed, and an oil and gas lease?

13. The severance of mineral rights has become very common. What problems do you think this might create?

14. For many oil and gas leasing transactions the lessee will use a standard form oil and gas lease. Why do you think they use a standard form and don’t draft leases on a case by case basis?

Osceola Mine Captain John Daniell & the ‘Hollow Earth’ Theory

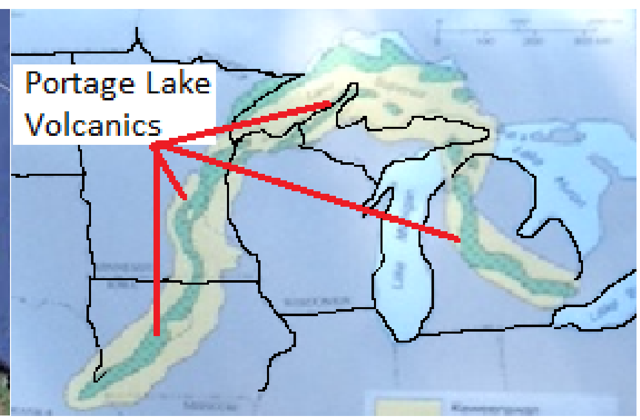
Most Americans assume that the first big mining boom in North America occurred in California in 1849, where thousands of easterners migrated to the gold fields in attempt to find their fortune. In reality the California gold rush was not the first U.S. gold rush, nor was it the first big mining boom.

The first U.S. gold rush occurred in North Carolina in the 1820’s after a local landowner found a gold nugget the size of a baseball in a local streambed. The first large mining boom in North America occurred in the 1840’s when the Cliff Mine lode was discovered in Michigan’s Upper Peninsula – producing massive amounts of ‘native copper’ and some associated silver and other minerals. Michigan’s ‘Copper Country” mining district became one of the most famous in the world – and made the financiers and investors (many who resided in Boston) incredibly wealthy.

The development of the copper deposits in Upper Michigan in the late 1800’s provides an interesting lesson on ownership theory and mineral development – and the role of technology and finance in the extractive industries.

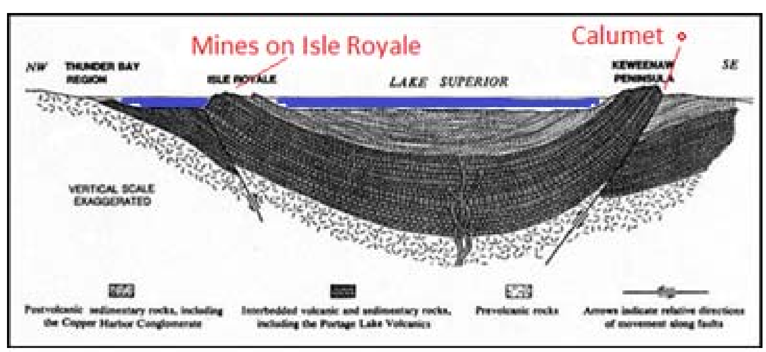
Portage Lake Volcanics

The geological history of the Lake Superior mining region is very interesting. Hundreds of millions of years ago it was home to massive volcanic activity and lava flows. In fact these flows can be seen today in outcroppings in Northern Michigan near the town of Calumet, and on Isle Royale fifty miles to the north in Lake Superior as well as on the Canadian shore. Buried deep underground this rock – some of the oldest on the face of the earth – extends underneath Iowa in one direction and all the way to Detroit in the other in an inverted “U” shaped pattern (see plat, Portage Lake volcanic formations are those colored in green).



As the molten lava flows cooled the rock shrunk it cracked into slabs, and sunk forming the basin that we now know as Lake Superior. In the process native copper and silver were also deposited.

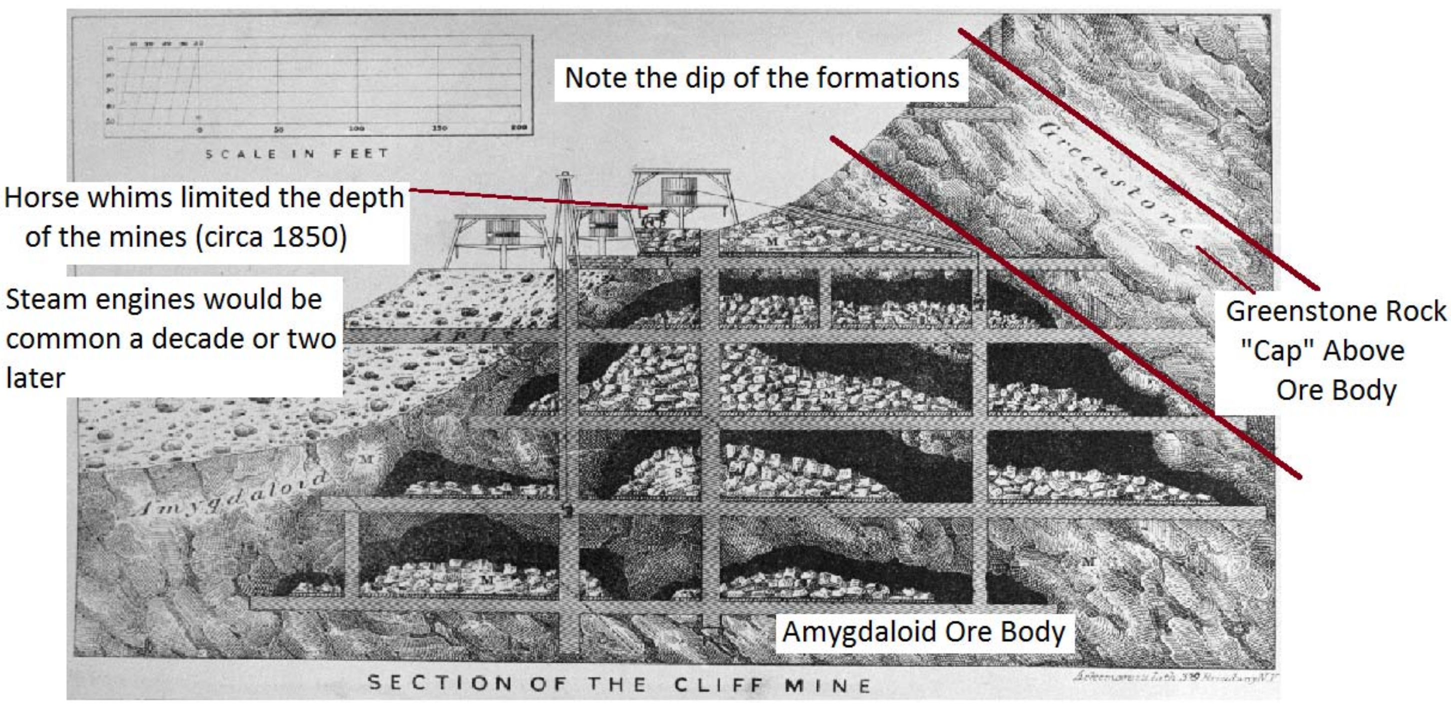
‘Native’ copper is essentially pure copper that does not need to be processed in a smelter to remove sulfur or other impurities. It exists in quantity no-where else on earth except in Michigan. The ore bodies were tabular in form, average from 5 to 30 feet or more in thickness, and dipped toward Lake Superior at angles of 30° to 72°.



What fascinated geologists is that the dip toward the lake was to the Northwest when observed in Michigan, and to the Southeast when observed near the Canadian shore on Isle

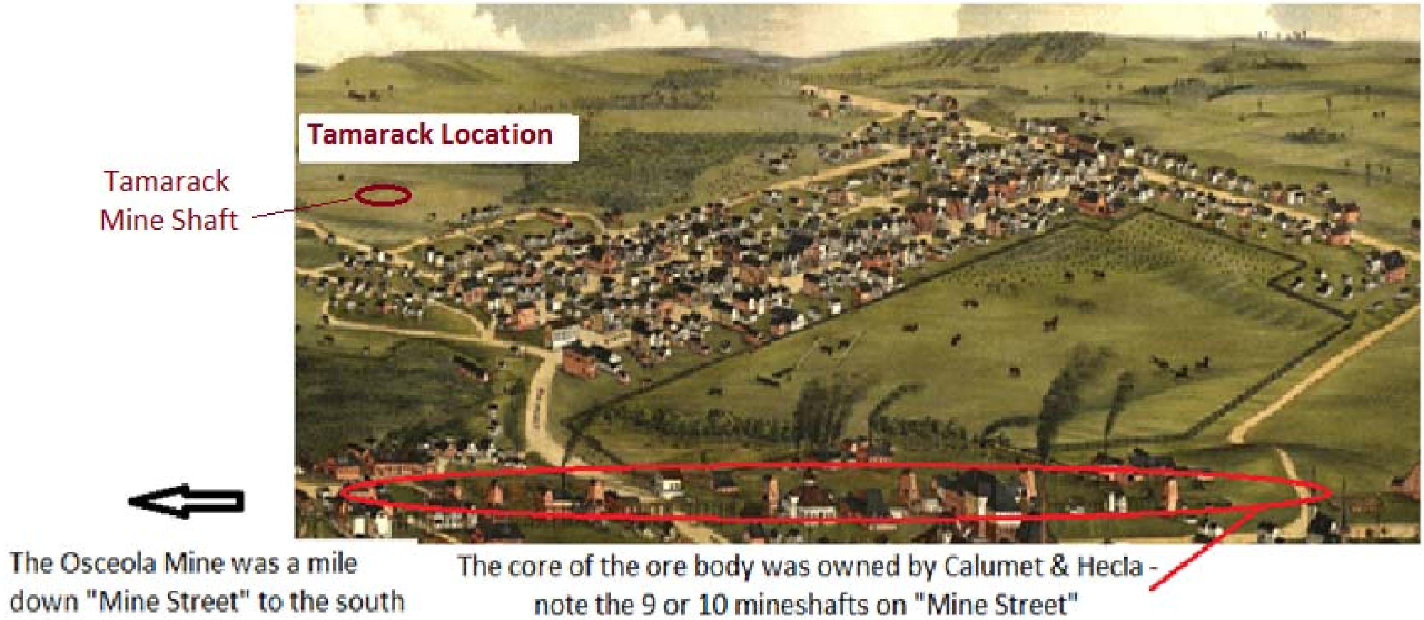
Royale. The formations at both locations were essentially identical. Both contained native copper and were dotted with pre-historic copper mining pits dug by unknown peoples!

If you worked underground in the mines near Calumet, Michigan, this is what you would see as a miner – an ore body that dipped toward Lake Superior at a fairly steep angle:



Like oil and gas mineral rights, the ownership rights to copper and silver ores stop at the property line. They extend from the surface to the center of the earth. The problem, or opportunity, for a mining company was created when the ore body slopes downward at an angle – with the rich ore possibly extending past the company's property line.

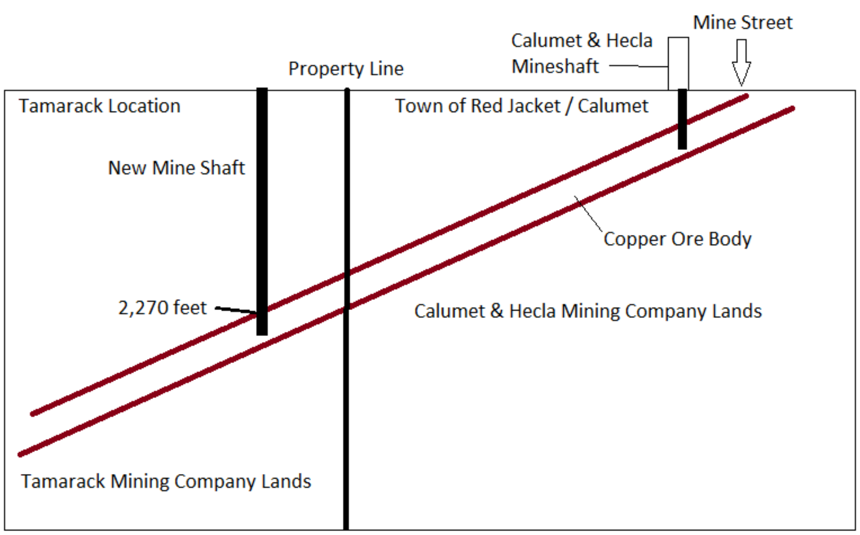
<u>Captain Daniell, Mineral Ownership & the $1.5 Million Gamble</u>
John Daniell worked as a mining captain at the Osceola Mine just south of the rich lodes of ore found in the town of Calumet. As a mining captain he was in charge of mining plans and strategy. He was disappointed that while his mine was only a mile south of some of the more profitable mines owned by Calumet & Hecla Mining Company the amount of copper in the Osceola lode would always make his mine marginal – not matter how good his mining strategy.



It was deep within the workings of the marginal Osceola Mine that Captain John Daniell would first envision the Tamarack Mine. After years working underground, Captain Daniell developed an intimate understanding of the conglomerate lode he was tasked to mine. He noticed the lode kept a consistent dip along its known depth - and postulated that this dip would continue indefinitely for as long and as deep as the lode ran.

With the geological model in mind Daniell envisioned the possibility of mining the same rich lode that Calumet & Hecla was already exploiting – by sinking vertical shafts down to the lode from lands west of their operations at a point he named “Tamarack Location” (see plat above). There were several problems however. No-one had ever mined copper from a deep shaft mine more than 2,000 feet deep with any degree of profitability. No-one was sure that the technology existing to mine that deep. The skilled mining labor needed was not in great supply. Last, until they actually dug the shaft – a process that would take three years and cost at least $1.5 million – they were not sure the copper ore continued to exist at those depths – and if it did they were not sure how rich the ore was.

Here is the geological model that Daniell envisioned:



One commentator described the venture as follows:

> "When the Tamarack Mine undertook the ambitious plan of mining the Calumet Conglomerate at depth, it was an incredibly risky and ambitious plan that had no contemporary counterpart. It was only blind faith that encouraged the investment in such a ludicrous scheme, faith in the experience and expertise of the old mine captain that had envisioned the possibility of mining the great C&H's lode right out from under it.
>
> The craziness wasn't so much in the plan's technological possibility as much as it was it's apparent disregard of any financial discipline. Sinking shafts is the single most expensive undertaking any mine can perform, one that makes absolutely no money but spends plenty. And in the Tamarack's case, that undertaking would require sinking through over 3200 feet of solid rock before a single ounce of copper could be recovered. To make matter's worse, the endeavor would take three and a half years to complete. Three and a half years of nothing but massive spending and plenty of red ink. But when it was done and the great Calumet Conglomerate was pierced – and its massive riches just lying in wait for the picking – the plan suddenly made perfect sense. So much sense in fact that it was repeated four more times."

Daniell took his idea to two Osceola Mine investors by the name of Clark and Bigelow, both wealthy mine financiers located in Boston. With these two men's backing, and over a million and a half dollars of capital, the newly formed Tamarack Mine quickly bought up a tract of land and the minerals immediately west of the existing Calumet & Hecla underground mines.

The first shaft was started in 1882. Three and one-half years and 2,270 feet later the shaft finally struck the great conglomerate lode, rich with native copper, just ten feet deeper then Daniell had estimated it would be found based on his engineering calculations. From initial production the Tamarack Mine would forever be known as one of the Copper Country's great profitable mines.

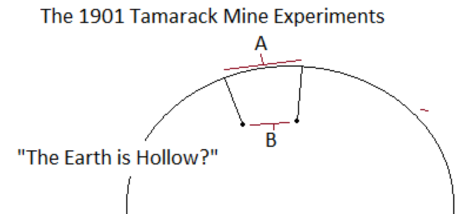
<u>Subsequent Operations</u>
The Tamarack Mine proved profitable for over a decade. By 1905 the Calumet & Hecla mines to the east began to 'work out' as they reached greater depth and approached the Tamarack property line, with a limited further life due to a lack of reserves.

To address the reserve problem Calumet & Hecla proposed a bill which was sponsored in the Michigan legislature that allowed mining corporations to acquire stock in other mining firms. This began a period when Calumet & Hecla Mining Company adopted a strategy of acquiring the interests, reserves, and control of many smaller mines in the area.

By 1910 Calumet & Hecla proposed a plan to consolidate company interests, including those of Clark and Bigelow and the shareholders of Tamarack Mining Company. As is so often the case in a consolidation or merger the value of the Tamarack ore and mine were disputed, and litigation ensued (<u>Hyams v. Calumet & Hecla Mining Co.</u>, 221 F. 529 (W.D. Mich. 1915)). In the end an acceptable price for the Clark and Bigelow interests were determined, and the Tamarack Mine properties were acquired by Calumet & Hecla.

<u>An Engineering Spectacle</u>
The Tamarack Mine became known as an engineering marvel. The deepest vertical shaft mine in the world scientists decided to conduct a unique experiment. To determine the circumference of the earth (remember this was pre-satellite imagery and even pre-airplane) scientists and engineers decided to

run an experiment. Using two of the vertical shafts at the Tamarack mine they suspended two sixty pound steel bobs on 4,250 feet of steel piano wire. The bobs were immersed in motor oil to damp out vibrations.



In theory, due to the force of gravity pulling the force to the center of the earth, the distance between the bobs at the bottom of the mineshaft (designated as 'B' in the diagram) should be less than the distance between the piano wire on the surface (designated as 'A' in the diagram). Knowing the distances, using complex mathematical formulas the scientists hoped to calculate the earth's circumference.

The results astounded. The distance between the bobs at the bottom of the mineshaft was around eight inches greater than the distance at the top! The engineers attempted to explain by examining airflow in the shafts, magnetic attraction, the much higher density of copper versus rock and the presence of large amounts of copper in the ore body, and numerous other theories - but in the end were unable to effectively explain why the bobs were further apart at the bottom of the shaft than at the top.

In light of the lack of explanation by the experts one observer noted that "maybe the earth is hollow" – a fact that would be supported by the experimental results.

Notes:

1. Note several physical attributes are present in both a mining and oil and gas exploration efforts that can influence the success or failure of a venture:

    - In general, the deeper a mine or well is drilled the older the formations encountered. In many ways drilling an oil and gas well is like opening a history book as to what existed at the site hundreds of millions of years ago. The operator is drilling many times into an ancient ocean bed, river channel, sand dune, or reef – hoping it has retained oil or natural gas in the pore spaces.

    - In general, the deeper the mine or well the hotter the down hole temperature. Temperature generally increases with depth, and for oil and gas has several implications: (1) the deeper a well is drilled the hotter the environment, and the more likely the hydrocarbons have been 'cooked' into natural gas, (2) at some locations the temperatures become so extreme the effectiveness of drilling fluids is impacted, making well completions difficult or impossible, and (3) at some extreme temperatures hydrocarbons will be 'cooked' until they are destroyed – remember these substances are subject to these temperatures for millions of years.

      For mining, of course the hotter the environment the more difficult it is for human labor. In the Calumet area the average year-round temperature for the copper containing rock is around 50 degrees at a depth of 700 feet. The more modern mines in the same rock formation had a temperature of roughly 90 degrees at around 7,000 feet – a difficult environment in which to perform heavy labor (humidity is roughly 100% also).

In some areas with more severe temperature gradients, like the Nevada Comstock Lode, the temperature several thousand feet below ground is well over 100 degrees F, making the working conditions like a steam bath. In some of these Comstock silver mines the men historically worked in their shorts once they reached the mine face, swinging sludge hammers for 12 hours a day. One mine visitor remarked that they were so well developed with the physical activity they resembled "ancient God's at work".

- In general the deeper the well or mine the higher pressure will be encountered. For miners this can result in dangerous 'rock blasts' where the rock face will explode due to the pressure of the overbearing rocks. This pressure, and danger, places a physical limit on how deep mines can be developed – depending on the properties and strength of the rock matrix.

  For energy firms the deeper the well in general the more concern about high pressure pockets of oil or natural gas. Three miles of overburden on a well creates a tremendous amount of force, for example, and drilling fluids and strategy are adjusted to take into the account the risk of high pressure reserves.

Questions:

1. Native copper and silver, like iron ore and lead, are embedded into the rock formations where they occur. From an ownership, financing, and developmental standpoint how might copper and the other hard minerals be different than oil and gas (which is present in the pore spaces in the underlying rock and is recovered in wells versus mines)?

2. Crude oil that usually needs to be refined before it can be used commercially. Likewise copper, silver, iron ore and lead all need to be processed and sometimes smelted to make commercial products. Do you think the 'heaven to hell' ownership theory applies once the copper, silver, iron ore, lead, or for that matter crude oil are removed or extracted from the ground? Are 'severed' minerals different than minerals 'in place'?

3. Note that Captain Daniell had a unique geological theory and strategy for potentially recovering copper from that deep underground. He relied on advances in technology to make his project viable – and himself and Tamarack Mining shareholders rich.

   This marriage of geological theory, strategy, and reliance on technological advances is similar to what we have seen in the last decade with horizontal drilling and hydraulic fracturing in the energy sector (more on this later in the course). Would you expect oil and gas extraction and exploration to rely heavily on technology, or as an 'old school' industry has the sector been bypassed by technological developments?

4. Capital requirements for many ventures prior to 1850 were minimal. Many ventures were small business, rural, and agricultural in nature. Only with the development of the railroads, steel mills, mines, and oil fields did we see a massive increase in the need for capital – and for business owners to raise funds. Prior to the 1800's most capital was provided by individuals or

by partnerships, but both had severe limitations. Large scale investment sometimes was undertaken by the crown or state, but political access and questions of control and favoritism arose – especially in risky ventures like mining.

Note the joint stock corporation was a relatively new type of business entity in the 1800's – and due to the limited liability and scalability provided the capital needed to develop much of our domestic energy and mineral industry. From a strategic and planning standpoint the energy exploration business is significantly different than the mining business with regard to the required resources – how so?

We will discuss organizational forms and relationships (individual, partnership, joint venture, undivided co-tenant, and corporations) and how they impact mineral and energy development in a future lecture.

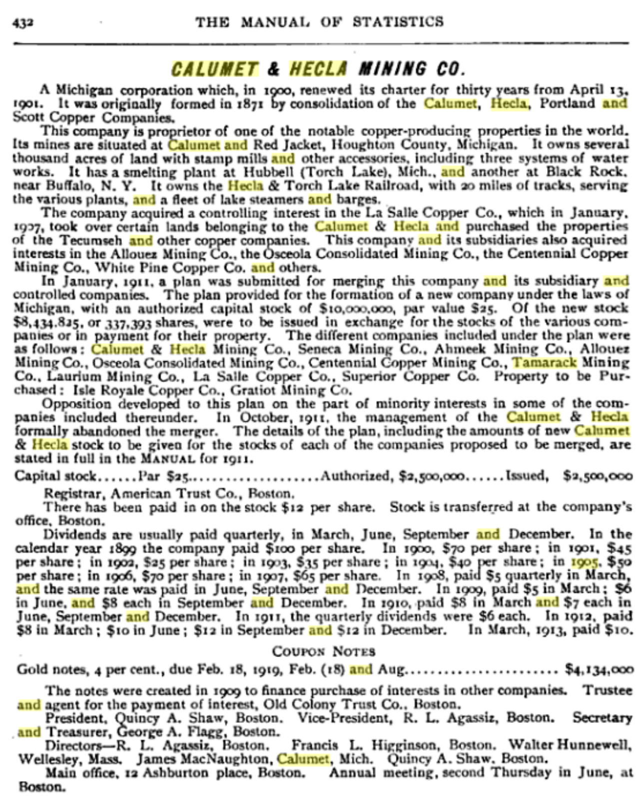
5. In the mining and extractive industries it is very common to see mergers, acquisitions, and divestitures as companies try to increase their reserves (like Calumet & Hecla), reposition their assets in light of new information (geologic or otherwise), or try to raise capital for ongoing expenditures or to pay off debt.

   In addition to providing a lot of work to transactional professionals (lawyers, financiers, accountants, etc.) these transactions raise a number of legal issues. What legal issues might you expect to encounter in an environment where transactions of mineral properties are common?

6. Mining companies, like energy companies, deal with a depleting asset. Oil or copper reserves only last so long until they are depleted. As the energy or mining properties near the end of their economic life what legal and economic issues would you expect to encounter?

   Note that energy and mineral assets that are considered depleted are not necessarily worthless. Increases in product price, or advances in technology, can make an oil field once considered worthless very valuable. An old saying in the oil patch is 'the easiest place to find new oil is in an old oil field'.

   We will discuss enhanced recovery, new seismic techniques, directional drilling, hydraulic fracturing, and other technical advances and the associated legal and economic issues later in the course.


432 THE MANUAL OF STATISTICS

CALUMET & HECLA MINING CO.

A Michigan corporation which, in 1900, renewed its charter for thirty years from April 13, 1901. It was originally formed in 1871 by consolidation of the Calumet, Hecla, Portland and Scott Copper Companies.

This company is proprietor of one of the notable copper-producing properties in the world. Its mines are situated at Calumet and Red Jacket, Houghton County, Michigan. It owns several thousand acres of land with stamp mills and other accessories, including three systems of water works. It has a smelting plant at Hubbell (Torch Lake), Mich., and another at Black Rock, near Buffalo, N. Y. It owns the Hecla & Torch Lake Railroad, with 20 miles of tracks, serving the various plants, and a fleet of lake steamers and barges.

The company acquired a controlling interest in the La Salle Copper Co., which in January, 1907, took over certain lands belonging to the Calumet & Hecla and purchased the properties of the Tecumseh and other copper companies. This company and its subsidiaries also acquired interests in the Allouez Mining Co., the Osceola Consolidated Mining Co., the Centennial Copper Mining Co., White Pine Copper Co. and others.

In January, 1911, a plan was submitted for merging this company and its subsidiary and controlled companies. The plan provided for the formation of a new company under the laws of Michigan, with an authorized capital stock of $10,000,000, par value $25. Of the new stock $8,434.825, or 337,393 shares, were to be issued in exchange for the stocks of the various companies or in payment for their property. The different companies included under the plan were as follows: Calumet & Hecla Mining Co., Seneca Mining Co., Ahmeek Mining Co., Allouez Mining Co., Osceola Consolidated Mining Co., Centennial Copper Mining Co., Tamarack Mining Co., Laurium Mining Co., La Salle Copper Co., Superior Copper Co. Property to be Purchased: Isle Royale Copper Co., Gratiot Mining Co.

Opposition developed to this plan on the part of minority interests in some of the companies included thereunder. In October, 1911, the management of the Calumet & Hecla formally abandoned the merger. The details of the plan, including the amounts of new Calumet & Hecla stock to be given for the stocks of each of the companies proposed to be merged, are stated in full in the MANUAL for 1911.

Capital stock......Par $25....................Authorized, $2,500,000......Issued, $2,500,000

Registrar, American Trust Co., Boston.

There has been paid in on the stock $12 per share. Stock is transferred at the company's office, Boston.

Dividends are usually paid quarterly, in March, June, September and December. In the calendar year 1899 the company paid $100 per share. In 1900, $70 per share; in 1901, $45 per share; in 1902, $25 per share; in 1903, $35 per share; in 1904, $40 per share; in 1905, $50 per share; in 1906, $70 per share; in 1907, $65 per share. In 1908, paid $5 quarterly in March, and the same rate was paid in June, September and December. In 1909, paid $5 in March; $6 in June, and $8 each in September and December. In 1910, paid $8 in March and $7 each in June, September and December. In 1911, the quarterly dividends were $6 each. In 1912, paid $8 in March; $10 in June; $12 in September and $12 in December. In March, 1913, paid $10.

COUPON NOTES

Gold notes, 4 per cent., due Feb. 18, 1919, Feb. (18) and Aug......................... $4,134,000

The notes were created in 1909 to finance purchase of interests in other companies. Trustee and agent for the payment of interest, Old Colony Trust Co., Boston.

President, Quincy A. Shaw, Boston. Vice-President, R. L. Agassiz, Boston. Secretary and Treasurer, George A. Flagg, Boston.

Directors—R. L. Agassiz, Boston. Francis L. Higginson, Boston. Walter Hunnewell, Wellesley, Mass. James MacNaughton, Calumet, Mich. Quincy A. Shaw, Boston.

Main office, 12 Ashburton place, Boston. Annual meeting, second Thursday in June, at Boston.

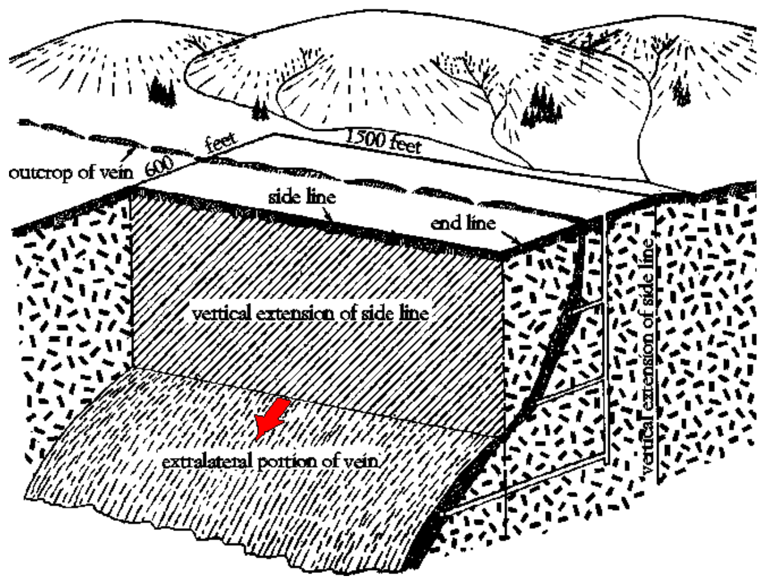
Manual of Statistics, Stock Exchange Hand-book

By Charles M. Goodsell, Henry E. Wallace 1913

United Copper Company, the 'Apex Rule' And the Panic of 1907

The General Mining Act of 1872 was passed by Congress to govern the prospecting and mining for hard minerals, such as gold, platinum, and silver, on federal public lands west of the Mississippi. This law codified the informal system of rules that evolved involving acquiring and protecting mining claims on public land, rules that were formed by prospectors in California and Nevada from the late 1840s through the 1860s.

Mining claims could be asserted once a discovery of a locatable mineral is made. The 1872 law granted what were called 'extralateral rights' to owners of the lode claims. As owners of the surface outcrop of a vein they had the right to follow and mine the vein wherever it led, even if its subsurface extension continued beneath other mining claims. This provision, also known as the 'law of the apex' or 'apex rule' led to lengthy litigation involving an army of lawyers and experts.



The key issue was the location of the apex since it granted vein ownership to the miner whose surface claim included the apex of the ore vein. The apex was defined as the point where the minerals outcropped or were closest to the surface.

Given the upfront capital expenditures necessary to extract and follow the ore in its subterranean meanderings, miners required sufficient security of ownership to proceed – and if claims were made against an operating mine severe economic damage might occur due to the delays as the issue was litigated. Graphic diagram courtesy:
http://www.unalmed.edu.co/rrodriguez/geologia/anatomy-of-a-mine/Anatomy%20of%20a%20Mine%20--%20Mining%20Law%20-%20Continued.htm

While creating uncertainty as to title, the law of the apex created some interesting opportunities according to the National Mining Hall of Fame and Museum:

> "Augustus Heinze, one of the three "Copper Kings" of Butte incited the long and violent "Apex War" that permanently altered the history of mining. In 1895, Heinze hit upon a scheme. The huge Amalgamated Copper Company, backed by Standard Oil, had absorbed the richest mines in the world in Butte. His plan was to put the "depraved trust" out of business. He bought the Rarus Mine which sat next to one of theirs. He then set forth to battle the mighty trust, both in the courts and underground."

Using the geological information developed from the Rarus mine, Heinze claimed that the apex of the entire mineral lode in Butte outcropped on his lands! And due to the fact that he claimed the operations at the Standard Oil mines cause irreparable damage to his operations he requested that the courts issue an injunctions shutting down their operations while the matter was settled in the courts (idling the mines, miners, engineers, equipment, and reducing the return on capital due to the delays). Skilled miners and a good workforce were not easy to assemble, and once idled many would leave for other viable mining operations. The Mining Hall of Fame commentary continues:

> “Heinze flooded them with over 100 law suits, and while the trust appealed, Heinze’s miners raided their properties and stole over a million dollars worth of high grade ore. But Amalgamated fought back: intruding spearheads were destroyed by blasts, corridors were flooded. Heinze twisted the Apex Laws and with his friend, Judge Clancey, the trust was brought down. . . .”

To end the dispute Heinze was bought out by the Standard Oil interests for $12 million, a good premium that some claimed amounted to something close to extortion. “In 1906, Amalgamated absorbed Heinze’s properties” according to the National Mining Hall of Fame, “but for over seven years he had fought the War of the Apex”

While the War of the Apex had been settled, hard feelings remained between the management at Standard Oil and Heinze and his partners. Several Standard Oil executives claimed they would get even with Heinze somewhere or somehow in the future. The role they had in the events following the settlement and purchase of his interests are disputed, but Heinze did meet his match shortly thereafter.

<u>Panic of 1907</u>

Heinze, now one of the wealthiest Americans after the sale of his copper interests, was not done speculating in the copper mining sector. He used the monies he won on the copper mining fights to form a company he named the United Copper Company. He placed several copper mining properties into the company. The stock of United Copper began to trade in the New York financial markets.

Heinze noticed one interesting thing about United Copper. Apparently a number of brokers had ‘gone short’ – sold the stock without owning it, expecting it to decline in value at which time they could replace the shares they had sold. He speculated that if he borrowed $1.5 million he could buy all the outstanding shares of United Copper – and those ‘shorts’ requiring shares would have to pay him a massive premium to buy shares he would then own.

Borrowing ‘on margin’ to acquire all the stock in United Copper it appeared his tactic was working – the price of the stock soared, although it was on thin volume. Then, once he had called in all the outstanding stock on the books of United Copper something astounding happened – somebody was selling large amounts of United Copper shares pushing the price down to levels not seen in years. His banks and financiers ‘called’ their margin loans, but the collateral (United Copper stock) fell as fast as they could liquidate the shares.

THE UNITED COPPER COMPANY INCORPORATED

Heinze Properties Consolidated with $80,000,000 Capital.

Stock Placed on the Market Jumps at Once from 33 to 35—Production Will Be 42,000,000 Pounds Yearly.

News of the formal incorporation in New Jersey of the United Copper Company, the new Heinze combination of copper properties, was receive in Wall Street yesterday about the same time that dispatches from Boston announced that the Calumet and Hecla Mining Company, one of the oldest copper companies, had cut its dividend from $10 to $5 a share.

Today these sales of shares not owned or authorized might be termed ‘naked shorts’ – selling stock you don’t own and which you have not borrowed to sell (it is illegal today, although some claim the practice is not uncommon on Wall Street even in light of regulations prohibiting this practice).

The capital of several banks, trusts, and brokers were essentially wiped out with the failure of the United Copper ‘short squeeze’ – and panic erupted on Wall Street. Eventually banker JP Morgan became involved (there was no Federal Reserve in 1907) which helped calm the markets to a degree. The massive disruption caused by the Panic of 1907 eventually led congress to create the Federal Reserve several years later.

In the end greed, the apex rule, and naked short sellers drove the financiers into a bank run – now known officially as 'The Panic of 1907'. And indirectly led to the creation of the Federal Reserve System.

Questions:

1. Which legal rule creates more uncertainty for the mineral developer, the eastern 'property line' or 'heaven to hell' rule adopted in states such as Michigan in the Daniell case, or the western 'apex rule' such as was adopted in Montana, Nevada, and California?

2. Does the location of a mine determine the ownership law and theory that is applied, or the state of incorporation of the mining company?

3. Is the location of the apex a fact question that is generally decided by a jury, or is it a legal question that is decided by a judge? Why would this matter?

4. If you were approached to invest in a copper mine in Michigan, or alternatively to invest in a mine in Montana, in which state would you have the most concerns as a shareholder with regard to a return on your investment?

5. Same question as #4, but assume you are a banker or financier being asked to fund the development of a mining operation.

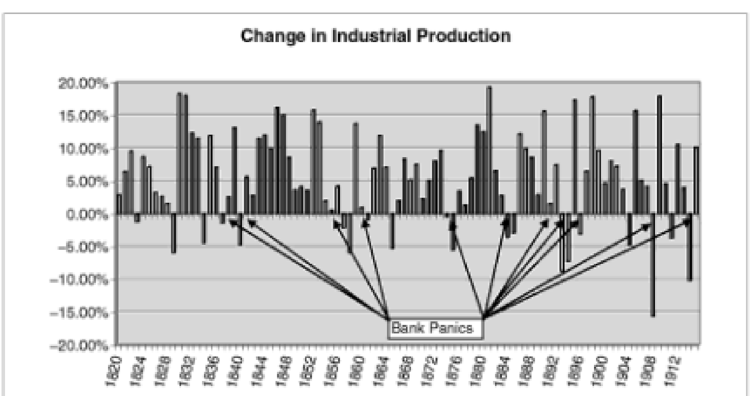
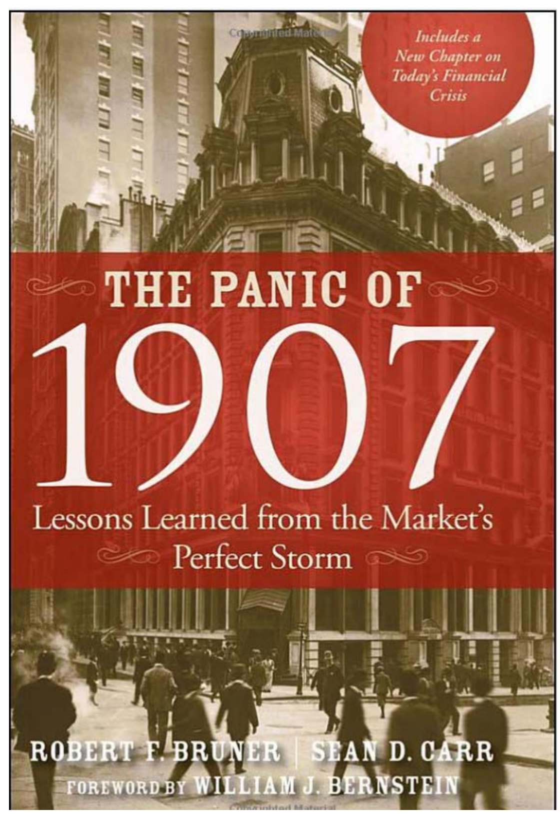


Figure L.3 Banking panics and business cycles.
SOURCE: Graph prepared by authors. Bank panics identified in Calomiris and Gorton (2000), p. 99. Data on industrial production from Davis (2004), the Davis Industrial Production Index, downloaded from NBER web site.



IEA: The Shale Mirage – Future Crude Oil Supply Crunch?

A number of investors have subscribed to the theory that we are entering a new era of global energy abundance, led by technological advances in horizontal drilling and hydraulic fracturing. The domestic price of natural gas in the U.S. has plummeted, and crude oil production has increased to the degree that domestic production in October, 2013 exceeded imported crude oil for the first time in 18 years.

So it was surprising that the most interesting message in the International Energy Agency's (IEA) annual World Energy Outlook (published in November of 2013) – considered the gold standard of energy analysis – was also the most disturbing for those who subscribe to the abundance theory: technology and higher prices have opened up new resources but the IEA is concerned that the world could face a 'future oil supply crunch' as shale development matures.

IEA Chief Economist Fatih Birol noted the positive growth in oil supply documented in the IEA report, but added "this does not mean the world is on the verge of an era of oil abundance".

All Liquids Are Not Equal

The IEA report noted that total world oil production (including natural gas liquids (NGL's)) in 2012 was 87.1 million barrels per day, an increase of 11.9 million barrels per day since 2000. But they noted that more than two-thirds of the increased supply was high-cost unconventional oil (tight oil, oil sands, deep-water oil) or natural gas liquids.

This distinction is important for two reasons. First, unconventional supplies generally have much higher break-even costs than conventional reserves. Finding and development costs from new reserves in unconventional shale plays run from $50 to over $80 per barrel. In 2000 conventional oil reserves were being added in the $10 to $30 per barrel range. Any sustained drop in global oil prices will quickly delay exploration efforts in high-cost prospects.

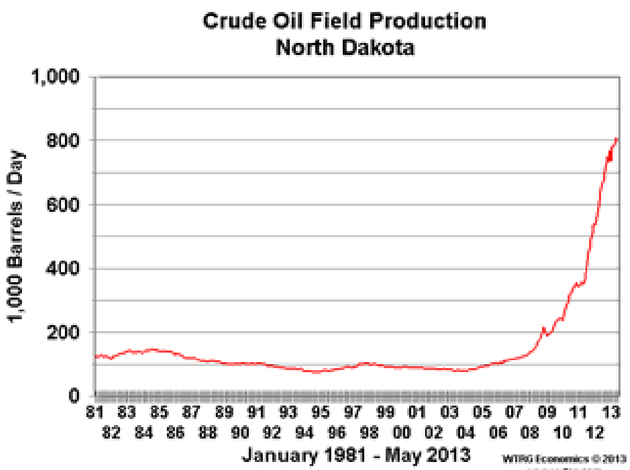
Second, natural gas liquids have a much lower energy density than crude oil. A barrel of NGL, energy wise, is not equivalent to a barrel of conventional crude oil. The heating content of NGL's is generally around 60-70% that of crude oil, and the sharp increase in U.S. liquids production from the Bakken, Eagle Ford, and Marcellus shales have a large NGL component.

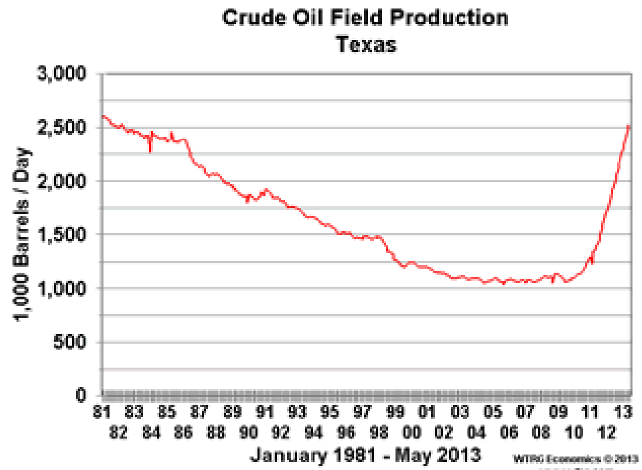
Refineries are limited as to how much NGL's they can blend into their feedstock when producing transportation fuels, which along with the lower energy content, explains why NGL's sell at a significant discount to crude oil prices.

U.S. Production Booming

Led by booming shale output, the IEA noted that non-OPEC supply gains from countries such as the U.S. were offsetting reduced OPEC production volumes seen from Libya, Nigeria, and Iran. The IEA raised its estimate of non-OPEC crude oil supply growth for 2013 by 0.1 million barrels per day to 1.3 million barrels per day in their report. For 2014 the IEA increased the non-OPEC growth estimate to 1.8 million barrels per day. Keep in mind, as noted above, this includes NGL's.

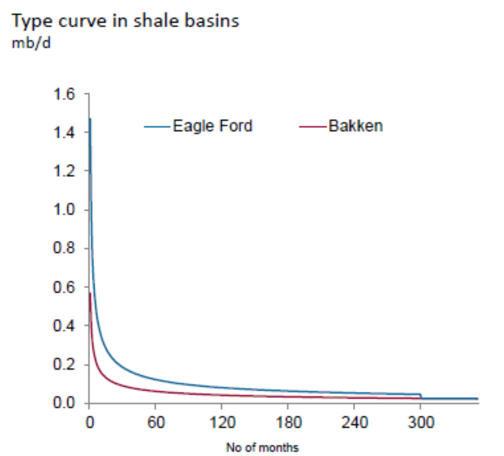
The massive increase in production in the U.S. has been centered in two states: North Dakota and Texas. Charts of historic crude oil production for the last 32 years set out below, courtesy James L. Williams of WTRG Economics (www.wtrg.com), illustrate the trend:





Exponential Decline Curve

While output in the U.S. is booming, the IEA raised concerns about supply growth longer term. The 'decline curve' – that is the natural decline in production rates – from hydraulically fraced wells in the Bakken and in the Eagle Ford formations is much steeper than for the conventional wells drilled in 2000.



Decline rates at liquid plays are extremely steep, and can range between 50-70% after the first year

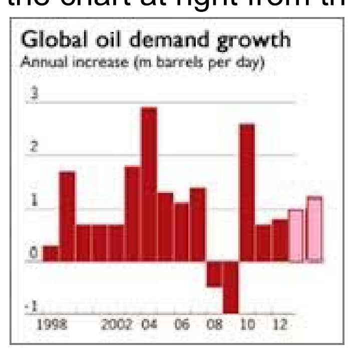
Source: American oil and gas reporter, Energy Aspects analysis

Addressing decline curve issues for unconventional wells, Amrita Sen of London based Energy Aspects consulting recently presented her research to the Aviation Fuel Forum in Miami. In a paper entitled "Reality Check: Scarcity to Abundance" she noted production declines in unconventional wells can be very steep, and in the first year "can range between 50-70%". Chart at right courtesy London-based Energy Aspects.

IEA Global Demand Projections Raised for 2014

Based on the latest data the IEA raised its 2013 global demand estimate to 91.0 barrels per day, and raised their 2014 estimate to 92.1 million barrels per day. That represents a roughly 1.0 million barrel per day increase in 2013 and a 1.1 million barrel per day increase in 2014.

The consistent growth in crude oil demand over the years is illustrated in the chart at right from the Financial Times. Except for the years during the Great Recession crude oil demand grows relentlessly with the global economy. We added the latest IEA demand estimates for 2013 and 2014 (in pink).



The good news, short term, is that if global demand increases by 1.1 million barrels per day as projected by the IEA, and U.S. unconventional production along with other non-OPEC members increases 1.8 million barrels per day, prices in 2014 should remain relatively stable all other factors constant. The IEA report predicts the price of crude oil will remain at the upper end of its recent range. But long term demand growth is relentless, year after year.

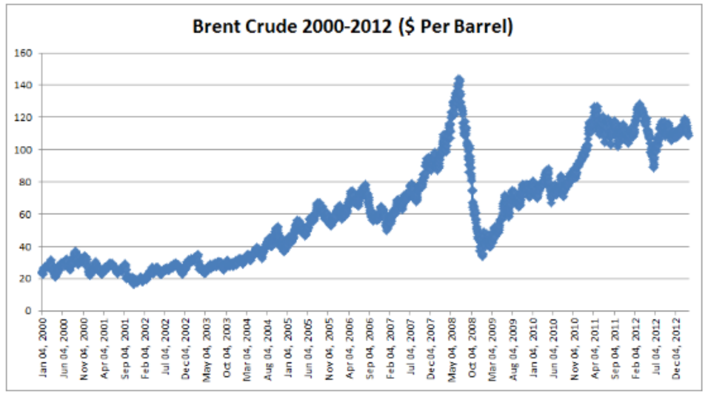
Supply Gains Are Costly, And Getting Moreso

The disturbing portion of the IEA report noted that capital expenditures in the energy sector have seen an astronomical increase. “These ever higher levels of capital expenditure have yielded ever smaller increases in the global oil supply” according to Mark Lewis, former head of energy research at Deutsche Bank.

Capital expenditures for oil and gas development increased from $250 billion in 2000 to $700 billion in 2012 (in constant dollars) according to the IEA report, while the global oil supply (adjusted for energy content) increased by only 14 percent. The report noted annual investments have effectively doubled from $350 billion in 2005 to roughly $700 billion in 2012.

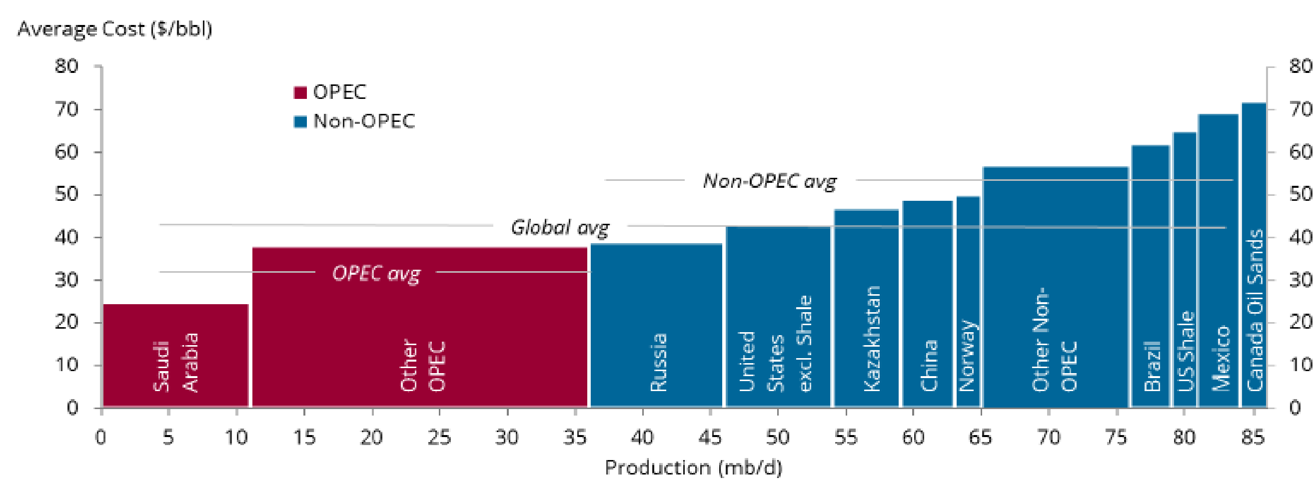
Reviewing the exponential increase, Lewis concluded “the most straightforward interpretation of this data is that the economics of oil have become completely dislocated from historic norms since 2000, and especially since 2005, with the industry investing at exponentially higher rates for increasingly small incremental yields of energy”.

Industry has been willing to finance exploration efforts as global crude oil prices have increased from $25 a barrel in 2000 to $110 in 2012 (chart at right courtesy Forbes). Since the cost curve for unconventional resource development is rising, along with capital expenditure requirements, any weakness in crude oil prices will be reflected in budgeting and will result in reduced developmental activity.



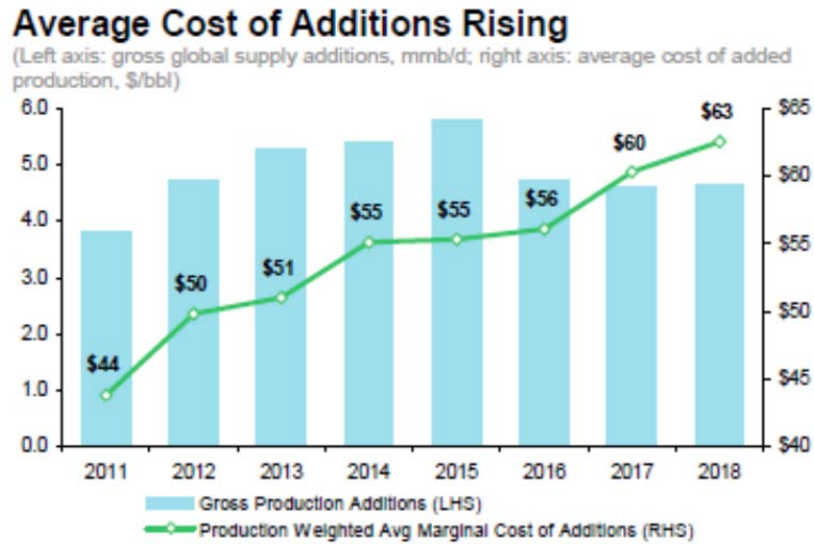
The “average cost curve for the oil market” chart below illustrates the fact that unconventional resources have a much higher break even cost levels (courtesy Amrita Sen of London based Energy Aspects). She concludes “shale plays lie at the higher end of the non-OPEC marginal cost curve, as infrastructure build-outs, decline rates, high levels of rig activity keep costs high”.

Average cost curve for the oil market
$/barrel



Shale plays lie at the higher end of the non-OPEC marginal cost curve, as infrastructure build-outs, decline rates, high levels of rig activity keep costs high

Morgan Stanley issued a report last month that also noted the rising incremental costs associated with increasing oil production. Supply gains are expected to be substantial, but any price declines would quickly impact activity and supplies. Morgan Stanley's experts expect oil prices to remain "range bound over the medium term" (Morgan Stanley cost chart is set out at right).



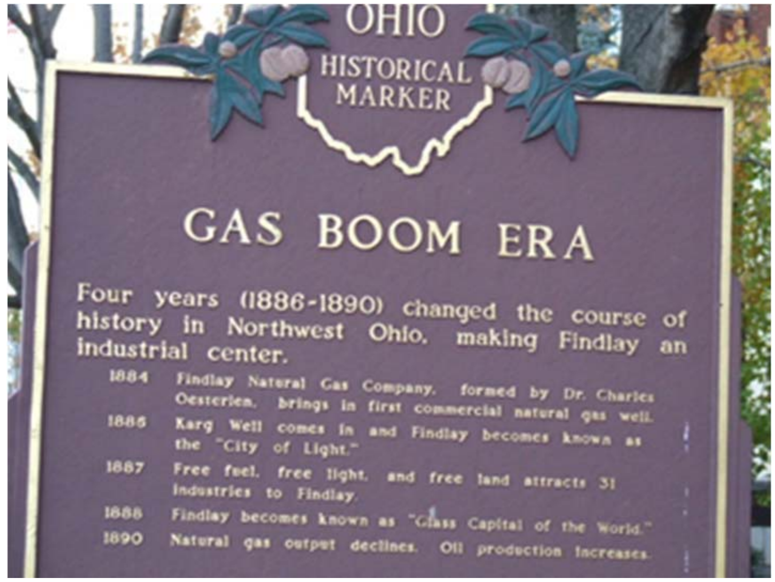
The steep decline curve for unconventional production, coupled with a slowdown in developmental activity should oil prices weaken, could quickly cause a 'supply crunch' and higher prices according to the IEA report and comments by their Chief Economist.

<u>Importance of Finance</u>
Because the cost of developing energy resources is becoming much greater as unconventional reserves are developed, and the returns from such development are increasingly dependent on oil or natural gas prices higher than they have been historically, the role of the financial experts has become more important in the sector.

The energy sector has always been capital intensive, but as the IEA study discussed above indicates the capital requirements continue to increase per unit of energy discovered. How this capital is raised and allocated, and how risks of price fluctuations over the life of a well are addressed, are becoming increasingly important.

<u>Kelly v. The Ohio Oil Company:</u> The 'City of Light'

Driving in the city at night we take illumination for granted – street and car lights, signs, warning flashers – but just over a century ago illumination was a major problem after dusk. Lanterns fueled by whale oil or later kerosene, candles, fires, and coal gas lights (lamps run on natural gas generated from plants that processed coal) were common solutions but proved wanting in supplying sufficient light for indoor or outdoor purposes. Fire was always a concern should equipment fail or be left unattended.



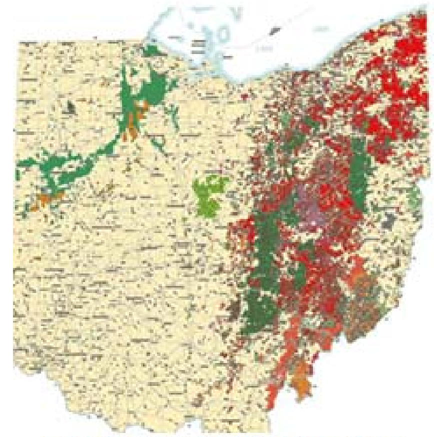
Only with the invention of the light bulb, and the development of electrical generation stations, was the nighttime illumination issue addressed successfully. As simple as it sounds economic productivity soared with this invention. Electrical power and small electric motors were quickly utilized in the manufacturing, farming, and mining industries, and with extended hours provided by illumination many firms saw leaps in their productivity. Due to the central distribution of electrical power many rural areas were left 'in the dark' until governmental policies encouraged rural electrification, subsidizing some of the development.

It is in this pre-light bulb environment we visit the State of Ohio in the 1800's. Natural gas and crude oil were considered a nuisance in Northwest Ohio, ruining a good water well. The hydrocarbons contained elevated levels of sulfur, an element that gave the liquids (and the water well) a pungent odor much like rotten eggs or the smell you might experience driving by a major oil refinery today. Some said the odor was actually a good attribute, acting as a warning to avoid the water wells and associated danger of fire and explosion.

This attitude that oil and gas were a nuisance all changed in 1886. During a four year period the course of history of Northwest Ohio was changed forever. In late 1885 a local doctor drilled a well named the "Karg" natural gas well near Findlay, Ohio – a well that came in with a pressure and volume so great it could not be controlled. Reports are that the roar from the well could be heard for 5 miles, and the flare from the flame could be seen from 40 miles on a clear night. The well burned for months, and Findlay quickly become known as the City of Light.

Some reports were that the Karg well was flaring 14 million cubic feet a day – others claimed up to 40 million cubic feet per day were being burned. To put that in prospective, at the current $4 per thousand cubic feet of natural gas market price, the well was flaring $56,000 to $160,000 of gas (in current prices) per day! Keep in mind the market for significant quantities of natural gas back in Ohio in 1886 was pretty much non-existent, so the value back then of this gas would have been much lower – if it had any value at all.

Seeing a resource that might be used to attract industry city officials in Findlay offered free heat, gas, power, and light from the what was thought to be inexhaustible reserves of natural gas. The population increased from 4,600 in 1884 to 14,000 in 1887, and glass works and other industries located near the city to take advantage of the power source. The gas was also used to illuminate the downtown area.


Oil & Gas Production Map

After several years the massive quantities of natural gas production declined. Crude oil and water intruded into the formations where the natural gas had been held. Our case, Kelley v. The Ohio Oil Company, involves a farm in Findlay – and one where the oil production had become the primary target.

In 1900, Ohio produced more oil than any other state in the United States. Production techniques discussed above, and illustrated in the case, caused the initial natural gas and crude oil boom to collapse. Ohio continues to produce significant quantities of oil and gas. Unconventional resources like the Utica Shale, primarily in Eastern Ohio, are likely to increase production of both natural gas and crude oil.

KELLEY v. THE OHIO OIL COMPANY

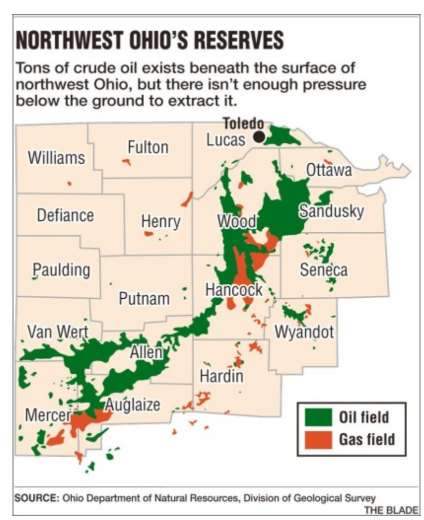
Supreme Court of Ohio
57 Ohio St. 317; 49 N.E. 399; 1897 Ohio LEXIS 121
December 14, 1897, Decided

PRIOR HISTORY: The Circuit Court of Hancock County.

The plaintiff in error was plaintiff below. The cause came on for hearing in the circuit court on appeal, upon the following petition and supplemental petition:

The defendant is a corporation formed and organized under the laws of Ohio.

"One John F. Hastings, of Findlay, in said county, is owner in fee seized and possessed of one hundred and sixty-five acres of valuable mineral oil land, in Findlay, Ohio, and more particularly designated as the west half of the northwest quarter of section No. 1, and the east half of the northeast quarter of section No. 2, in township one, north range, ten east, and that plaintiff has a contract and agreement with said Hastings whereby plaintiff has the right to operate said lands for oil, and take the oil from said land, yielding to said Hastings, a portion or royalty of the oil so produced, the balance to be retained by plaintiff as his own property, and in virtue of said contract, plaintiff is now at work on said land, has two wells completed and a rig up and ready to begin the drilling of a third well thereon.



That said Hastings' land is joined on the east and west by lands now in the possession [***2] and control for oil purposes of the defendant, on which they now have producing oil wells; and the east eighty acres of said Hastings' farm is joined on the south by mineral oil lands owned in fee by the said defendant, and on which also the defendant has producing oil wells. [Map at right courtesy the Toledo Blade (1994 article)].

"That underlying the land of said Hastings, and the lands so adjoining the same on the south and west and east, as aforesaid, is a formation of porous sand or Trenton rock, so-called, which is permeated with valuable mineral oil; that the nature of said mineral oil deposit is such, that when in the process of operating, an oil well is drilled from the surface down into and through said oil-bearing rock, and the usual pumping appliances attached to and employed on said well to extract oil therein, the oil will be drawn to said opening from a long distance through said porous rock, and all the oil within a radius of from two hundred to two hundred and fifty feet surrounding such well, will be drawn to and extracted by means of such well, so that in order to drain and exhaust all the oil in the land it is only necessary to drill the wells from four to five hundred feet apart.

"The defendants, well knowing the premises [***3] and designing wilfully and unlawfully to extract the mineral oil from in and under the said Hastings' land, by means of surface operations on the land so owned and controlled by them, in fraud and violation of the plaintiff's right, and from motives of unmixed malice, have located a line of oil wells along the entire east line of said farm, and upon and along the said south line of the east eighty acres of said farm, which wells are so located just twenty-five feet from the line of Hastings' land, and just four hundred feet apart, all of which wells so located, the defendants threaten and intend to drill at once, with the design and to the unlawful intent and purpose of aforesaid.

"That in view of the well-known tendency of said wells to drain a large extent of territory immediately surrounding them, it is the custom and almost universal practice of oil operators when operating adjoining lands, to locate their wells at least two hundred feet from the line of lands, in order that so far as reasonably practicable, each operator's well shall draw its supply from his own land, and not unnecessarily disturb or detract from the oil mineral wealth of the adjoining lands.

"That the defendant's [***4] holding on the east, consist of about one hundred and sixty acres in a body, and on the south, a very large tract, to-wit: several hundred acres, and there is in the defendants operating said land for oil, no sort of necessity or excuse for the defendants to locate their said wells so unusually near the Hastings line, as there are no wells at all on the Hastings' east or south line, except the wells operated by the defendant, which are more than two hundred feet from the defendant's line, and by plaintiff's contract with Hastings, which is of record well known to the defendant, no well is to be drilled by the plaintiff within two hundred feet of the exterior line of the farm unless it becomes necessary in order to protect the line; so that the only motive of the defendant in so locating its said wells, was to injure the plaintiff and to get the oil which would be available to him in his operation of said farm.

"If the defendants are permitted to extract the plaintiff's oil in the manner as aforesaid, the plaintiff will suffer irreparable injury and will have no adequate legal remedy, for the reason that it will be impossible to determine the exact proportion of the product belonging [***5] to the plaintiff.
"Wherefore, the plaintiff prays that a temporary restraining order issue, enjoining the defendant from drilling and operating any oil well twenty-five feet, or at any point within two hundred feet, of the line of said Hastings' farm, unless it should become necessary to approach nearer in order to protect the line, and that on the final hearing that said injunction be made perpetual."

"And now comes the plaintiff by leave of this court, and for a supplemental petition and in addition to the allegations of the original petition, alleges that since the dissolution of the temporary injunction granted in this action, the defendants have proceeded and located and drilled, and are now operating for oil, or about to begin operating twelve oil wells, nine of which are at the points stated in the petition; and three of which are on the Reimund farm adjoining the Hastings farm on the west; all of which wells are so completed and operating by means of pumping appliances, and all which wells are so operating about twenty-five feet from the lines of said farm. That all of said wells are oil producing wells of greater or less capacity; and that by means thereof, the defendants [***6] are daily extracting large and valuable quantities of mineral oil, a large part of which mineral oil is so drawn and extracted from the deposits thereof in the land of said Hastings, and which oil the plaintiff has, by his contract with said Hastings, the right to take and use and enjoy.

"That said wells draw their supply so indiscriminately from the mines and lands of said Hastings and of the defendants, that it is impossible to distinguish that of the defendant from that of the plaintiff, but all of said oil is so being taken by the said defendant and converted to its own use.

"Wherefore, in addition to the prayer of the petition, the plaintiff prays that the defendant be required to account to the plaintiff for the oil so taken; that the amount thereof be ascertained and that the plaintiff may have a decree in judgment against the defendant therefor and for all proper relief."
The circuit court was of opinion that the petition and supplemental petition failed to state a cause of action against the Oil Company, and therefore refused to hear any evidence, and found from the pleadings in favor of the defendant, to which plaintiff excepted.

DISPOSITION: Judgment affirmed.

OPINION BY: BURKET

OPINION
The question is not as to the motive, fraud or malice which may have induced the oil company to drill the wells sought to be enjoined. The only question of practical importance is, had the oil company the legal right to drill the wells?

When a person has the legal right to do a certain act, the motive with which it is done is immaterial. The right to acquire, enjoy and own property, carries with it the right to use it as the owner pleases, so long as such use does not interfere with the legal rights of others.

To drill an oil well near the line of one's land, [***16] can not interfere with the legal rights of the owner of the adjoining lands, so long as all operations are confined to the lands upon which the well is drilled. Whatever gets into the well, belongs to the owner of the well, no matter where it came from. In such cases the well and its contents [*328] belong to the owner or lessee of the land, and no one can tell to a certainty from whence the oil, gas or water which enters the well came, and no legal right as to the same can be established or enforced by an adjoining land owner.

The right to drill and produce oil on one's own land is absolute and can not be supervised or controlled by a court, or an adjoining land owner. So long as the operations are legal, their reasonableness can not be drawn in question.

As was pointed out in Letts v. Kessler, 54 Ohio St., 73, [HN5] it is intolerable that the owner of real property, before making improvements on his own lands, should be compelled to submit to what his neighbor, or court of equity might regard as a reasonable use of his property.

Petroleum oil is a mineral, and while in the earth it is part of the realty, and should it move from place to place by percolation or otherwise, [***17] it forms part of that tract of land in which it tarries for the time being, and if it moves to the next adjoining tract, it becomes part and parcel of that tract; and it forms part of some tract, until it reaches a well and is raised to the surface, and then for the first time it becomes the subject of distinct ownership separate from the realty, and becomes personal property, the property of the person into whose well it came. And this is so whether the oil moves, percolates, or exists in pools or deposits. In either event, it is property of, and belongs to, the person who reaches it by means of a well, and severs it from the realty and converts it into personalty.

While it is generally supposed that oil is drained into wells for a distance of several hundred feet, the is matter somewhat uncertain, and no right of [*329] sufficient weight can be founded upon such uncertain supposition, to overcome the well-known right which every man has to use his property as he pleases, so long he does not interfere with the legal rights of others.

Protection of lines of adjoining lands by the drilling of wells on both sides of such lines, affords an ample and sufficient remedy for the [***18] supposed grievances complained of in the petition and supplemental petition, without resort to either an injunction or an accounting.

The case of Coal Company v. Tucker, 48 Ohio St., 41, and Collins v. Chartiers Valley Gas Company, 131 Pa. St., 143, and other like cases in which some harmful substance was sent, conveyed or caused to go from the premises of one to the premises of another, have no application here, because in this case, nothing reached the plaintiff's lands from the premises of the defendant, and the only complaint is, that the oil company so used its own premises as to secure and appropriate to its own use, that which came into its lands by percolation, or by flowing through unknown natural underground channels. This it had a right to do. While the drilled oil well is artificial, the pores and channels through which the oil reached the bottom of the well, are natural.

Judgment affirmed.

Questions:

1. In what state were the lands located in this case? Why is that important?

2. In what year was the dispute decided by the court? Why is that important? What court made the decision?

3. In a lawsuit the ‘plaintiff’ is the party that brings or initiates the lawsuit or action asking for relief. They have the burden of proving their case, and if they meet that burden they also have to prove they have been damaged and to what extent. Who is the plaintiff in this case?

4. In a lawsuit the 'defendant' is the party against whom the action is filed. Who is the defendant in this case? Does it make any difference that a defendant is a company or corporation?

5. In the case they describe the plaintiff's property as follows: the west half of the northwest quarter of section No. 1, and the east half of the northeast quarter of section No. 2, in township one, north range, ten east.

   A. How many acres of land are involved in this dispute?

   B. How many acres are in a "section" of land?

   C. How long is each side of a section? Note in many states the government has reserved an easement so they can build roads along these section lines – which is why we see many of these roads across the country named "Section Line Road"

   D. State regulations, including those of the Texas Railroad Commission, require a sign at each oil or natural gas well with the well name, operator, emergency contact information, and legal description of the lease tract.

The Della Pia well, located in a Filer Township neighborhood, contains 43,000 parts per million Hydrogen Sulfide gas, far exceeding the lethal concentration. This photograph shows that this dangerous well has no phone number posted in case of emergency.

   E. Draw the plaintiff's property on the section map below:

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Township One North

Range Ten East

6. Does the motive of the defendant in drilling so close to plaintiff's land matter in this case?

7. In light of this decision what issues would a banker or financier have with regard to financing oil and gas ventures? Would this decision create issues even if they knew for sure that oil and gas were under the lands to be developed?

8. Why would the plaintiff complain about the defendants wells being so close to the property line if they could drill offsetting wells on their lands?

9. The court notes that the plaintiff claims as follows:

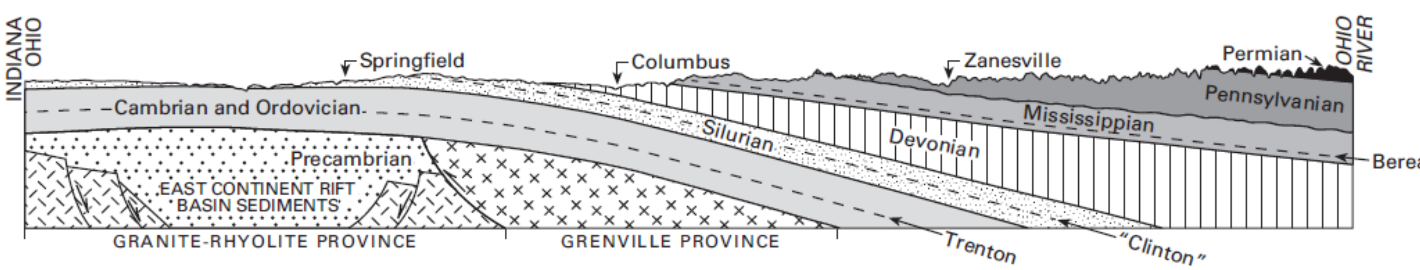
    "the nature of said mineral oil deposit is such, that when in the process of operating, an oil well is drilled from the surface down into and through said oil-bearing rock, and the usual pumping appliances attached to and employed on said well to extract oil therein, the oil will be drawn to said opening from a long distance through said porous rock, and all the oil within a radius of from two hundred to two hundred and fifty feet surrounding such well, will be drawn to and extracted by means of such well"

    How does the plaintiff know that a well will drain a 'radius of from two hundred to two hundred and fifty feet'? If the property line is straight, but the drainage radius is curved, do you think this would cause ownership or reserve recovery issues?

10. The "Trenton Rock" was a well known target formation in Ohio at this time. In many places it was only 1,500 feet or less below the surface. Apparently it was a limestone reef formation that was formed millions of years ago when the area was covered with a shallow sea. According to geological interpretation around 450 to 500 million years ago a shallow warm sea covered Ohio, and the state was located south of the equator. As time progressed sea levels fell, and the shallow sea covering Ohio disappeared. The pore spaces of the limestone were filled with oil or natural gas millions of years later. Southern Michigan likewise had a shallow sea and limestone formations form during this time period.

    The Ohio Department of Natural Resources published a cross section chart of the formations underlying the state. Note the "Trenton" formation designated at the bottom of the diagram in the Cambrian and Ordovician age rocks.

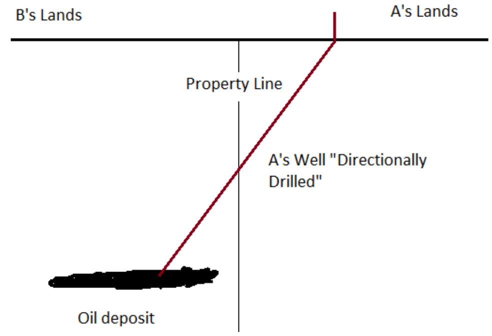
    Due to the geological forces that shaped the area a party in West Ohio driving east would find the age of the rocks outcropping on the surface would get younger and younger as they approached the Pennsylvania state line. The Cambrian is 500+ million years old, Ordovician 450-500 million, Devonian 360–420 million years old, to the Pennsylvanian 300-315 million years old and Permian (250-300 million). So a party driving from Columbus to the Ohio River on the Pennsylvania state line would actually be going back in time more than 100 million years – if time were measured by the outcropping rock!



    Today Barnett shale wells being drilled in the Dallas/Fort Worth area of Texas are drilled to roughly 7,000 feet more or less. Drilling rigs can drill to 20,000 feet or deeper in the modern era. With depth we find higher pressures and temperatures, which makes drilling more difficult.

    Does the age of the formations, or depth they are found at, have any legal or business related consequences we should be aware of?

11. Under the holding of this case can a party ‘slant drill’ under a neighbor’s land to get the oil or natural gas? ‘Slant drilling’ being defined as having the surface location on lands that you own or lease, and the ‘bottom’ of the hole located on your neighbor’s property?



Note that an operator of a well being drilled by regulation might be required to conduct a ‘downhole’ survey and file the results with the state agency under Texas Railroad Commission Rule 11 which provides:

> All wells shall be drilled as nearly vertical as possible by normal, prudent, practical drilling operations. Nothing in this section shall be construed to permit the drilling of any well in such a manner that the wellbore crosses lease and/or property lines (or unit lines in cases of pooling) without special permission.

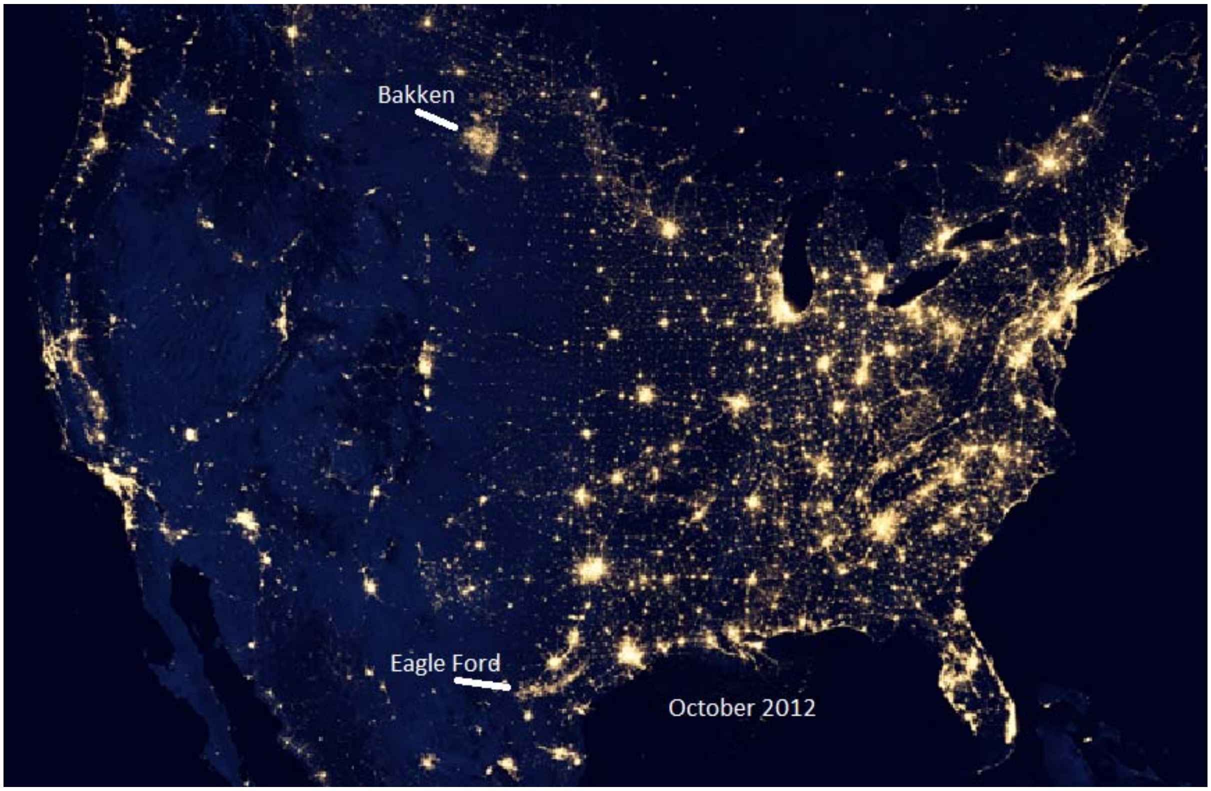
12. The “City of Light” has been re-created on a small scale in Dallas/Fort Worth as wells are completed and ‘flared’ as the operators recover ‘hydraulic fracturing’ water and lower formation pressure to encourage oil and natural gas production. The following flare was on I-20 in Grand Prarie at 4 am in the morning – and I took a picture with my phone as I drove by. The well flare was visible for more than five miles away – I had guessed it was a major warehouse fire when I first saw it. The light from the flare was reflecting off the low cloud cover, making it more impressive.

The picture at right was allegedly taken near Benbrook, Texas, in 2009 as a new Barnett shale well is flared to the atmosphere. Burning the gas in theory should burn off all the contaminants that might cause health issues – hydrogen sulfide, benzene, toluene, xylene, ethyl-benzene and other impurities. Putting the natural gas into a pipeline instead of flaring it would raise issues since the gas quality is unknown (heating value, moisture content, impurities) and might put the natural gas distribution system at risk.

Picture Source: http://www.texassharon.com/2009/06/30/chesapeake-energy-flares-barnett-shale-well-in-benbrook-texas-neighborhood/

The New ‘City of Light’: Bakken & Eagle Ford Fields

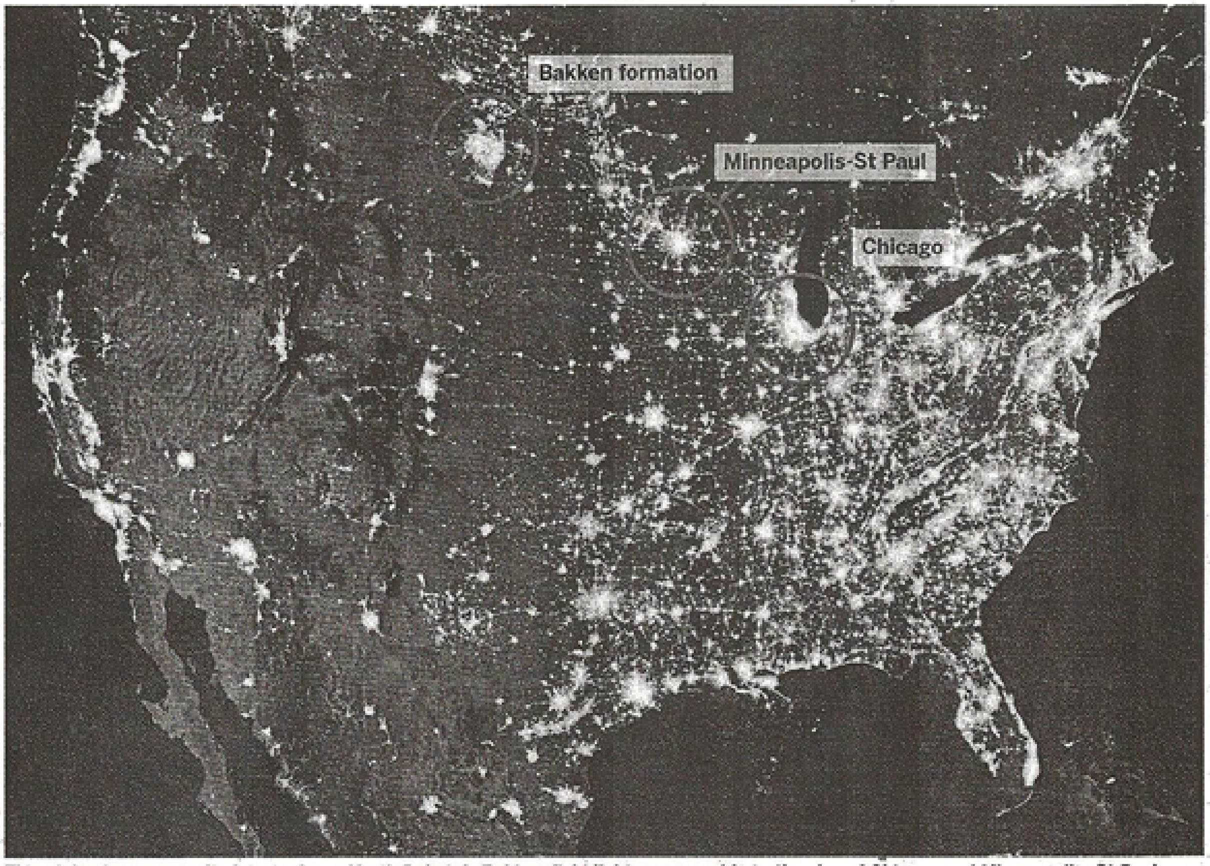
One hundred and twenty five years after the famous Karg natural gas well blew out, making Findlay, Ohio the ‘City of Light’ we find a different oil and gas exploration driven ‘city of light’ – this time located on the desolate plains of North Dakota. The NASA image below was taken in October of 2012. It appears that a city the size of Minneapolis, Dallas or Denver exists on the North Dakota plains. Equally interesting is the ‘golden crescent’ in South Texas, site of the Eagle Ford play.



NASA images taken several years earlier show no North Dakota city of light, or Texas golden crescent. The development of unconventional shale formations has changed the economy – and the environment – and can be seen even from space.

From the front page of The Financial Times (Jan 28, 2013):

Shale boom fires environment fears as US gas flaring is visible from space



This night-time composite image shows North Dakota's Bakken field lights comparable to the size of Chicago and Minneapolis–St Paul Nasa

By Ajay Makan in London and Ed Crooks in New York

Companies at the heart of the US shale oil boom are burning off enough gas to power all the homes in Chicago and Washington DC combined, in a practice causing growing concern about the waste of resources and damage to the environment.

The volume of unwanted gas being flared off in North Dakota, the state leading the shale revolution transforming the outlook for US energy, rose by about 50 per cent last year. The surge at the state's Bakken formation is being replicated in other shale regions with Texas' state regulator issuing 1,963 permits to flare in 2012, sharply up from the 306 in 2010.

The rapid increase has made the US one of the world's worst countries for gas flaring. The volume of gas it flares has tripled in five years, according to World Bank estimates, and it is the world's fifth highest, behind Russia, Nigeria, Iran and Iraq.

The flaring is a result in large part of North America's low gas price, which makes it uneconomic to build pipelines and tanks to handle gas released by oil production. Flaring can be the safest way to dispose of it.

The lights of flares burning in the Bakken and Texas' Eagle Ford shale fields can be seen in night-time satellite photos.

The volume of gas it flares puts the US fifth in the world rankings, behind Russia, Nigeria, Iran and Iraq

Flaring has alarmed investors and environmental campaigners because of the waste and its consequences for greenhouse gas emissions, air pollution and disturbance to communities.

Flaring in North Dakota lifts by about 20 per cent the emissions from the state's oil production, refining and transport, compared with the US average, according Financial Times analysis of official data.

Investors managing a total of $500bn last year wrote to oil companies including ExxonMobil, Chevron, Statoil and US independents warning that "excessive flaring, because of its impact on air quality and climate change, poses significant risks for the companies involved". Since then, flaring in the US and concerns over it have only increased.

This month, Mercy Investment Services, which manages the investments of the Sisters of Mercy order of nuns, filed a shareholder resolution calling on Continental Resources, the leading oil producer in the Bakken, to adopt clear goals for cutting or eliminating flaring.

Continental said it already flared proportionately less gas than the industry average, was making progress on further reductions and agreed to report on its progress in 2013.

The North Dakota legislature is considering a bill to encourage flaring reduction through tax breaks.

Flaring puts heat on US, Page 2
Gains of US shale, Page 17

Natural Gas Flaring & Oil & Gas Development

In Texas the regulators realize that many newly developed areas might require flaring to insure the safety of the drilling crews and public, especially when testing a newly drilled well.

The Railroad Commission's Statewide Rule 32 allows an operator to flare gas while drilling a well, and for up to 10 days after a well's completion, so that operators can conduct production testing to determine if they will completed or plug a newly drilled well.

The majority of flaring permit requests received by the Commission are for flaring 'cashinghead gas' – that is natural gas that is produced with the crude oil or natural gas liquids from oil wells. Permits to flare from gas wells are not typically issued as natural gas is the main product of a gas well.

Flaring of casinghead gas for extended periods of time may be necessary if the well is drilled in areas new to exploration. In new areas of exploration, pipeline connections are not typically constructed until after a well is completed and a determination is made about the well's productive capability.

Commission staff can issue flare permits for 45 days at a time, for a maximum limit of 180 days. The 180-day limitation does not apply for volumes of gas less than or equal to 50 thousand cubic feet (mcf) of hydrocarbon gas per day for each gas well (with natural gas selling at near $5 MCF, this is a loss of revenue of $250 per day maximum).

The Commission is allowed to renew a 180 day flaring exception authorized by Rule 32, with an administrative renewal by the agency not to exceed a period of 180 days.

Bottom line is that flaring is allowed under these rules in Texas for up to 12 months, and for longer periods for small emissions of cashinghead gas. It is in the interest of all the parties that the production, if economic, be sold to third parties for transport to a viable market.

Due to the intense development of the liquids rich North Dakota Bakken formation, and the Eagle Ford formation in Texas, flaring has become a major issue in these fields due to the lack of pipeline infrastructure. Liquids can be easily stored and trucked off site for sale, but natural gas is much more difficult to store and sell. The lack of pipelines also impedes natural gas sales.

With the rule of capture, a shut in oil well that also produces natural gas runs the risk that oil reserves will be captured by offset wells or operators, reducing the oil and gas in place and impeding the economics of the prospect. On the other hand, flagrant flaring of natural gas as the operator produces and sells the crude oil and natural gas liquids might be considered a waste of valuable assets endangering both the environment and cheating the royalty/mineral owner out of proceeds that would be obtained of the sale of the natural gas product.

FX Energy's Szymanowice #1
Production Test, Poland
Jan. 2014

The following article addresses the fact that regulators continue to examine the issue in an attempt to balance the interests of all the parties involved, as well as the public interest in the efficient development of oil and gas reserves.

THE DICKINSON PRESS

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NORTH DAKOTA WANTS 'A BETTER PLAN' ON

FLARING NATURAL GAS

Reuters File Photo

An aerial image shows a natural gas flare after sunset outside of Williston on March 12. Oil drillers in North Dakota's Bakken shale fields are losing out on more than $100 million per month in lost revenue as the amount of natural gas flared continues to balloon, despite near-universal efforts to curb the controversial practice, according to a study released July 29.

Oil regulator: 1,500 wells around Oil Patch burning away resource

By TJ Jerke
Forum News Service

BISMARCK — North Dakota's top oil regulator said Wednesday about 1,500 oil wells around the Oil Patch are flaring natural gas and not connected to a pipeline.

Of those, he said upwards of 450 are in such remote locations, it's unlikely they will ever get connected.

"We want to do something to encourage them to implement new well processes," said Lynn Helms, director of the Department of Mineral Resources. "We may not be able to get at the number of wells flaring, but we can affect the volume of gas flared."

Helms brought the issue before the North Dakota Industrial Commission, composed of Gov. Jack Dalrymple, Attorney General Wayne Stenehjem and Agriculture Com-

But Helms brought up the issue of flaring Wednesday and the state's policy that allows oil companies to continue flaring and pumping oil at full potential while they get gas-gathering pipelines in place.

Operators that are flaring are supposed to reduce the amount of oil production according to a specified schedule. For example, operators could be required to reduce production to 200 barrels per day after 60 days and to 150 barrels per day after another 60 days.

Companies report to the department every six months, and those still not connected to a natural gas pipeline often request extensions to keep producing oil at the higher rate — and continue flaring.

This month, Helms said he signed 21 extensions with another 117 requests pending.

He said it's even more important to have the conversation about flaring as oil companies are drilling more wells per oil pad.

Stenehjem couldn't agree more, adamant that the state

Interoil Corp. (IOC): International Natural Gas Development & Flaring

Crude oil has historically been the easier hydrocarbon to produce from a producing well since it can be easily stored, and shipped via train, barge, pipeline, or truck to a refinery for further processing. In addition, crude oil, from an economic standpoint, has historically been the more lucrative product to producer as compared to natural gas.

Over the last several decades natural gas has become much more valuable as a fuel, and the historical perception of the fuel as a low value byproduct of crude oil production has disappeared. Natural gas in generally burns cleaner than crude oil, and is cheaper on a heating content basis, but lacks the energy density of oil or refined products such as diesel fuel.

The main problem with natural gas is that it is very difficult to store and ship compared to crude oil. A pipeline is generally the method of transportation used to move the natural gas to market, and in developed economies natural gas storage caverns can be used for gas storage.

In more remote areas of the world a discovery of a natural gas field, however large, is problematic since pipelines of any distance are expensive to construct, and existing markets tend to be distant from newly discovered fields. One alternative, a very expensive option, is to liquefy the natural gas by cooling it to extremely cold levels then shipping the natural gas liquid (NGL) in large ocean-going vessels.

The cost of setting up a 'train' of equipment to liquefy natural gas in the quantities to make the operation economically viable usually cost between $5 to $10 billion. Facilities to re-gassify the LNG usually cost around $1 billion. The ships, specially constructed, are also very expensive.

So when drilling in remote areas the goal is to find crude oil. Natural gas, if found, will need to found in large quantities to justify a massive LNG liquefaction facility – and it will be difficult without production data to know if enough reserves exist to economically justify construction. In addition, the political environment can also be a concern, due to taxation or even questions with regard to the stability of the nation involved.

Where crude oil is found natural gas is usually associated with production. Unlike the U.S. where flaring is restricted, in many less developed countries the operator is allowed to produce the crude oil, recover the natural gas liquids that might be produced, and can flare the natural gas due to a lack of market and a viable alternative to monetize that asset.

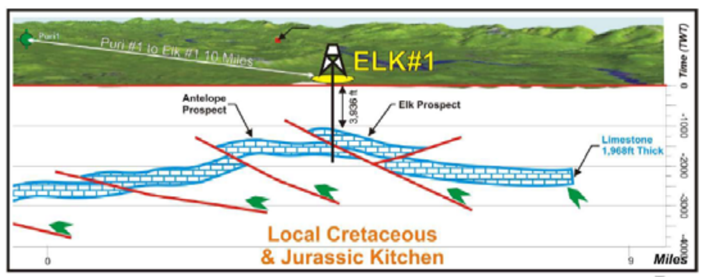
All these factors have been in play when Houston-based Interoil Corp (IOC) began drilling in the wilds of Papua New Guinea for crude oil about a decade ago. After using seismic technology, and several dry holes, the company found an oil well with lots of natural gas – or a natural gas well with a lot of oil.

A summary of the situation, written up in August of 2006, is as follows:

INTEROIL CORP. (IOC - $19.13) issued an updated drilling report on their Elk #1 well located in Papua New Guinea. The Elk well is an oil prospect, but oilfields in Papua New Guinea tend to have associated natural gas. We contacted a petroleum engineer with 30 years experience and asked him to review the drilling reports and give us his impression. He concluded the well will most likely produce a 'significant' amount of liquids if it is not an oil well - and he surmises that IOC drilled into the gas cap of an oil reservoir (IOC used seismic to locate the structure, so it makes sense they hit at the gas cap).

The Elk prospect is undrilled, untested, and remote, and the Elk well is the third well of an eight well wildcat drilling program, all the wells to be drilled by the end of next year (2007). The first two wells were non-commercial (dry) - the success ratio for wildcats is roughly one in eight to one in ten. IOC has shot a substantial amount of seismic surveys over the prospect areas in an attempt to locate attractive drilling locations and potential hydrocarbon traps.

A picture of the well being flared is at right. The amount of gas, downhole pressure, and calculated open flow volumes were quite impressive. IOC announced that additional wells might be needed at the Elk location to evaluate the find.



The structure at the Elk is a large fault separated anticline with a large pay zone - but they need to drill through the rest of the pay zone to confirm it is present. IOC has drilled roughly 6 feet into pay zone according to reports, and have another 1900 feet to go - a very large pay zone if seismic and other indications are correct.

The reservoir is permeable and porous and highly pressured - very positive. Hydrocarbons are obviously present, so we know we have the petroleum source rock if we have a trap - which bodes well for future wells to be drilled, increasing the odds of success in this prospect as well in the other nearby prospects.

Liquids, if this is an oil well, are light and sweet (premium) and could be refined in their Papua New Guinea facility. If the well is not an oil well the liquids are still very high quality and they will produce get a large volume of them, assuming the well can be produced and the gas is not stranded.

The latest Raymond James report on the company had a $30 target price. In their latest report Raymond James concludes:

> The news of the apparent discovery is clearly bullish. The high flow rate and pressure indicate a potentially significant discovery. The company noted, and we would emphasize, that these test results are preliminary, and further testing will be required to establish commerciality. In addition to acquiring wireline logs and further data for evaluation, current plans call for appraising Elk #1 with two or three additional wells. As we stated before, given the seismic control, new rig capabilities, reservoir quality rock

encountered at Triceratops (a nearby prospect), and the results encountered to date, we are very optimistic on the prospects for Elk. We reiterate our Outperform rating.

A June 29th article in PNGIndustryNews.net noted:

> Just this week, InterOil struck gas at its Elk-1 wildcat well in PNG's Gulf Province. Gas started to flow under tremendous pressure just 2m after the company's rig entered the zone of interest. It still has 600m to go.
>
> Together with the adjoining Antelope structure, there is a total area of 46 square kilometres. Until this structure is drilled, possibly after some step-out wells at Elk, the experts will have to wait in anticipation to discover if there may be oil, gas or nothing in there.
>
> But Elk itself, where InterOil had a pre-drill estimate of its potential at 3.8 trillion cubic feet, could be much larger, given the gas pressures and flows that have been witnessed. It is also possible that it is underlain by an oil leg – something that laboratory testing on the wetness of the gas could indicate.
> All this is excellent news for InterOil, which recently signed a memorandum of understanding with the PNG Government and two global partners for possible development of a liquefied natural gas project.

Keep in mind until the company drills deeper and conducts further tests we will not know if the well is commercial. This company is a legitimate microcap energy play that could easily double if the upcoming exploration news is positive. We expect this well to reach total depth within the next two months. Additional drilling reports and testing information will be released by the company as warranted. We have over-weighted our portfolio with this position.

This well was flared in August of 2006, but the uncertainty regarding the stability of the government, the question as to if this was a natural gas well or oil well, the questionable ability to market the natural gas (and the cost and delays inherent in building a LNG facility), meant that the stock did not immediately react to the massive find – and one of the largest natural gas flares ever seen from a well.

The company recently announced they are partnering with a larger entity to build a LNG plant which will export the natural gas to Asian markets.

Technology: Rotary Drilling & Downhole Surveys

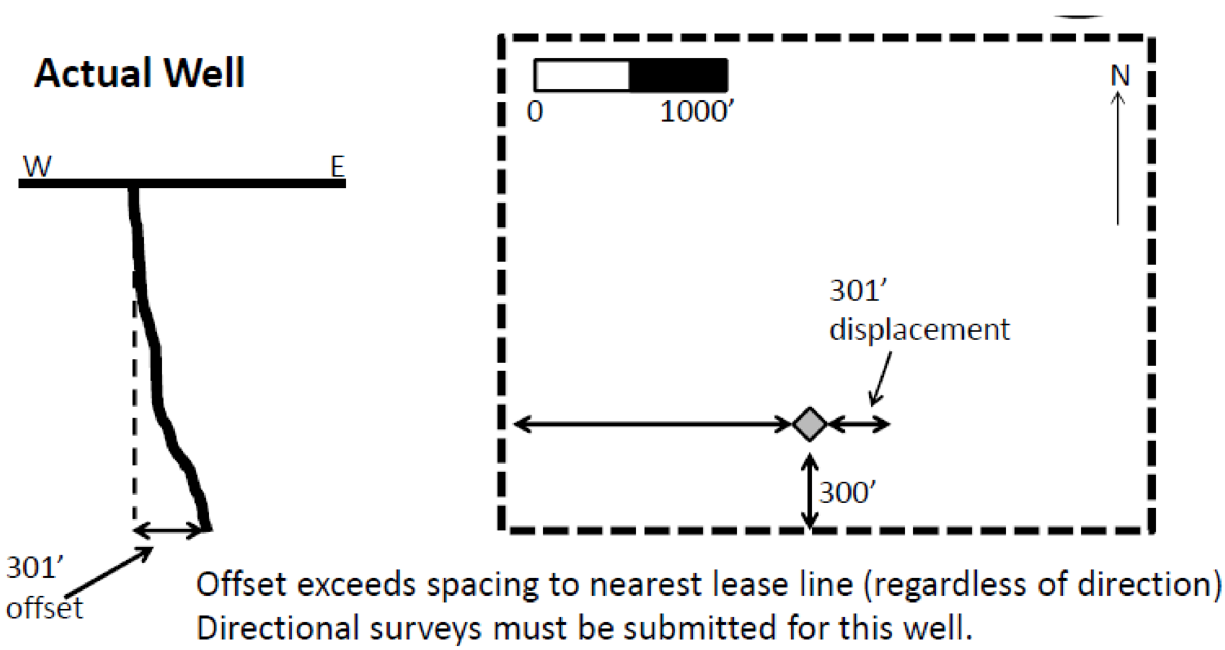
In the early years of oil and gas development in Texas many exceptions were granted allowing operators to drill on very small leases, and either by accident or on purpose the wellbore could be deviated across lease and property lines. As a result the Texas Railroad Commission adopted regulations (Statewide Rule 11) for the drilling of vertical wells which specifies that:

> "all wells shall be drilled as nearly vertical as possible by normal, prudent, practical drilling operations. Nothing in this section shall be construed to permit the drilling of any well in such a manner that the wellbore crosses lease and/or property lines (or unit lines in cases of pooling) without special permission."

The Commission requires that the operator of a new well being drilled submit an inclination, gyroscopic, or "MWD" (measurement while drilling" survey for review on most wells drilled, with several minor exceptions under the rule. This submission can be done online, and accessed by third parties online, and must be certified as accurate by a third party service company.

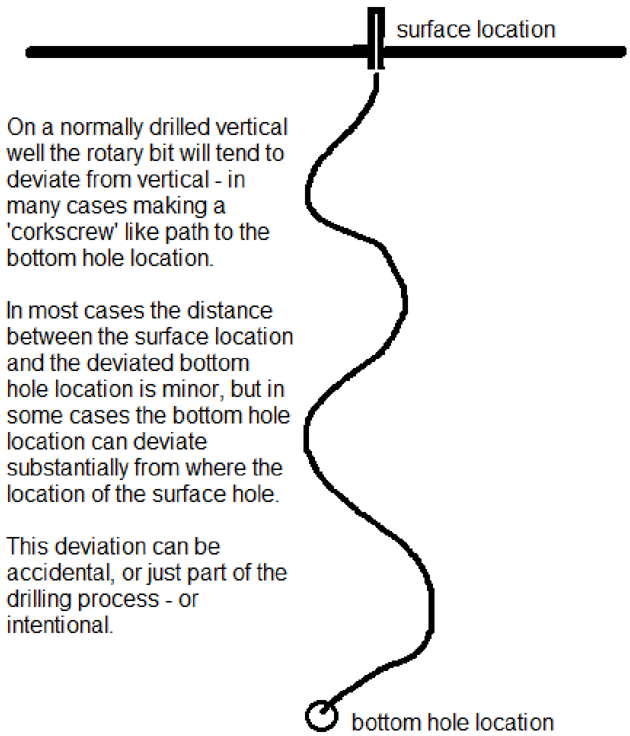
Should the survey indicate the well is closer to the lease line than regulations permit it will either need to be plugged back, or production could be penalized as the regulators attempt to insure each owner obtains their 'fair share' of production and the reserves in place (protecting the 'correlative rights' of the mineral owners and lessees).

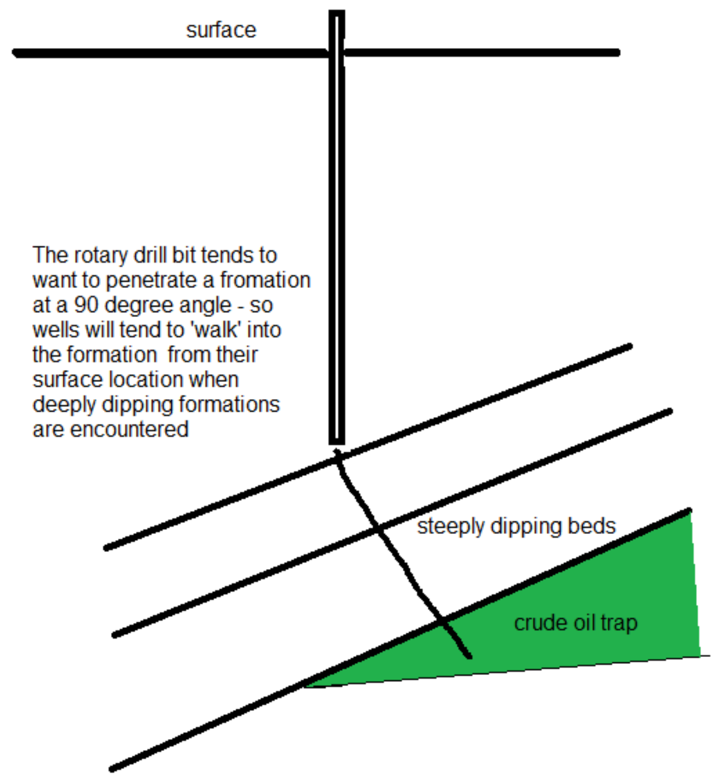
When using an inclination survey the presumption is that the well is deviating toward the nearest lease line for spacing and setback purposes, and the operator might have to run more accurate surveys to locate the bottom hole location for the well to insure that it is in compliance with the setback rules (plat below from TRRC seminar presentation).



In many cases the displacement between the surface location and the downhole location is accidental. With rotary drilling the drill bit constantly turns to the right as it penetrates the ground. As a result in many cases it makes a 'corkscrew' like wellbore (highly exaggerated in the illustration) as the well is drilled.

When steeply dipping formations are present the rotary bit will tend to 'bite' or 'walk' into the formation at a 90 degree angle – which also will move the downhole location away from the surface location. Formations of different hardness and compaction will also impact the speed of drilling and deviation.





The following is an odd story about the application of World War II technology to oil and gas industry downhole surveys, recently retold by a professional acquaintance:

> Some may not be aware that gravity assures that the old cable tool drilling rigs drilled a straight, vertical hole. Then rotary drilling rigs were introduced, their well bore tends to 'walk up dip'; by that I mean when a rotary rig drills into formations at depth that are dipping, there is a tendency for the bit to wish to drill at right angles to the dipping formation (the bit walks up dip).
>
> Due to the fact that rotary drilling did not drill a straight vertical well, there was the problem of not knowing the bottom hole location (also needing to know the vertical depth as opposed to the measured depth). There was the need/desire to obtain a directional survey of the well bore to accurately understand the trajectory of the well bore.
>
> The first well logging tool that was constructed to do this used a bit of surplus WWII hardware - and that was the inertial guidance system from the German V-2 Rocket. The technology that allowed a rocket launched from Peenemünde on the German Coast to strike the Docks in the East End of London was harnessed to create a new well logging tool.

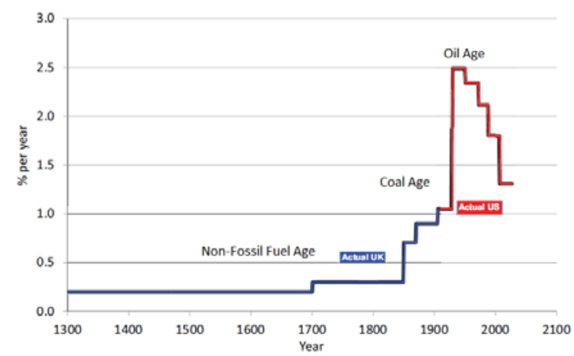
Studies: Has U.S. Economic Growth Permanently Slowed?

Northwestern University economist and productivity expert Robert Gordon published a study in 2012 addressing the question of whether growth of the U.S. economy has permanently slowed. Why can't we live in a no-growth environment?

First, population growth requires economic growth just to keep everyone with the same standard of living. Second, developing countries seek to have the luxuries that we take for granted in North America and in Europe. Third, aging societies will require more and more complex health care, services that can only be provided effectively with the resources generated from a growing economy. Keep in mind that in general, economic growth requires more energy.

While we take global economic growth for granted there was virtually no economic growth before 1750 according to Gordon – the economy was in a permanent state of stagnation. Due to the lack of growth and innovation a person born in 1700 would expect to live a life very similar to that experienced by their ancestors 200 years before.

Figure 1 Growth in real GDP per capita, 1300-2100



In all of human history it is only during the last 250 years we have seen a rate of economic growth that has materially improved the lives of each succeeding generation.

Dr. Gordon's study asks if the rapid progress and economic growth seen over the past 250 years was a "unique episode" in human history. If so "economic growth may not be a continuous long-term process that lasts forever."

In his research paper, "Is U.S. Economic Growth Over?" published by the National Bureau of Economic Research, Gordon identifies six "headwinds" that buffet the U.S. economy: (1) a labor force shrinking as the population ages, (2) a "plateau in educational attainment," (3) increasing inequality, (4) outsourcing, (5) ever-higher energy prices, and (6) rising government and household debt.

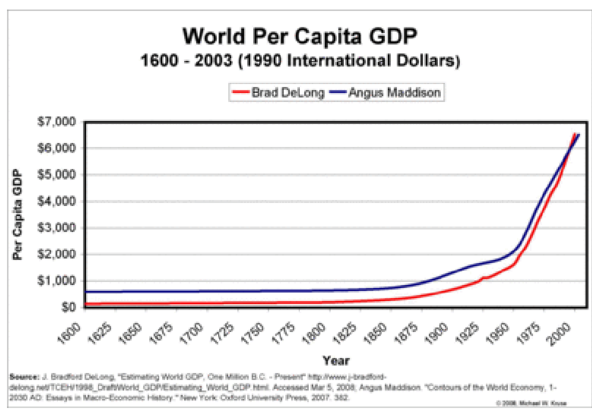
He claims that inventions during the industrial revolution — first the steam engine, the internal combustion engine, then widely available electricity — jump-started the economy, but modern innovations such as the computer, telecommunications, and Internet may not have this power. If his thesis is correct the economy may continue to grow at a very slow rate compared to the last century.

Age of Fossil Fuels – The use of coal, crude oil, and natural gas all correlate very closely with historical economic growth. In fact, based on the energy content of the fossil fuel used daily by the average American it could be argued that each citizen has around 150 'energy servants' at their disposal.

Most economists, including those who prepared the data behind Gordon's chart, have argued that economic growth drives energy demand. The correlation between economic growth and fossil energy use generally yields a coefficient of determination in the 0.9 range or above – meaning energy use and growth track each other very closely.

Rubin on Oil Prices & Growth – Also addressing the issue of economic growth economist Jeff Rubin has published a new book in 2012 entitled "*The Big Flatline: Oil and the No-Growth Economy*". He claims that for most of the last century inexpensive oil powered global economic growth. But in the last decade he notes the price of oil has quadrupled, and "that shift will permanently shackle the growth potential of the world's economies." He notes:

> The countries guzzling the most oil are taking the biggest hits to potential economic growth. That's sobering news for the U.S., which consumes almost a fifth of the oil used in the world every day. Not long ago, when oil was $20 a barrel, the U.S. was the locomotive of global economic growth; the federal government was running budget surpluses; the jobless rate at the beginning of the last decade was at a 40-year low. Now, growth is stalled, the deficit is more than $1 trillion and almost 13 million Americans are unemployed.
>
> And the U.S. isn't the only country getting squeezed. From Europe to Japan, governments are struggling to restore growth. But the economic remedies being used are doing more harm than good, based as they are on a fundamental belief that economic growth can return to its former strength. Central bankers and policy makers have failed to fully recognize the suffocating impact of $100-a-barrel oil.
>
> Oil provides more than a third of the energy we use on the planet every day, more than any other energy source. And you can draw a straight line between oil consumption and gross domestic product growth. The more oil we burn, the faster the global economy grows. On average over the last four decades, a 1 percent bump in world oil consumption has led to a 2 percent increase in global GDP. That means if GDP increased 4 percent a year — as it often did before the 2008 recession — oil consumption was increasing by 2 percent a year.
>
> At $20 a barrel, increasing annual oil consumption by 2 percent seems reasonable enough. At $100 a barrel, it becomes easier to see how a 2 percent increase in fuel consumption is enough to make an economy collapse.



As the cost of fossil fuels increases the high degree of correlation between fossil fuel use, economic growth, and the cost of energy will be an important one. Chart at right courtesy Kruse Kronicle: http://www.krusekronicle.com/kruse_kronicle/2008/03/charting-histor.html

Questions:

1. If the U.S. economy has permanently slowed due to the higher energy costs set out in the reports noted above, what policy implications does this have for the U.S. – and our global trade partners?

2. Both Japan and Germany have legislatively, and from a regulatory standpoint, sharply reduced their future commitment to nuclear power after the earthquake related accident in Japan caused unexpected damage. Historically nuclear power was a main tool for policy makers attempting to encourage energy supplies that historically have been needed to fuel economic growth. What is the policy implication of a world where nuclear power plays a reduced role in the developed economies?

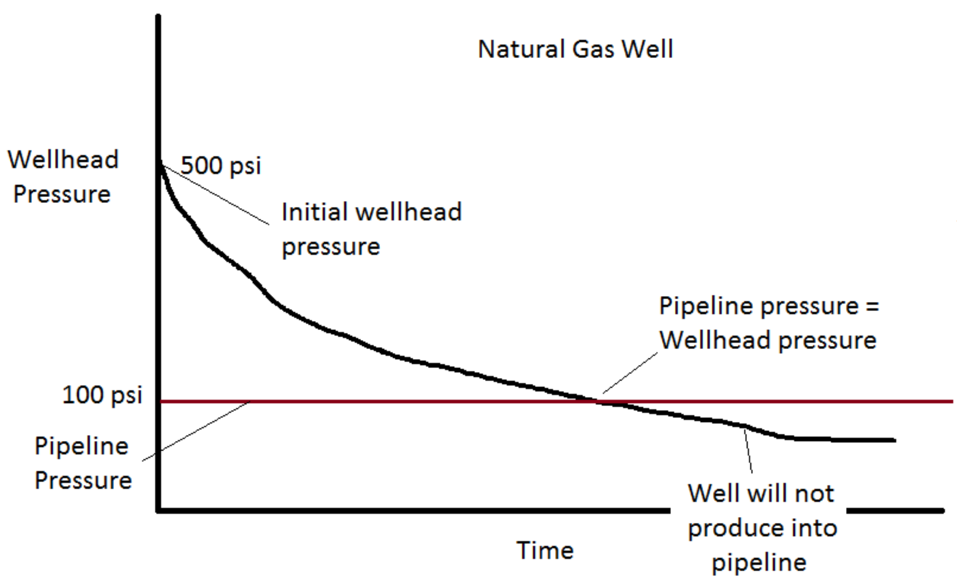
Natural Gas Compression: United Carbon Co. v. Campbellsville Gas Co.

Natural gas in most situations is much more difficult to market than crude oil to market for several reasons. First, a gathering system and pipeline needs to be constructed from the well to a collection system. Crude oil can generally be stored at the well site in a tank, and worst case sent by tanker truck to a nearby collection point.

Second, natural gas wells need to have sufficient pressure for the natural gas in the underground formation to enter the natural gas pipeline. The laws of physics provide a gas will flow from high pressure to low pressure – so if a natural gas pipeline is operating at very high pressures then it might be difficult for a natural gas well to naturally flow into that pipeline.

Further, over time the wellhead pressure – the natural pressure at the well from the formation – generally declines as natural gas is produced leaving unfilled void space. In some more ideal conditions the natural gas that is produced is replaced by water or crude oil which intrudes into the host formation, which helps maintain reservoir pressure and the ability of the will to produce into the pipeline.

The situation can graphically be illustrated as follows:



In this case a natural gas well is completed and has a well head pressure of 500 pounds per square inch (PSI). As the well produces the pressure naturally declines until the well head pressure equals the pipeline pressure (100 psi in this example). When the pressure at the well head and the pressure in the pipeline are equal the well stops flowing. The natural gas well might have a significant amount of reserves left, and if vented into the atmosphere (which has a psi of 14.7) would create a very nice flare if the natural gas was ignited.

So how does a producer extract the natural gas that might be left when a well becomes 'pressure depleted', or when a pipeline is operating at a pressure that restricts well production?

The answer is for a producer to add 'compression' at the well – a small engine that 'pushes the natural gas into the pipeline'. Others have described a compressor engine as one that 'sucks the natural gas out of the ground'. In developed areas the noise of a small compressor engine running consistently, and the emissions from the internal combustion engine, has raised concerns of homeowners and landowners.

Economically the compressor can be worth its weight in gold. A well that cannot produce due to diminished pressures might be considered depleted. The addition of a compressor adds additional revenues many times over and above the cost of the equipment. Better, some compressor companies lease the machines by the month, so producers are not saddled with heavy capital expenditures or equipment that is mis-sized for the wells for fields being addressed. Once a well is totally depleted the compressor can be returned to the leasing company.

Industry-wide the amount of horsepower used for compression has increased at a constant rate of between 5% and 10% per year over the last decade according to analysts. Unconventional shale wells and coal bed methane wells require extensive compression services (more on unconventional and coal bed methane wells later in the class).

A compressor used at a well site can be anywhere from the size of a lawnmower engine to that of a small car. On large interstate transmission lines a compressor can be the size of an engine used to power a destroyer in World War II. Several smaller compressor units are shown below:



The legal question that arises in light of the Kelly v. Ohio Oil Co. case (that allows an owner to drill close to an offsetting owners property line even if oil or natural gas might be captured from under those non-owned lands): Can a producer extract natural gas out of the formation, and can a producer inject or 'push' the gas in the wellbore into the natural gas pipeline, even if other producers or owners might be impacted or harmed? The following case addresses the issue.

United Carbon Company et al. v. Campbellsville Gas Company
COURT OF APPEALS OF KENTUCKY
230 Ky. 275; 18 S.W.2d 1110; 1929 Ky. LEXIS 70
July 2, 1929, Decided

PRIOR HISTORY: Appeal from Taylor Circuit Court.
DISPOSITION: Judgment reversed, with instructions.

CASE SUMMARY, PROCEDURAL POSTURE: Appellant corporate owner of natural gas wells sought review of a decision from the Taylor Circuit Court (Kentucky), which granted judgment for appellee gas company and enjoined the corporate owner from decreasing the natural flow of gas in the gas company's wells and lines by use of a compressor.

OVERVIEW: A gas company filed suit against the corporate owner of natural gas wells seeking to enjoin the corporate owner from using a compressor, which the gas company contended had materially reduced the flow of gas from all the wells in the gas field. The corporate owner contended that it installed the compressor solely for the purpose of maintaining the proper pressure in the mains in the municipality and to procure gas for the purpose of furnishing other communities in which it was seeking franchises. The court reversed the circuit court's judgment enjoining the corporate owner from using the compressor and the court remanded the case with instructions to dismiss the gas company's petition. The court concluded that the corporate owner could use a compressor to pump natural gas even though the flow of gas in other wells was diminished. The court did not find any sinister purpose on the part of the corporate owner in the use of the compressor since it was installed because the sinking pressure in the gas field made the service in the municipality very unsatisfactory. The court ruled that the gas fields would be of little use if the owners of the wells could not use compressors.

OUTCOME: The court reversed the circuit court's judgment enjoining the corporate owner from decreasing the natural flow of gas in the gas company's wells and lines by use of a compressor and the court remanded the case with instruction to dismiss the gas company's petition against the corporate owner.

JUDGES: JUDGE DIETZMAN. Whole court sitting.
OPINION BY: DIETZMAN

OPINION OF THE COURT BY JUDGE DIETZMAN--Reversing.

The appellant, United Carbon Company, is the owner of a large number of natural gas wells scattered over Taylor and Green counties. Part of the gas it secures from these wells it sells to the Taylor-Green Gas Company, which supplies the gas under a franchise to the residents of the town of Campbellsville. These two companies have been thus engaged for several years last past. In the early history of the gas field of Taylor and Green counties, the gas pressure was quite strong, but, due to the activities of a carbon black plant, which has since been dismantled, the gas pressure has steadily declined until now, as seems to be conceded, it is less than five pounds rock pressure.

Most of the gas wells of the appellant are remotely located from the town of Campbellsville, but it has two upon what is known as the Chandler lease, which lies just outside [***2] of the city limits of Campbellsville. Due to the low pressure in its wells, the appellant had for some time prior to the organization of the appellee been taking the gas which it secured from its more remotely located wells and storing it in the [*276] wells on the Chandler lease, from which later it was drawn as needed to supply the town.

In the spring of 1928, the appellee was organized to supply natural gas to the town of Campbellsville. It purchased or leased small tracts of land near to the Chandler wells on which it drilled for and procured natural gas. It also drilled two other wells some little distance away from the Chandler wells, but close to a natural gas well on the graded school lot, the gas from which was used by the graded school for its purposes. Under a franchise which it procured from the town of Campbellsville, the appellee entered into active and effective competition with the appellant in the supply of natural [**1111] gas to the residents of Campbellsville. In the winter of 1928-29 the appellant installed on its Chandler lease a compressor which can be so operated as not only to sustain or increase the pressure in the service mains but also by suction [***3] to increase materially the flow of natural gas from the wells to which it may be coupled.

Appellant insists that it installed this compressor solely for the purpose of maintaining the proper pressure in the mains in the town of Campbellsville and to procure gas for the purpose of furnishing other communities in which it was seeking franchises, that it had determined to install this compressor long before the appellee was ever thought of, and that it was not installed with the intent of working any hardship on the appellee. The appellee insists that the working of this compressor has materially reduced the flow of gas from all the wells in this gas field, and especially from the gas wells which it owns. It also hints that the primary purpose of the appellant in installing this compressor was to destroy the appellee's competition by ruining its wells. For these reasons the appellee brought this suit to enjoin the appellant from using the compressor. On final hearing the court entered a judgment enjoining the appellant "from decreasing the natural flowage of gas in appellee's wells and lines of pipe by use of the compressor in evidence." From that judgment this appeal is prosecuted.

In the absence of any statute controlling the question, may an owner of a natural gas well increase the flow of natural gas from such well for a legitimate purpose by the use of a compressor? This question has never been presented for decision before in this state. In its discussion, however, there are four cases from this court to which reference must be made. The first of these cases [*277] is that of Louisville Gas Co. v. Kentucky Heating Co., 117 Ky. 71, 77 S.W. 368, 25 Ky. Law Rep. 1221, 70 L. R. A. 558, 111 Am. St. Rep. 225, 4 Ann. Cas. 355. There the appellant was enjoined from wasting natural gas which it took from its wells in such large quantities as to materially reduce the pressure in the wells of the appellee. In that opinion we said:

> "While natural gas it not subject to absolute ownership, the owner of the soil must, in dealing with it, use his own property with due regard to the rights of his neighbor. He cannot be allowed deliberately to waste the supply for the purpose of injuring his neighbor. . . ***. Every owner may bore for gas on his own ground, and may make a reasonable use of it; but he may not wantonly injure or destroy the reservoir common [***5] to him and his neighbor***."

The next case is that of Commonwealth v. Trent, 117 Ky. 34, 77 S.W. 390, 25 Ky. Law Rep. 1180, 4 Ann Cas. 209, which was a companion case to the Louisville Gas Co. case, supra. There the court upheld a penal action against an individual who was wasting the natural gas taken from certain wells for the sole purpose of injuring gas wells belonging to competitors. The case went off on the same grounds as did the Louisville Gas Co. case, supra.

The next case is that of Calor Oil & Gas Co. v. Franzell, 128 Ky. 715, 109 S.W. 328, 33 Ky. Law Rep. 98, 36 L. R. A. (N. S.) 456. There the right of the Calor Oil & Gas Company, which was the subsidiary through which the Louisville Gas & Electric Company was competing in the gas field with the Kentucky Heating Company, to condemn a right of way for its pipes, was upheld. In the course of the opinion, we said in answer to the argument that the activities of the Calor Oil & Gas Company would serve to reduce the gas in the wells of the Kentucky Heating Company:

> "But each has the legal right to the legitimate use of the gas underlying its own property, and neither can complain of such use by [***6] the other. HN2We have already held . . . that one who illegitimately wastes or destroys the gas . . . may . . . be enjoined from committing such wrongful

> acts; but all parties owning gas wells in the districts are free to make any legitimate use of gas they choose, and [*278] the fact that this legitimate use tends to exhaust the supply gives the other owners of gas wells in the district no just ground of complaint."

The last case is that of Louisville Gas Co. v. Kentucky Heating Co., 132 Ky. 435, 111 S.W. 374, 33 Ky. Law Rep. 912. That was a suit brought by the Kentucky Heating Company for damages done to its wells by the wasting of the gas which was enjoined in the case reported in 117 Ky. 71, supra. The case was reversed for errors occurring during the trial, in which the Kentucky Heating Company secured a verdict for $ 60,000. In the course of the opinion we said:

> "The right . . . to take from subjacent fields or reservoirs is a right in common. There is no property in the gas until it is taken. Before it is taken it is fugitive in its nature, and belongs in common to the owners of the surface. The right of the owners to take it is without stint; [***7] the only limitation being that it must be taken for a lawful purpose and in a reasonable manner. Each tenant in common is restricted to a reasonable use of this right, and each is entitled to the natural follow of the gas from the subjacent fields, and any unlawful exercise of this right, by any tenant in common, which results in injury to the natural right of any other tenant or surface owner, is an actionable wrong. The damage sustained is only that which results from an improper interference with the natural flow of the gas in the wells and pipes of another. . . .
>
> "Appellants had the right, as had every other surface owner, to take from the field, in its natural flow, gas without stint; and, had [**1112] the same quantity or more been taken in rightful use, and the same damage ensued, or even had the field been destroyed thereby, appellee would have no just cause of complaint."

From these cases we gather that the owner of a gas well has no right to waste the product of that well, at least in such fashion as to injure the wells of his neighbor; that he has the right to use without stint for any legitimate purpose the natural flow from his well; but whether he has the right [8] to stimulate that natural flow for a legitimate purpose is neither discussed nor decided. The last of these cases was decided in 1909 when the [*279] issue of a stimulation of the flow had never been raised, and probably there were no compressors in use in the state.***

Natural gas, like oil, is fugitive in its nature. It belongs to him who, having the surface right to do so, reduces it to possession, at least if such reduction to possession is for a legitimate purpose. This is so even though by so reducing it to possession his neighbor loses from such wells as he may have. This principle is strikingly illustrated in this case, for appellees, by buying or leasing the insignificant tracts of land immediately adjoining the Chandler lease and drilling for gas thereon, have depleted the wells of the appellant located on their Chandler lease, and also rendered them unfit for the storage purposes we have mentioned. However, as appellee rightly contends, this was its right as the owner or lessee of these tracts, no matter how small or insignificant they may be.

In Summers on Oil and Gas, sec. 24, it is said:

> "In conclusion it may then be said that the courts by an unbroken line of [***9] dicta and actual decision have held that the land owner had legal privileges of taking oil and gas from his own land, even though in so doing he take a part or all of the oil and gas from the land of his neighbor, and that his neighbor has no rights that he so take the oil and gas from their lands. But the particular land owner also has no rights that his neighbors take the oil and gas by operations

> conducted upon their lands, and the neighbors of course have correlative legal privileges to so take his oil and gas. The courts have so held because of the peculiar physical facts of oil and gas, any other rule would not result in their speedy and efficient production which social welfare demands."

If, instead of drilling other wells upon its Chandler or other leases, the appellant chose to stimulate the flow from the wells it had on these leases, did such a choice of alternatives render its conduct illegal?

As to oil wells, it is the settled practice, fortified by judicial decision where the question has arisen, that the owner of such wells may pump them, even though by so doing the flow of oil in the wells of others is diminished. So much is conceded by Thornton in his Treatise [***10] on The Law of Oil and Gas (3d Ed.) sec. 32, though he will not [*280] apply the doctrine to gas wells. Thus in Jones v. Forest Oil Co., 194 Pa. 379, 44 A. 1074, 48 L. R. A. 748, this principle was applied and upheld, the court saying:

> "In this case the defendant has the exclusive right to bore for oil on the farm of the Boyce heirs adjoining a farm owned by plaintiff. The right being a lawful one, the defendant is at liberty to use all lawful means to obtain 'all the gas and oil contained in, or obtainable through the land.' Westmoreland Natural Gas Co. v. De Witt, 130 Pa. 235, 18 A. 724, 5 L. R. A. 732; and to that end it may resort to the use of all known lawful modern machinery and appliances."

In answer to the argument that the use of the pump reduced the flow in the wells of others, the court in this Jones case said:

> "Plaintiff assumes that there is a certain fixed amount of oil and gas under his farm, in which he has an absolute property. True, they belong to him while they are part of his land; but when they migrate to the lands of his neighbor, or become under his control, they belong to the neighbor. . . . 'They (oil and gas) belong [***11] to the owner of the land, and are part of it, so long as they are on or in it, and are subject to his control; but when they escape, and go into other land, or come under another's control, the title of the former owner is gone. Possession of the land, therefore, is not necessarily possession of the gas. If an adjoining or even a distant owner drills his own land and taps your gas, so that it comes into his well and under his control, it is no longer yours, but his.' . . . If possession of the land is not necessarily possession of the oil and gas, is there any reason why an oil and gas operator should not be permitted to adopt any and all appliances known to the trade to make the production of his wells as large as possible?"

After discussing the right to pump percolating waters, the court in the Jones case continued:

> ***"If it is lawful to take water from a substrata by the 'exercise of all the skill and invention of which man is capable,' we see no reason why it is not lawful to produce oil by those means."***

[*281] In Nourse v. Andrews, Mayor, 200 Ky. 467, 255 S.W. 84, we made the distinction between the rights of owners of the soil in subterranean streams [***12] and their rights to subterranean percolations. As to the latter, the dictum in this Nourse case brings them within the doctrine of the Jones case, supra.

In the case of Higgins Oil & Fuel Co. v. Guaranty Oil Co., 145 La. 233, 82 So. 206, 5 A. L. R. 411, the same rule as was followed in the Jones case, supra, was adopted as controlling the issue in that case. The court, in the course of its opinion said:

> ***"Defendant does not contest the right of plaintiff to get out of its land all the oil it [**1113] possibly can, and by means of a well, but contests plaintiff's right to do this by means of a pump, because the pump sucks the oil from under defendant's land. The argument is that plaintiff may appropriate the oil passing from defendant's land to plaintiff's provided the oil passes, or flows, from the one tract to the other 'naturally,' that is, by gravity, and not as the effect of the use of artificial means. So far as artificiality is concerned, we do not see the difference between a well and a pump; both are artificial; both cause the oil to flow from the neighbor's land; and both produce that effect by creating a vacuum which the oil from the neighbor's land comes [***13] in to fill. . . . Plaintiff's right to operate this pump would appear, therefore, to be clear."***

To the same effect is Kelly v. Ohio Oil Co., 57 Ohio St. 317, 49 N.E. 399, 39 L. R. A. 765, 63 Am. St. Rep. 721.

It being settled that the owner of an oil well may pump the same, although the flow of wells in adjoining land may be thereby diminished, we see no reason why the same result should not attach to the question of pumping from gas wells. Both oil and gas are alike in the properties which have induced the courts to sustain the right of the owner of an oil well to pump the oil therefrom. No distinction in reason suggests itself to us between the right of the owner of an oil well to pump it and the right of an owner of a gas well to pump it.

Where the question has arisen (even in Indiana where the courts have held that at common law as well as under the statute an owner of a gas well may not pump it at less than atmospheric pressure so as to injure the flow of gas in wells of other owners; see [*282] Manufacturers' Gas & Oil Co. v. Indiana Natural Gas & Oil Co., 155 Ind. 461, 57 N.E. 912, 50 L. R. A. 768), it has been held that the owner of a gas [***14] well may stimulate its flow by the exploding of nitroglycerine in the wells. It was so held in the case of Texas Pacific Coal & Oil Co. v. Comanche Duke Oil Co. (Tex. Civ. App.) 274 S.W. 193. Although this opinion of the Court of Civil Appeals of Texas was reversed when the case reached the Supreme Court of Texas--see Comanche Duke Oil Co. v. Texas Pacific Coal & Oil Co. (Tex. Com. App.) 298 S.W. 554--the right to use nitroglycerine was upheld, but it was also held that by its use the user had no right to make a physical invasion on the property of his neighbor. In the opinion of the Court of Civil Appeals it is said:

> "The owner of the surface of one tract of land, and of a producing well thereon, cannot complain if his neighbor sinks a well on the adjoining tract, even though the latter operation drains all the oil from beneath both tracts, and thereby completely destroys the purpose and value of the first well. This rule rests upon the doctrine stated, that HN4the owner of the surface obtains no title to the oil beneath that surface until and unless he first reduces it to his possession; for, so long as it is in the fugitive state, it is subject to capture [***15] by any person seeking it in good faith from his own premises as a base, and when once captured the title becomes vested in the captor. Offset wells are thus authorized by the (general) rule stated, which is universal.
>
> "The doctrine goes further. If the offset well does not efficiently tap the source from which the pioneer well gets its flow, then the operator of the former may resort to artificial means in order to force production, and by this means he may destroy the value of the initial well by absorbing the

> entire source. This may be done by the use of pumps sunk into the offset well, to operate which the owner may use all the force necessary to accomplish the purpose, even though it may divert the whole supply of the first well and thus completely destroy its value."

The Indiana case to which we referred is that of People's Gas Co. v. Tyner, 131 Ind. 277, 31 N.E. 59, 16 L. R. A. 443, 31 Am. St. Rep. 433.

[*283] ***If the flow of natural gas may be stimulated by the use of nitroglycerine, we see no good reason why it may not be stimulated by the use of a pump.***

We are not unmindful of the Indiana cases to which we have referred, but they seem to go off on the idea that gas is more like unto subterranean streams than to oil or subterranean percolating waters. But we believe the better analogy is to oil. This corresponds to geological information, and it corresponds to the experience of those who labor in the oil and gas fields. As said in Wettengel v. Gormley, 160 Pa. 559, 28 A. 934, 40 Am. St. Rep. 733:

> "It is well understood among oil operators that the fluid is found deposited in a porous sand rock . . . below the surface. This rock is saturated . . . and when the hard stratum overlying it is pierced by the drill the oil and gas find vent and are forced, by the pressure to which they are subject, into and through the well to the surface. . . . An oil or gas well may . . . draw its product from an indefinite distance, and in time exhaust a large space . . . The vagrant character of the mineral, and the porous sand-rock in which it is found, . . . fully justify the general conclusion we have stated above, and have led to its general adoption by practical operators."

See, also, Niles v. Meade, 189 Ky. 243, 224 S.W. 854. We are convinced that the rule as to gas wells should be the same as to oil wells, and [***17] hence are unable to follow the Indiana court in its conclusion as to the right of an owner of a gas well to pump it at common law.

The New York case of [**1114] Hathorn v. Natural Carbonic Gas Co., 194 N.Y. 326, 87 N.E. 504, 23 L. R. A. (N. S.) 436, 128 Am. St. Rep. 555, 16 Ann. Cas. 989, which involved the right of an owner of a water well in the Saratoga Springs district to pump the water in large quantities, not for the purpose of using or selling the water as such, but for the purpose of extracting the gas from it and throwing the water away, rests either on the doctrine of waters which the New York court adopted or principles of waste--the idea being that the natural product was wasted as such--or both.

Oil and gas being under our decisions analogous as to what rights the owners of the wells through which they are reduced to possession have, and the owner of an oil well having a right to pump it, at least for a legitimate [*284] purpose, we are of the opinion that the owner of a gas well has the like right.

The record fails to show any sinister purpose on the part of the appellant in the use of the compressor here in question. It was installed because of [***18] the sinking pressure in this gas field which made the service in the town of Campbellsville very unsatisfactory. It is not disputed that the town of Greensburg, served from wells in this field also, would be without gas but for the use of a compressor. The appellant is also seeking, as it had a right to do, other cities to supply with natural gas. All these purposes are legitimate. If the appellee's wells are hurt by the use of the compressor, the difference between the hurt to their wells and the hurt done the Chandler wells when appellee sunk its wells is one of degree rather than of substance.

It is well known, and this record so discloses, that the gas fields of Eastern Kentucky would be of but little use if the owners of the wells could not use compressors. They have been used in that territory for a long time, and the dearth of legal contest over their use is somewhat persuasive of the prevalent idea of the lawfulness and the reasonableness of their use.

We are therefore of the opinion that the lower court erred in granting the injunction it did. Its judgment is therefore reversed, with instructions to dismiss the appellee's petition.

Questions:

1. Even if a compressor impacts other producers (by making the pipeline pressure higher thus reducing the amount of natural gas other operators can inject into the line), does this case allow a producer to add compression? What if a compressor extracts natural gas from across lease lines?

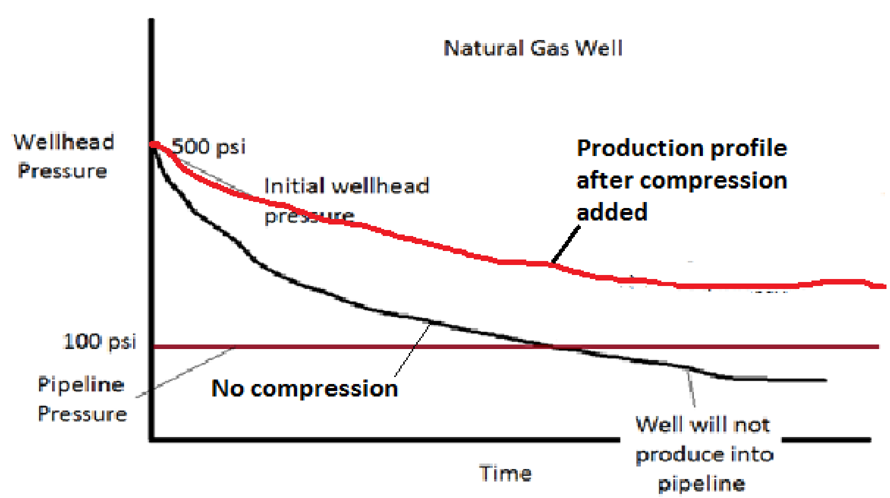
2. A similar situation exists for an oil well. When a pump is added the amount of oil that can be extracted from a well generally increases, sometimes to the disadvantage of the offsetting producers. Operators can install a pump on the surface, or install one down hole inside the well bore. Do you think this court would permit an oil producer to add a pump to assist in removing the oil from the oil reservoir?

3. More and more formations require 'dewatering' of the wellbore to recover injected hydraulic fracturing fluid. Dewatering is also required to reduce the naturally occurring reservoir pressure so crude oil or natural gas will flow toward the wellbore. For example, the Mississippian Lime formation in Northern Oklahoma and Southern Kanas requires extensive dewatering – many times it takes a month or more of pumping water from a well to determine if a well is economic. The volume of water produced is so large in some of these areas it requires one water disposal well per four or five productive wells. What does this case mention with regard to removing water so that oil production might be enhanced?

4. According to the court, can a producer who has the right to extract natural gas waste the product if it harms other producers in the field? For example, assuming flaring is legal, can a producer flare the natural gas even when a pipeline connection is available, knowing the natural gas being flared might be from a common reservoir?

5. Note the plaintiff requested, and obtained from the lower court, an injunction prohibiting the use of a compressor at the natural gas wells in question. On appeal the appellate court reversed the decision allowing the defendant to use a compressor. What is required to be shown by the plaintiff to get an injunction? How is it different than awarding the plaintiff damages? Who decides if the plaintiff will get damages or an injunction in a given case?

6. In light of the decision in this case, you recommend that your company install compression at several natural gas wells on your leases. With compression the pressure and production curve is altered

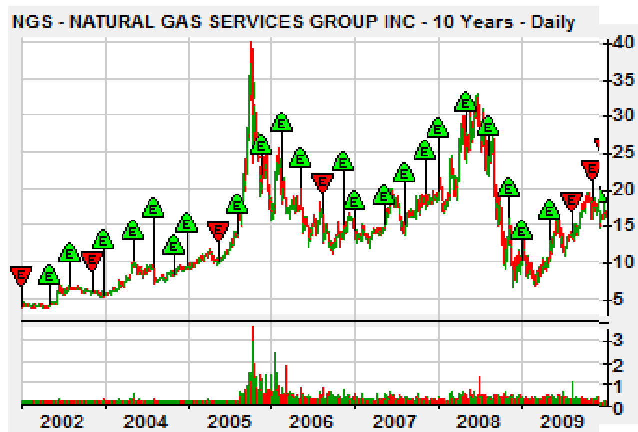


as indicated. What impact do you think that the compression will have on the well's cash flow model?

What information do you need to prepare an analysis for management whether to add compressors at this well site as well as on other wells in the field?

7. Natural Gas Services Group (NGS) is a publicly listed microcap company headquartered in Midland, Texas that provides natural gas compression services and equipment to the natural gas industry.

   A relatively illiquid firm, the company was well managed and was a steady growing entity. The stock traded between $5 and $10 per share in 2004 and 2005 until an unexpected event shocked the natural gas industry – Hurricane Katrina came ashore in the fall of 2005. Much of the offshore natural gas productive capacity as well as onshore pipelines were damaged or temporarily shut down. The stock skyrocketed to nearly $40 per share in days!



   Why would a small Midland, Texas based company that rents natural gas compression equipment see their market value triple in days after the hurricane? What if you had information several days before the hurricane made landfall as to where it would most likely come onshore, and with what intensity?

8. Natural Gas Services Group (NGS) in conjunction with their initial public offering in October 2002 issued "IPO Warrants" which gave the holder the right to convert one warrant for one share of stock at $6.25 per share. These warrants were publicly traded. What do you think this warrant was worth when the stock was selling for $6.00 per share in early 2004? What do you think the warrant sold for in early September 2005 when the stock sold for $24.00 per share?

   Note that while publicly traded warrants are not that common anymore, publicly traded options are very similar and have been offered on many smaller firms. Also note that investments in small, public, well managed energy firms can in some cases generate substantial returns for investors – or for employees with stock options.

9. A well site natural gas compressor also assists a producer in meeting certain marketing obligations and economic conditions required to maintain and extend the term of an oil and gas lease. We will discuss these issues when we review the oil and gas lease form and provisions.

Natural Gas Infrastructure Development & Trends

In the United States, the first intentional use of natural gas occurred in 1821 when William Hart drilled a well to tap a shallow gas pocket along the bank of Canadaway Creek near Fredonia, New York. He piped the gas through hollowed logs to a nearby building where he burned it for illumination. In 1865, the Fredonia Gas, Light, and Waterworks Company became the first natural gas company in the United States. The first long-distance gas pipeline ran 25 mi (40 km) from a gas field to Rochester, New York, in 1872. It too used hollowed logs for pipes.

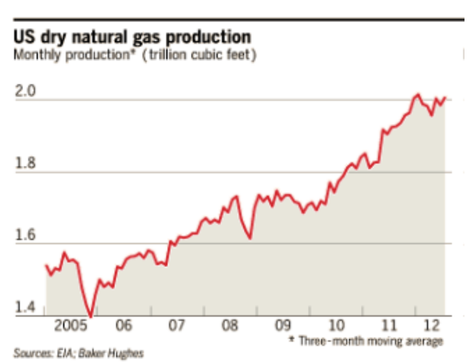
One of the first lengthy pipelines was constructed in 1891. This pipeline was 120 miles long, and carried natural gas from wells in central Indiana to the city of Chicago. However, this early pipeline was very rudimentary, and was not very efficient at transporting natural gas. It wasn't until the 1920s that any significant effort was put into building a pipeline infrastructure.

The sheer volume of the fields emphasized the need for advancements in pipeline technology to transport the natural gas to distant urban markets. In particular, new welding technologies allowed pipeline builders in the 1920s to construct longer lines. In the early years of the decade, oxy-acetylene torches were used for welding, and in 1923 electric arc welding was successfully used on thin-walled, high tensile strength, large-diameter pipelines necessary for long-distance compressed gas transmission. Improved welding techniques made pipe joints stronger than the pipe itself; seamless pipe became available for gas pipelines beginning in 1925.

Along with enhancements in pipeline construction materials and techniques, gas compressor and ditching machine technology improved as well. Long-distance pipelines became a significant segment of the gas industry beginning in the 1920s. After World War II, welding techniques, pipe rolling, and metallurgical advances allowed for the construction of reliable pipelines. This post-war pipeline construction boom lasted well into the '60s, and allowed for the construction of thousands of miles of pipeline in America.

Metropolitan manufactured gas distribution companies, typically part of large holding companies, financed most of the pipelines built during this first era of rapid pipeline construction. Long distance lines built during this era included the Northern Natural Gas Company, Panhandle Eastern Pipe Line Company, and the Natural Gas Pipeline Company.

Midwestern urban utilities that began receiving natural gas typically mixed it with existing manufactured gas production. This mixed gas had a higher heating content than straight manufactured gas. Eventually, with access to reliable supplies of natural gas, all U.S. gas utilities converted their distribution systems to straight natural gas.

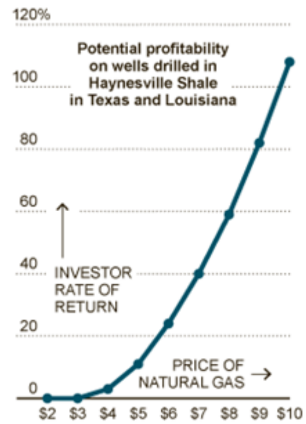


Because the domestic markets for natural gas continue to expand, and the pace of natural gas shale development continues, it has been estimated that the amount of compression horsepower has increased by 5% to 10% per year in the field since 2000 (the power of the compression engine is measured in horsepower, just like a car).

Domestic Natural Gas Markets - Turning Positive

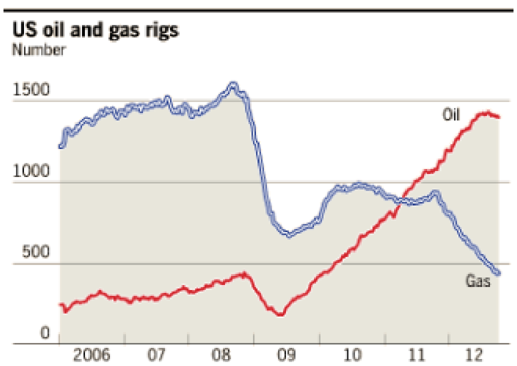
Over the last five years natural gas production in the U.S. has increased by roughly 20% as the impact of horizontal drilling, hydraulic fracturing, and robust exploration efforts have led to what some have referred to as a 'glut' of natural gas. Some experts claim that the U.S. will see a century of inexpensive natural gas production due to the development of the huge shale reserves located in North America – great for U.S. manufacturers but not necessarily for natural gas producers.

Until recently drilling and developmental activity has continued unabated even in the face of falling natural gas prices and declining rates of return on exploration expenditures. Domestic natural gas prices fell this summer to levels not seen in a decade. Meanwhile crude oil prices have tripled.



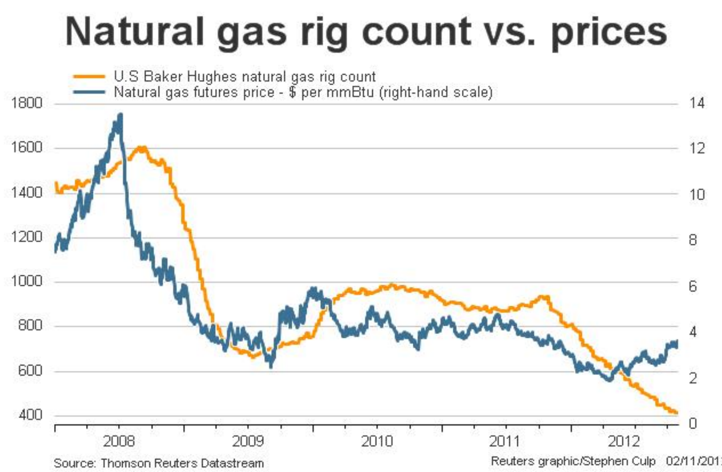
As natural gas prices have fallen companies in the chemical and fertilizer sectors have announced millions of dollars in capital expenditures to expand their production facilities. Cheap natural gas gives many of these firms a competitive advantage over European companies who are paying on average three to five times more for natural gas.

Lower natural gas prices this summer made U.S. natural gas fired electrical generation more attractive than coal fired plants. Over the last 12 months a massive amount of incremental demand has been generated from natural gas fired plants that historically has been used as 'peaker' plants – facilities that only operated during the summer period of peak electrical demand.



Although it has taken some time, the lack of returns on natural gas exploration and development have lead many companies to reduce investments in natural gas prospects – shifting the exploration efforts to basins that are more productive of crude oil. The number of rigs drilling for natural gas has recently hit a 13 year low, while rigs drilling for oil have predominated. (Charts courtesy Financial Times and New York Times).

Spot prices for natural gas on the futures market have recovered from the sub-$2 per million British thermal units (BTU) levels they hit this summer. The commodity currently trades at around $3.50 per million BTUs. Even at current prices most natural gas prospects are uneconomic, or marginally profitable at best.



While oil drilling will generate 'associated gas' in addition to the liquids, we find the reduction in rigs drilling for natural gas as a good step toward balancing demand and supply. Rigs today are much more efficient compared to those drilling just five years ago due to advances in fracing technology, completion methodology, and drilling productivity. As a result we expect natural gas supplies to slowly decline, but not plummet to the extent the rig count has declined.

Consultant Reports. Pointing out that economics will prevail over the predictions of some that we will see decades-long supplies of ultra-cheap natural gas, energy consultant Arthur Berman made a presentation on natural gas shale development in the U.S.at a Houston conference recently. He made the following points:

- It is doubtful that shale gas will meet supply expectations except at much higher prices.
- Decline-curve analysis indicates reserves are lower than operators claim.
- Natural gas demand has increased but recently supply has flattened.
- EPA regulations will increase demand for the clean burning fuel further.
- Shift to liquid-directed drilling & flight from dry gas will decrease gas supply.
- Capital expenditures necessary for supply maintenance are not supportable.
- Considerable uncertainty exists in natural gas price forecasts.
- Credible forecasts put average 2012 gas prices around $2.70/mmBtu.
- Credible forecast put 2013 average gas price in $3.40-$4.50/mmBtu range.

Likewise Raymond James & Associates issued a bullish report on the sector entitled “Look for Very Bullish Gas Supply/Demand Variables Through This Winter” – pointing out the following:

> *Our U.S. natural gas supply/demand math says the U.S. indeed setting up for a potentially large weather driven rally this winter . . . temperatures should still be considerably colder than last year due to an abnormally warm weather experienced during the 2011/2012 winter season.*
>
> *We estimate that the normalizing of weather alone could tighten the entire gas market by as much as 6 Bcf/d during this winter* [the Raymond James report notes that *“usually a one or two Bcf/day swing in gas supply or demand is a ‘big deal’”*].
>
> *Of course, this could lead to record weekly withdrawals and a massive year over year storage deficit (using the 10-year “normal”). Gas traders should hold onto their hats, as this should be the leading driver of prices early this winter. For reference, if the market extrapolates these trends, we wouldn’t be surprised to see prices touch as high as $5/Mcf over the next 6 months.*

In addition to the reports noted above, several natural gas companies have reported that they expect their natural gas production to decline in 2013. Chesapeake Production, the nation’s second largest natural gas producer, expects natural gas production to decline next year by seven percent from current levels.

One energy company executive noted “for those who question the [impact of the] natural gas rig count reduction, from 900 rigs to 400 rigs, without any associated production impacts, we can look at ourselves to see the lag . . . industry wide, you are just beginning to see natural gas production rollover. Once it begins, it will accelerate, then I think we are looking at a two year window monthly reductions in domestic natural gas supply.”

The consensus at a recent industry conference in Houston also expected domestic natural gas production to decline in 2013, with prices moving higher from the lows we have seen in 2012.

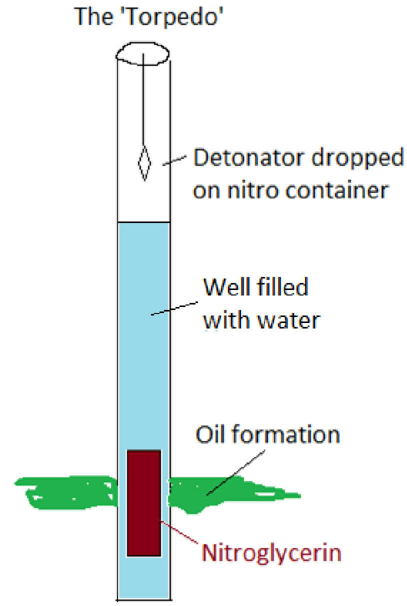
Question:

1. Once the technology developed from hollow wood pipes to steel and natural gas could be transported over long distances, did this impact how the natural gas industry was regulated?

The People's Gas Company v. Tyner & the Nitroglycerin Torpedo

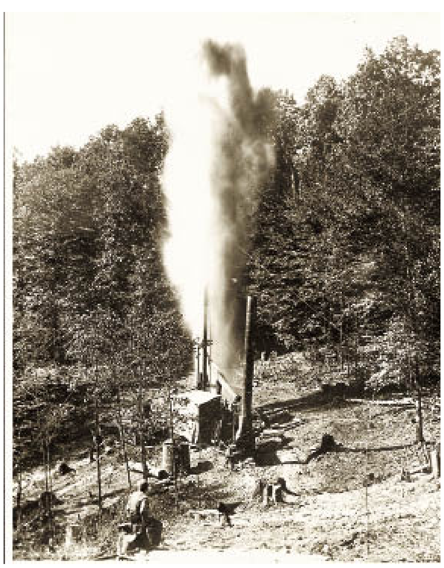
One of the early operational issues that many crude oil producers experienced was the fact that the wells would tend to plug up with paraffin or wax or similar substances accumulating after they had produced for a short period of time. The quality of the oil determined how quickly, or if, the wax or paraffin precipitated out of the oil. Some oil was much thicker, and some held varying degrees of impurities.

Keep in mind the crude oil in the ground was usually under pressure, and at elevated temperatures, so once liberated from that high pressure – high temperature environment dissolved substances were more likely to precipitate as the oil cooled down and reached ambient pressure found in the well bore and at the surface.



A creative inventor named Edward Roberts designed a solution to the problem – an explosive charge he would put in the wellbore that he would ignite. The blast would clean the well bore of wax and paraffin, and if the blast was powerful enough it had the additional benefit of creating additional fractures in the rock that allowed the oil to flow to the wellbore.

Roberts patented the process, and charged \$100 to \$200 per shot with an additional royalty of 1/15th of any increased production from the blast. Keep in mind this is in the late 1800's so these charges were incredibly high. As a result a number of producers rigged their own explosive to shoot a well, violating the patent, which resulted in a large amount of litigation. Since the blast was illegal these producers generally shot at night, hence creating the term 'moonlighter'.



Before shooting the well the explosive, usually nitroglycerin, was placed in the well in a metal canister and lowered to the point where the blast was desired. A pointed rod was dropped down the well, and when it penetrated the canister the well exploded. Usually they filled the well up with water to help keep the explosive pressures directed into the wellbore walls, but this water also had a great effect at the surface as it was shot out of the well. The picture is from a well being shot in Oil City from the Drake Well Museum.

Of course, nitroglycerin is very unstable. Getting the chemical to the well site was a challenge since many of the roads were dirt, mud, and full of rocks and holes. It was common for the explosive to detonate during transportation or prematurely at the well, causing many deaths and injuries.

None-the-less torpedoing a well usually resulted in increased production – and eventually was replaced with hydraulic fracturing techniques we see used today (more on hydraulic fracturing later in the course).

Our next case deals with using nitroglycerin to shoot a well. The only problem was that the operator of the well decided to shoot the well in a residential neighborhood in the middle of a small Indiana city.

The People's Gas Company et al. v. Tyner.
SUPREME COURT OF INDIANA
131 Ind. 277; 31 N.E. 59; 1892 Ind. LEXIS 180
April 27, 1892, Filed

PRIOR HISTORY: [***1] From the Hancock Circuit Court.

DISPOSITION: Judgment affirmed.

CASE SUMMARY
PROCEDURAL POSTURE: Appellant neighbors challenged the judgment of the Hancock Circuit Court (Indiana) granting appellee property owner a temporary injunction in his action to obtain an injunction to prevent the neighbors from exploding a gas well near his home.

OVERVIEW: The neighbors, a gas company and others, dug and constructed a natural gas well near the property owner's residence. The neighbors planned to "shoot" the well with a large quantity of nitro-glycerine or other nitro-explosive compound to increase the flow of gas. The property owner sought an injunction against the neighbors to prevent them from using the explosives, alleging that it was dangerous to property and life. The trial court granted a temporary injunction. The court affirmed on appeal. Although the court found that the neighbors had the right to sink the well and draw gas from the land of the property owner, the neighbors did not have the right to endanger property and lives of those who have no connection with their operations. The court concluded that the neighbors should have been content with the flow of gas that could have been contained without shooting the well.

OUTCOME: The court affirmed the trial court's judgment entering a temporary injunction in favor of the property owner.

OPINION BY: Coffey

Coffey, J.--This was an action by the appellee against the appellants, in the Hancock Circuit Court, for the purpose of obtaining an injunction.

The complaint alleges, substantially:

that the appellee and his wife are the owners, by entireties, of the real estate therein described, which consists of four city lots in the city of Greenfield;

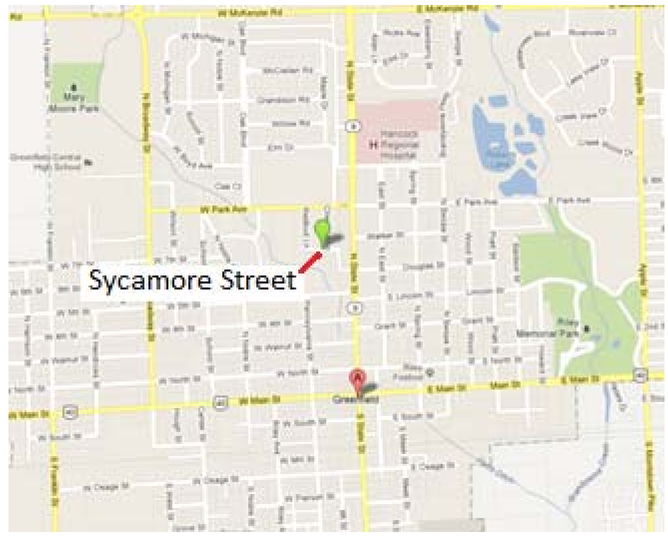
that the lots are inclosed together by a fence, and that his dwelling house and residence, in which he and [*278] his family reside, is situated on the lots; that the lots are near the center of the city, and, with his residence thereon, are of the value of four thousand dollars;

that with full knowledge of all the facts the appellants, regardless of the rights of the appellee, and of the safety, peace, comfort and lives of himself and family, have, without his consent and over his objections, within the last forty days, dug and constructed a natural gas well, to the depth of about one thousand feet, and about two hundred feet distant from the [***2] appellee's residence, with only a street forty feet in width between the appellee's lots and the lot on which the well is sunk; that the appellants are about to "shoot" said well, and will do so unless restrained;

that for the purpose of "shooting" the well, the appellants, about midnight of the day of August, 1889, unlawfully procured to be brought, and unlawfully permitted a large quantity of nitro-glycerine, or other nitro-explosive compound, to be and remain upon Sycamore street, a public street in the city, and within less than two hundred feet of appellee's residence, for about three hours, in the midst of and surrounded by a large number of people;

that appellants, by their employees, threatened and attempted to "shoot" said gas-well, and that they still threaten so to do with their said nitro-glycerine, or other nitro-explosive compounds, and will so do unless restrained;

that nitro-glycerine is highly explosive and very dangerous to property and life, and is liable to explode under any and all circumstances, and at any time or place, and that an explosion of sixty or one hundred quarts of said explosive, at any given place on the surface of the earth could, and [***3] probably would, destroy life and property for a distance of five hundred yards in all directions from such explosion;



that the handling or storing thereof in or about appellants' gas-well will endanger the lives of his family, as well as the safety of his property, and that the shooting of said well with nitro-glycerine will greatly injure and damage the appellee's said property both above [*279] and under the surface of the earth, and endanger his life and and the lives of his family.

This complaint was verified, and upon it, and the affidavits filed in support of its allegations, the court granted a temporary injunction, from which this appeal is prosecuted.

The affidavits filed by the appellee tended to prove that the appellants' gas-well is within the corporate limits of the city of Greenfield; that a short time prior to the filing of the complaint in this cause, the appellants deposited in or near the derrick at the well, described in the complaint, about one hundred and seventeen quarts of nitro-glycerine, weighing about three hundred and forty pounds, with the intention of exploding the same in the well. The affidavits further tend to show that nitro-glycerine is very [***4] explosive, and that it is liable to explode at any time; that the explosion of that quantity of nitro-glycerine upon the surface of the earth would be likely to destroy life and property at any point within five hundred yards of such explosion.

It is contended by the appellants:

First. That they had the right to use their own property as to them seemed best, and, for that reason, they could not be enjoined from exploding nitro-glycerine in their well for the purpose of increasing the flow of natural gas, though such explosion might have the effect to draw the gas from the land of the appellee.

Second. That as bringing nitro-glycerine into the corporate limits of a town or city in a greater quantity than one hundred pounds is made a crime by statute, it can not be enjoined.

On the other hand, it is contended by the appellee:

First. That natural gas is property, and that the appellants have no legal right to do anything upon their own land which will draw such gas from his land, and appropriate it to their own use.

Second. That as he is liable to suffer an injury peculiar to himself, to which the public in general is not subject, by the [*280] unlawful act [***5] of the appellants in bringing nitro-glycerine within the corporate limits of Greenfield, he is entitled, for that reason, to an injunction.

It has been settled in this State that natural gas, when brought to the surface of the earth and placed in pipes for transportation, is property, and may be the subject of interstate commerce. [**60] State, ex rel., v. Indiana, etc., Co., 120 Ind. 575, 22 N.E. 778.

Water, petroleum oil and gas are generally classed by themselves as minerals possessing, in some degree, a kindred nature. As to whether the owner of the soil may dig down and divert a well defined subterranean stream of water there is much diversity of opinion and conflict in the adjudicated cases, but the authorities agree that the owner of a particular tract of land may sink a well and appropriate to his own use all the percolating water found therein, though it may entirely destroy the well on his neighbor's land. Angell Watercourses, section 112; Hanson v. McCue, 42 Cal. 303; Wheatley v. Baugh, 25 Pa. 528; Frazier v. Brown, 12 Ohio St. 294; Acton v. Blundell, 12 M. & W. 324; Delhi, Trustees, etc., of, v. Youmans, 50 Barb. 316; [***6] Mosier v. Caldwell, 7 Nev. 363; New Albany, etc., R. R. Co. v. Peterson, 14 Ind. 112; City of Greencastle v. Hazelett, 23 Ind. 186.

It is a familiar maxim that in contemplation of law land always extends downward as well as upwards, so that whatever is in a direct line between the surface of any land and the center of the earth belongs to the owner of the surface. Mr. Angell says that it would seem to follow from this maxim that whether what is subterranean be solid rock, mines or porous soil, or salt springs, or part land and part water, the person who owns the surface may dig therein and apply all that is there found to his own purposes ad libitum. Angell Watercourses, section 109.

Upon this principle it was held by this court in the case of New Albany, etc., R. R. Co. v. Peterson, supra, that if an adjoining land-owner, in lawfully digging upon his own land, [*281] draws the water from the land of another, to his injury, such injury falls within the description of damnum absque injuria, which can not become the ground of an action.

In the case of Haldeman v. Bruckhart, 45 Pa. 514, it was said: HN5"The purchaser of lands [***7] on which there are unknown subsurface currents, must buy in ignorance of any obstacle to the full enjoyment of his purchase indefinitely downwards, and the purchaser of lands on which a spring rises, ignorant whence and how the water comes, can not bargain for any right to a secret flow of water in another's land."

Mr. Gould, in his work on "Waters" (2d ed.), section 291, says: "Petroleum oil, like subterranean water, is included in the comprehensive idea which the law attaches to the word land, and is a part of the soil in which it is found. Like water, it is not the subject of property except while in actual occupancy, and a grant of either water or oil is not a grant of the soil or of anything for which ejectment will lie."

In recognition of the principle here announced, in the case of Brown v. Vandergrift, 80 Pa. 142, it was said by the court that "The discovery of petroleum led to new forms of leasing land. Its fugitive and wandering existence within the limits of a particular tract was uncertain, and assumed certainty only by actual development founded upon experiment."

What is said of the fugitive character of percolating water and of petroleum oil applies with greater [***8] force to natural gas.

In the case of Westmoreland, etc., Gas Co. v. De Witt, 130 Pa. 235, 18 A. 724, it was said: "Water and oil, and still more strongly gas, may be classed by themselves, if the analogy be not too fanciful, as minerals feroe nature. In common with animals, and unlike other minerals, they have the power and the tendency to escape without the volition of the owner. Their 'fugitive and wandering existence within the limits of a particular tract is uncertain.' * * They belong to the [*282] owner of the land, and are part of it, so long as they are on or in it, and are subject to his control; but when they escape, and go into other land, or come under another's control, the title of the former owner is gone. Possession of the land, therefore, is not necessarily possession of the gas. If an adjoining, or even a distant, owner, drills his own land, and taps your gas, so that it comes into his well and under his control, it is no longer yours, but his."

EDITION THE BOLIVAR BREEZE

Typical Glycerin Wagon of Early Days

A shooter's wagon of the early '90's is pictured above in front of the George H. Parker store building, on the site of the present C. E. Parker drug store. Seated on the wagon from left to right are the late G. W. VanCuren and Elba Kilmer, both well-known oil and gas well shooters of the day. Mr. Kilmer was killed in the early 1920's while shooting a well.

It is not denied by the appellee in this case that the appellants have the perfect legal right to sink a well into their own land and draw therefrom all the gas that may naturally flow to it; but he contends [***9] that they have no right to explode nitro-glycerine in the well to increase the natural flow.

When it is once conceded that the owner of the surface has the right to sink a well and draw gas from the lands of an adjoining owner, no valid reason can be given why he may not enlarge his well by the explosion of nitro-glycerine therein for the purpose of increasing the flow. The question is not as to the quantity of gas he may take, but it is a question of his right to take the gas at all.

So far as this suit seeks to enjoin the appellants from exploding nitro-glycerine in their gas well, upon the ground that it will increase the flow of the gas to the injury of the appellee, it can not, in our opinion, be sustained.

The rule that the owner has the right to do as he pleases with or upon his own property is subject to many limitations and restrictions, one of which is that he must have due regard for the rights of others. It is settled that the owners of a lot may not erect and maintain a nuisance thereon whereby his neighbors are injured. If he does so, and the injury sustained by such neighbor can not be adequately compensated in damages, he may be enjoined. [***10] Owen v. Phillips, 73 Ind. 284.

If the appellants in this case have been guilty of the folly of sinking a gas well in the center of a thickly populated city where they can not collect the necessary quantity of [*283] nitro-glycerine to shoot it without endangering the property and lives of those who have no connection with their operations, they should be content with such flow of gas as can be obtained without such shooting.

It certainly can not be maintained that the destruction of human life is an injury which can be compensated in damages. No authority has been cited, and we know of none, supporting the position of the appellants that the appellee is not entitled to an injunction because the accumulation of nitro-glycerine within the corporate limits of a town or city is a crime. It has long been settled that a private citizen may maintain an action for a public wrong if he suffers an injury peculiar to himself and not sustained by the public in general. Blackstone Commentaries, bk. 3, p. 219; Powell v. Bunger, 91 Ind. 64; Ross v. Thompson, 78 Ind. 90; Cummins v. City of Seymour, 79 Ind. 491; McCowan v. Whitesides, 31 Ind. 235; [***11] Fossion v. Landry, 123 Ind. 136, 24 N.E. 96; First Nat'l Bank, etc., v. Sarlls, 129 Ind. 201, 28 N.E. 434; Adams v. Ohio Falls Co., post, p. 375.

The sufficiency of the complaint, as it would be when tested by demurrer, is not involved here.

This is a mere temporary injunction. To authorize the court to grant such relief it was not necessary that a case should be made that would entitle the appellee to relief at all events at the hearing. In such cases it is sufficient if the court finds, upon the pleadings and evidence, a case which makes the transaction a proper subject for investigation in a court of equity. Spicer v. Hoop, 51 Ind. 365.

In our opinion the court did not err in granting the temporary injunction in this case.

Judgment affirmed. Filed April 27, 1892.

Questions:

1. With regard to a water well, what does the court say with regard to an owner’s right to produce the water even if it is drawn from the neighbor’s lands?

2. How does the court describe the nature of the natural gas?

3. Can an owner shoot nitroglycerin to draw gas to the owner’s wellbore

4. Are there limits on the rights of a well owner with regard to using nitroglycerin to enhance production?

5. Note the landowner obtained a temporary injunction to stop the shooting. What needed to be shown to get the injunction?

6. Could the landowner just been concerned about drainage of natural gas from under his four lots, and used the safety concern about nitroglycerin as an excuse to attempt to shut down the offsetting operations?

Spindletop & The Rule of Capture

On January 10, 1901, a tremendous roar was heard in the little sawmill town of Beaumont, Texas. With the roar came a 150-foot plume of oil that could be seen for miles. The event took place in the Spindletop oil field and changed the course of history. This was the birthplace of the modern oil industry.

Prior to the discovery of the Spindletop Field many thought that the oil industry was too small to produce enough fuel for the automobile manufacturing sector. Most vehicles at the turn of the century were therefore powered by electricity or steam, and the internal combustion engine was not dominant.

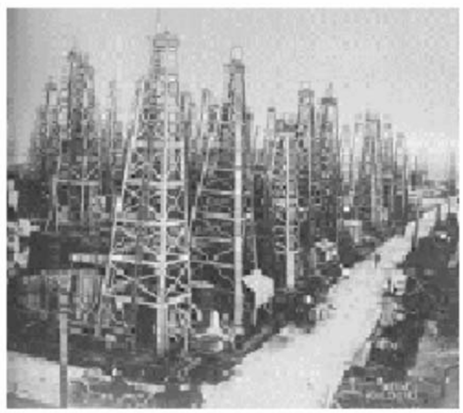
On the discovery of the Spindletop well production in Texas immediately doubled – and the internal combustion and automobile sectors began their long economic ascent.

Note in the pictures the density of the drilling pattern. This resulted in an incredible waste of reservoir energy, and oil was produced as fast as possible since if it was not produced the next rig could acquire ownership by producing that oil under the "Rule of Capture."

Oil was stored in tanks, pits, barrels, or any container available while any water or salt water produced was dumped into pits or into local streams. The waste, and accompanying pollution, were quite incredible by modern standards.

Spindletop Field, Texas
Birthplace of the Modern Oil Industry

1901



1903

1905

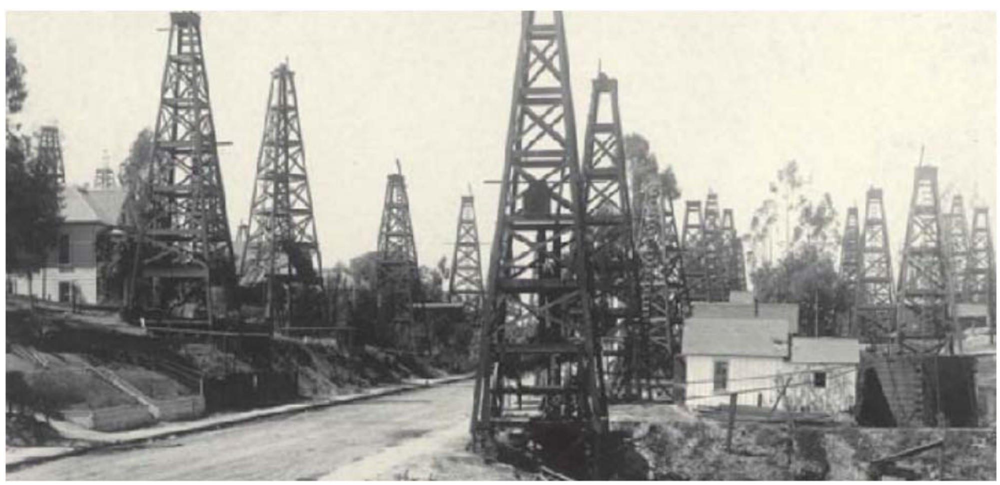
By 1902, there were nearly 300 wells on Spindletop hill, and 600 individual oil companies. But rampant over-drilling began to turn the boom to bust in two years. Over the next 30 years, the U.S. witnessed a string of historic oil strikes in West Texas, Tulsa and the great East Texas field that transformed the Southwest.

"In a sense, Spindletop foreshadowed the future of the oil industry. The uncontrolled gushers created the first oil field environmental disasters. Spindletop raged with a fire for a solid week in September, 1902 when one of the wells ignited from a cigar carelessly discarded by a driller. The well was gushing high above the derrick top when the flames reached it. There was no chance to close it in because valves had not been installed. It was brought under control by a combination of steam and sand.

In recent times, oil field pollution has become a major problem in the oil patch of Texas, Louisiana and Oklahoma. Property owners became rich from the oil beneath their land, but over the years, many have filed lawsuits against oil producers for contamination of groundwater" Source: NPR Website

'Rule of Capture' & Environmental Damange

Oil and gas production is subject to a unique legal principle developed under common law. First, unlike many countries in the U.S. individuals can own the minerals and the right to extract them (many other countries reserve mineral ownership to the state). But ownership of oil or gas in the U.S does not vest until the production is 'captured'. So the incentive is to produce as much oil as possible as fast as possible – or ownership was lost.



Environmental and safety issues often were ignored in the wild rush to drill and produce. At right, a picture from Los Angeles illustrates the wild drilling and production races occurred even in residential areas – to the detriment of the environment.

And old saying in the oil patch is that the easiest place to find new oil is in an old field, since technology generally improves over time allowing for the recovery of additional in place reserves or the development of deeper horizons. This may be true in Spindletop, as evidenced by this recent article in the Houston Chronicle:

HOUSTON ★ CHRONICLE

houstonchronicle.com and chron.com | Thursday, February 7, 2013 | Vol. 112 No. 117 | We recycle | $1.00 ★★★

Texas Energy Museum

One well struck oil at Spindletop in 1901. Two years later, the hill was covered with derricks. Now a new group wants to drill even deeper.

Still gushing over Spindletop

Historic well site not dry yet, team backed by 3-D seismic data believes

By Emily Pickrell

Spindletop.

The name evokes an oil discovery that made history. When a well piercing the salt dome near Beaumont first gushed in 1901, it introduced a cheap supply of commercial energy that transformed the oil industry and American life.

More than 100 years later, the oilmen are back at Spindletop,

Houston Chronicle

calculating how to extract even more oil from deeper levels at the hallowed site, which they believe may contain millions more barrels of crude.

Two exploration companies are working together to finance and build a well at Spindletop, based on new data that allows them to better predict where profitable pockets of oil and gas may be buried.

Spindletop continues on A6

<u>Wronski v. Sun Oil Company</u> and the 'Fair Share' Doctrine

Michigan's oil and gas production history is not as long as that of Pennsylvania's, Ohio's, or Indiana's, but the geological conditions that formed petroleum deposits in those areas also created favorable conditions in Michigan's Lower Peninsula.

Several reef structures, formed in an ancient sea, extend across lower Michigan. These are relatively older formations formed during the Silurian geologic age, roughly 420 to 445 million years ago. The map at right (from the State of Michigan Department of Natural Resources) highlights the oil and natural gas fields in the Silurian age 'Niagaran reef fields'.

Around 420 million years ago earth experienced one of the five major periodic extinctions to end the Silurian age, with around 60% of marine species wiped out, never to reappear on the earth. The cause is uncertain although it appears the earth may have become an ice ball, with severe global cooling. The Silurian extinction was the second largest in earth's history, the extent of which was only exceeded by the extinction at the end of the Permian period that would occur 170 million years later.

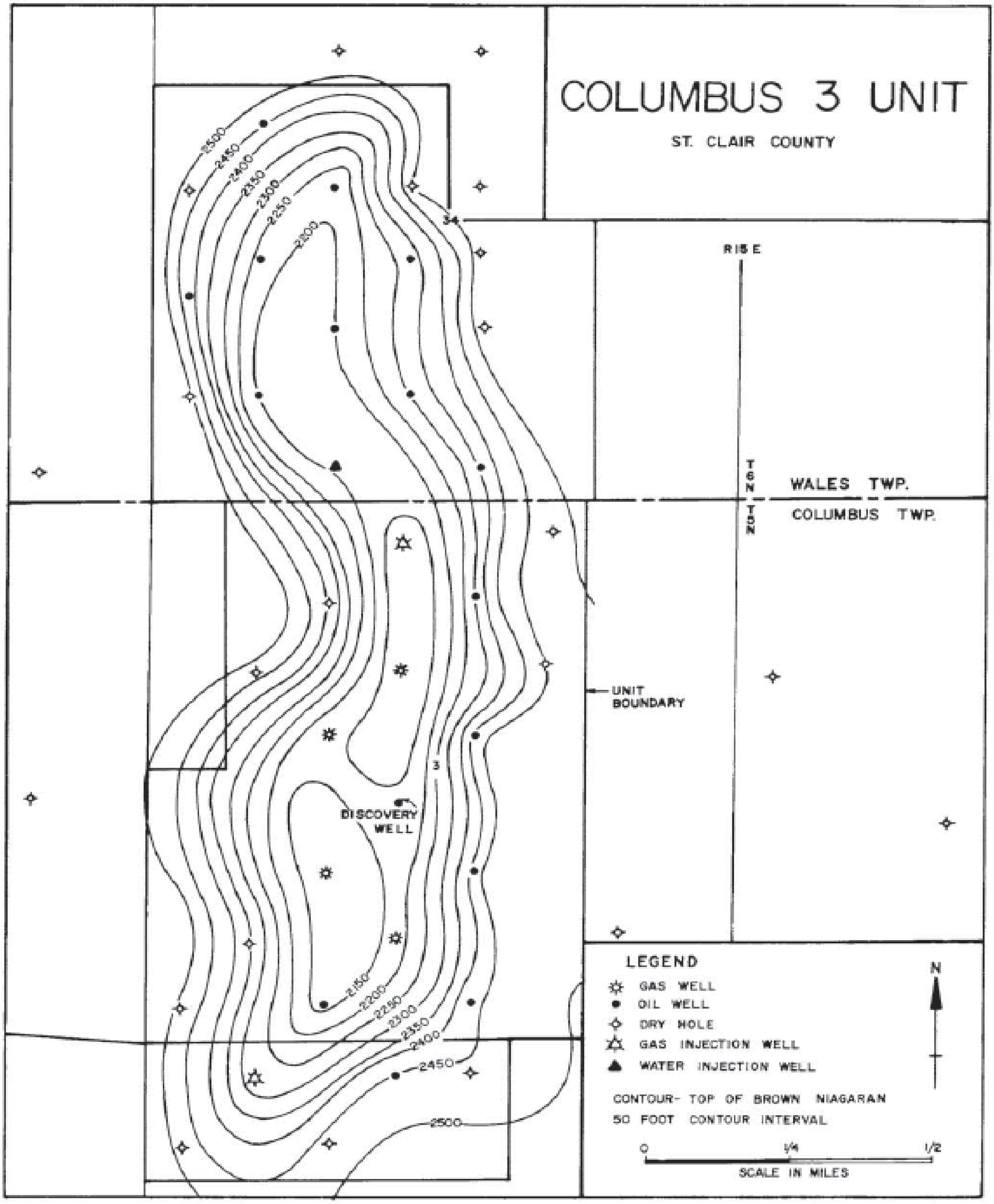
The <u>Wronski</u> case is interesting for several reasons. It sets out the 'fair share' doctrine, otherwise known as the 'correlative rights doctrine'. It also illustrates a 'gas drive' reservoir in a 'structural' trap. Further, it illustrates how recovery of the oil and gas in place can be maximized by unitization (a combination of each party's interest under a state order which maximizes recovery and provides a fair formula to share production). It also illustrates methods to control the wild drilling and production races that result from the rule of capture – drilling units and proration (production) limits established by the state regulatory agency. Last, it sets out the measure of damages for both a good faith and bad faith conversion of oil in place.

One other oddity about the case – apparently the field was found in 1968 using 'gravity anomaly data', a method that is not commonly utilized by most explorationists then or now (other technologies have proven more valuable for exploration, like seismic data (more on this later in the course)).

Gravitational data is obtained by taking reading about a kilometer apart throughout the region with a device called a gravimeter. The gravimeter measures the gravitational field and this reading correlates with the density of the region. By studying the differences in the density, you can predict which areas of the region might contain oil. A University of Nevada webpage notes that:

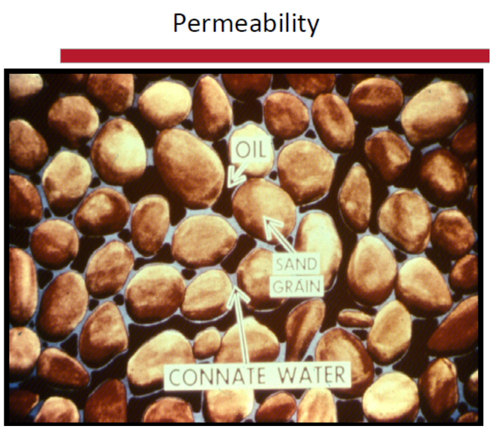
> "Gravity differences occur because of local density differences. Anomalies of exploration interest are often about 0.2 mgal. …Gravity surveys on land often involve meter readings every kilometer along traverse loops a few kilometers across. …In most cases, the density of sedimentary rocks increases with depth because the increased pressure results in a loss of porosity. Uplifts usually bring denser rocks nearer the surface and thereby create positive gravity anomalies. Faults that displace rocks of different densities also can cause gravity anomalies. Salt domes generally produce negative anomalies because salt is less dense than the surrounding rocks. Such folds, faults, and salt domes trap oil, and so the detection of gravity anomalies associated with them is crucial in petroleum exploration."

Here is a ‘structure map’ published by the State of Michigan of the oil and gas field involved in Wrongski:

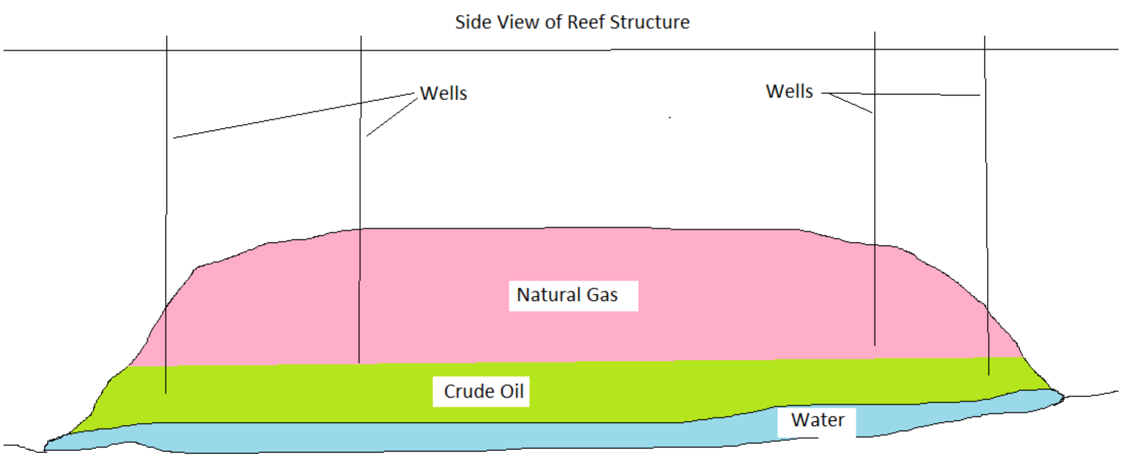


Note you are looking down on the formation. The top of the page is North. The legend on the map indicates the symbols depicting gas wells, oil wells, dry holes, gas injection wells, and water injection wells. Note the numbers on the contour lines is the depth of the reef below the surface (hence 2500 means that the reef is found at 2500 feet below the surface at that contour line). Note also the contour lines in the middle of the structure are labeled '2150' – meaning they are 2150 feet below the surface. So what we are looking at is a 350 foot tall underground 'hill' or reef filled with oil and gas and water. Note that we have what is called 'closure' of the structure – that is as oil and natural gas migrate to the surface they are trapped in the reef structure and cannot escape. Some structures are only 'closed' on three sides – and over millions of years the hydrocarbons migrate out of the opening to be lost from the structure. Seismic data, which we will discuss in the future, can help define if a structure has closure before it is drilled. Note the structure is around one-half mile wide and two miles long – a good sized 'trap' for any hydrocarbons that might be present.

Not shown on the map are two measurements that tell us a lot about how productive the field might be if hydrocarbons are present. First the porosity of the reservoir formations is generally defined as the fraction of the rock that is void space. Porosity determines how much oil or natural gas can be held in the rock. Permeability is the second major physical attribute of the formation of interest to the engineer. Permeability is defined as how easily the fluid can move through the rock, and determines how quickly the hydrocarbons might flow to the well bore.



Permeability and porosity are illustrated by the slide from the University of Houston at right, with both crude oil and connate water located in a sandstone matrix.



Instead of looking down at the structure as we did in the map above, looking at the structure from the side we can see the portion of the reservoir filled up with natural gas, the portion filled up with crude oil, and the water underlying both hydrocarbons. Note that in general natural gas will migrate to the highest point on the structure, with crude oil underneath if it is present.

In this case the pressure from the entrapped natural gas pushes the oil into the well bore according to the engineering report, followed by the water table which also adds some energy to help push the hydrocarbons to the wells. To maximize oil production the case notes that both natural gas and water produced from the field were re-injected to help maintain reservoir pressure.

Last, the engineering data from the State of Michigan report on the field is in the table at right. Keep in mind that crude oil was the main economic driver for the development of this field. Due to abundant supplies of natural gas it usually has been a secondary target for many producers.

ENGINEERING DATA

Type of reservoir energy	Gas cap
Original reservoir pressure	1447 psia
Reservoir temperature	72° F
Viscosity of original reservoir oil	.95 cp
Bubble point pressure	1447 psia
Formation volume factor	1.281 Reserve bbl./stock tank bbl.
API oil gravity	40.2°
Original solution gas-oil ratio	615 c.f.p.b.
Average porosity	10% gas zone, 12% oil zone
Average permeability	80 md. gas zone, 150 md. oil zone
Connate water, estimated	12% gas zone, 14% oil zone
Net oil pay thickness	51 feet*
Acre feet of oil pay	23460*

WRONSKI v. SUN OIL COMPANY
Court of Appeals of Michigan
89 Mich. App. 11; 279 N.W.2d 564; 1979 Mich. App. LEXIS 2039; 63 Oil & Gas Rep. 182
January 10, 1978, Submitted
March 19, 1979, Decided

OPINION BY: HOLBROOK, JR.

Plaintiffs are the owners of 200 acres of land and the attendant mineral rights located [**567] in St. Clair County. Plaintiffs Koziara own two 20-acre tracts (Tracts 1 & 2) and one 40-acre tract (Tract 6). Plaintiffs Wronski own an 80-acre tract (Tract 7) and a 40-acre tract (Tract [*16] 13). These properties overlie the Columbus Section 3 Saline-Niagaran Formation Pool, and Tracts 2, 6 and 7 have producing oil wells. Tracts 6 and 7 are under lease to defendant Sun Oil Company.

The Supervisor of Wells, Michigan Department of Natural Resources, pursuant to the authority granted him by 1939 PA 61, as amended, 1 established 20-acre drilling units for the Columbus 3 pool, and provided for a uniform well spacing pattern. 2 The purpose of this order was to "prevent waste, protect correlative rights and provide for orderly development of the pool". 3 The supervisor, by a proration order effective February 1, 1970, further limited production in the Columbus [***10] 3 pool to a maximum of 75 barrels of oil per day per well. This order remained in effect until June 30, 1974, when Columbus 3 was unitized.[1]

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[1] FOOTNOTES

1 Supervisor of wells act, MCL 319.1 et seq.; MSA 13.139(1) et seq.

2 The Supervisor of Wells Order of May 22, 1969, established:

"(B) DRILLING UNIT

The drilling unit for wells drilled for oil and gas in the pool defined in (A) above shall be a tract of approximately 20 acres, rectangular in shape, formed by dividing a governmental surveyed quarter-quarter section of land into an east half and a west half thereof.

"(C) WELL SPACING PATTERN

Defendant Sun Oil leases property from H. H. Winn (Tract 9) and from [***11] H. H. Winn, et al (Tract 12). Sun Oil has drilled several wells on these tracts in compliance with the uniform well spacing pattern, including well 1-C on Tract 9 and wells 3 and 6 on Tract 12. These three wells were operating during the effective date of the proration order and were subject to its terms. Plaintiffs contend that Sun Oil illegally overproduced more than [*17] 180,000 barrels of oil from these three wells, and that the illegally overproduced oil was drained from beneath plaintiffs' lands. They sought rescission ab initio of their oil and gas leases with Sun Oil coupled with an accounting, or in the alternative both compensatory and exemplary damages.

After a bench trial the court found that Sun Oil had intentionally and illegally overproduced 150,000 barrels of oil, and that 50,000 barrels of this oil had been drained from plaintiffs' property. The court held that this overproduction and drainage constituted tortious breaches of Sun Oil's contractual obligations under the oil and gas leases entered into with plaintiffs, as well as violating plaintiffs' common-law rights to the oil beneath their property. The court refused to rescind the leases, but [***12] awarded compensatory and exemplary damages. 4 [**568] Sun Oil appeals contending that the [*18] findings of the court are contrary to the great preponderance of the evidence, that an improper formula for compensatory damages was applied, that the award of exemplary damages was contrary to law and that the court lacked jurisdiction. Plaintiffs cross-appeal contending that rescission should have been granted, that an improper formula for compensatory damage was applied and that the exemplary damages awarded were inadequate.

"The Court determines on the basis of all the testimony and evidence in this case and after considering the matters stated above, that it would be reasonable and proper to assess exemplary damages against Defendant Sun Oil Company in the amount of Fifty (50%) per cent of the compensatory damages previously awarded to the Plaintiffs. The Court finds exemplary damages to be assessed against Defendant Sun Oil Company in the amount of Forty-Four Thousand Five Hundred Sixty-Three and 50/100 ($ 44,563.50) Dollars and awarded to plaintiffs Eugene H. Koziara and Aniela Koziara. The Court finds exemplary damages to be assessed against Defendant Sun Oil Company in the amount of Twelve Thousand Six Hundred Forty-Two ($ 12,642.00) Dollars and awarded to Plaintiffs Walter F. Wronski and Eleanor J. Wronski." Trial court opinion at 15-19.

[***]

The findings of fact made by the trial court are challenged as against the great weight of the evidence. This case involves an action sounding in equity and was tried by the court without a jury. [*20] The court made extensive findings of fact as required by GCR 1963, 517.1. HN5The findings of fact made by the trial court will not be [**569] set aside unless clearly erroneous. GCR 1963, 517.1, Rencsok v Rencsok, 46 Mich App 250; 207 NW2d 910 (1973). Review of the record discloses sufficient facts upon which the trial court could find that Sun Oil systematically, intentionally and illegally produced the H. H. Winn, et al, No. 3 and No. 6 wells, and the H. H. Winn C-1 well in an amount of 150,000 barrels over that allowed by the proration order. The record also supports the finding that one-third of this illegally produced oil was drained from the property of the plaintiffs. We are not convinced that had this Court been the trier of fact that we would have come to a different

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Permits shall be granted for the drilling of wells for oil and gas in the pool defined in (A) above provided the wells are located in the center of the northeast one-quarter (NE1/4) or the center of the southwest one-quarter (SE1/4) of a governmental surveyed quarter-quarter section of land."

3 Supervisor of Wells Order of May 22, 1969.

result, and do not reverse or modify these findings. Norton Shores v Carr, 81 Mich App 715, 720; 265 NW2d 802 (1978).

The trial court found that Sun Oil's actions were intentional tortious [***16] breaches of its contractual obligation to both plaintiffs under their respective oil and gas leases. It found breaches of the implied convenant to prevent drainage as well as a failure to comply with the orders of the Supervisor of Wells as required by the provisions of the lease. It also found that:

> "Sun Oil Company has violated the common law rights of Plaintiffs Wronski and Koziara by illegally, unlawfully and secretly draining valuable oil from beneath their properties."

The nature of Sun Oil's violation, while not clearly stated by the trial court, was a claim for the conversion of oil. Conversion is any distinct act of dominion wrongfully [*21] exerted over another's personal property in denial of or inconsistent with his rights therein.'" Thoma v Tracy Motor Sales Inc, 360 Mich 434, 438; 104 NW2d 360 (1960), quoting Nelson & Witt v Texas Co, 256 Mich 65, 70; 239 NW 289 (1931).

We only address the finding regarding conversion as it is dispositive [***17] of the questions in this appeal.

In Michigan we adhere to the ownership-in-place theory. Attorney General v Pere Marquette R Co, 263 Mich 431; 248 NW 860 (1933). HN7Under this theory "the nature of the interest of the landowner in oil and gas contained in his land is the same as his interest in solid minerals". William and Meyers, Oil and Gas Law, § 203.3, p 44. Solid minerals are a part of the land in or beneath which they are located, Mark v Bradford, 315 Mich 50; 23 NW2d 201 (1946), and as a consequence the owner of land is also the owner of the oil and gas in or beneath it.

Oil and gas, unlike other minerals, do not remain constantly in place in the ground, but may migrate across property lines. Because of this migratory tendency the rule of capture evolved. This rule provides:

> "'The owner of a tract of land acquires title to the oil and gas which he produces from wells drilled thereon, though it may be proved that part of such oil or gas migrated from adjoining lands. Under this rule, absent some state regulation of drilling practices, a landowner * * * is not liable to adjacent landowners whose lands are drained as a result of such operations * * *. The remedy of the injured landowner under such circumstances has generally been said to be that of self-help -- "go and do likewise".'" William and Meyers, supra, § 204.4, pp 55-57. (Emphasis supplied.)

This rule of capture was a harsh rule that could [*22] work to deprive an owner of oil and gas underneath his land. To mitigate the harshness of this rule and to protect the landowner's property rights in the oil and gas beneath his land, the "fair share" principle emerged.

"As early as 1931, the Board of Directors of the American Petroleum Institute expressed this principle by declaring a policy:

> "that it endorses, and believes the petroleum industry endorses the principle that each owner of the surface is entitled only to his equitable and ratable share of the recoverable oil and gas energy in the [**570] common pool in the proportion which the recoverable reserves underlying his land

bears to the recoverable reserves in the pool." Graham, Fair Share or Fair Game? Great Principle, Good Technology -- But Pitfalls in Practice, 8 Nat Res Law 61, 64-65 (1975).

The API clarified the principle in 1942 by saying:

"Within reasonable limits, each operator should have an opportunity equal to that afforded other operators to recover the equivalent of the amount of recoverable oil [and gas] underlying his property. The aim should be to prevent reasonably avoidable drainage of oil and gas across property lines that is not offset by counter drainage." Id. at 65.

This fair-share rule does not do away with the rule of capture, but rather acts to place limits on its proper application. Texas has adopted both the ownership-in-place doctrine and the fair-share principle. Its courts have addressed the interrelationship between these two principles and the rule of capture.

"It must be conceded that under the law of capture there is no liability for reasonable and legitimate drainage from the common pool. The landowner is privileged [*23] to sink as many wells as he desires upon his tract of land and extract therefrom and appropriate all the oil and gas that he may produce, so long as he operates within the spirit and purpose of conservation statutes and orders of the Railroad Commission. These laws and regulations are designed to afford each owner a reasonable opportunity to produce his proportionate part of the oil and gas from the [***20] entire pool and to prevent operating practices injurious to the common reservoir. In this manner, if all operators exercise the same degree of skill and diligence, each owner will recover in most instances his fair share of the oil and gas. This reasonable opportunity to produce his fair share of the oil and gas is the landowner's common law right under our theory of absolute ownership of the minerals in place. But from the very nature of this theory the right of each land holder is qualified, and is limited to legitimate operations." Elliff v Texon Drilling Co, 146 Tex 575, 582; 210 SW2d 558 (1948). (Emphasis supplied.)

The rule of capture is thus modified to exclude operations that are in violation of valid conservation orders. Michigan recognizes the fair-share principle and its subsequent modifications of the rule of capture. When an adjacent landowner drilled an oil well too close to a property line the Supreme Court said that this:

"[Deprived] plaintiff of the opportunity of claiming and taking the oil that was rightfully hers; and defendants must respond in damages for such conversion." Ross v Damm, 278 Mich 388, 396; 270 NW 722 (1936).

The supervisor [***21] of wells act also incorporated the fair-share principle into § 13. This section concerns proration orders and states in part that:

"The rules, regulations, or orders of the supervisor shall, so far as it is practicable to do so, afford the owner of each property in a pool the opportunity to [*24] produce his just and equitable share of the oil and gas in the pool, being an amount, so far as can be practicably determined and obtained without waste, and without reducing the bottom hole pressure materially below the average for the pool, substantially in the proportion that the quantity of the recoverable oil and gas under such property bears to the total recoverable oil and gas in the pool, and for this purpose to use his just and equitable share of the reservoir energy." MCL 319.13; MSA 13.139(13). (Emphasis supplied.)

This right to have a reasonable opportunity to produce one's just and equitable share of oil in a pool is the common-law right that the trial court found Sun Oil violated. Under the authority of Ross v Damm, supra, if it can be said that Sun Oil's overproduction deprived plaintiffs of the opportunity to claim and take the oil under their respective [***22] properties, then Sun Oil will be liable for a conversion.

Production in the Columbus 3 field was restricted to 75 barrels of oil per well per day. Compulsory pooling was also in effect, limiting the number of oil wells to one per 20 acres, and specifying their location. The purpose behind proration is that the order itself, if obeyed, will protect landowners from drainage and allow each to produce their fair share. A violation of the proration order, especially a secret violation, allows the violator to take more than his fair share and leaves the other landowners unable to protect their rights unless they also violate the proration order. We therefore hold that any violation of a proration order constitutes conversion of oil from the pool, and subjects the violator to liability to all the owners of interests in the pool 7 for conversion [*25] of the illegally-obtained oil. 8 See Bolton v Coats, 533 SW2d 914 (Tex, 1975), Ortiz Oil Co v Geyer, 138 Tex 373; 159 SW2d 494 (1942).

The trial court found that Sun Oil produced 150,000 barrels of oil from the Columbus 3 pool in contravention of the order of the Supervisor of Wells, and that 50,000 barrels of [***23] this oil had been drained from the lands of plaintiffs, which the trial court identified as a violation of the plaintiffs' common-law rights. The finding that Sun Oil is liable to plaintiffs for the conversion of 50,000 barrels of oil is affirmed.

The rule as to the amount of damages for a conversion of oil was established in Michigan in Robinson v Gordon Oil Co, 266 Mich 65, 253 NW 218 (1934). The Court stated:

> "The general rule in the United States in actions for the conversion of oil, as in the case of conversion of minerals and other natural products of the soil is that, although a wilful trespasser is liable [***24] for the enhanced value of the oil at the time of conversion without deduction for expenses or for improvements by labor, an innocent trespasser is liable only for the value of the oil undisturbed; that is, he is entitled to set off the reasonable cost of production." (Citations omitted.) Robinson, supra, at 69. (Emphasis supplied.)

This rule sets the liability of the convertor as the enhanced value of the oil at the time of conversion, but then subdivides this liability into two subrules depending upon the nature of the conversion. These two subrules are a "mild" rule which applies to innocent or nonwilful conversion and a "harsh" rule which applies to bad faith or wilful conversions.

Both the mild rule and the harsh rule are [*26] discussed in Anno: Right of trespasser to credit for expenditures in producing, as against his liability for value of, oil or minerals, 21 ALR2d 380. It indicates that:

> "The 'mild' rule is applied where the trespass is inadvertent or not wilful or not in bad faith, and fixes the damages as the value of the minerals in situ. Where such value can be ascertained, the question of allowance or disallowance of credit to the trespasser [***25] for his expenditures in producing the minerals is not reached. Where evidence of value in situ cannot be obtained, two methods are used to establish the equivalent of such value: (1) the royalty method, whereby the injured party is allowed the amount for which the privilege of mining and removing the minerals under the customary lease or conveyance of the mineral rights could be sold, and (2) the value of the minerals after extraction less the production costs." 21 ALR2d at 382.

Both methods of determining the value of the minerals in situ have been applied in Michigan, the royalty method in Ross v Damm, supra, and the value of minerals after extraction less production costs method in Eagle Oil Corp v Cohassett Oil Corp, 263 Mich 371; 248 NW 840 (1933). The annotation further indicates that:

> "The 'harsh' rule is applied where trespass is wilful or in bad faith, and allows the injured party the enhanced value of the product when and where it is finally converted without any credit to the trespasser for his expenses in producing it or for any value he might have added to the minerals by his labor. The award of enhanced value as damages without any credit to [***26] the trespasser for his expenditures in production is actually an award of compensatory damages plus punitive damages because of the wilfulness or bad faith of the trespass." 21 ALR2d at 382. (Emphasis supplied.)

While there are no reported cases applying this harsh rule in Michigan, Robinson v Gordon Oil Co, supra, clearly indicates that it is the law within this state.

The trial court applied the "mild" rule with a royalty method of determining the value in situ and added exemplary damages. This method was improper since the court specifically found that Sun Oil was an intentional and wilful convertor and that the oil was produced in violation of the leases. The "harsh" rule should have been applied in this instance, and plaintiffs awarded the value of the oil at the time of conversion. The addition of exemplary damages was also improper.

In Michigan the categories of punitive and exemplary damages are often incorrectly interchanged. Punitive damages are damages awarded solely to punish. Kewin v Massachusetts Mutual Life Ins Co, 79 Mich App 639; 263 NW2d 258 (1977). Exemplary damages are compensatory in nature and not punitive, since they are properly an element of actual damages. Ray v Detroit, 67 Mich App 702; 242 NW2d 494 (1976). The trial court assessed what it called exemplary damages.

"The Court finds the primary purpose of exemplary damages in Michigan to be an assessment of damages against a defendant that will discourage the defendant from continuing with intentional, wilful and illegal acts and to encourage a defendant to adopt practices and procedures that will prevent damages and losses to plaintiffs as well as to parties similarly situated to plaintiffs." 9

It is clear that the exemplary damages awarded were actually punitive damages. Application of the "harsh" rule of damages includes an amount for [*28] punitive damages and they may not be assessed twice.

As indicated in Robinson v Gordon Oil Co, supra, the measure of damages is the value of the oil at the time of the conversion. This is in keeping with the general rule in conversion actions that the measure of damages is the market value [***28] at the time of the conversion plus interest. Baxter v Woodward, 191 Mich 379; 158 NW 137 (1916), Bowen v Detroit United R Co, 212 Mich 432; 180 NW 495 (1920), Ross v Damm, supra, Embrey v Weissman, 74 Mich App 138; 253 NW2d 687 (1977). The evidence at trial indicated that the selling price for oil from the Columbus 3 field during the period of conversion was from $ 3.17 to $ 5.02 per barrel, with a weighted average price of $ 3.65 per barrel. The price fluctuated from $ 13.35 to $ 5.15 per barrel, with a weighted average of $ 10.34 per barrel, in the period after the conversion ended and up to the time of trial. The trial court utilized $ 12.50 per barrel as an average price upon which to calculate damages. This figure was clearly erroneous because it does not reflect the value of the converted property at the time of conversion. There is a doctrine that the measure of damages for conversion of goods that fluctuate in value is the highest value between conversion and judgment, but this has never been applied in Michigan. See Anno: Allowance as damages for conversion of commodities or chattels of fluctuating value, of increase in market value after the time of conversion [***29] , 40 ALR 1282; 87 ALR 817. We do not choose to apply this doctrine in this instance.

Sun Oil's conversionary actions occurred from February 1970 through June 1974. When a conversion occurs over such an extended period of time it [*29] is difficult to [**573] fix a market price. A weighted average might effectively compensate the plaintiffs, or it might understate the total damages. Since it is impossible to accurately determine the proper price, the highest price during the period, $ 5.02 per barrel, should be utilized. This will insure that the innocent party will receive adequate compensation for the injury suffered.

Plaintiffs requested that the leases with Sun Oil be rescinded ab initio, but this remedy was refused by the trial court. HN16The grant or denial of rescission is not a matter of right, but rather lies within the discretion of the trial court. Bechard v Bolton, 316 Mich 1; 24 NW2d 422 (1946). Plaintiffs have been adequately compensated by the damage award. We agree with the trial court that rescission would not be appropriate in this instance.

Affirmed in part. Reversed in part. Remanded for entry of a judgment not inconsistent with this opinion. No costs, neither party having prevailed in full.

Questions:

1. The case notes that this field has both natural gas and crude oil wells drilled into the structure. Almost every crude oil well produces natural gas, and many natural gas wells produce some ‘liquids’ with the vapor stream that can be refined with crude oil. How does a producer know if they have an oil well or a natural gas well?

2. Why do you think it might matter if a well is classified as a crude oil well versus a natural gas well?

3. From a physical production standpoint, do you think it is harder to market natural gas or crude oil? What is needed to market natural gas? What are the legal issues that might arise where you have both crude oil and natural gas in the same reservoir (as is the case here)?

4. Note that it appears no pipelines were near the field, at least initially. Can a producer just ‘flare’ the natural gas and produce the crude oil? From a correlative rights/fair share standpoint is flaring acceptable?

5. The case mentions that drilling and spacing units are “approximately 20 acres, rectangular in shape, formed by dividing a governmental surveyed quarter-quarter section into an east half and west half thereof.’ What is a drilling and spacing unit? Why is it rectangular?

6. If a drainage radius of the well is circular (many are) does the rectangular unit impact the party’s correlative rights? Are drilling units set up before or after most of the wells are drilled? Do you think notice needs to be given the owners before a spacing unit is established?

7. The case notes that the "WELL SPACING PATTERN” is as follows:

Permits shall be granted for the drilling of wells for oil and gas in the pool defined in (A) above provided the wells are located in the center of the northeast one-quarter (NE1/4) or the center of the southwest one-quarter (SE1/4) of a governmental surveyed quarter-quarter section of land.

What is a well spacing pattern? Why is one needed here?

8. How is the rule of capture impacted by the fair share doctrine (otherwise known as the doctrine of correlative rights)?

9. The fair share doctrine was initially adopted in Oklahoma. Under the doctrine the state regulatory agency could justify regulating the production rate and well density in a given field. Can an operator ignore a state conservation order like Sun Oil did in this case without consequence?

10. In addition to limiting the well density under the spacing rules set out above, what else did the state's regulatory agency limit in an attempt to maximize hydrocarbon recovery? Did it just impact the crude oil production or also natural gas?

11. The case sets out two rules that are to be used to calculate damages from conversion. Note in this case the oil was in place in the ground (and Michigan is an ownership in place state like Texas). What is the good faith measure of damage for conversion of oil in place as set out by the court? The bad faith measure? Is there much difference?

12. Note the court also initially awarded punitive damages in this case. What are punitive damages, why are they awarded, and why was the award of punitive damages vacated on appeal in this case?

13. The field was 'unitized' in 1974 according to State of Michigan records. Note how the production of crude oil responded to the field wide management efforts made under the state's unitization order:

Year	Gas		Oil		Water (estimated)	
	Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
1969			180,820	180,820		
1970			382,202	563,022	53,655	53,655
1971			398,152	961,174	40,880	94,535
1972			401,631	1,362,805	24,455	118,990
1973			387,750	1,750,555	19,710	138,700
1974			360,473	2,111,028	55,480	194,180
1975			669,880	2,780,908	29,930	224,110
1976			737,938	3,518,846	30,660	254,770
1977			612,163	4,131,009	26,100	280,870

Why do you think that the crude oil production increased so much after 1974? Is this evidence that state approved unitization/development or conservation plans might promote the recovery of oil reserves in place?

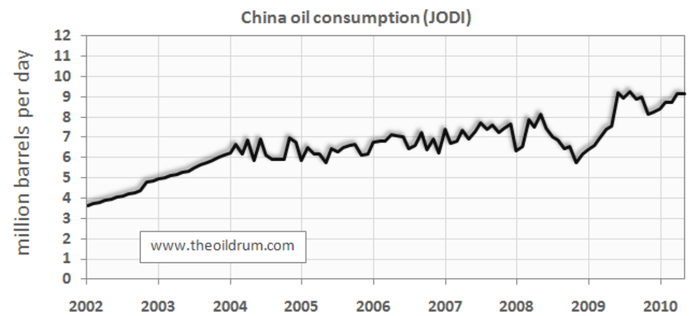
14. In Elliff v Texon Drilling Co, 146 Tex 575, 582; 210 SW2d 558 (1948) the fair share doctrine protected an owner from the negligent or wasteful operations off the offset operator whose negligence caused a well to blowout. A massive amount of natural gas and condensate were from the common reservoir were lost in the blowout, and the operator claimed they were protected from liability under the rule of capture. The court found that due to the operator's negligence they were not protected under the rule of capture, that the offset owners in the common reservoir had obligations to only take their fair share, and that to hold otherwise would violate the correlative rights of all the owners in the field.

15. In cases in the early 1900's the courts held that state laws or regulations requiring an owner to plug a natural gas well (instead of allowing it to vent or flare) was constitutional. Why would an owner who had drilled a natural gas well allow it to vent or flare? Note that a venting natural gas well not only impacts the ultimate recovery of hydrocarbons from the common reservoir but also can pose a serious safety hazard to the public.

China Becomes Largest Global Energy Consumer

Since the early 1900's the U.S. has been the world's largest energy consumer and the world's largest auto manufacturer. It took a century to accomplish, but in 2010 China knocked the U.S. from its perch as the world's largest auto market. In 2011 the International Energy Agency claimed China's total energy usage exceeded the U.S. for the first time – making China the world's largest energy consumer.

In November of 2012 China's oil demand hit the highest level on record – 10.5 million barrels per day according to Platt's – and demand is expected to continue to set records in 2013. Global demand will be 90.5 million barrels per day in 2013 according to forecasts, with China accounting for roughly one-half of the global demand growth.



Over 50 per cent of the country's oil consumption is being supplied by foreign sources. Keep in mind China was an oil exporter as recently as 1992. China's total energy consumption was just half that of the U.S. 10 years ago, but in many of the years since China saw annual double-digit growth rates

Historical International Energy Agency forecasts of China's oil demand have been much too conservative. They expected China's energy use to exceed that in the U.S. in about 2015. But with the global recession in 2008 U.S. energy use was impacted more severely, slowing American industrial activity and energy use.

While current oil demand is of interest, the real trend individuals should focus on is the fact that China's oil consumption will grow quickly over the next few decades. In a recent 2010 report Raymond James discussed the soaring demand:

> *'Despite China's attempts to slow down its breakneck economic growth rate, the surge in auto sales - up 48% y/y in 1H10 after a 45% jump in 2009 - is continuing in full force. We now estimate that an additional 20 million Chinese vehicles in 2011 could generate annual oil demand growth of 200,000 to 400,000 bpd.*
>
> *This represents nearly a quarter of global oil demand growth from new Chinese cars alone. Add in increasing Chinese trucking, petrochemical and aviation consumption, and total Chinese oil demand growth in 2011 should be well north of 500,000 bpd and could drive over half of the global oil demand growth next year.'*

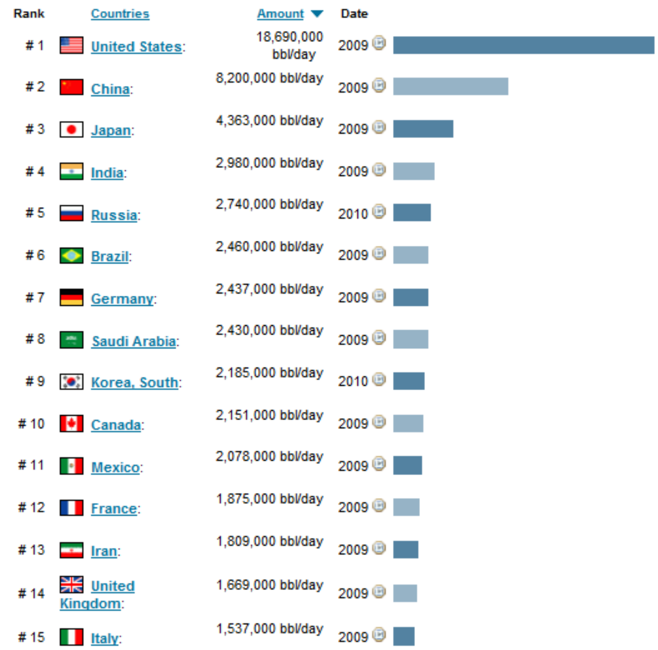
The Globe & Mail published an interesting 2010 article on the future demand for energy from China—specifically crude oil:

> *'. . . China's energy consumption growth rates are even more impressive and were wildly underestimated by the IEA and other energy demand forecasters. Between 2000 and 2009, China's energy use more than doubled, thanks to double-digit economic growth rates and a rising population. The IEA predicted energy use would rise 3 to 4 per cent a year. The real figure was four times greater. . . .*
>
> *The United States is still the leading oil consumer, at 19 million barrels a day against China's second-place 9.2 million. But China could catch up fast. There's a reason why its oil companies have become the industry's most voracious oil project buyers in recent years. Not long ago, China was a net oil exporter. Now it's glomming onto every drop it can find, from Alberta to Sudan. . . .*
>
> *Car ownership rates in China (and India) are very low by Western standards. A UBS report called "What if everyone in ChIndia had a car?" notes that only 4 per cent of Chinese over the age of 14 and 1 per cent of*

Indians have cars. In South Korea, the figure is 26 per cent; in the United States, 44 per cent; in Japan, 46 per cent.

If the car penetration rate were to reach simply the South Korean levels, it would imply a 1,125-per-cent growth rate in the number of cars in China and India, UBS says. That would boost global auto sales, in dollars, 5.7 times. . . . '

China's economic rise has required enormous amounts of energy—especially since much of the past decade's growth was fueled not by consumer demand, as in the U.S., but from energy-intense heavy industry and infrastructure building. And historically per capita use of energy grows exponentially once a country develops a large middle class that can afford automobiles, transportation services, housing, and more energy intensive diets. Should per capita demand for oil in China follow the historical path of those in the U.S., Korea, or Japan, oil imports to China will soar.



The chart of crude oil use at right indicates China's increasing demand to fuel their automotive fleet and industry (keep in mind that crude oil is only part of the energy mix – they are huge coal users, as well as natural gas, which drives their total energy consumption above U.S. levels).

Also keep in mind that on a per capita basis China's use of oil is well down the list – they use roughly 10% of per capita amount that is used by individuals in the U.S.

As China industrializes, and becomes more like western economies with automobiles, housing, refrigeration, diet needs moving toward what is standard in Europe and the U.S., total energy use will move upward.

Keep in mind that markets are global, and crude oil produced in West Texas can be sold at international prices. So what happens in China and India can have a major impact on the value of production, and the value of producing properties, in Texas.

Figure 1: China's Oil Demand and Global Market Share

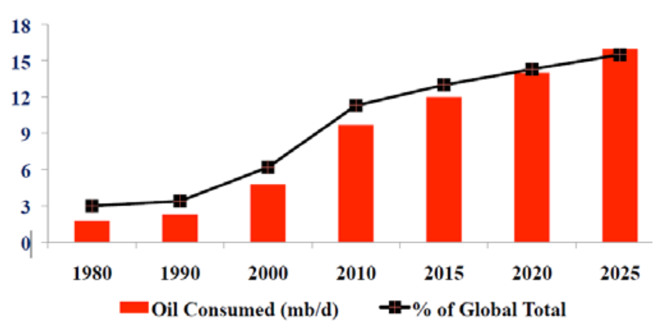
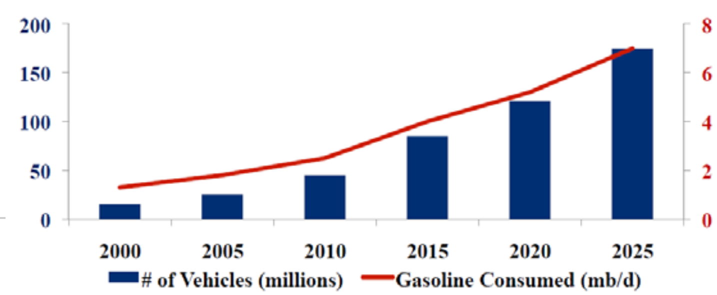


Figure 2: China's Expanding Vehicle Fleet and Gasoline Use, 2000-2025



Charts courtesy Jude Clemente, JTC Energy Research Associates, LLC energy report (Jan. 2011)

Limiting Well Density: Rule 37 and Spacing

Due to the ‘drilling and production races’ that ensued under the rule of capture was adopted it became apparent that some limitations were needed to reduce waste, fires, and to promote a reasonable development of the underground asset. Several different strategies were employed, but the basic concept was that the well density in a field would be limited by regulation.

Before property rights could be impacted by restricting drilling activity the courts had to determine if the state had the authority to restrict drilling activity by statute or regulation. The answer turns on what is known as the state’s ‘police power’. The police power is appropriately used to protect the public’s health, welfare, or safety – and all three of these interests can be adversely impacted by drilling and production activities. The courts in general have upheld the state’s police power to regulate. In a few cases of extreme regulation they have found an unconstitutional taking of property rights has occurred.

Texas Railroad Commission

In Texas the task of limiting well density fell on the Texas Railroad Commission. It regulates the exploration, production, and transportation of oil and natural gas. The agency’s website describes the role as follows:

> Its statutory role is to prevent waste of the state's natural resources, to protect the correlative rights of different interest owners, to prevent pollution, and to provide safety in matters such as hydrogen sulfide. It oversees hazardous materials pipelines and natural gas pipelines and distribution systems as well as propane, butane, compressed natural gas, and liquefied natural gas. . . .
>
> The Railroad Commission of Texas had its origin in the demands of the shipping public in the late 1880s that insisted that railroads be subject to regulation based on public interest.
>
> An advocate for governmental regulation, Attorney General James Stephen Hogg ran for Governor in 1890 with the issue of railroad regulation as the focal point of the campaign. Hogg was elected Governor in the general election and the voters also approved an amendment to Article X, Section 2 of the Texas Constitution that empowered the Legislature to enact statutes creating regulatory agencies. These elections paved the way for the Legislature to enact on April 3, 1891 "An Act to Establish a Railroad Commission of the State of Texas," that later was placed in the Texas Revised Civil Statutes under article 6444 et seq. (House Bills 1, 3, and 58, 22nd Texas Legislature, Regular Session).
>
> The Commission originally consisted of three members appointed by the Governor for three-year terms. Governor Hogg appointed the first three Commissioners in 1891 including John H. Reagan, who resigned as U.S. Senator from Texas to serve as the first Chairman. The Texas Constitution, Article XIX, Section 30 was amended in 1894 to provide for elective six-year overlapping terms for the Commissioners. That same year John H. Reagan was elected and served until his retirement in 1903.
>
> . . . The Railroad Commission's authority was broadened beginning in 1917 with the passage of the Pipeline Petroleum Law (Senate Bill 68, 35th Legislature, Regular Session) that declared pipelines to be common carriers like railroads and placed them under the

> Commission's jurisdiction. This was the first act to designate the Railroad Commission as the agency to administer conservation laws relating to oil and gas.
>
> The Commission's regulatory and enforcement powers in oil and gas were increased by the Oil and Gas Conservation Law (Senate Bill 350 of the 36th Legislature, Regular Session), effective June 18, 1919. This act gave the Railroad Commission jurisdiction to regulate the production of oil and gas. Acting upon this legislation, the Commission adopted in 1919 the first statewide rules regulating the oil and gas industry to promote conservation and safety, including Rule 37. This rule requires minimum distances between wells at drilling sites in order to protect field pressure and correlative rights.

Texas Railroad Commission Rule 37

The original Railroad Commission Statewide Rule regulating the oil and gas industry was adopted on November 26, 1919, making Texas the first state to adopt a rule limiting well density. Rule 37 was promulgated primarily to reduce fire hazards, and to minimize the danger of water percolation into oil stratum from wells drilled in too great a number or in too close proximity. See: *Railroad Commission v. Bass, l0 S.W.2d 586 (Tex. Civ App.- Austin 1928} writ dism'd, 51 S.W.2d 1113 (Tex. Comm'n App. 1932}*

The original Rule 37 read as follows, and generally allowed one well to be drilled per two acres:

> No well for oil or gas shall hereafter be drilled nearer than three hundred (300) feet to any other completed or drilling well on the same or adjoining tract or farm; and no well shall be drilled nearer than one hundred and fifty (150) feet to any property line; provided that the Commission, in order to prevent waste or to protect vested rights, will grant exceptions permitting drilling within shorter distances than as above prescribed, upon application filed fully stating the facts, notice thereof having first been given to all adjacent lessees affected thereby. Rule 37 shall not for the present be enforced within the proven oil fields of the Gulf Coast.

The concept remains the same, but the distances have been altered in the current Rule 37 to allow roughly one well per forty acres:

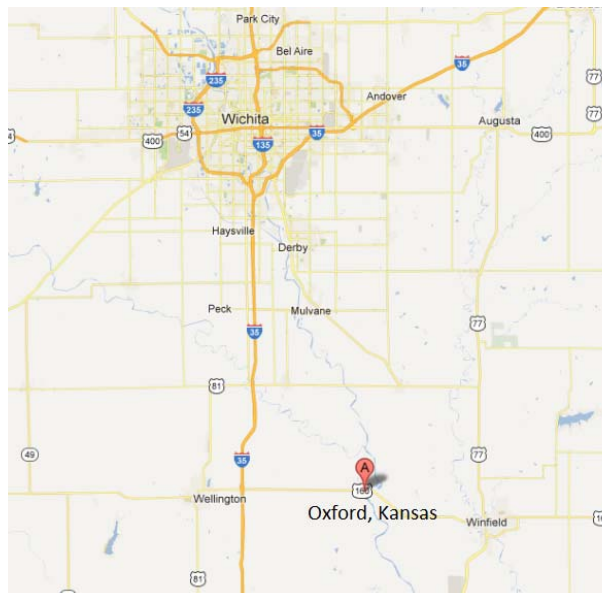
> No well for oil, gas, or geothermal resource shall hereafter be drilled nearer than 1,200 feet to any well completed in or drilling to the same horizon on the same tract or farm, and no well shall be drilled nearer than 467 feet to any property line, lease line, or subdivision line; provided the commission, in order to prevent waste or to prevent the confiscation of property, may grant exceptions to permit drilling within shorter distances than prescribed in this paragraph when the commission shall determine that such exceptions are necessary either to prevent waste or to prevent the confiscation of property.

These statewide field rules apply unless special field rules have been adopted for drilling and developmental activities by the Commission. In most developed fields special rules are in place by Commission order, and they usually have a similar regulatory theme to limit the well density thus altering the rule of capture. In addition to Rule 37, the Railroad Commission’s Rule 38 requires an operator to assign a minimum number of leasehold or mineral acreage to a well, again an attempt to limit well density.

To prevent waste, or to protect correlative rights, the Commission can grant exceptions to Rule 37 and Rule 38 after application and notice to impacted parties. The administrative orders that issue from such applications can be accessed in the Commission's records.

In <u>Railroad Commission v. Bass</u>, *I0 S.W.2d 586 (Tex. Civ App.- Austin 1928} writ dism'd, 51 S.W.2d 1113 (Tex. Comm'n App. 1932}* the plaintiff had a strip of land 3,190 feet long but only 56.7 feet wide. Wells were drilling or approved on both sides of the land. The plaintiff wanted to drill ten wells on his strip but the Commission only allowed two after a hearing on the merits. Allowing ten wells on each side and on the plaintiff's strip of land would result in a very high well density, with risk of fire and water intrusion. On appeal the court upheld the Commission's authority to regulate well density under the oil and gas powers delegated by the legislature.

<u>Drilling & Spacing Units</u>
One of the first regulations restricting drilling activities using a drilling unit concept was adopted by the town of Oxford, Kansas. The town had the good fortune – if you owned the minerals and did not mind a wild boomtown driven by drilling and production races – to sit over a very productive oil field.



Due to the fires, explosions, oil and waste pits, in the city the town mandated that only one well could be drilled per city block. Any owners in the 'drilling block' could participate in the cost and production of a well (assuming the well was productive) or could lease their mineral to others who would bear the developmental risks.

The drilling limitation was challenged in *Marrs v. City of Oxford .* (D. C. Kan. 1928) 24 F. (2d) 541, *Aff'd* (C. C. A. 8th, 1929) 32 F. (2d) 134. Several parties filed suits in the United States court in Kansas, attacking the validity of this ordinance on the ground that it deprived them of rights guaranteed by the Fourteenth Amendment to the Constitution of the United States. Their contentions were denied and the ordinance was sustained by the courts.

This drilling block concept was later adopted by Oklahoma City who found itself in a similar situation when one of the largest oil fields in the world at the time was discovered in the city limits, and later the concept was adopted by the entire state.

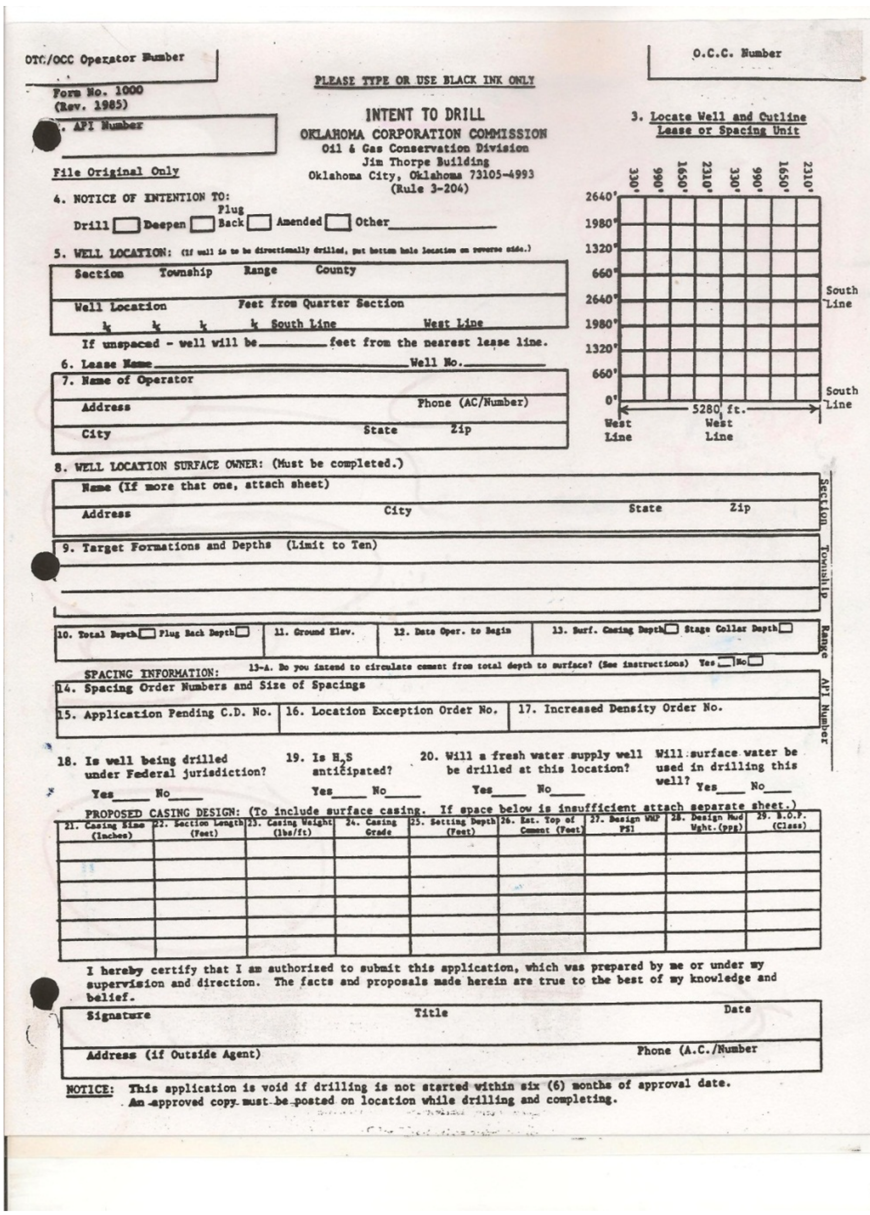
The basic concept of the regulation is that a drilling unit is established, the size of which will allow a well to efficiently and effectively drain the acreage in the unit. The well must be drilled a certain distance from the unit lines, in what some have referred to as a 'drilling window' near the middle of the drilling unit. The requirement that the well be drilled a certain distance from the unit line is to protect the correlative rights of all the owners in the field. An exception to this location can be granted on a showing of good cause.

Because the initial well may not drain the drilling unit additional wells might be allowed under special 'increased density' orders. These orders are only issued if the applicant shows that the initial well is not protecting correlative rights or preventing waste and generally require a hearing.

Summary To address the dangers and waste caused by rule of capture states adopted measures to limit well density, and these have generally been upheld by the courts. Special field rules, statewide rules, drilling and spacing units, or drilling blocks all proved effective in controlling the frenzy of activity driven by oil and gas speculators.

Note Oklahoma's capital building in the picture at right with the well out front in a 'drilling block'. Also note the row of wells on the right side of the picture (neatly arranged, one per block, under the Oklahoma City ordinance adopted to restrict well density).

Applications to drill will generally require spacing information before a permit will be issued. In this case an Oklahoma Corporation Commission form requests spacing information (items 14 and 15 require spacing information, and item 3 requires a plat with the well located and spacing unit outlined



OTC/OCC Operator Number

O.C.C. Number

Form No. 1000
(Rev. 1985)

PLEASE TYPE OR USE BLACK INK ONLY

INTENT TO DRILL
OKLAHOMA CORPORATION COMMISSION
Oil & Gas Conservation Division
Jim Thorpe Building
Oklahoma City, Oklahoma 73105-4993
(Rule 3-204)

. API Number

File Original Only

3. Locate Well and Cutline Lease or Spacing Unit

330' 990' 1650' 2310' 330' 990' 1650' 2310'

2640' 1980' 1320' 660' 2640' 1980' 1320' 660' 0'

South Line

South Line

5280 ft.

West Line

West Line

4. NOTICE OF INTENTION TO:
Drill ☐ Deepen ☐ Plug Back ☐ Amended ☐ Other ____________

5. WELL LOCATION: (If well is to be directionally drilled, put bottom hole location on reverse side.)

Section Township Range County

Well Location Feet from Quarter Section
¼ ¼ ¼ ¼ South Line West Line

If unspaced - well will be ________ feet from the nearest lease line.

6. Lease Name ______________________ Well No. ________

7. Name of Operator
Address Phone (AC/Number)
City State Zip

8. WELL LOCATION SURFACE OWNER: (Must be completed.)
Name (If more that one, attach sheet)
Address City State Zip

9. Target Formations and Depths (Limit to Ten)

Section Township Range API Number

10. Total Depth ☐ Plug Back Depth ☐	11. Ground Elev.	12. Date Oper. to Begin	13. Surf. Casing Depth ☐ Stage Collar Depth ☐

13-A. Do you intend to circulate cement from total depth to surface? (See instructions) Yes ☐ No ☐

SPACING INFORMATION:

14. Spacing Order Numbers and Size of Spacings

15. Application Pending C.D. No.	16. Location Exception Order No.	17. Increased Density Order No.

18. Is well being drilled under Federal jurisdiction? Yes_____ No_____

19. Is H_2S anticipated? Yes_____ No_____

20. Will a fresh water supply well be drilled at this location? Yes_____ No_____

Will surface water be used in drilling this well? Yes____ No____

PROPOSED CASING DESIGN: (To include surface casing. If space below is insufficient attach separate sheet.)

21. Casing Size (Inches)	22. Section Length (Feet)	23. Casing Weight (lbs/ft)	24. Casing Grade	25. Setting Depth (Feet)	26. Est. Top of Cement (Feet)	27. Design WHP PSI	28. Design Mud Wght. (ppg)	29. B.O.P. (Class)

I hereby certify that I am authorized to submit this application, which was prepared by me or under my supervision and direction. The facts and proposals made herein are true to the best of my knowledge and belief.

Signature Title Date

Address (if Outside Agent) Phone (A.C./Number

NOTICE: This application is void if drilling is not started within six (6) months of approval date. An approved copy must be posted on location while drilling and completing.

Questions:

1. Would you think that drilling and spacing units are established before or after a well is drilled? What legal or operational issues does this create?

2. Would you think that the well density should be different for crude oil than for natural gas, all else being equal?

3. What happens if you find a house and lake at the legal drilling location as designated by order establishing the drilling and spacing unit?

4. Would you think a mineral owner would want a smaller or larger unit if they had leased their minerals to a developer, all things otherwise being equal?

5. If you were a lessee operator, would you want a smaller or larger unit, all things being equal?

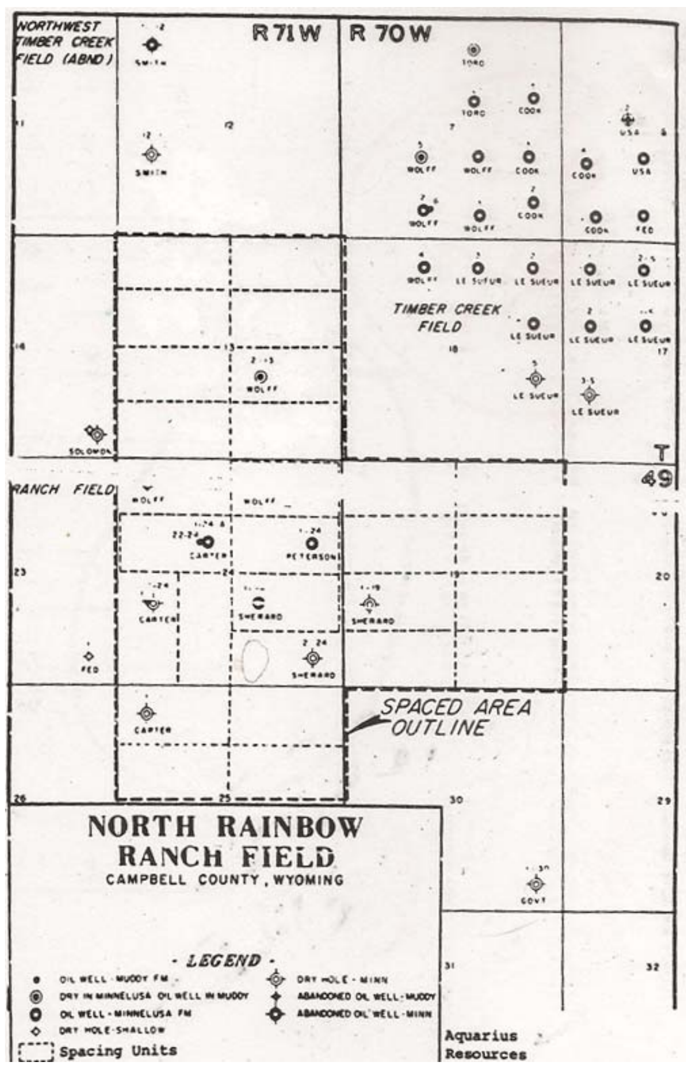
6. After a well is drilled and the parties allocate the risks and rewards, would you think it would be common to see an application filed to change the size of the unit and who can participate in continued development of the underlying minerals?

7. What experts would you think might be required to establish the size of a drilling and spacing unit?

8. Would you expect notice would need to be given to impacted parties before any hearing establishing unit size?

9. Note the Wyoming spacing units in the plat at right. Those wells (designated by donut looking graphics) in the northeast of the plat are on what acre spacing?

   Those wells to the southwest are on what acre spacing? Can you tell what the drilling pattern is in the southwest wells?

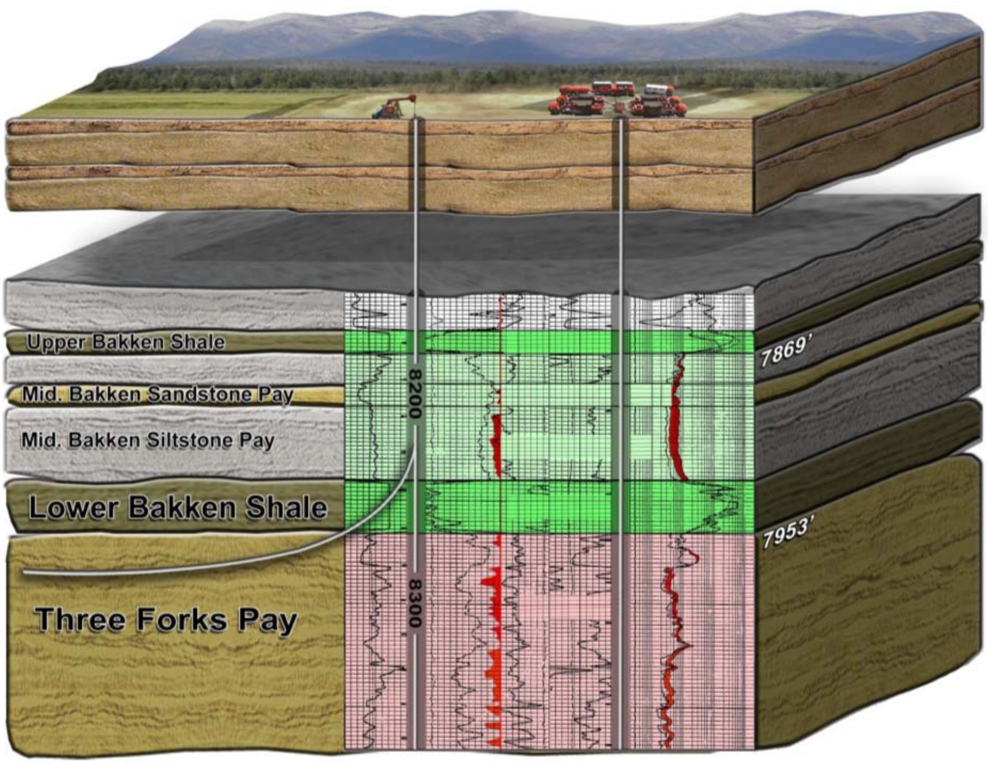


Horizontal Drilling & Well Density Issues

Historically most wells were drilled vertically. In unusual conditions, which usually involved surface obstructions, wells would be drilled directionally to the target formation. But the technology to drill horizontally for thousands of feet had not been developed – and initially it was very difficult to keep the wellbore in the target formation.

Around a decade ago the technology to drill a well horizontally evolved where it became cost competitive as a developmental alternative. Measurement while drilling ('MWD') techniques allowed the operator to keep the rotary bit in the target formation while the well was drilled hundreds, then thousands, of feet horizontally.

A major positive of horizontal drilling is that the amount of wellbore in the target zone expands exponentially as compared to a vertical well. A diagram of the horizontal drilling concept, in this case highlighting the North Dakota Bakken and Three Forks shales, is from the American Eagle Energy company:



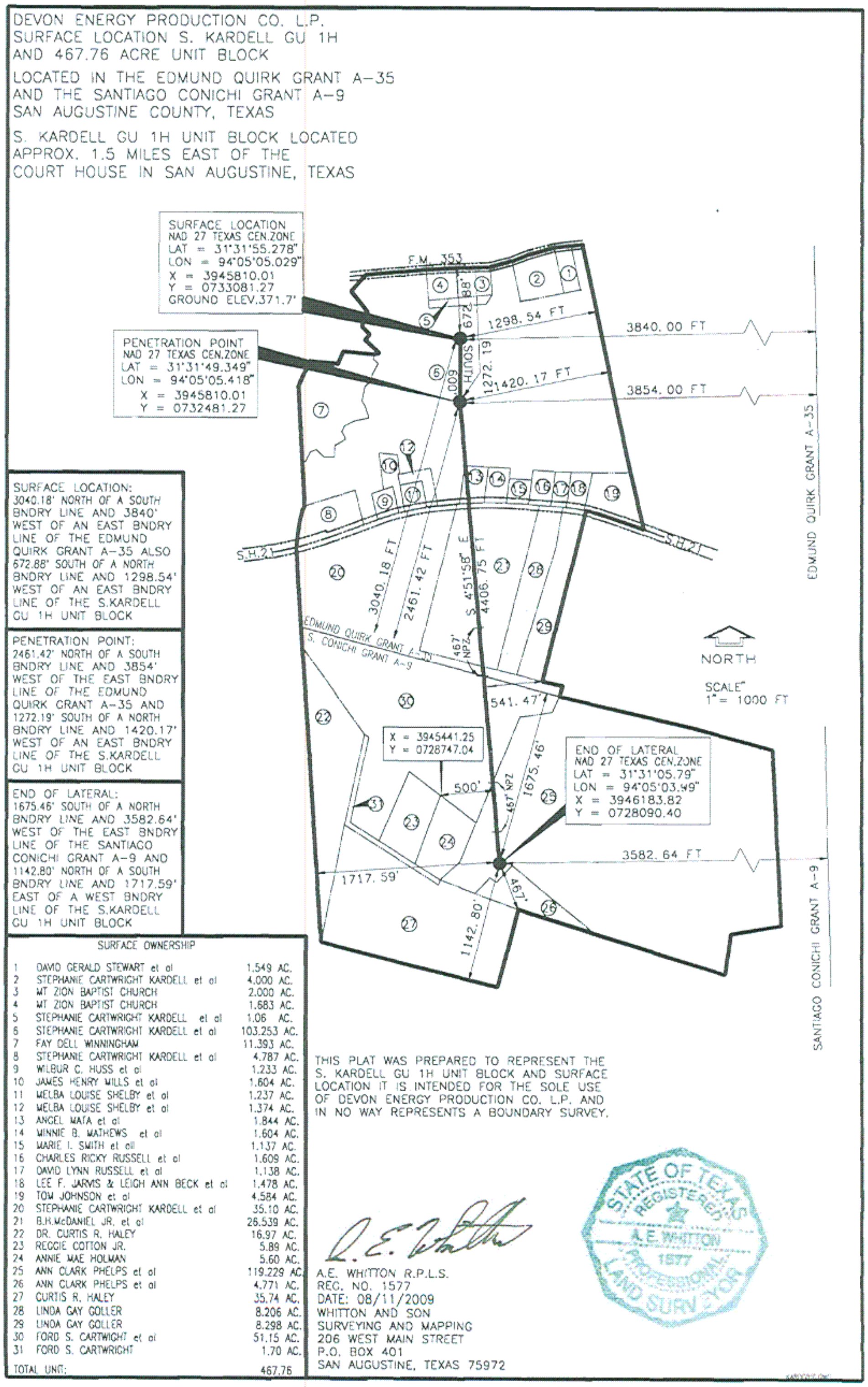
One regulatory issue that arose with horizontal wells was the question of how an operator, and the regulators, would know if the wellbore crossed the property line – which would be a trespass as well as a violation of existing setback regulations.

Additional issues arose with regard to oil and gas lease 'pooling' clauses, which we will discuss later in the course.

When a well is drilled horizontally the Texas Railroad Commission Statewide Rule 11 requires that a third party conduct a downhole deviation survey, and such a survey needs to be filed with the agency.

There are two critical points identified in the survey. One of the points is the horizontal well 'endpoint' or 'toe' – which needs to be further from the lease line than the regulatory minimum setback. The second is the point in the 'heel' of the well where the wellbore penetrates the target formation.

An example of a plat of a horizontal well, with the endpoint and heel at least the regulatory 467 feet from the lease line, is as follows:



Bottom line, on all horizontal wells the regulatory agencies will require downhole surveys to insure the wells comply with setback requirements from adjoining lease or ownership lines.

Theories of Ownership

In the early period of development all oil and gas law many courts were troubled in their attempts to classify the nature of the mineral interest. Early courts believe that oil and gas was migratory, similar to an underground stream. As we have seen the courts developed the theory that oil or gas was not owned until it was captured. But the interest a mineral owner had in oil and gas underground in place was not as easy to classify.

Two theories of ownership evolved:

Non-Ownership Theory

Non-ownership theory is based on the concept that oil and gas in the ground was migratory or fugitive in nature therefore could not be owned in place. Owners of minerals in these jurisdictions just have the right to explore for the oil or gas if they own the minerals. But ownership could ripen or vest if the oil or gas was captured in these jurisdictions.

The mineral interest is generally classified as an ‘incorporeal hereditament’ in these jurisdictions (meaning it does not have a physical form but can be inherited, music composition is an example of an incorporeal hereditament). Jurisdictions adopting this theory include Oklahoma, California, Alabama, Illinois, and Wyoming.

Ownership in Place Theory

Ownership in place theory adopted the concept that you could own the oil and gas in the ground, subject to divestiture if someone else captured that oil. Mineral interest is generally classified as a ‘corporeal hereditament’ in these jurisdictions (meaning it has a physical form and can be inherited, a piano is an example of an corporeal hereditament). States that adopt the ownership in place theory include Texas, Arkansas, Kansas, Colorado, and New Mexico.

Note that both ownership theories are subject to the rule of capture and the doctrine of correlative rights. For most legal issues the nature of the ownership will not be a deciding factor. One question arises where the difference might be deciding: the issue of abandonment. Some courts have ruled that incorporeal hereditaments can be abandoned, which means mineral in non-ownership states might be abandoned in certain fact situations. Very few cases have ruled that minerals have been abandoned based on the specific facts involved.

Corporeal hereditaments cannot be abandoned according to the common law. Therefore in ownership in place states like Texas mineral interests are not subject to abandonment theory.

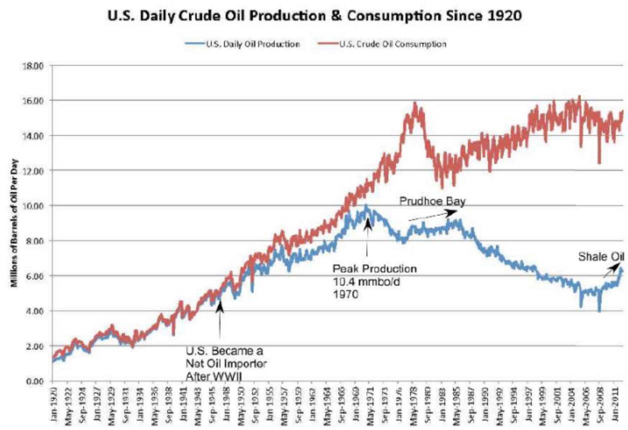
Historically challenges to regulatory or legislative actions were also somewhat more difficult in those states that held that minerals were not owned in place. The ‘taking’ argument, claiming a regulation amounted to a taking of property, was a bit more tenuous if an owner did not own the oil or gas in place (just having the right to drill for the hydrocarbons).

Bottom line: In Texas mineral owners own the oil and gas in place, subject to title being divested by capture. Ownership is also subject to the ‘fair share’ or correlative of rights doctrine.

IEA Study: Is the U.S. the Next Saudi Arabia?

If we can legally utilize nitroglycerin or compressors to enhance production, and drain oil or natural gas from under adjoining lands, under the United Carbon Co. v. Campbellsville Gas Co. and Kelly v. The Ohio Oil Company cases, then using the legal reasoning you would expect the use of hydraulic fracturing and directional drilling should also be a tool available to a producer to increase recoveries.

In most jurisdictions hydraulic fracturing and directional drilling is legal, subject to regulations, and they have substantially increased domestic production over the last few years. The International Energy Agency (IEA) studied domestic production trends in 2012, and forecast that advances in shale drilling technology will essentially make the U.S. energy independent.



The U.S., according to the report, will produce more oil than Saudi Arabia - becoming the largest oil producer on the planet! A more balanced view, and one we tend to agree with, was presented in 2012 by Arthur Berman of Labyrinth Consulting Services, Inc. at an engineering conference in Houston. Berman charts domestic crude oil production and consumption for the last 90 years in the chart at right.

Berman reviews the IEA report, and discusses the ‘Good News Propaganda Campaign about Oil’, noting as follows:

- U.S. oil production peaked in 1970 at 10 million barrels per day
- U.S. oil production today is around 6.3 million barrels per day
- U.S. oil consumption today is around 15.4 million barrels per day
- The gap between production and consumption is 9.1 million barrels per day
- The total contribution of shale oil to U.S. supply is presently 1.2 million barrels per day and will probably not increase to more than 2.0 mmbopd (14% of consumption) by 2020 because of high decline rates
- It is unlikely that the U.S. will become energy independent

From a technical standpoint Berman points out the following:

- Shale oil wells have high decline rates and require substantial capital expenditure to keep production flat, much less increasing
- Oil production from the Eagle Ford and Bakken shales will probably increase U.S. supply by 1-2 million barrels per day by 2020 depending on oil price
- Shale oil has only reversed the U.S. production decline for 18 months
- Most fields will reach peak production in 3-5 years and then decline
- The oil plays require very high oil prices to be commercial
- Oil prices must remain high to sustain drilling required to add production

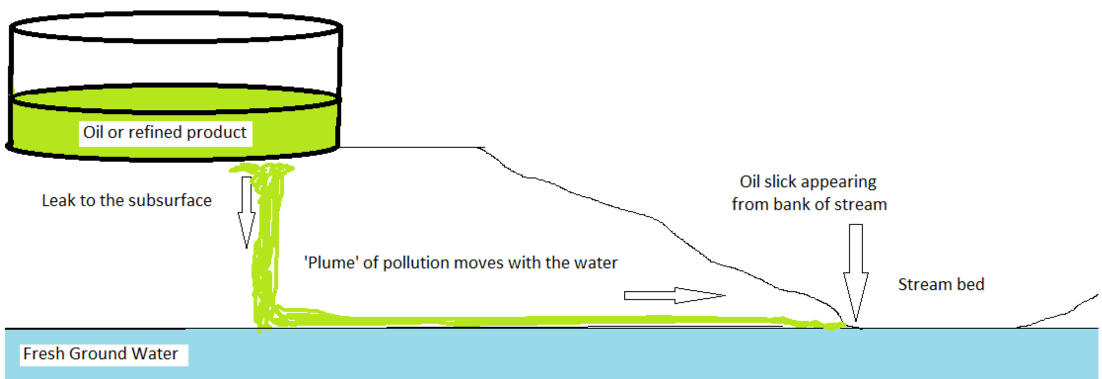
Bottom line is that we should see a lot more domestic oil and gas exploration activity, and opportunities, in the U.S. over the next decade but there are practical and physical limitations on how much oil and natural gas can be produced. Small exploration and production companies growing domestic production and reserves should do well in this environment.

Latent Environmental Defects & Groundwater Pollution

The Champlin Exploration v. Western Bridge case deals with a situation where the groundwater around a refinery was clearly contaminated with crude oil and refinery product – so much so that you could dig a ditch and recover product that was floating on the water table. At the time this case was published many assumed that the facts were pretty particular and this was not a common situation. Over time it became apparent that groundwater contamination from crude oil spills or leaks is much more frequent than many would expect.

From a physical standpoint, realize that crude oil and refined products are lighter than water. So if they escape into the ground they will 'float' on the water table. They will also move with the direction of the groundwater flow (if the groundwater is moving). Generally groundwater movement is very slow, and it generally moves downhill with gravity. Streams make a perfect barrier where the water table on the bank of the stream and the stream level are generally the same.

So if you have oil underground on top of a water table moving toward a stream many times you will find the oil discharging from the banks of the stream into the water – hopefully in small amounts.



The fact that oil tends to make a thin sheen or haze makes even small leaks of oil an environmental concern. The diagram illustrates how crude oil or refined products might leak, then travel on the top of the water table to the nearest stream. Underground storage tanks for heating oil also tend to leak, some estimates are that around 25% of these tanks release heating oil (keep in mind in the Northeast U.S. around one-third or more of the houses are still heated with heating oil).

Keep in mind several things here. First, this is underground, you can't see the groundwater being contaminated until it appears in the creek (or in a water well). This can take decades if the groundwater movement is slow.

Second, since we can't see the pollution occurring it is tough to pinpoint the source, especially if we have multiple oil field operations in the area (the rule of capture almost guarantees more than one operator will be in the area if it is an oil field, refineries also tend to be segregated near each other due to transportation reasons). It is difficult to conduct environmental tests, and expensive, to determine if crude oil has escaped containment.

Many legal issues are raised by this scenario – mainly dealing with how to prove responsibility, how to measure damages, and how to deal with the time lag between contamination and discovery. We will discuss some of these issues later in the course.

Over the last several decades the science involving detection and proof have improved considerably. Consider the following article dealing with a mysterious spill of oil on a river, and the science that was used in an attempt to identify the origin:

The Boston Globe
March 27, 2006 Monday

WHODUNIT?; A COAST GUARD CHEMIST IDENTIFIES THE UNIQUE FINGERPRINTS OF OIL SPILLS TO HELP DETERMINE WHO IS RESPONSIBLE.

By Beth Daley, Globe Staff

The oil seemed to materialize out of nowhere in Chelsea's Island End River in the early-morning hours of Jan. 10. By day's end a small greenish film had expanded to several hundred square yards of viscous diesel fuel. As cleanup crews positioned booms around the estimated 10,000-gallon spill and began vacuuming it up, Coast Guard investigators set out to find its source.

Two weeks later they got an answer: The oil appeared to be a perfect match with fuel from a nearby ExxonMobil pipeline.

In a real-life version of the television drama "CSI," a chemist at the Coast Guard's Marine Safety Laboratory in Groton, Conn., had painstakingly traced the same unique mix of molecules in the two samples, chemical "fingerprints" that didn't exist in three other possible sources nearby. That, along with other evidence, pointed to ExxonMobil.

"There appears to be no other viable source near that spill," said Coast Guard Lieutenant Commander Claudia Gelzer. ExxonMobil denies that the oil is definitively theirs, but the federal government is going after the company to pay the $140,000 it spent to scrub the environment clean.

Oil has a life history, researchers say, that can be read like a book, revealing chemical characteristics that can document its origins, processing, and sometimes even the last tank it was pumped from. "It's not like saying you have fuel oil in a tank and fuel oil in the environment and they are the same," said Kristy Juaire, a chemist at the Marine Safety Laboratory, which handles all the agency's oil fingerprinting. Oil, she said, "is very particular."

Every year, Coast Guard officials attempt to fingerprint the oil in hundreds of unclaimed spills around the country to trace leaks, plug them, and make sure the culprits pay for cleanup. The instruments they use have helped identify everything from chemical contaminants in soil to drugs in urine but hold particular importance in oil spills, where other evidence is often submerged or washed away. Tracing a spill's source quickly can also help stop an undetected leak before it causes severe environmental damage.

Even when a spill's source is known, fingerprinting is vital to rule out what Coast Guard officials call "spills of opportunity," when other boats dump their oily waste in the middle of a spill to save themselves the cost of proper disposal.

Near San Francisco over the course of the 1990s, a mysterious oil source killed some 51,000 seabirds. Thick oil and tar balls periodically washed up on shore, but scientists were at a loss to explain where it came from.

It wasn't until 2002 that authorities realized the sunken SS Jacob Luckenbach, a freighter loaded with

457,000 gallons of bunker fuel, might be to blame. The vessel collided with its sister ship in 1953 and sank about 17 miles off San Francisco. In 2002, authorities matched the oil on the sunken ship with the oil that had washed up, and the leak was plugged.

Many of the Coast Guard's biggest civil and criminal cases are decided in Juaire's lab, a nondescript basement research facility next to Long Island Sound. Samples from the Exxon Valdez spill are kept in a locked refrigerator there, along with samples of a 2003 oil spill in Buzzards Bay that leaked almost 100,000 gallons of fuel oil off Cape Cod. Coast Guard officials say the lab's findings have consistently held up in court over the lab's nearly 30-year history.

To determine whether the samples match, Juaire, 27, feeds the oil samples into a gas chromatograph that separates each sample into its constituent parts. Then the samples are fed into a mass spectrometer that further reduces the sample into molecular fragments, revealing "bio-markers" and other compounds that act as each sample's fingerprint.

This spectrometer information is spit out in reams of graphs with peaks and valleys that distinguish about 37 different molecular signatures. Juaire places the graphs on a light table and compares each peak and valley among the samples. The exercise can take an entire day, and if the molecular signatures match, there is little doubt they derived from a common chemical source.

But it's never clear that a match will be found. Sometimes a sample degrades so much from sunlight or time in the water that its key chemical signatures are altered. Other times investigators aren't able to pinpoint the true origin of a spill or conclude there may be more than one source with the same fingerprint.

For example, Juaire says, there have been cases where fishing vessels were all fueled from the same dock, making it tough to determine which vessel was to blame for a spill. In fact, Juaire's lab makes a positive match only half the time. In the last four years, there have been 152 oil spills of more than 100 gallons each that haven't been solved.

"I'd rather be cautious and know someone got off than be wrong," said Juaire, who took the chemist's job after graduating with a master's degree in geochemistry from Brown University five years ago. Before 9/11, the laboratory typically processed about 400 cases each year, representing thousands of samples. But the number plummeted when the Coast Guard took on more homeland defense duties. Now the number of samples is increasing again, and last year the lab was involved in 256 cases.

In Chelsea, ExxonMobil says the Coast Guard has not proved the oil spill is theirs. A spokesman said the company always accepts responsibility when it causes a spill, but in this case "we don't believe their evidence is conclusive. Diesel fuel is a very standardized product and can be found on vessels and shore facilities throughout the Boston Harbor area," said the spokesman, Brian Dunphy.

Coast Guard officials said they have other evidence linking the spill to the company but declined to comment in depth because their investigation is ongoing.

"In CSI, they can solve the crime in nine seconds with the science and it's 100 percent certain," said Christopher M. Reddy, an associate scientist at Woods Hole Oceanographic Institution who studies marine pollution. "But in a lot of these cases there is a certain level of uncertainty and it may take time for the most accurate results." Exxon, he said, is sure to push the Coast Guard to prove its case.

With regard to spills, an interesting case dealing with a 50 year old leak from a refinery was filed by the State of New York when the oil (allegedly from oil refinery operations) began polluting creeks in Brooklyn:

Platts Oilgram News
February 9, 2007 Friday

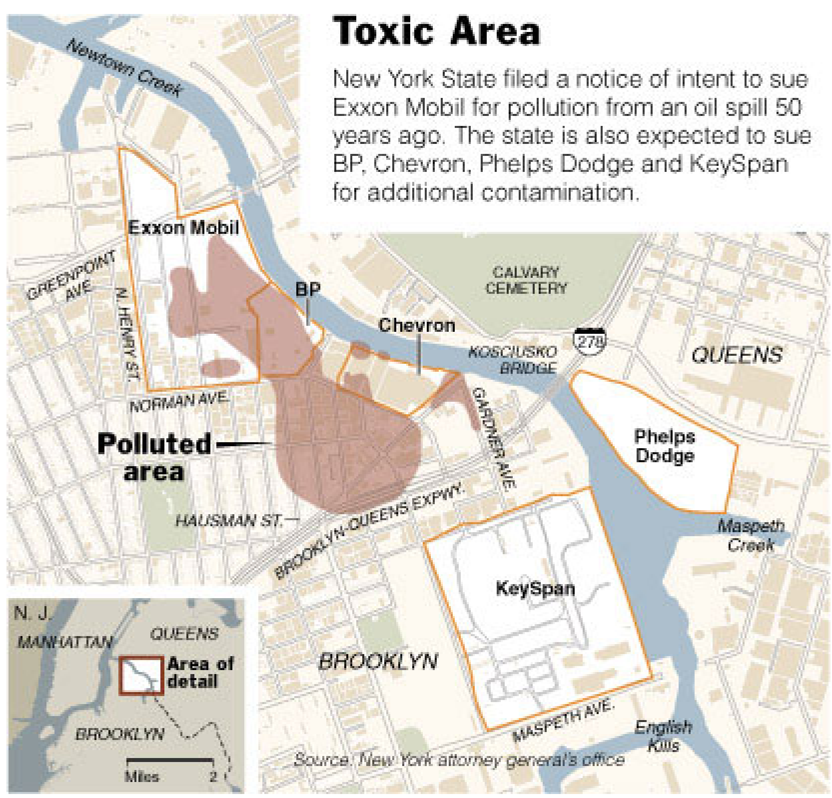
New York plans to sue majors over 50 year old Brooklyn oil spill
By: Kevin Saville

New York State's new attorney general, Andrew Cuomo, said February 8 he plans to sue ExxonMobil, Chevron and BP for decades-old oil pollution in Brooklyn. Cuomo said utility KeySpan and metals company Phelps Dodge also helped contaminate Newtown Creek, which separates the New York City boroughs of Brooklyn and Queens.

The suit seeks cleanup of the creek and removal of some 17 million gallons of leaked oil under 55 acres of homes and businesses in Brooklyn's Greenpoint area. Cuomo said he will sue under the federal Resource Conservation and Recovery Act, claiming "imminent and substantial endangerment to health and the environment." ExxonMobil and BP also will be sued for alleged violation of the federal Clean Water Act.

Sworn in as attorney general January 1, the son of former New York Governor Mario Cuomo acknowledged ExxonMobil is his main target. Its predecessors Standard Oil Company of New York and Mobil had refineries in the area for a century until 1965, when the Greenpoint plant was decommissioned.

"The toxic footprint of ExxonMobil is found all over this area," Cuomo said. "It is ExxonMobil's oil that remains under the homes and businesses. And it is ExxonMobil that has dragged its feet and done as little as possible to address the dangers that it created."



Texaco, before its merger with Chevron, and BP ran terminals along Newtown Creek that added to the pollution, said Cuomo. ExxonMobil noted it has been cleaning up Greenpoint since 1979 and signed a consent decree to that end with the state's Department of Environmental Conservation in 1992. "Remediation is ongoing and we are working aggressively," ExxonMobil spokeswoman Prem Nair told Platts.

Nair said 9.3 million gallons of oil products have been removed from the ground by ExxonMobil and other companies over the years. Cost of the cleanup is "confidential," she said. After closing Greenpoint in 1965, Mobil sold 10 acres to BP, which opened a products terminal there in 1969 that is still in use, Nair said. Mobil had a separate terminal on the site until 1993.

BP said it "strongly disagrees" with its inclusion in the pending lawsuit, particularly since the continuing cleanup at its Greenpoint terminal has been monitored by the state DEC under a consent order. BP said it has "worked closely" with regulators "to ensure the DEC is aware of all these things" and has removed more than 3 million gallons of oil residue from its site so far. "So it is all the more disappointing the state has included BP in this action," the major said.

Chevron said it has worked with the DEC since 2005 to address contamination at the site Texaco ran more than 40 years ago. "To date," Chevron said it has "met every project milestone the state has established for this cleanup, and over the last 18 months work has resulted in a more than 90% reduction of material impacting the creek."

Questions:

1. Assume you are going to buy a 10 acre tract of land in Texas. You know Texas has been a major oil and gas producing and refining venue for decades. Are there any facts or things you might consider researching before closing on the property?

2. Assume that as a potential buyer you might want to test some of the soil or water on the 10 acre tract mentioned in question one. What are the pros and cons of such testing activity? If you are not yet the owner, just have a contract on the land, do you have the right to go on the land and collect samples?

3. If, as a seller of the 10 acre tract, you know the property has been heavily contaminated by oil and gas operations do you have a duty to tell the prospective buyer that the land or groundwater is polluted?

4. From a legal perspective, do you think the rapid evolution of technology in the environmental field (like the 'oil fingerprint' case above) makes it easier to identify the responsible party if it is contaminated?

5. Note also that many more environmental science programs exist to train individuals how to identify environmental threats, and how to conduct samples of properties in question. Many of these programs offer a certification or degree. From a legal standpoint, why would it matter if the party taking samples had an environmental certification or degree or not (assuming that the sampler was competent regardless of training).

We will talk more about environmental concerns involved in oil and gas operations later in the class. Generally groundwater contamination from oil and gas operations is a major concern if the owner is going to use the groundwater. Pits or wastes on the property can also create issues. Salts, produced in the water that is generally produced along with oil can cause soil fertility issues as well as erosion issues.

Champlin Exploration v. Western Bridge – Oil Capture & Release

The Champlin case is a bit confusing since we have two parties with almost identical names. Champlin Exploration is a producer of oil and gas that operates oil wells in a designated area and sells the oil and gas produced to a third party. Champlin Refining is a separate company, and iis an oil and gas refiner that operates an oil refinery.

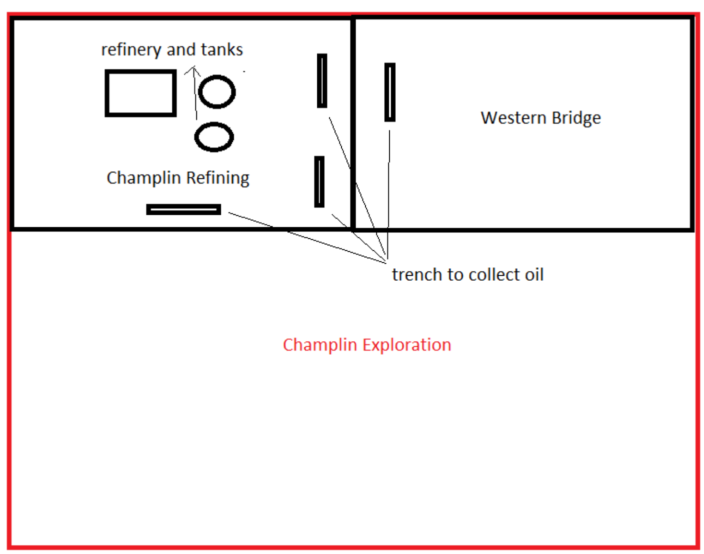
The oil producer (Champlin Exploration) is the party that filed suit, trying to determine who owned the oil that was leaking from the refinery (Champlin Refining). The main question become: If you capture and pay for oil that subsequently escapes or is released from your pipelines or refinery terminal is it still your oil – or does the rule of capture apply again such that the oil can be captured again, with ownership vesting on capture in another party?

CHAMPLIN EXPLORATION, INC., Appellant, v. WESTERN BRIDGE AND STEEL CO., INC., Appellees
Supreme Court of Oklahoma
1979 OK 108; 597 P.2d 1215; 1979 Okla. LEXIS 257; 64 Oil & Gas Rep. 160
July 17, 1979

PRIOR HISTORY: Appeal from the District Court of Garfield County, Oklahoma Honorable George Howard Wilson, Judge. Suit for recovery of refined hydrocarbons which had escaped into the ground by a unit operator against the refiner. Trial court held hydrocarbons were property of the refiner and denied operator's claim and demand for an accounting.

DISPOSITION: AFFIRMED.

CASE SUMMARY OVERVIEW: The refiner operated an oil refinery in a unit. Refined hydrocarbons escaped from the refinery and leaked onto the refiner's land and adjoining land. The operator collected the escaped hydrocarbons and sold them. When the refiner discovered the leaks, it dug trenches on its land and recovered the hydrocarbons. The operator filed an action against the refiner and other surface owners in the unit for an accounting and a declaratory judgment as to the ownership of the escaped hydrocarbons.



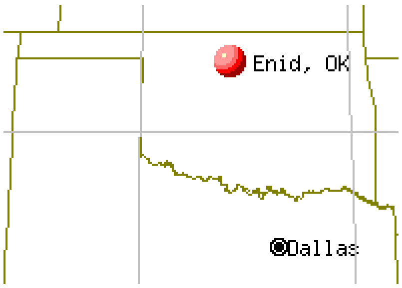
The trial court entered a judgment for appellees. On appeal, the court affirmed the trial court's judgment. The court held that an owner of refined hydrocarbons did not lose title to escaped hydrocarbons unless it was shown by competent evidence that he had abandoned the hydrocarbons.

The court ruled that the law of capture as to chattels previously reduced to possession by an owner was conditioned upon the theory of abandonment of lost property. The court determined that the refiner recaptured the hydrocarbons after it discovered the leaks, so there was no abandonment by the refiner. The

court held that the refiner owned the recaptured hydrocarbons.
OUTCOME: The court affirmed the trial court's judgment for appellees in the operator's action for an accounting and a declaratory judgment as to the ownership of the hydrocarbons.

OPINION BY: DOOLIN
We are called upon to decide, in this case, if a refiner loses title to refined hydrocarbons when they escape from him into the ground. To put it another way; are refined hydrocarbons subject to the law of capture when they escape into the ground?

We hold that an owner of refined hydrocarbons does not, ipso facto, lose title to escaped hydrocarbons unless it is shown by competent evidence that he has abandoned same. Champlin Exploration, Inc. (unit operator) under a valid corporation commission order and operating agreement, brought suit against Champlin Petroleum Company (refiner) and other defendants who owned surface or mineral estates in the unit area; Western Bridge & Steel Company, Inc., Dosan Refining Company and Jim Peckham. Despite the similarity in names the record indicates that Champlin Exploration, Inc. and Champlin Petroleum Co. are separate legal entitles.

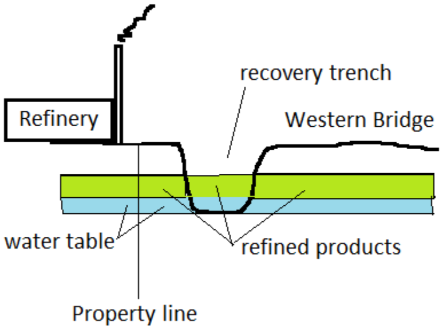


When the refiner discovered losses and leakage was occurring from its refinery, located within the unit area, it took immediate steps to recover what turned out to be refined hydrocarbons. Refiner caused trenches to be dug on its premises to recover and trap the escaped substances. Refiner pumped out the trenches and returned the hydrocarbons to its possession. The area of reclamation was subject to the operating agreement within the unit area.

Peckham, President of Western Bridge & Steel Company, Inc., as an individual and acting on his own, had for some time been collecting refined hydrocarbons in trenches or holes upon Western's premises which were adjacent to the refiner's premises. Western owned only the surface to these and adjoining premises, within the unit area. Peckham sold the hydrocarbons to Dosan Refining Company.

Unit operator brought suit seeking: (1) a declaratory judgment as to ownership of the escaped substances, and (2) an accounting against all defendants.

The evidence in this matter is not at variance. Both Peckham and the refiner took refined hydrocarbons from shallow holes or trenches from 6 feet deep to 18 or 20 feet deep. Natural forces such as gravity and water pressures caused the escaped hydrocarbons to collect in such areas where they were pumped into trucks or tanks.



The substances had migrated a few hundred feet at most, from the leaking pipes or conduits installed by the refiner. The evidence disclosed the leaks have been repaired and for all intents and purposes the recovery by refiner and Peckham has ceased.

Trial court entered judgment for the defendant refiner and ordered case dismissed as to other defendants, holding the refiner was the owner of the escaped substances. We affirm.

Unit operator relies primarily on our holding in Frost v. Ponca City, 541 P.2d 1321 (Okla. 1975) to support its theory of error. Its contention basically is that once refined hydrocarbons escape into the ground, the escaped substance is again subject to the law of capture by virtue of having returned to the forces of nature under the surface of the earth.

In Frost, refined hydrocarbons had apparently seeped into and under property located within the city limits. The fumes from the seepage were creating a nuisance. The defendant city, pursuant to its police power, prohibited the plaintiff and any others, similarly situated, from drilling within the city by a city ordinance. The city then drilled wells, sold the recovered substances, and kept the proceeds.

Plaintiff, as owner of a mineral estate, brought a class action to recover the amount of hydrocarbons taken by the city, and this court found for plaintiff, allowing defendant credit for its expenses in producing, transporting and selling the hydrocarbons. In its brief, filed in the instant case, unit operator argues Frost holds that hydrocarbons which escape into the ground, even though previously refined and processed, were ipso facto, subject to the law of capture. Refiner does not attack our holding in Frost but argues it has narrow or limited application. It points out that in the Frost case the escaped refined hydrocarbons had been abandoned for no one claimed previous title or ownership.

Ordinarily a landowner, lessee or unit operator who brings hydrocarbons to the surface and reduces them to actual possession acquires absolute ownership of the substances, subject to the operation agreement or lease, if any.

In Crosson v. Lion Oil & Refining Co., 169 Ark. 561, 275 S.W. 899, 42 ALR 574 (Ark. 1925) 5 the Supreme Court of Arkansas turned the recovery of oil which had escaped from a pipe line of an owner upon the principles or theories of lost or abandoned properties. In Crosson, the owner who had reduced crude oil to his possession was allowed to recover the crude from a neighbor who had impounded it. In essence that court held HN3title to lost property does not vest automatically in its finder or capturer for our purposes; there must have been an abandonment by its previous owner.

Thus the law of capture in oil and as to chattels previously reduced to possession by an owner is conditioned on the well known and existing theory of abandonment of lost property. Professor Eugene Kuntz, in his definitive work on oil and gas, states the principle as follows: "If oil should escape from a well, tank, or pipeline, the owner may lose possession but he retains title unless the oil is abandoned." We can see no reason why his conclusions should not apply to refined hydrocarbons where problems of identity and other applications of the laws of evidence are comparatively simple and easy to apply.

The evidence in this case is clear and convincing; not only did the refiner capture his lost property, it was so pure and refined that it could be blended back into the marketable stock of the company with little or no treatment. We note also, refiner's operation to recover his lost property was confined to his premises; there was no abandonment under these circumstances.

It is uniformly held, once oil and gas is extracted from the earth, it becomes tangible, personal property and subject to absolute ownership. See Kuntz, the Law of Oil and Gas § 2.5 and citations under footnote 2 of that work; Frost v. Ponca City, 541 P.2d 1321, 1323.

We conclude that the refiner had not abandoned his refined hydrocarbons; there is no evidence of an intent to abandon by refiner.
JUDGMENT AFFIRMED.

Questions:

1. Once oil or gas is extracted from the earth, what did the court say with regard to whether is was real or personal property? Why would it make a difference?

2. Once the refiner lost containment of the oil at their facility did it become subject to the rule of capture again?

3. In this case even the surface owners were digging holes from which they were extracting oil or refined products. In this case what substances are owned by the surface owner, and why might the refiner be concerned about liability for contaminating those substances?

4. Although the refined products were being dug up the refiner claimed that all leaks have been plugged. How long can refined products exist underground before they deteriorate or decompose?

5. The Oklahoma Historical Society published a brief history of the Champlin Refining Company:

   The Champlin Refining Company, which for many years held the distinction of being the nation's largest fully integrated oil company under private ownership, was based at Enid, Oklahoma. In 1916 Enid banker and entrepreneur Herbert Hiram Champlin (1868-1944) bought a lapsed oil lease on the Beggs farm in the fledgling Garber Field about fifteen miles north of Enid. Champlin was reluctant to enter the new and highly speculative oil business, but at his wife's urging he agreed to invest twenty-five thousand dollars in the venture.

   Champlin's first well came in on Christmas Day 1916 as a 250-barrel producer. The banker-turned-oilman drilled more wells on his 160-acre lease and in July 1917 purchased a small refinery on the outskirts of Enid, enlarged it to provide a market for the oil from his wells, and established the Champlin Refining Company.

   In order to provide a secure market for the refinery's growing output, He purchased a series of small oil companies that operated service stations. By the mid-1920s Champlin Refining Company was marketing petroleum products in a six-state area centered on Oklahoma. As the organization grew, it drilled more wells, built a large pipeline network, opened additional refineries, and greatly expanded the retail operation, all under the auspices of Champlin's private ownership.

The article notes the refinery was closed in 1984, several years after this case. The refinery equipment was moved to Corpus Christi, Texas. From the facts in the case would you expect any environmental remediation to be required at the site?

In today's environment, a leak of petroleum like we saw in the Champlin case would likely focus on issues more in line with the following case recently decided near Baltimore:

Platts Oilgram News
March 13, 2009 Friday

ExxonMobil liable for leak damages, jury finds
By: Gerald Karey

A jury in Baltimore County, Maryland, March 12 found ExxonMobil liable for $150 million for damages caused by the leak of 26,000 gallons of gasoline from a pipe into groundwater in the town of Jacksonville.

The jury awarded varying amounts in damages to about 300 plaintiffs to compensate for declining home values, lifetime medical monitoring for cancer, and emotional distress. The jury did not find the company guilty of fraud by concealment and did not impose punitive damages. The plaintiffs were seeking at least $1 billion in damages.

ExxonMobil said in a statement that it intends to review its legal options and make a decision about how to move forward. The company said it was pleased that the jury "agreed that this was an unfortunate accident not an intentional or fraudulent act."


NEXT UP: WAKE FOREST
FRIDAY 03.13.2009
THE BALTIMORE SUN
baltimoresun.com
SUMMARY OF THE NEWS
A 'sorry' Madoff off to jail
Exxon liable for gas leak damage
Jury awards Balto. Co. area neighbors $150 million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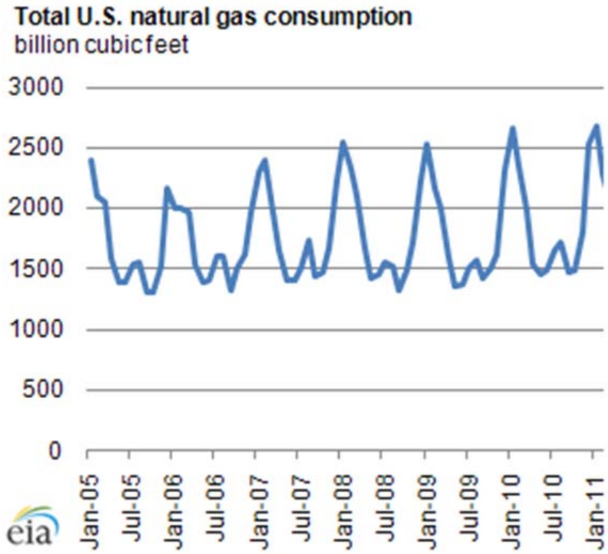
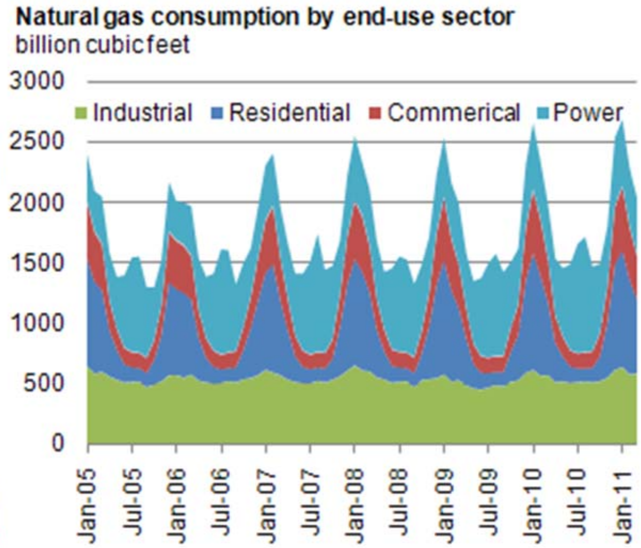
the baltimore sun | friday 03.13.2009
from page one
Exxon held liable in gas leak
map it

Ownership Issues in Natural Gas Storage & Marketing

The U.S. Energy Information Administration published the following charts and commentary with regard to natural gas consumption in the United States:





> “Consumption of natural gas is seasonal, with consumption patterns among end-use sectors highly driven by weather. Total natural gas consumption peaks during the winter, when cold weather increases demand for natural gas heating. A second, smaller peak occurs during the summer, when electricity generation using natural gas increases to serve summer air-conditioning load.
>
> Residential and commercial demand for heating accounts for over 50% of the natural gas delivered for end-uses in the United States during the winter. During the summer, total consumption of natural gas is, on average, about 30% lower than in the winter, with about half the gas used to generate electricity for air-conditioning.
>
> In contrast to these seasonal patterns, natural gas demand in the industrial sector is more even throughout the year, although it has varied from about 20% to 40% of total consumption over the past six years.”

Much of the demand for space heating is from the Midwest. This market was developed very early with the natural gas wells in Indiana and Ohio supplying the market with as much gas for heating as they could take – limited only by the crude pipleine transportation methods of the day (see the Kelly case and ‘City of Light’ discussion earlier in the text about natural gas development in Ohio in the late 1800’s).

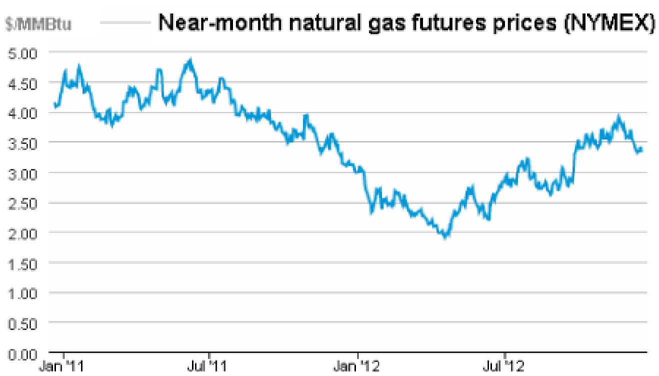
Because of the size of the Midwest market, when forecasters are trying to predict natural gas demand for heating in the winter the rule is that they can look at the forecast for Chicago and extrapolate to get an accurate estimate of total U.S. demand. The Eastern seaboard residential sector still uses substantial amounts of fuel oil for heating purposes. Some east coast markets still have over one-third of the households buring crude oil for heat. In the

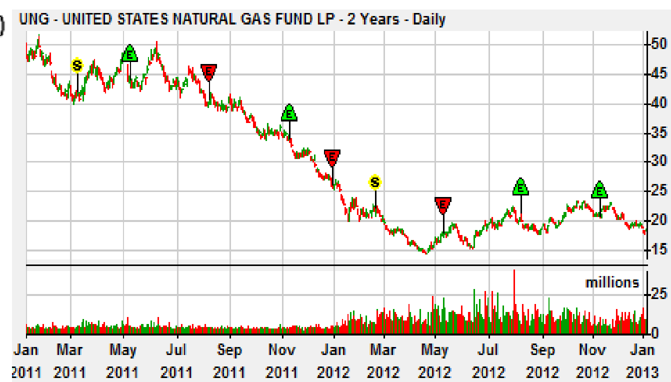
Midwest most markets have over 85% of the furnaces buring natural gas, with a share heated by electricity and fuel oil.

Historically natural gas was sold under long term contracts with fixed terms. Prices varied very little over time. Today natural gas is traded daily on the spot market. A bitterly cold forecast for Chicago can move the price of natural gas upward as traders jump in the market. Many gas traders and investors subscribe or follow weather forecasts closely since the price of natural gas correlates with temperatures and heating demand. Some traders spend thousands of dollars for access to professional meterologists and their forecasts.

Volatility of natural gas pricing is a factor that historically has not been an issue due to the long term natural gas sales contracts. Today volatility and hedging natural gas pricing is a major management and financial task for producers and major natural gas consumers.

The individual investors can also 'bet' or hedge on natural gas prices by buying an exchange traded fund (ETF) that tracks the price of natural gas. A two year chart of NYMEX futures contracts and of the United States Natural Gas Fund (UNG) exchange traded fund which tracks the natural gas futures are set out below.





Questions:

1. Take a look at the two year charts above, covering the same period of time. Can you see any issues, since they are both tracking futures prices covering the same commodity?

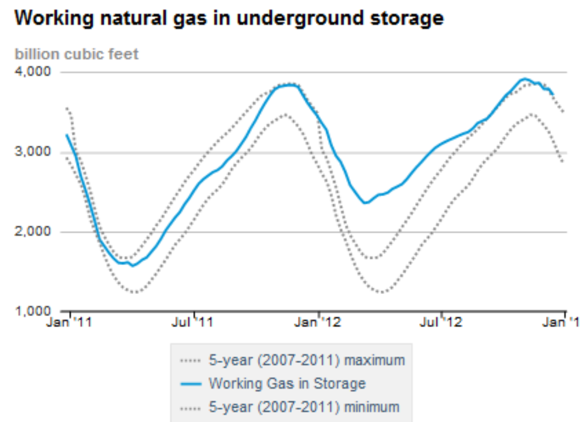
2. For companies that are public, for financial report purposes the SEC requires them to 'mark to market' the value of their natural gas futures contracts. Ironically in many hedging situtions when the price of natural gas falls the company has to report a gain on their futures contracts and in their quarterly earnings. Note that at lower natural gas prices the value of their assets in the ground will have declined (and was not marked to market). In light of the SEC mark to market rule, how do you think analysts should evaluate a natural gas producer if they are trying to establish a fair valuation?

3. Note that crude oil futures also exist and can be traded daily, and exchange traded funds also track oil futures prices. The problems noted in question one, mainly tracking error, also exists on the crude oil exhange traded fund instruments.

Many of the natural gas fields in the U.S. are located in Texas, Oklahoma, Kansas, Louisiana, or offshore Gulf of Mexico. The end market for natural gas heating is in the Midwest in many cases, creating a problem for engineers: Because peak demand for natural gas in the winter can be 40% higher than it is in the spring and fall how can consumers transport the gas most effectively to the end market?

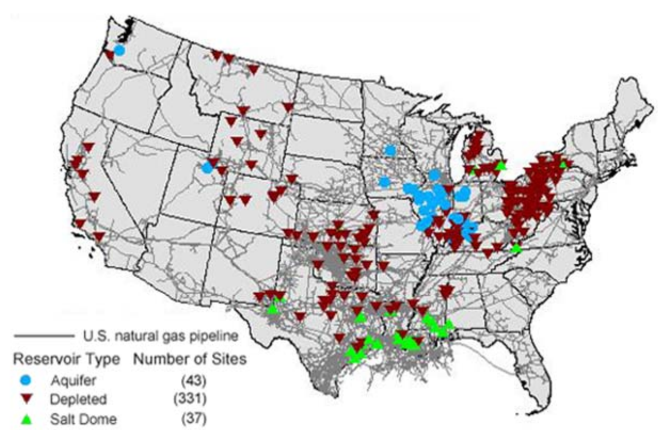
The answer was not to construct a 'mega-pipeline' that could handle peak demand, but to ship the gas up towards the heating market during the slow consumption periods during spring and fall and store that natural gas in depleted oil or natural gas fields. This sector of the industry is known as the natural gas storage sector. Some of the legal issues in this sector are addressed in our next case (Texas American Energy).

In addition to the long term weather forecast, natural gas traders also keep track of the amount of natural gas held in storage facilities. This data is collected by the U.S. Energy Information Admistration and published weekly – usually on Thursday mornings.

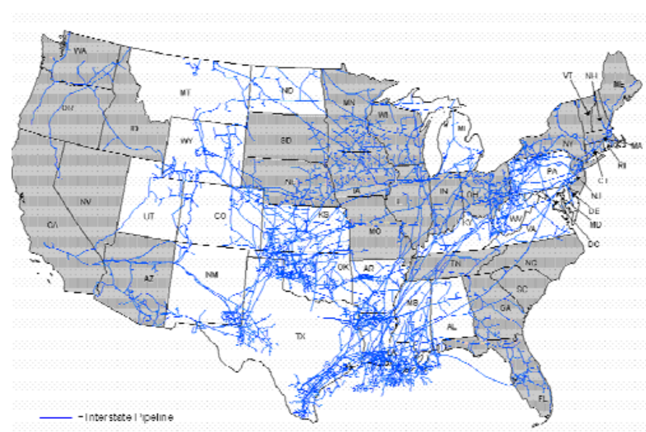


The spot price of natural gas can jump or dive if traders are surprised by the weekly storage report, at least on a temporary basis. An EIA chart of storage, and five year averages, is set out at right.

The Energy Information Administration published a rough map of the location of the natural gas storage facilities in the U.S.



To move the natural gas to the consuming area's storage facilities long distance pipelines needed to be constructed. With the massive natural gas production gains from new technologies (horizontally drilling into the formations, hydraulic fracture) many of these pipelines have had to be upgraded or supplemental systems constructed to move the product. Sometime these projects attract legal or regulatory objections from those concerned about environmental or safety issues. A map of the major interstate pipelines was recently published by the Energy Information Administration:



Keep in mind that each pipeline requires 'booster stations' with massive engines need to push the natural gas toward market about every thirty miles. These 'compressor stations' frequently run 24 hours a day, all year round.

On larger pipelines the size of the compressor station and engines can be quite substantial. A compressor station on a major pipeline might look as follows:

Questions:

1. From an environmental standpoint, what legal or regulatory issues do you think you might encounter when constructing or operating a natural gas compressor station? (Before answering, you might glance at a court's discussion regarding one of these stations below)

In Gault v. Transcontinental Gas Pipe Line Corp., D.C.Md., 102 F.Supp. 187 the court noted "the plaintiffs in this case filed a suit in the Circuit Court for Howard County, Maryland, to enjoin a noise and vibration nuisance." The plaintiffs owned housing near the compressor station, and testified as follows:

> ". . . The effects of the noise and vibration resulting from the plant have been testified to by all of the plaintiffs. It is perhaps most clearly explained and expressed as to its effects by Mr. and Mrs. Zoller whose residence recently constructed at a cost of $ 35,000, is situated about 1650 feet southeast of the plant. They describe the noise and vibration as 'intolerable' whereby the windows rattle, there is a 'hum' in the air, a heart-palpitating sensation and interference with sleeping. The particular complaint is that the noise and vibration is incessant, practically 24 hours a day. Mr. Zoller has been obliged for comfortable reading and quiet to spend his evenings in the basement of the house as he cannot sit in comfort in his living room or den on the ground floor. The noise seems to increase at night as compared with the day time. Occasionally there is very annoying smoke and soot which apparently emanates from the burning of surplus gas or oil from the premises on or near the compressor plant.
>
> The noise is also described as like that emanating from a railroad train going over a trestle, as a percussion sound or a rumbling as of an approaching airplane. When the wind is from the southeast, that is blowing toward the plant and not away from it, there is some relief. The noise and vibration was so annoying last summer that the Zollers spent the summer at a small residence property that they own on the Severn River, but which they had expected to sell when their new home was constructed in Howard County.
>
> Mrs. Zoller described the sensation of the vibration in the ears as like that experienced on an ocean liner. Other witnesses gave similar descriptions of the effect of the noise and vibration such as the rattling of windows and at times of metal dishes in the kitchen. Another plaintiff described the general effect of the noise and vibration as that of a never-ending freight train of empties. The plaintiffs agree that since the changes were made at the plant there has been some lessening of the noise but the effects of the vibration are still experienced without material change. The sense of vibration is said to be due to a very low pitch of sound emanating from the plant which can be personally felt by the body but not of itself perceptible to the ear. . . ."

Texas American Energy Corp. v. Citizens Fidelity Bank & Trust Co.

Supreme Court of Kentucky
736 S.W.2d 25; 99 Oil & Gas Rep. 258
September 3, 1987, Decided

PROCEDURAL POSTURE: Respondent and movant, both parties to a lawsuit involving natural gas rights, filed a joint petition for a declaration of rights pursuant to Ky. Rev. Stat. Ann. § 418.020 from the Court of Appeals, Hopkins Circuit Court (Kentucky).

OVERVIEW: Movant natural gas company and respondent bank filed a joint petition for a declaration of rights, pursuant to Ky. Rev. Stat. Ann. § 418.020, because a dispute had arisen as to whether injected stored gas was personal property, susceptible of encumbrance merely by a security interest agreement as provided for in Article 9 of the Uniform Commercial Code (UCC), Ky. Rev. Stat. Ann. § 355.9-102 (1)(a), or whether such stored gas, upon injection, once again became in the eyes of the law an interest in real estate, the encumbrance of which could be accomplished only by a real estate mortgage. The court held that natural gas once converted to personal property by extraction remained personal property notwithstanding its subsequent storage in underground reservoirs with confinement integrity. As long as the reservoirs could be defined with certainty and their integrity could be maintained, the company that originally extracted the gas did not lose title and the gas did not become the property of the owners of the surface above the storage fields. The stored gas was "goods" and the manner of encumbering it was controlled by the UCC.

OUTCOME: The court held that when previously extracted oil or gas was subsequently stored in underground reservoirs capable of being defined with certainty and the integrity of said reservoirs was capable of being maintained, title to such oil or gas was not lost and said minerals did not become subject to the rights of the owners of the surface above the storage fields.

OPINION OF THE COURT

This court having granted discretionary review from an opinion of the Court of Appeals and being of the opinion that the Amended Opinion of the Hopkins Circuit Court by Honorable Thomas B. Spain, judge of said court, is correct, hereby adopts that opinion as the opinion of this court, as follows:

"This is a proceeding on a Joint Petition for a declaration of rights, pursuant to K.R.S. 418.020. [Movant], Texas American Energy Corporation (Texas American), is the successor by purchase to the assets and property of Western Kentucky Gas Company (Western), the principal business of which is the purchase of natural gas for resale to consumers.

"Effective June 29, 1983, Texas American entered into a $ 24,000,000 Revolving Loan Agreement with [**2] Respondent, Citizens Fidelity Bank & Trust Company, of Louisville, Kentucky, and Interfirst Bank Dallas, N.A.; The Northern Trust Company and Bank of the Southwest National Association, Houston (the Banks) to provide funds to Western for the periodic purchase of natural gas from its supplier. Such purchased gas is extracted from natural gas fields in Texas and Louisiana and piped to Western's pipeline distribution system in Kentucky. Western then stores surplus gas in its underground storage fields during the off-season and retrieves it during the peak demand mid-winter months for distribution to its customers.

"To secure the above-mentioned loan, Texas American, Citizens Fidelity and the Banks all agreed for a security interest to be conveyed in Texas American's gas in storage as discussed above. A dispute has arisen, however, as to whether such injected stored gas is personal property, susceptible of encumbrance merely by a security [*26] interest agreement as provided for in Article 9 of the Uniform Commercial Code (K.R.S. 355.9-102 (1) (a)) as insisted by Texas American or whether such stored gas upon injection, once again becomes in the eyes of the law, an interest in real [**3] estate, the encumbrance of which could be accomplished only by a real estate mortgage, as argued by Citizens Fidelity and the Banks.

"Western has six storage fields, four of which are in Daviess County, Kentucky, and two of which are in Hopkins County, to wit: The St. Charles Storage Field and the Kirkwood Springs Storage Field. These storage fields are comprised of underground acreage leased from mineral owners containing various types of sandstone formations capable of accepting and containing natural gas because of being surrounded by strata that are impervious to the migratory characteristics of natural gas. These formations once contained indigenous or 'native' gas, but it has been long ago produced to depletion.

"It is not disputed that once foreign gas (sometimes called 'extraneous gas') is injected into these storage reservoirs, it is trapped, cannot escape, and remains exclusively within Western's control, because of Western's method of maintaining the integrity and viability of its storage fields through constant maintenance of 'cushion gas' therein. Furthermore, the Kentucky Department of Mines and Minerals has recently promulgated regulations requiring a 2,000 foot buffer [**4] zone around a gas storage field. Western has obtained permits for such buffer zones around its field, thus assuring their continued protection and integrity.

"With these facts in mind, we now move to the first question to be answered, namely whether natural gas, removed from its original 'home' and injected into a foreign location with confinement integrity, remains personal property as it is uniformly held to be upon its original production, or whether it reverts to an interest in real estate.

"The parties agree that until now the case law in Kentucky has considered such injected or extraneous gas not to be personal property when it is not confined. This is because of an opinion of the late revered Commissioner Osso Stanley of the former Court of Appeals in the now fifty-year-old case of Hammonds v. Central Kentucky Natural Gas Co., Ky., 255 Ky. 685, 75 S.W.2d 204 (1934).

"In that case Della Hammonds owned 54 unleased acres located within the boundary of the gas company's 15,000 acre gas storage field. It was undisputed that the reservoir underlay her tract. She sued alleging trespass because the gas company's injected gas had 'invaded' the formation under her land without [**5] her consent. The trial Court found against her but Kentucky's highest Court reversed, holding that once the foreign gas was injected back into the earth, (into an uncontrolled gas storage formation), it ceased being the property of the gas company, and would only become personal property again when and if it was produced or reduced to actual possession by extraction a second time.

"In reaching this conclusion, Commissioner Stanley traced the evolution of judicial thought with regard to oil and gas as distinguished from the 'solid minerals.' He adopted the then popular theory that because of their fugacious nature, oil and gas were 'wild and migratory in nature,' and hence similar to animals ferae naturae (i.e. wild by nature). This being so, he reasoned, the law as applied to wild animals ought to be applicable by analogy to oil and gas -- minerals ferae naturae. Consequently, since a fox until his capture in the forest belonged to all mankind, and if trapped and released in another forest reverted to common property, shouldn't the same logic apply to 'captured' and injected natural gas? Commissioner Stanley also quoted from Thornton's Work on Oil and Gas, Sect. 1264, wherein [**6] Judge Willis equated injected gas in storage with timber. 'Standing in the woods, timber is a part of the land. When severed it becomes personal property. If made into lumber and used to construct a building it becomes again a part of the land to which it is attached. When gas is stored in the natural reservoir it is subject to all the properties [*27] that inhered in it originally. A neighbor could take it with impunity through adjacent wells, if he owned land within the radius of the reservoir. Hence it should be taxed only as part of the land in which it is placed, and in such circumstances could not be treated as personal property.'

"Texas American calls this Court's attention to the cases of White v. New York State Natural Gas Corporation, 190 F. Supp. 342 (W.D. Pa. 1960) and Lone Star Gas Company v. Murchison, 353 S.W.2d 870; 94 A.L.R. 2d 529 (Tex. 1962). In both these cases Hammonds is referred to and rejected, along with the 'wild animal' analogy as applied to injected stored gas. The following portion of the opinion in White is particularly succinct:

'Generally stated, the law relating to ownership of wild animals is based on possessory concepts, [**7] with title being acquired only by reduction of the animal ferae naturae to possession and being divested by loss of possession through escape and return of the animal to its natural and ferocious state. 2 Am. Jur., Animals § 8-13.

It becomes readily apparent, however, that a strict application of this analogy to the present facts is of no benefit to the plaintiff's cause. To begin with, the storage gas in question has not escaped from its owners. On the contrary, it is yet very much in the possession of the storage companies, being within a well-defined storage field, the Hebron-Ellisburg Field, and being subject to the control of the storage companies through the same wells by which the gas originally had been injected into the storage pool. Citing cases.

Moreover, there has been no return of storage gas to its 'natural habitat' since Southwest gas, differing materially in chemical and physical properties from native Oriskany gas, is not native to the Oriskany Sands underlying the Hebron-Ellisburg Field. Deferring to the analogy of animals ferae naturae under the circumstances of this case would no more divest a storage company of title to stored gas than a zookeeper [**8] in Pittsburgh to title to an escaped elephant. 2 Am. Jur., Animals § 13.

"In Lone Star the Court comments that our Hammonds case 'in its application of ferae naturae doctrine, has been the subject of violent adverse criticism by many authors and law review writers' (Citing Summers, 'Oil and Gas' permanent Ed. Vol. 1, p 173; 21 U. Kan. City L. Rev. 217, 220 (1954), 35 Va. L. Rev. 947 (1950), 16 Tex. L. Rev. 370, and numerous others.) The Opinion then continues: 'From the available authorities on this subject and based upon what we consider to be sound and logical reason, especially in the light of advanced knowledge and scientific achievement in the oil and gas industry, we are of the opinion that the rule of the Hammonds case should not be embraced as the law in Texas. An exegesis of the Hammonds opinion, when considered in the light of present day development of the gas industry, is unimpressive. The analogy of wild animals upon which Hammonds is founded fails to undergird the ultimate decision of that case. Gas has no similarity to wild animals. Gas is an inanimate, diminishing non-reproductive substance lacking any will of its own, and instead of running [**9] wild and roaming at large as animals do, is subject to be moved solely by pressure or mechanical means. It cannot be logically regarded as personal property of the human race as are wild animals, instead of being turned loose in the woods as the fanciful fox or placed in the streams as the fictitious fish, gas, a privately owned commodity, has been stored for use, as required by the consuming public being, as alleged by appellant, subject to its control and withdrawal at any time. Logic and reason dictates the application of the White decision rather than Hammonds, to the end, that in Texas, the owner of gas does not lose title thereof by storing the same in a well-defined underground reservoir.'

"For the same 'sound and logical reason, especially in the light of advanced knowledge and scientific achievement in the oil and gas industry . . .' this Court is of the opinion that it is time to limit Hammonds [*28] and to now hold that HN1natural gas once converted to personal property by extraction remains personal property notwithstanding its subsequent storage in underground reservoirs with confinement integrity.

"Hammonds should be narrowly construed or limited as it applies [**10] to the instant case, for the reason that the fact situations in the two are distinguishable. In Hammonds there was a known 'leak' in the gas storage reservoir inasmuch as Mrs. Hammonds' land was, in fact, a part of the natural reservoir, though not controlled by the storage company. In the case at hand, however, it has been stipulated that the gas reservoir has total integrity, and the gas cannot escape nor can it be extracted by anyone except Western. Using the ferae naturae analogy, Western has captured the wild fox, hence reducing it to personal property. The fox has not been released in another forest, permitting it to revert to the common property of mankind; but rather, the fox has only been released in a private confinement zoo. The fox is no less under the control of Western than if it were on a leash.

"Accordingly, the Court is of the opinion that Hammonds does not control in the instant case and that under the stipulated facts, the injected gas remains the personal property of Western.

"This being so, there is no more reason to require that it can only be hypothecated or encumbered by a real estate mortgage than there would be to require such of a recreational [**11] vehicle temporarily parked at a campground or of coal stockpiled at a tipple."

End of opinion of lower court.

It is therefore the opinion of this court that, HN2in those instances when previously extracted oil or gas is subsequently stored in underground reservoirs capable of being defined with certainty and the integrity of said reservoirs is capable of being maintained, title to such oil or gas is not lost and said minerals do not become subject to the rights of the owners of the surface above the storage fields. Such previously extracted oil or gas, thus stored, is "goods" under the Uniform Commercial Code of Kentucky and the proper manner of encumbering an inventory of said minerals in storage is controlled thereby. Any language indicating the contrary in Hammonds v. Central Kentucky Natural Gas Co., 255 Ky. 685, 75 S.W.2d 204 (1934); Central Kentucky Natural Gas Co. v. Smallwood, Ky., 252 S.W.2d 866 (1952); and Smallwood v. Central Kentucky Natural Gas Co., Ky., 308 S.W.2d 439 (1958), is specifically overruled.

Stephens, C.J., and Gant, Lambert, Leibson, Vance and Wintersheimer, JJ., concur.

Stephenson, J., dissents and files a separate dissenting opinion.

DISSENTING OPINION BY JUSTICE STEPHENSON

The majority opinion ignores the most significant aspect of this entire proceeding; that is, an abuse of the Declaratory Judgment Act, KRS 418.020. This act requires that a real controversy exist. There is none here. The issue here is a theoretical argument about the nature of the natural gas stored in Texas American's reservoirs. Texas American requested and received an opinion that the gas is personal property and thus subject to a security interest. Citizens Fidelity argues the natural gas is real property although it may consider it anyway it wishes for the purpose of lending money. The majority view is not binding on Citizens Fidelity in any respect. This court has, therefore, delivered an advisory opinion without any reference to a long-standing policy against such opinions.

Hammonds, Central Kentucky Natural Gas, and Smallwood are so different in factual situations that the only justification for citing them is to emphasize that difference. To reach the result of this advisory opinion which binds neither of the parties, nothing in the three cases is overruled.

Accordingly, I dissent.

Questions:

1. Owners of mineral interests are considered to have an interest in real property. Once severed, does natural gas remain classified as real property? What are the implications?

2. Does the rule of capture apply when natural gas has been captured and then re-injected into a well defined natural gas storage field?

3. Note that statutory procedures exist to establish natural gas storage facilities, and such provisions usually provide for a primary regulatory to have authority to oversee operations. Why do you think statutory procedures are required to establish these facilities?

Odorants: Why Natural Gas Smells

Natural gas historically could be a nuisance for drillers looking for crude oil. Sometimes it was flared or vented, and being heavier than air accumulated in low lying areas and ignited – creating safety issues for the operator and landowners.

Many times odorless, natural gas could ignite unexpectedly, and tragically in some cases, as the following article and picture from the Texas State Library and Archives and more recent articles indicate:

Texas State Library & Archives Commission

Agency Info | General Interest | Librarians | Govt Agencies | Catalogs & Searches | Publications | News | TRAIL

Making Information Work for All Texans

The biggest story of the early years of natural gas in Texas was also one of the most tragic accidents in American history. At 3:05 p.m. on March 18, 1937, a massive natural gas explosion ripped through the school building in New London, Texas, a Rusk County town in the East Texas oil fields.

The blast lifted the school off its foundations and sent it crashing back to earth, the entire structure collapsing in a huge pile of brick, steel, and concrete. Despite a frantic rescue effort, more than one half of the students and teachers – some 298 people -- were killed.

The subsequent investigation exposed the unsafe practice of “green” gas being tapped off as residue from the oilfields. Because natural gas is heavier than air, leaking natural gas flows along the ground surface, pooling in low spots. The New London School was located in just such a low spot.

Since most East Texas natural gas is odorless, the stage was set for tragedy. As a direct result of the New London disaster, states all over the country began to require that natural gas be mixed with a malodorant to give early warning of a gas leak. The foul odor most people associate with gas is actually Mercaptan, the odorant added to natural gas. In Texas, the responsibility for overseeing this safety measure was added to the duties of the Railroad Commission.

In order to assist in detecting leaks, a minute amount of odorant is added to the otherwise colorless and almost odorless gas used by consumers. The odor has been compared to the smell of rotten eggs, due to the added tert-Butylthiol (t-butyl mercaptan). Sometimes a related compound, thiophane may be used. Situations in which an odorant that is added to natural gas can be detected by analytical instrumentation, but cannot be properly detected by an observer with a normal sense of smell, have occurred in the natural gas industry. This is caused by odor masking, when one odorant overpowers the sensation of another. As of 2011, the industry is conducting research on the causes of odor masking.

Natural gas explosions are thankfully rare, but still occur with some frequency across the nation. The drilling boom for domestic natural gas has increased the number of pipelines – and the number of potential accidents – from natural gas leaks. The following are two such recent incidents:

<u>Natural gas explosion rocks closed Wichita middle school</u>

The Associated Press

Thursday, November 25, 2004

WICHITA — An apparent natural gas explosion Wednesday morning knocked down a wall on two floors of the Marshall Middle School, which was not in session because of the Thanksgiving holiday.

"We can thank the Lord this occurred today and not yesterday," Wichita Deputy Fire Chief Mike Rudd told reporters. . .

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<u>Irving Home Explodes Due to Gas Leak</u>

by BRETT SHIPP / WFAA-TV

wfaa.com

Posted on February 2, 2010 at 10:55 PM

IRVING — An elderly Irving couple is hospitalized — one of them clinging to life — following yet another natural gas explosion in North Texas.

The blast ripped through their home early Sunday morning. It has all the earmarks of a tragedy that has repeatedly injured and killed North Texans over the past 30 years. Relatives say Joseph and Peggy Manthiey never smelled a thing before being blown out of bed early Sunday morning.

Kyla Kirby and Jake Westerman raced across the street and found the house in flames and the Manthieys burned and in shock in their front yard. They said Mr. Manthiey was burned the worst. "The explosion had blown him out of the house into the back yard," Kirby said. "He was so burned, he was like — his flesh was off."

Atmos Energy crews have since discovered probable culprit, a major leak on a service line across the street from the Manthiey's home. While that leak has been repaired, crews are still working up and down the block finding more.

Neighbor Kayla Rice said Atmos Energy crews found a leak in her front yard. "It bothers me that they won't give me any information and tell us anything," she complained. "They are in our front yard working all day long, but they won't say anything." Atmos Energy declined an on-camera interview with News 8, but issued this written statement:

"Safety is our number one priority. We have checked out the area to make sure it is safe and are working with the city and state to investigate the cause."

It's similar to the statement Atmos issued after a house explosion in Mesquite last November. Kristi Samons was at home at the time and survived the gas explosion, which Atmos first blamed on carbon monoxide.

The official preliminary cause of that blast was judged to be a leaking compression coupling on the Atmos gas line. For days afterward, gas leaks were discovered all over the Mesquite neighborhood.

Much like the situation in Mesquite just a couple of months ago, Atmos crews are finding more leaks in the Irving neighborhood surrounding Sunday's blast.

In May of last year, less than a mile away from Sunday's explosion in Irving, another house exploded. Again, it is being blamed on a leaking compression coupling on an Atmos gas line.

In Cleburne in 2007, two people died in a house explosion, which again, was blamed on a leaking compression coupling. In Wylie in 2006, there was another house explosion. Two people died and again, a leaking compression coupling was blamed.

Following a News 8 investigation, the Texas Railroad Commission ordered the removal of faulty couplings attached to gas meters. But there are an estimated three million other compression couplings still in the ground that may be prone to leaks.

State Rep. Robert Miklos (D-Mesquite) says the time has come for Railroad Commissioners to order the rest of the dangerous couplings removed. "We can't say that five, ten, fifteen people a year blowing up in their homes is somehow the cost of doing business," Miklos said. "The government's role is to ensure the safety of its citizens."

Rep. Miklos says he will file a request for a special legislative hearing on the explosions, calling for the Texas Railroad Commission to answer questions about what more can be done to keep this from happening again.

Herald.ie

France hit by giant stink-bomb
Tue, Jan 22, 2013 03:03 AM EST

A foul-smelling cloud of gas from a chemical factory has spread across parts of northern France, prompting scores of calls to emergency services. France's Interior Ministry said the gas, mercaptan, is harmless but because of prevailing winds has spread more than 60 miles, into the Paris region. Among other uses, mercaptan is added to municipal gas to alert people of leaks.

The factory in the northern city of Rouen is owned by Lubrizol, a subsidiary of investor Warren Buffett's Berkshire Hathaway. "Bearing in mind the lack of danger, residents of the areas concerned are asked not to call emergency services," the Interior Ministry said.

An Energy Backed U.S. Dollar?

For thousands of years money has been literally either silver or gold coinage. With the advent of paper money several centuries ago the paper notes became redeemable in gold or silver at a set rate – essentially a paper version of the coin. The U.S. was one of those countries that adopted a system that backed the U.S. dollar with a set amount of gold, until the Nixon administration abandoned the gold standard in 1971.

To replace the gold standard the U.S. adopted a 'fiat' currency system, one where the dollar was backed only by the U.S. government and the Federal Reserve. The 'problem' with a fiat currency according to some economists is that the dollar is only backed by a 'promise to repay' – not physical gold or silver. A promise, they point out, is only as reliable as the entity that makes it.

To address these concerns several U.S. Senators proposed that the U.S. dollar should be backed by units of energy. One of the leading proponents of this legislation, Senator Mark Hatfield of Oregon, in 1973 suggested having a measure of energy replace money as a standard of value. Hatfield argued that "Energy is the currency around which we should be basing our economic forecasts, not money supply." One commentator pointed out:

> "This recent call for the adoption of an energy standard of value is not, however, the first time such a proposal has been aired in the U.S. About fifty years ago in the midst of the Great Depression, Harper's Magazine published an article "Technology Smashes the Price System" by the industrial engineer Howard Scott, who stated that:
>
> > "It is the fact that all forms of energy, of whatever sort, may be measured in units of ergs, joules or calories that is of the utmost importance. The solution of the social problems of our time depends upon the recognition of this fact. A dollar may be worth -- in buying power -- so much today and more or less tomorrow, but a unit of work or heat is the same in 1900, 1929, 1933 or the year 2000."
>
> Scott and the fascinating Technocracy movement he founded proposed that dollars and money be replaced by energy certificates denominated in units such as ergs or joules, equivalent in total amount to the appropriate national net energy budget, which could then be divided equally among all members of the North American Continental Technate. The Technocrats argued that apolitical, rational engineers should be vested with authority to guide the nation's economic machine into a thermodynamically balanced load of production and consumption, thereby doing away with unemployment, debt and social injustice." (See: Ernst Berndt, "From Technocracy to Net Energy Analysis: Engineers, Economists and Recurring Energy Theories of Value", Sept. 1982)

Professional economists "have been notably cool to the notion" of an energy-based currency according to Berndt. Today we see continued arguments about whether the dollar should return to the gold standard, with concerns about the stability of fiat-based currency systems. What we don't see is any serious argument to adopt an energy-based or energy-backed dollar.

Measured as a unit of energy, recent articles have noted that a U.S. citizen, on average has around 200 energy 'servants' per day working around the clock to assist them in their activities. The engineers estimated the average energy output of a person working 24 hours per day, and calculated the energy value of the fuels consumed per capita, to arrive at the servant value. Except for the very wealthy, or very powerful, they concluded that very few in human history have had so many servants to assist one in their daily activities. For the average U.S. citizen our access to cheap, reliable energy sources is nothing short of a miracle.

J.C. Ellis, Plaintiff v. Arkansas Louisiana Gas Company, Defendant

Civil No. 76-211
UNITED STATES DISTRICT COURT FOR THE EASTERN DISTRICT OF OKLAHOMA
450 F. Supp. 412; 1978 U.S. Dist. LEXIS 18650; 61 Oil & Gas Rep. 368
March 31, 1978

Morris, United States District Judge

The principal question in this case has not been decided in Oklahoma and remains undecided in the overwhelming majority of jurisdictions in the United States. The question is: when the oil, gas and other minerals have been severed by conveyance from the fee simple estate in a tract of land, and subsequent to severance natural gas is injected in and under that tract of land as a part of an underground gas storage reservoir, from whom must the injector secure permission to store natural gas?

Plaintiffs, James C. Ellis and Wanda Lou Ellis, his wife, are the surface owners of approximately 78 acres of land in Pontotoc County, Oklahoma. They seek to recover damages and injunctive relief for the unauthorized use by defendant of an underground strata of plaintiffs' land for the storage of natural gas. Plaintiffs also seek damages for the unauthorized use of an injection well located on plaintiffs' land and claim that an easement given by [**2] plaintiffs to defendant which grants defendant the right to operate a gas injection well on plaintiffs' land should be rescinded for lack of consideration. Mr. Ellis will sometimes be referred to herein as plaintiff.

The defendant denies any liability to plaintiffs, claims it has the right to inject gas by virtue of certain oil and gas leases, gas storage leases and the gas injection easement granted to defendant by plaintiffs. Defendant further claims that plaintiffs' action is barred by the doctrine of prescription.

The case was tried to the court without a jury. At trial neither side introduced into evidence the instruments which effected the severance of the oil, gas and other minerals from the surface and because the court viewed the record as incomplete without such instruments, the court invited counsel to submit them for the court's consideration and to make them part of the record. By stipulation filed on November 22, 1977, counsel so stipulated.

** [text omitted] **

In 1946 and 1947, subsequent to the severance of the surface from the oil, gas and other minerals, the mineral interest owners executed instruments denominated as gas storage leases in favor of Southwest Natural Gas Company. These gas storage leases were thereafter acquired by the defendant.

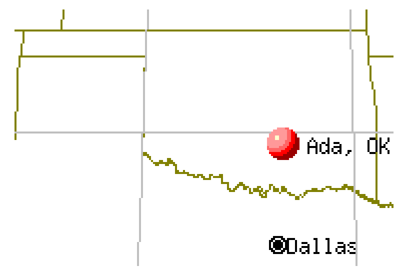
The gas storage lease on Tract I provided in part as follows:

WHEREAS, Second Party is desirous of obtaining a lease on the above described premises for the purpose of introducing and storing gas in, and extracting said gas from, any sand or formation down to a depth of 1,500 feet deemed suitable by second party for such purposes but particularly in and from what is commonly known as the Cromwell Sand found at approximate depth of 1,300 feet;

NOW, THEREFORE, for and in consideration of the sum of Ten Dollars ($10.00), cash in hand paid by second party, receipt whereof is hereby acknowledged, first party hereby grants and leases unto second party the exclusive right and privilege of introducing and storing gas in any form and extracting and taking such gas from said sand or sands, either through a well or [**9] wells now or to be situated on said premises, or through wells located on adjacent and surrounding premises, and for the purposes of laying pipe lines, building power stations and structures, warehouses, dwellings, telephone and telegraph lines used in conjunction with the storing and extracting of said gas, together with the right of ingress and egress, and the further right to drill any additional well or wells on said premises in such locations as deemed advisable by second party for the purpose of introducing or extracting gas already introduced and stored. (Emphasis added). (Defendant's Exhibit 3).
The gas storage lease on Tract II contained virtually identical language with minor differences in language being used to identify the parties (Defendant's Exhibit 4). The surface owners did not join in the execution of the gas storage leases.

** [text omitted] **

Tracts I and II are located within the confines of what is sometimes referred to as the Ada Storage Facility. (Plaintiff's Exhibits 3 and 4). The sand strata which is being used for the underground storage of gas by the defendant is the Upper Cromwell Sand. It is bounded on all four sides by an impermeable barrier of some type and thus makes a good underground gas storage reservoir (Tr. 46-47). The total acres inside the reservoir limits are 1230; of those 1230 acres plaintiffs own approximately 78 (Tr. 49, 44 & 64). The average pay thickness of the reservoir as a whole is 100 feet with the average pay thickness in and under plaintiffs' land being 96 feet (Tr. 49; Plaintiff's Exhibit 5).



The reservoir comprising the Ada Storage Facility (the Upper Cromwell Sand) was originally a gas only producing reservoir; there was never any oil in this reservoir (Tr. 48). The reservoir was discovered as a producing gas reservoir in 1922, it produced [**13] more than 23 billion cubic feet of gas before it was depleted in 1928 (Tr. 50). "The volumes of recoverable native gas originally in place therein were depleted prior to the commencement of gas storage operations . . ." (findings of the Oklahoma Corporation Commission on October 3, 1973, p. 3 of Order attached as Exhibit A to Exhibit A of Plaintiff's Request for Admissions. See Tr. 75). It has been used continuously since 1949 by the defendant for underground storage of natural gas and some use was made of it as a storage facility prior to that time (Order and Journal Entry of Judgment of District Court within and for Pontotoc County, Oklahoma, filed December 16, 1975, a part of plaintiffs' request for admissions; Tr. 75).

Plaintiffs' expert witness, Victor W. Pryor, testified that it had been used as an underground storage facility for approximately 50 years (Tr. 48). There are nine gas producing-injection wells in the reservoir (Plaintiffs' Exhibit 3, Tr. 49). Two of the nine injection wells are located on plaintiffs' Tract I (Plaintiffs' Ex. 3; Tr. 7) although one has been plugged (Tr. 126). A third injection well, the Balthrop # 6, is located just across the road immediately [**14] north a short distance from plaintiffs' house (Plaintiffs' Ex. 3; Tr. 11). On plaintiffs' land and south of their house 450 to 500 feet is an injection well. It is identified as WP # 3 (Plaintiffs' Ex. 2; Tr. 127). This well has been serviced by an employee of defendant once or twice a week, and oftener when the weather was cold from 1945 to the date of trial (Tr. 127, 128, 141).

Plaintiff knew what the well [*418] was being used for (Tr. 130). The WP # 3 "sticks up out of the ground there and it has a big blow pit to the west of it that takes up nearly a half acre where, when it gets water in the tank it has a huge silver tank, when they take gas out of the ground moisture comes up and catches and blows it out in the pit and the pit takes up some of it, the well takes up some of it, and then at times the cattle in the pasture, it has a big handle on it, pull it down and it blowed gas, after the fluid is all gone it blows natural gas and sometimes the cattle gets against that, it has an automatic turn-on and turn-off, and sometimes it gets hung and blows gas, and that gas smell gets real strong at times. And it would make noise, wake us up in the middle of the night and [**15] make noise. I called Mr. Scroggins if it gets hung and he would come down and fix it. The blow pit killed a few trees around there and all. I guess you expect stuff like that." (Tr. 11-12).

Although plaintiff testified that he did not know at the time he purchased Tract I that it was part of an underground gas storage reservoir (Tr. 18, 22) and that he did not learn that it was until 1967, the court finds that he in fact had both actual and constructive knowledge that Tract I was part of a gas storage reservoir at the time he bought it in 1963. Mr. Davidson, plaintiffs' grantor, told Mr. Ellis prior to his purchase of the land that he was getting the "surface only" -- none of the minerals -- but "because of the storage of gas . . . on the place, he would get free gas for this one house." (Tr. 120). Furthermore, the Gas Storage Lease which covered Tract I was recorded in the office of the County Clerk of Pontotoc County on February 14, 1947 (Defendant's Ex. 3) thereby giving him constructive knowledge of its terms. 16 O.S. § 16. And he had the title examined prior to purchase (Tr. 121). Moreover he described in considerable detail the gas injection well just south of his house [**16] -- how it looked, how it sounded and how it smelled. Thus, although the testimony is in conflict the court finds that plaintiff knew that the land in question was being used as a gas storage reservoir.

There is no issue in this case relating to who is entitled to produce the injected gas although both sides have directed this court's attention to various cases which do involve that issue. See Hammonds v. Central Kentucky Natural Gas Co., 255 Ky. 685, 75 S.W.2d 204 (1934); Lone Star Gas Co. v. J. W. Murchison, 353 S.W.2d 870, 94 A.L.R.2d 529 (Tex.Civ.App. 1962), error refused n. r. e.; White v. New York State Natural Gas Corp., 190 F. Supp. 342 (W.D.Pa. 1960). Plaintiffs, as surface owners, are not asserting that they have title to or the right to drill into and produce any of the injected gas. But plaintiffs do assert that after the pore spaces in the reservoir rock have been depleted of native natural gas -- and it is uncontroverted in this case that all economically recoverable gas reserves were depleted by 1928 (Tr. 50) -- that they, as surface owners, own the reservoir and the void pore space in the rocks which is now being utilized by the defendant in storing natural [**17] gas produced elsewhere and injected into the reservoir. They claim in essence that their land is being used by the defendant without authority and that they are entitled to damages for its unauthorized use.

Defendants, on the other hand, deny liability and assert that because of the peculiar nature of the common law concerning ownership of natural gas in place, the ownership of the subsurface strata does not determine the right to store and recapture natural gas and that one injecting natural gas into such a stratum cannot be held to have committed a trespass. It further argues that gas storage rights were properly secured from the mineral owners by the oil and gas leases and the gas storage leases in 1928, 1946 and 1947 and that it is the mineral interest owner and not the surface owner who is empowered by law to grant storage rights to the defendant.

The defendant argues that under the authority of Hammonds, supra; Central Kentucky Natural Gas Co. v. Smallwood, 252 S.W.2d 866 (Ky. 1952) and West Edmond Salt Water Disposal Association v. Rosecrans, 204 Okla. 9, 226 P.2d 965 (1950) one who reinjects gas or water into a reservoir loses ownership of [*419] the reinjected [**18] fluid, that such fluid becomes subject to the law of capture and that because ownership is lost by virtue of reinjection, the defendant cannot be held liable for trespass or damages. The defendant especially urges West Edmond because it was decided by the Oklahoma Supreme Court.

There is no question, this being a diversity case, but that this court is obligated to follow state law. But in this court's view, West Edmond is not dispositive. West Edmond was concerned with the potential liability of a party who injected salt water into an underground formation, which formation was already saturated with salt water. Proof was adduced that salt water, which was injected by defendant into a well located on a 40-acre tract which adjoined plaintiffs' land to the west, was forced to the east through the porous stratum into which it was injected where it commingled with the salt water which already saturated that stratum in and under plaintiffs' land. Unlike the facts in this case, no one knew what the perimeter boundaries were of the Hoover-Tonkawa formation into which the salt water was injected. That "formation was saturated with salt water and was of great extent, the actual [**19] boundaries thereof not being capable of accurate ascertainment." 204 Okla. 9, 226 P.2d 965, 968. The court did find, however, that following injection of salt water into the Hoover-Tonkawa Sand, the defendants lost ownership of the injected salt water, did seem to say that minerals were faere naturae and did cite Hammonds, supra, with approval. 226 P.2d at 970-71.

The factual setting of West Edmond is important. There, the salt water which was injected was commingled with the salt water which already saturated the stratum in and under plaintiffs' land. The salt water was a valueless substance. No one knew what the confines or boundaries were of the formation into which the salt water was injected. In the case before this court none of those circumstances exist. There is no commingling of economically recoverable native gas and storage gas. The reservoir was depleted prior to injection. All of the gas injected is owned by the defendant. The limits of the reservoir are well defined. All of this is undisputed.

In a fact circumstance quite similar to the one which is before this court, and in declining to follow the animal faere naturae analogy, the court in [**20] White, supra, stated:
It becomes readily apparent, however, that a strict application of this analogy to the present facts is of no benefit to plaintiff's cause. To begin with, the storage gas in question has not escaped from its owners. On the contrary, it is yet very much in the possession of the storage companies, being within a well-defined storage field, the Hebron-Ellisburg Field, and being subject to the control of the storage companies through the same wells by which the gas originally had been injected into the storage pool. 190 F. Supp. 342, 348.

Looking at this same analogy, Professor Kuntz has noted:

The analogies used are imperfect and objectionable, and the result reached is reasonable only if compelled by a lack of scientific knowledge. The result is not reasonable if the character and area of the reservoir can be determined or if the specific substance can be identified and traced.

If the underground area is capable of being defined with certainty, ownership of the substances injected should not be lost, unless it appears that they have been abandoned. Further, the injector should be held to be a trespasser if the substance was intended [**21] to invade the land of another. 1 Kuntz, The Law of Oil and Gas § 2.6, p. 71.

This court's decision in this case is limited to a circumstance where the reservoir is defined and there is no commingling between economically recoverable native gas and injected gas. In this factual setting, it is my view that the law of Oklahoma is that the injector does not lose ownership of the gas by injecting it into the underground reservoir. And for these reasons I do not regard Bezzi v. Hocker, 370 F.2d 533 (10th Cir. 1966) as determinative in this case. See, Lone Star Gas Co., supra.

[*420] But the question still remains: Did the severed mineral interest owners have the legal right to grant gas storage rights to the defendant? If they did the plaintiffs cannot prevail because such rights were granted to the defendant. Professors Williams and Meyers say that in this country there "are two reported cases dealing with this matter." 1 Williams and Meyers, Oil and Gas Law, § 222, p. 328.3. A Kentucky case, Central Kentucky Natural Gas Co. v. Smallwood, 252 S.W.2d 866 (1952), noted in 7 Okla.L.Rev. 225 (1954) has held that the mineral interest owner has authority, [**22] to grant a gas storage lease.

A West Virginia case, Tate v. United Fuel Gas Co., 137 W.Va. 272, 71 S.E.2d 65 (1952) holds that the surface owner has authority to grant a gas storage lease. These two cases, looking in opposite directions, were both decided in 1952. The Court of Claims has also addressed the question more recently and has concluded that the right and power to use a depleted reservoir for gas storage purposes is vested in the surface owner. Emeny v. United States, 188 Ct. Cl. 1024, 412 F.2d 1319 (1969).

Writers and academicians who have looked at the question are about equally divided. Professors Williams and Meyers urge "adoption of the view that the mineral severance should be construed as granting exclusive rights to subterranean strata for all purposes relating to minerals, whether 'native' or 'injected,' absent contrary language in the instrument severing such minerals." Williams and Meyers, supra, at p. 333. In accord with this view, see Stamm, Legal Problems in the Underground Storage of Natural Gas, 36 Tex.L.Rev. 161 (1957). A contrary view is expressed by McGinnis, Some Legal Problems in Underground Gas Storage, Southwestern Legal [**23] Foundation, 17th Annual Institute on Oil and Gas and Taxation 23 (1966); Scott, Underground Storage of Natural Gas: A Study of Legal Problems, 19 Okl.L.Rev. 47 (1966); Creekmore and Harvey, Subsurface Storage of Gas, 39 Miss.L.J. 81 (1967).

There are several factors which should be considered in arriving at a decision concerning whether the mineral owner or the surface owner has the right and power to grant the storage right and to receive the compensation therefor. One is intention. What was the intention of the parties at the time the minerals were severed from the surface? Was it the intention that the mineral interest owner have the power to explore, develop, produce and store gas in and under the land in question? The first place to look in ascertaining that intention are the deeds which effect the severance. In this case it seems quite clear that the mineral severance instruments gave to the mineral interest owner all of the oil, gas and other minerals "that may be produced"; that he had the "right of ingress and egress at all times for the purpose of mining, drilling and exploring said lands." Indeed all of the words used denote exploration, production [**24] and development. Nothing is said about injection, storage or occupation. And there is nothing before me which suggests that these rights should be reasonably inferred from other language used in the deeds.

Speaking to this same point, Mr. McGinnis has stated:

It is submitted, however, that neither the right to store nor the right to use the surface in connection with storage should be implied or presumed in the absence of clear evidence of intent to grant such rights. McGinnis, Some Legal Problems in Underground Gas Storage, supra, at 51. Although Professors Williams and Meyers are of the view that the power to grant storage rights should be in the mineral interest owners, they urge this position "absent contrary language in the instrument severing such minerals." (Emphasis added).

While the severing instruments in this case do not negate in express terms the right to inject or store gas (that is to say, they do not read "the mineral interest owner shall not have the power or right to inject or store gas") the only reasonable construction of the language used is that no such power is bestowed upon him. This court accordingly concludes that [**25] the parties did not intend [*421] that the mineral interest owner should have injection, storage or occupation rights.

Apart from intention, if A owns a tract of land in fee simple and conveys to B all of the oil, gas and other minerals in and under and that may be produced from that tract of land, A retains everything which he did not convey. It is clear in Oklahoma that a grant of minerals simply gives to the grantee the right to explore for, produce and reduce to possession, if found, the oil, gas and other minerals. It is an incorporeal interest analogous to a profit to hunt and fish on the land of another. Rich v. Doneghey, 71 Okl. 204, 177 P. 86 (1918).

Such a deed does not convey the minerals in place and does not convey the stratum of rock containing the pore spaces within which the oil and gas may be found. In the hard mineral area of the law and in the absence of language in the severing deed dictating a different construction, the English and Canadian rule is that the cavern which remains in the land after the hard minerals are mined is owned by the mineral interest owner; the American view is that the cavern is owned by surface owners. See Mines and Minerals [**26] , 54 Am.Jur.2d § 204 (1971); Mines and Minerals, 58 C.J.S. § 162, at 338 (1948); Stamm, Legal Problems in the Underground Storage of Natural Gas, supra, at 168; Creekmore and Harvey, Subsurface Storage of Gas, supra, at 96; Lyndon, The Legal Aspects of Underground Storage of Natural Gas, 1 Alberta L.Rev. 543, 545 (1961).

There is no reason in principle why the American rule should not apply to a depleted gas storage reservoir. Mr. Scott, in addressing himself to this question, has stated:

Based upon the foregoing principles, the surface owner alone should be compensated for the use per se of a stratum. He is the owner of this formation, and like an owner of a warehouse, he is entitled to the rental or other compensation paid for the use of his property. Scott, Underground Storage of Natural Gas: A Study of Legal Problems, supra, at 61.

** [text omitted] **

For all of the foregoing reasons the court concludes that the defendant did not have the authorization or permission to inject and store the gas in the subsurface stratum of plaintiff's land.

The court went on to find that a 'prescriptive easement' existed in favor of the defendant company as evidence indicated "knowledge on the part of the landowners and their predecessors in title of actual, adverse, open, notorious, peaceable, exclusive and hostile possession by the gas company for a period of time far in excess of 15 years was overwhelming."

Questions:

1. Did the mineral owner or surface owner have the right to grant underground storage rights to the natural gas company?

2. What did the court say to the defendant company's argument that under the rule of capture once it re-injected the natural gas underground it lost ownership rights, therefore as a non-owner could not be liable for trespass?

3. Who owns the pore spaces in the rock, or the mine voids in mined out areas, or caverns under the land, under the American law of mining?

4. What other attributes does the surface owner have or own?

5. With regard to water injection from oil and gas operations who do you think owns the pore spaces in a formation containing water? We will talk more about water injection and mineral and surface owner rights in that regard later in the course.

6. Salt domes near the Gulf Coast have proven very efficient natural gas storage reservoirs. One such storage facility is located in the Spindletop field – originally developed in 1901 and now used in part for propane, butane, and natural gas storage:

BEAUMONT **ENTERPRISE**

www.BeaumontEnterprise.com — FRIDAY, MARCH 1, 2013

Dan Wallach/The Enterprise

Coastal Caverns Inc., a subsidiary of Vitol Inc., will join with a Japanese company, Itochu Corp., to spend $500 million to develop storage caverns in the Spindletop salt dome.

$500 million gas project is in the works

Add another multi-million project to the growing list in Jefferson County so far in 2013. A Netherlands-based company, Vitol Inc., which operates Coastal Caverns Inc. at the Spindletop site, plans to scour gas storage caverns out of the subterranean salt dome in a $500 million project with partner Itochu Corp. of Japan.

The project would be able to process up to 100,000 barrels per day of propane and butane with exporting capability of up to 3 million tons per year. The company said the site easily could expand for a second phase to allow for more than 6 million tons per year.

The site also has permits for up to 30 million barrels of storage capacity. The company said in a statement that construction would employ about 100 people and create about 30 permanent jobs on expected completion in late 2014

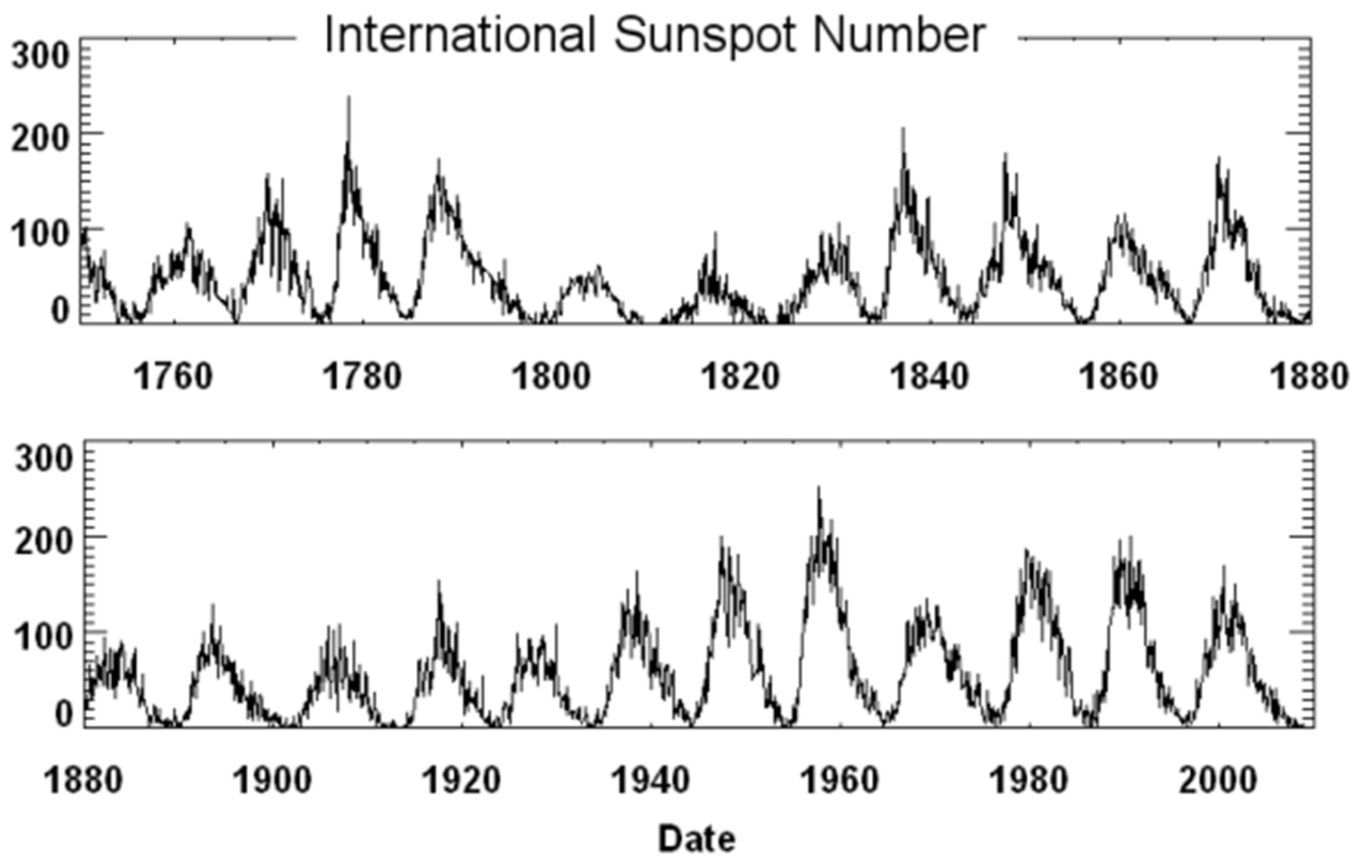
Sunspots: Little Ice Age, or Global Warming Ahead?

As scientists study historical weather patterns they are becoming more aware of how unstable global patterns have been – and how they tend to change over time. Because accurate weather records extend back only a few centuries scientists use ‘proxy’ records to assess global climate conditions over time, including ice cores, tree rings, archeology data, and even records of wine harvests.

While a current debate exists as to the extent carbon emissions might be warming the global atmosphere, impacting agricultural processes and strengthening storms, a counter argument has arisen that claims that sunspots can be used to explain global warming and cooling. While the suggestion initially might be taken as a unsophisticated attempt to rebut the global warming argument sunspots are an indicator of the energy radiating from the sun, which in turn warms the earth.

Historical agricultural data indicates during periods of low sunspot activity crops tend to be more meager, and economies have historically grown slower during these periods. In extreme cases food shortages have arisen due to the short growing seasons.

Sunspots have been monitored since around 1610, shortly after the invention of the telescope. They provide a long-running direct measurement of the sun’s activity. The number of sunspots each year varies significantly, and over the centuries it appears sunspots have an 11-year cycle of activity from peak to trough.



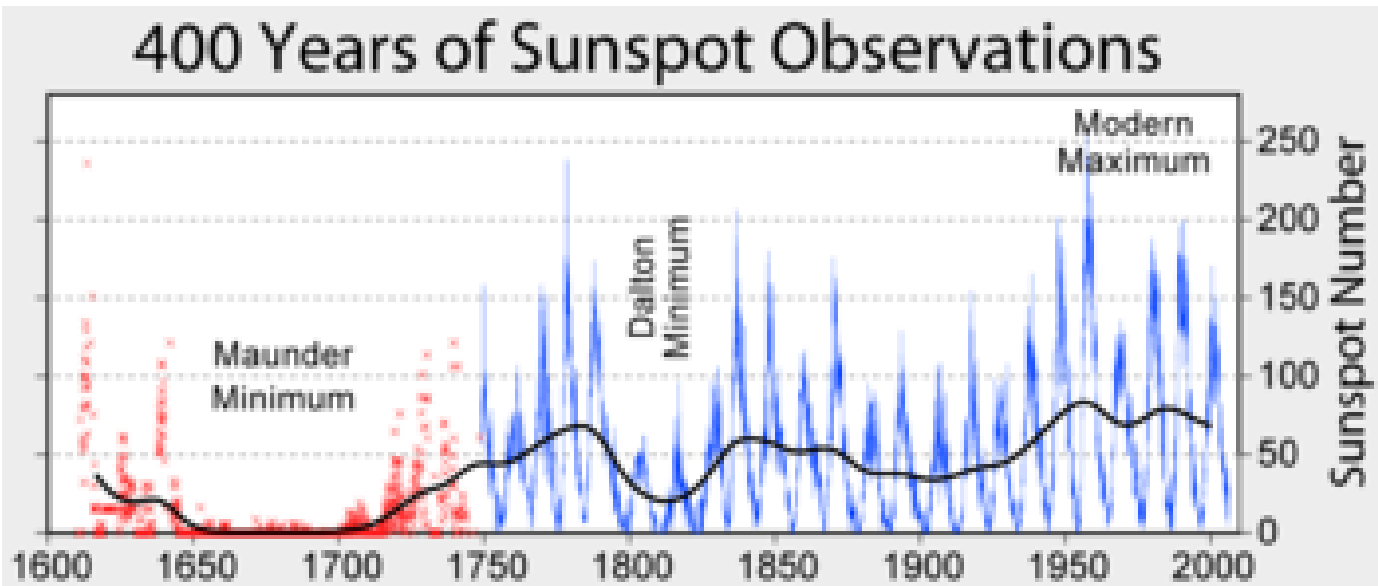
Solar activity data appears to indicate that over the last century the number of sunspots rose in number and intensity. At the same time the Earth's climate became steadily warmer. In theory, the more sunspots the more energy should reach the earth. Solar activity and temperature appear to correlate closely.

One solar scientist recently published a paper on the issue of climate and sunspot activity, and found that the most striking feature is that looking at the past 1,150 years the sun has never been as active as it has been during the past 60 years.

The Maunder & Dalton Minimums

While the sun has been active over the last 60 years, the historical periods of solar inactivity – dubbed the Maunder Minimum and Dalton Minimum after the astrologists who studied them - coincided with an irregular periods of rapid climate shifts.

The climate cycles brought intensely cold winters, although periodically intense summer heat waves would also appear. The Maunder cycle is often referred to as the "Little Ice Age" – but climate experts claim the period is punctuated by both cold weather and rapid climate shifts.[2]



We are now in sunspot 'Cycle 24', and what is unique is that scientists are saying the sun is at its weakest sunspots wise as it has been for a century. If there is a correlation between sunspots, solar energy, and global weather patterns the data may make a statistical case for such a relationship over the next decade.

[2] See: Fagan, "The Little Ice Age – How Climate Made History", Basic Books (2000). See also Diamond, "Collapse – How Societies Choose to Fail or Succeed", pp. 211-276, Viking Press (2005).

Studies: Are High Energy Prices Always Good?

One of the problems we face in the energy sector is the difficulty planning when prices might swing violently up or down in response global supply or demand developments. Legally and from a business standpoint this raises issues with regard to royalty payments, developmental obligations, fair valuation of properties for transactional purposes, efficient levels of staffing, capital allocation levels, among other issues.

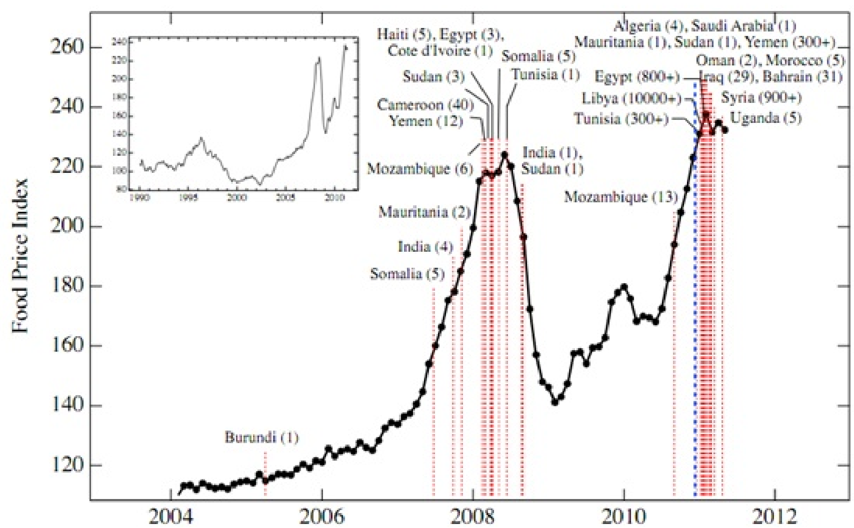
With the concern about price volatility, and supply changes (massive increases in supply from directionally drilled and fraced wells as well as from tar sands, or massive declines in supply from political unrest or technical production, refining, or transport problems) the recent report on food pricing and the energy markets was of interest.

Researchers at the New England Complex Systems Institute (CSI) studied periods of social unrest in the Middle East and North Africa to attempt to explain the underlying causes of the riots that swept these areas in 2008 and 2011. The Cambridge-based researchers looked at a variety of factors that could trigger unrest – poverty, oppression, unemployment, etc. in an attempt to explain the disturbances.

The 2012 study found the factor most responsible for triggering riots and social unrest was rising food prices. High food prices do not trigger riots themselves according to the research, but created conditions in which social unrest could flourish.

Since the majority of the world's crude oil is produced and exported from the Middle East and North Africa – roughly one of every two barrels is exported from this region – instability in this area would create major global economic problems.

While the anti-U.S. riots in Libya, Egypt, Yemen, Iran and elsewhere in the Middle East and North Africa that broke out last month were blamed on an American-made video, the study claims that periods of social instability in this region can be accurately predicted by food prices – and the film happened to be the trigger for the unrest.



CSI Findings - Plotting global food prices, as measured using the United Nation's Food and Agriculture Organization's (FAO's) Food Price Index, against the dates of recent unrest the researchers found a high degree of correlation between the high food prices and periods of instability. The chart above (from the CSI report) covers the period from January 2004 to May 2011.

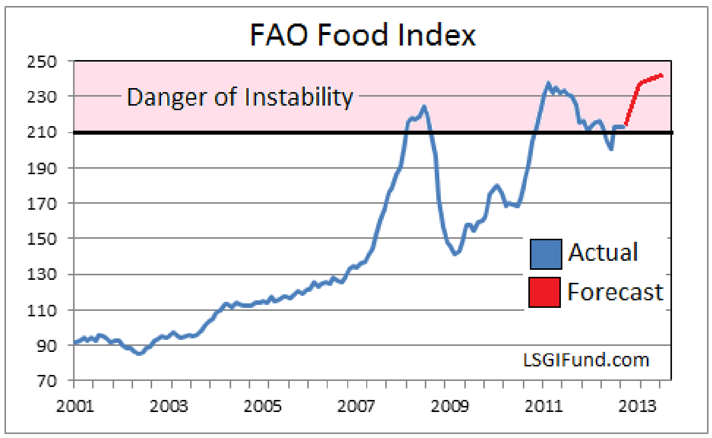
When the FOA's Food Price Index climbed above the threshold level of 210 the researchers found that conditions tend to ripen into periods of social unrest. The study doesn't claim that a breach of the 210 level immediately leads to riots, just that the probability of instability becomes much greater.

The FAO Food Price Index is at 216 in late 2012, slightly above the instability threshold identified in the report. The FAO Index has been above the threshold level for most of the year. Going forward the price of food is expected to move upward with the drought in the U.S. and Russia adding to pricing pressures, thus increasing the probability of unrest.

For the millions of people in developing economies food comprises anywhere from 35% to 80% of routine household expenses. The Middle East and North Africa are major importers of grains and foodstuffs, so increasing food costs are quickly reflected in local prices. In the more developed economies household expenditures on food are more like 10% to 15%. High food prices have a larger and more direct impact on households in developing economies, posing a challenge for these governments.

One of the authors of the report predicted another “massive food price spike” this fall and winter, even bigger than the last one seen in 2011. This crest will be exacerbated by this summer’s drought and heat wave in many grain growing areas. He noted that “when people are unable to feed themselves and their families, widespread social disruption occurs. We are on the verge of another crisis, the third in five years, and likely to be the worst yet, capable of causing new food riots and turmoil on a par with the Arab Spring.”

Rabobank Report - World food prices are forecast to hit an all-time high in 2013 - and then keep rising - as crops in the U.S. have been hit by the country's worst drought since 1936 according to a report issued in 2012 by Rabobank, a financial institution specializing in agriculture economics and research.

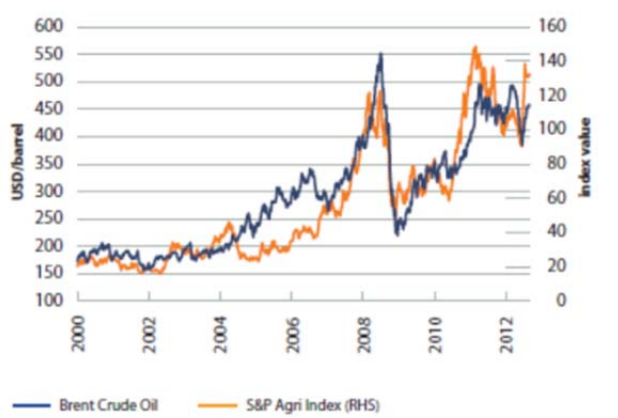


Food prices, as measured by the United Nations FAO Food Price Index, could climb by 15% from current levels according to Rabobank, reaching a record 244 by July, 2013 (see chart). This price level would be well into the zone where the probability of instability in the Middle East increases substantially. The FAO index previously hit an all-time high in February, 2011, just as the ‘Arab Spring’ ignited riots across the region.

As a result of drought in key exporting countries and rapid demand growth, Rabobank forecasts the combined global wheat, rice, corn and soybean stocks-to-use ratio will fall to 19.6 per cent in 2013. In addition, export bans and commodity stockpiling by concerned governments could exacerbate commodity price volatility.

According to the report the most affected commodities are those largely used in animal feed (corn and soybeans) and are not core food staples (wheat and rice), therefore the impact of the price increases might be more severe in economies that consume high levels of meat and dairy products.

Figure 1.6: Agricultural commodity prices and energy prices remain strongly correlated



Source: Bloomberg, Rabobank, 2012

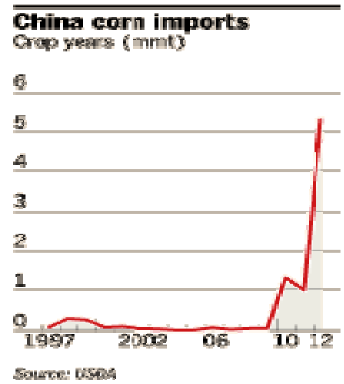
The Rabobank report also made the following points regarding the agricultural sector:

- Food security remains a highly sensitive issue in many regions. They expect to see a return of government intervention, which could exacerbate food and commodity price volatility. Increases in commodity stockpiling and other interventionist measures, such as export bans, are a distinct possibility as governments react to protect domestic consumers from increasing world food prices. Increased intervention will likely add to increasing world food prices.

- The scale of the production setbacks in 2012 will underscore the need for an almost unprecedented amount of demand rationing. Rabobank's crop modeling indicates that there may still be a considerable downside from current official production forecasts. Fundamentals remain much tighter than current official market estimates.

- The price of energy and agricultural products have correlated very closely over the last decade. The increasing production of biofuels has been one reason for this high degree of correlation, as well as the upgrading of diets and lifestyles in China and other developing countries.

- With regard to China, the Financial Times pointed out last month that China's corn imports are going through the roof – and are expected to stay elevated for quite some time. The increase in demand, and extended drought, should help put a floor under any price weakness. The Financial Times chart at right is stunning.



Questions:

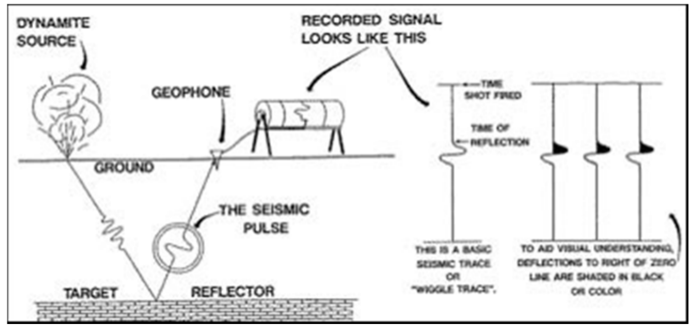
1. The U.S. has taken a very aggressive legislative and regulatory position with regard to promoting the use of biofuels in the transportation sector. Roughly 42% of the U.S. corn crop in 2012 was used for ethanol production. The legislative mandate requires that additional non-corn biofuels be developed and introduced into the U.S. fuel supply over the next decade. If increasing demand for biofuels increases the cost of grains globally, could this impact the energy sector?

2. On a British thermal unit (BTU) basis, some studies have shown that it takes as much energy to produce a gallon of ethanol as is released when this fuel is burned. If true, is the ethanol mandate good national policy?

3. The price of U.S. farmland has in general increased substantially since the biofuel mandates were first adopted in 2007-8. Some claim the increased price of corn will support the higher farmland prices, while others claim that farmland prices have entered a 'bubble' much like the Internet stock mania of the early 2000's. Have biofuel mandates created an environment where capital is being misallocated to farmland when the goal of energy dependence would be better served if it was allocated toward oil and gas research or development?

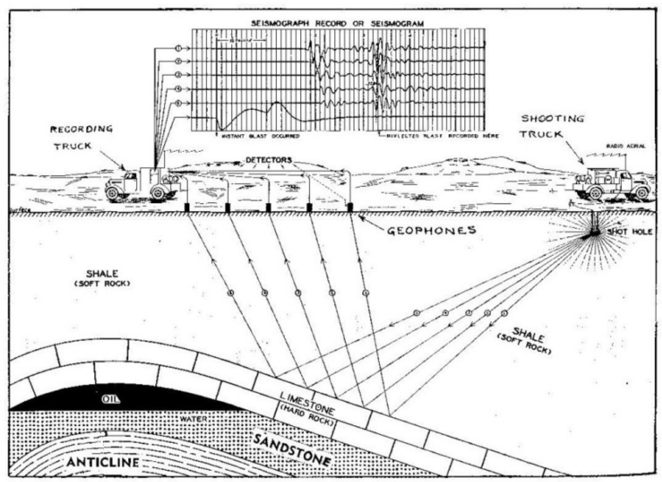
Overview of Reflection Seismology

Starting in the 1920's oil and gas operators developed a new tool to assist them in locating their exploration wells. 'Reflection seismology' or 'seismic' exploration utilizes shock or sound waves generated on the surface to penetrate the ground. When such waves encountered different formations or rocks they tended to be reflected back to the surface to varying degrees, and some waves took longer to return than others.



The energy source in the early years was a hole drilled on the land and filled with dynamite. Environmentally these holes sometimes caused issues since they might penetrate the water table, and if not correctly plugged rainwater could allow contaminants down hole. Other penetrated formations might have shallow hydrocarbons or salt water which also could contaminate fresh groundwater.

Probably of most concern to the surface owner was the damage that blasting could cause to structures or to existing water wells. Unfilled blasting holes were also a safety hazard, and it was not infrequently that animals broke or injured themselves when stepping on improperly or unplugged shot holes.



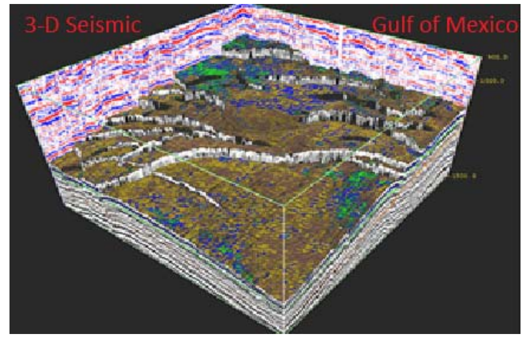
Technology has advanced so that today that instead of explosives a Vibroseis or 'thumper' truck is utilized to generate the energy needed for seismic mapping.

The thumper truck is a large vehicle with a weight attached that pulsates, sending shock waves into the ground. In many developed areas explosives are prohibited, so these trucks are utilized exclusively.

The usefulness of seismic data is a function of the company's ability to process it. Over time as computers have evolved the seismic imaging has become much more dynamic. From a two dimensional (2D) graphic output computers were used to allow three dimensional (3D) output, with the scientist being able to 'walk' through formations thousands of feet underground in specially built computer laboratories. Seismic can also track the crude oil or gas as it is produced, a process known as 4D seismic.

Three dimensional seismic generally requires more data, so shot lines generally have to be much closer together than in a traditional 2D shot. The data derived from the seismic can allow an operator to locate a well at an ideal location on the structure, alleviating the need to drill multiple wells to effectively recover reserves in place. With wells costing millions to drill, such seismic is very valuable in maximizing return on investment. Seismic can also help a scientist determine if there is 'closure' in a structure, that is whether the shape of the structure might trap hydrocarbons.

The software and technology relating to seismic processing continues to evolve. Seismic data becomes suspect when attempting to identify structures around salt domes on the Gulf of Mexico coast, for example, since the salt tends to distort the signal. Formations below the ‘salt layer’ deep in the Gulf of Mexico are also distorted to some extent, but technology to shoot and process the data continues to evolve.



<u>3D Seismic vs 2D Seismic</u>
An article by Pamela Percival in Basin Oil & Gas recently discussed the additional benefits, and the additional costs, of shooting 3D seismic in areas like Fort Worth’s Barnet shale – an ‘unconventional’ natural gas resource (we will discuss development of this resource later in the course):

3-D seismic increases drilling success rate
January 2009 Issue No. 13

> Although acquiring and interpreting three-dimensional, or 3-D, seismic data can be very expensive, experts contend that using seismic is usually well worth the cost – especially in unconventional shale resource plays. In fact, the success rate on wells drilled using 3-D seismic data can approach 90 percent.
>
> That’s according to George McDonald, vice president of field operations for Texas-based Dawson Geophysical (www.dawson3d.com), which claims 25 percent of the seismic acquisition market in the lower 48 states, where the company operates 16 crews.
>
> Geophysicist Wayne Hoskins, owner of the MapSnapper Group (www.mapsnapper.com) in Euless, agrees that 3-D seismic “has pretty well become state-of-the-art for the industry. The success rate for drilling operations has increased dramatically.”
>
> And the experts at Chesapeake Energy assert that the use of 3-D seismic has increased the likelihood of successful reservoir locations by up to 50 percent.
>
> “By providing data about the location of natural gas reservoirs, 3-D seismic imaging ensures more accurate placement of drillsites and results in more productive wells,” according to Chesapeake’s Web site.
>
> Part of the expense of a 3-D seismic acquisition project is the length of time and the amount of human resources it can take to complete a project. For example, a 3-D project covering 50 square miles can take up to a year. The process can include survey design, permitting to gain permission to perform the seismic survey on various pieces of property, the actual field work of locating and connecting “geophones” to collect the data, as well as recording and interpreting the data. Geophones essentially function as sensitive microphones that detect ground velocity produced by seismic waves and transform the motion into electrical impulses.
>
> A 3-D seismic survey covering an area of 30 square miles or larger could cost $25,000 to $80,000 per square mile, depending on the terrain and other factors, estimated Dawson’s McDonald. Hoskins estimated total project costs for such a seismic project could run from $75,000 to $175,000 per square mile, depending upon the number of permits required.

In comparison, two-dimensional, or 2-D, seismic is paid for simply by the linear mile at a cost of about $2,000 per linear mile, McDonald said. 2-D is less expensive, but also supplies much less information.

2-D seismic data is displayed as a single vertical plane or cross-section sliced into the earth beneath the seismic line's location, McDonald explained. Many times operators will do a 2-D survey first to see if the information from that survey indicates it would be worth advancing to a 3-D survey, he said.

"2-D is like an x-ray and 3-D is like an MRI (magnetic resonance imaging)," Hoskins said, comparing the seismic pictures to medical imaging. "In the data processing, the presentation and the analysis, there are a lot of similarities to medical imaging."

Of course, seismic projects in urban areas can be very time consuming and costly.

"Sometimes just to acquire the permits for a large project can take up to a year to get an area ready for a seismic survey," McDonald said. "It will then take six to eight weeks to record the data. It's a slow process. If you have obstacles, like downtown Fort Worth, it could take longer. Shooting DFW airport (Dallas-Fort Worth International Airport) took six to eight months. We might have 80-man crews spread out over a large area. The boxes (containing geophones) may be laid out at 1,720-foot spacing." . . .

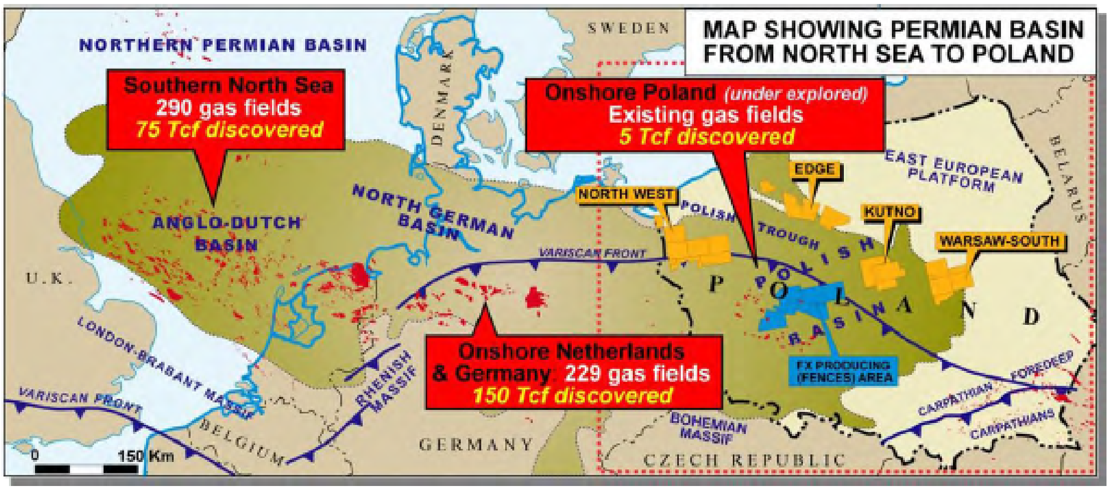
One thing that has tremendously increased the amount and accuracy of information obtained through seismic surveys in recent years is the explosion in the number of available "channels." A channel is a string of geophones hooked up and recording information. Dawson's McDonald compared the channels to the pixels in a digital image --- the more pixels, the sharper the image. "It's the same way with seismic," McDonald said. "The more phones you put out, the better the image you get."

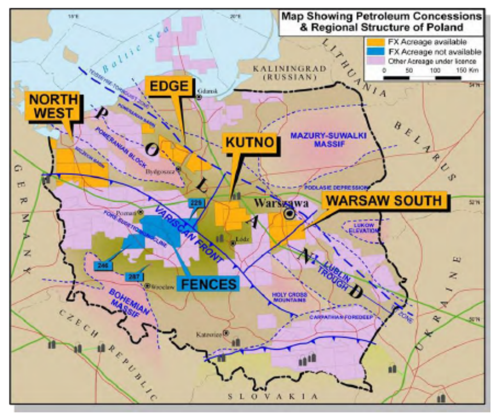
Bob Chandler, manager of technical support and engineering at Dawson, recalled that when he got into the seismic business in 1974, the company had 1,500 channels. Today, it has 115,000 channels and may use 8,000 to 10,000 channels just with one crew.

By comparison, Plano-based TGC Industries, also known as Tidelands Geophysical (www.tgcseismic.com), announced in mid-2008 that it was adding 4,000 additional channels of seismic recording equipment to meet growing customer demand, bringing its total available recording channels to 47,000.

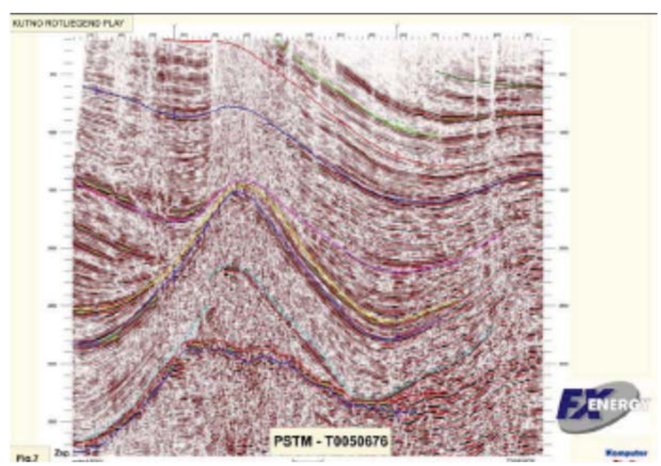
Seismic Indentified Prospect: FX Energy's Kutnos-2 Well

Dan Steffens of the Houston based Energy Prospectus Group made a presentation to the SMU Energy Club at the School of Business several years ago. He mentioned a company named FX Energy, a U.S. based company drilling for natural gas in Poland. Natural gas in Europe is two to three times more expensive than in the U.S., a major plus for producers.





Steffens noted that the firm had obtained seismic data and was preparing to drill into the largest undrilled structure in onshore Europe. A deep well named the Kuntos-2 well after the town it was located in, roughly three miles deep, the well targeted the Rotliegend formation – a Permian age formation that was productive across Poland and Germany, just at much shallower depths.



The seismic data at right is the FX Energy prospect and indicates the massive structure exists – a 250 million year old sand dune buried three miles underground. Questions the seismic could not answer (and required a $20 million well to be drilled) were:

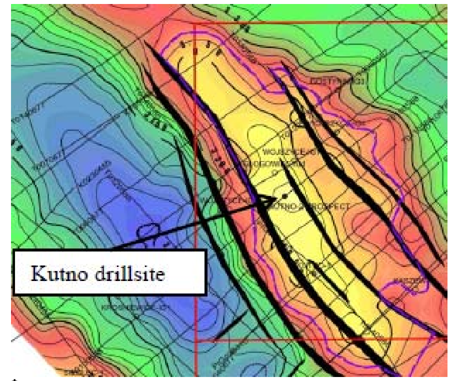
(1) was the formation full of natural gas or water?

(2) was the salt formation just above the Rotliegend formation a good 'cap rock' (keeping the natural gas trapped in the formations below)

(3) was the formation permeable enough to allow natural gas to flow to the well bore (this could be remedied somewhat with hydraulic fracturing)

(4) what was the porosity of the formation, that is how much natural gas could it contain (deeper formations tend to be compacted by the weight of the earth, so tend to be less porous with depth)

The seismic data indicated that the structure was closed, that is was like an inverted bowl that could capture and hold reserves of natural gas. The map at right indicates the 'high point' of the structure in yellow.



Modeling the well, if it was productive the reserves would add around $273.73 per share to the company's discounted present value of proven reserves. Prior to drilling the Kutno well FX Energy had a discounted present value of proven reserves of $5.67 a share and a stock price of around $6.00 a share. The company forecast a one-in-ten chance of the Kutnos-2 well being productive. Steffens' noted this was in his opinion 'a million dollar lottery ticket with no downside'.

Net Asset Value (NAV) Analysis 12/31/2011 ($ in millions, except per share amounts)	**Total**	**per share**	**per share**
P50 value pre-tax	$289	$5.46	$5.46
Net cash	$11	$0.21	$0.21
P-50 Net Asset Value	**$300**	**$5.67**	**$5.67**

Prospect	Potential Recoverable		FX Net Interest	Net Potential Recoverable		Chance of Success	Est. Net Value (mm)	Risked Value	Unrisked Value	Net Cost to FX (mm)
BOLD=Well in current budget	(Bcfe)	(Bcme)	after 1st well	(Bcfe)	(Bcme)		*	per share	per share	First Well
Fences - Lisewo satellites (5)	**60**	**1.6**	**49%**	**29**	**0.8**	**75%**	**$67**	**$1.27**	**$1.69**	**$5**
Fences - Lisewo SE	**350**	**9.4**	**49%**	**172**	**4.6**	**50%**	**$262**	**$4.94**	**$9.88**	**$5**
Fences - Plawce (tight gas)	**250**	**6.7**	**49%**	**123**	**3.3**	**50%**	**$187**	**$3.53**	**$7.06**	**$7**
Fences - Mieczewo	**30**	**0.8**	**49%**	**15**	**0.4**	**50%**	**$22**	**$0.42**	**$0.85**	**$5**
Fences - Miloslaw	50	1.3	49%	25	0.7	20%	$15	$0.28	$1.41	$5
Fences - Plawce East	875	23.5	49%	429	11.5	20%	$262	$4.94	$24.71	$5
Block 246 - Frankowo	**50**	**1.3**	**100%**	**50**	**1.3**	**20%**	**$31**	**$0.58**	**$2.88**	**$6**
Block 246 - Gorka Duchowna	50	1.3	100%	50	1.3	20%	$31	$0.58	$2.88	$6
Edge - Tuchola	**110**	**2.9**	**100%**	**110**	**2.9**	**20%**	**$67**	**$1.27**	**$6.34**	**$10**
Edge - Unislaw	110	2.9	100%	110	2.9	20%	$67	$1.27	$6.34	$12
WS - Grojec	100	2.7	51%	51	1.4	20%	$31	$0.59	$2.94	$5
WS - Boglewice	200	5.4	51%	102	2.7	20%	$62	$1.18	$5.88	$5
WS - Potycz	90	2.4	51%	46	1.2	20%	$28	$0.53	$2.65	$5
NW - Plonsko N	150	4.0	100%	150	4.0	20%	$92	$1.73	$8.64	$12
Kutno	**9500**	**254.7**	**50%**	**4750**	**127.3**	**10%**	**$1,449**	**$27.37**	**$273.73**	**$10**
Total Risked Potential	**11,975**	**321.0**		**6,210**	**166.5**		**$2,671**	**$50.47**	**$357.88**	**$103**

Question:

1. In a high-risk, high-return situation like this how do you determine 'fair value' for the company and its' assets?

2. The Kutnos-2 well was completed in October of 2012. Looking at the chart of the share price do you think it was productive?

KENNEDY v. GENERAL GEOPHYSICAL CO. et al.

Court of Civil Appeals of Texas, Galveston
213 S.W.2d 707; 1948 Tex. App. LEXIS 1443
July 22, 1948

CASE SUMMARY: Appellant landowner sought review of an order of the trial court (Texas), which entered a judgment for appellees, oil company and geophysical company, in the landowner's action for trespass arising from geophysical operations on adjoining land.

OVERVIEW: The oil company employed the geophysical company to conduct geophysical operations in connection with oil exploration. The geophysical company sought the landowner's permission to conduct the operations on his land. The landowner refused. The geophysical company conducted the operations on adjoining land. The operations mapped the subsurface of the adjoining land by detonating explosives, which caused vibrations to pass through the landowner's property. The landowner filed an action against appellees, claiming that the vibrations constituted a trespass. The trial court entered a judgment for appellees. On appeal, the court affirmed the trial court's judgment. The court held that the landowner failed to prove physical damage to his land caused by the vibrations or that appellees obtained information about the subsurface his land via the geophysical operations, so the landowner was not entitled to damages for trespass. The court determined that the landowner could not recover exemplary damages because he failed to prove malice by appellees.

OUTCOME: The court affirmed the trial court's judgment for appellees in the landowner's action for trespass.

MONTEITH, Chief Justice. This action was brought by appellant, C. W. Kennedy, Jr., for the recovery of damages alleged to have been sustained by him by reason of the acts of appellees, General Geophysical Company and Skelly Oil Company in securing information as to the presence or absence of oil, gas or other minerals in and under a tract of 339 acres of land belonging to him in Houston County, Texas, and for an alleged trespass in the form of vibrations caused by explosions of dynamite in conducting geophysical operations in close proximity to appellant's land. He sought exemplary damages by reason of the alleged willful and malicious acts of appellees in conducting such operations and in the securing of such information.

In the trial before the Court, without a jury, judgment was rendered in favor of appellees and that appellant take nothing by his suit.

At the request of appellant the trial court prepared and caused to be filed his findings of fact and conclusions [**2] of law in which he found, in substance, on what we deem to be sufficient evidence, that:

Appellee, General Geophysical Company, had been employed by Skelly Oil Company to perform certain geophysical operations for the purpose of securing information relative to sub-surface structure of certain lands in Houston County, Texas;

That these geophysical operations were conducted by boring holes in the ground and placing dynamite or other explosives therein, which were caused to explode; that at various distances from these 'shot-holes,' receiving instruments called seismometers, or jugs, were placed, which received vibrations caused by the explosions at the 'shot-points' and transmitted them through a cable to a recording truck, and that by interpretation of these vibrations the depth points below such receiving instruments were determined;

That appellant was the owner of 339 acres of land in the vicinity of these operations, and on or about August 1, 1947, an agent of appellee General Geophysical Company requested appellant's permission to conduct geophysical operations on his land, and that he was informed by appellant that [*709] he could neither 'shoot' his land or the land along [**3] the road adjoining his land without paying for the right to do so;

The court found that neither appellees nor their agents or employees went upon or 'shot' any part of appellant's land, and that the General Geophysical Company did not place any 'shot-point,' receiving set, or recording trucks on any part of said land, but that it did 'shoot' land near plaintiff's land, one of such 'shots' being within 10 or 15 feet of the boundaries thereof, but that on no occasion of such 'shooting' did a straight line running from such 'shot-point' to a 'receiving set' or 'jug' cross any part of plaintiff's land; that the shots and receiving sets were placed along or on a public road or highway adjoining the land at distances of 150 feet apart;

The court found that the vibrations received by these receiving instruments or 'jugs' go down from the 'shot-point' vertically and then back up to such receiving sets or 'jugs,' and that by the interpretation of these vibrations so received and recorded, information is gotten relative to the depth points under such receiving sets and that no interpretation or geophysical information as to plaintiff's land was given Skelly Oil Company by either the General [**4] Geophysical Company or its agents; and that no receiving sets were placed on said land; that the appellees got no reliable information as to the sub-surface structure under appellant's land by reason of the 'shooting' and that any information that appellees may have gotten as to sub-surface structure under plaintiff's land would be based on assumption or supposition that the sub-surface structure under plaintiff's land, was the same as that along the road adjacent to the land on which the receiving sets were placed;

The court found that there was no evidence introduced upon the trial as to the extent and intensity of either the horizontal or vertical vibrations emanating from the explorations at the 'shot-points' except that the vertical vibrations going straight down and back to the receiving sets were sometimes sufficient to be received by the 'jugs' several hundred feet away from the points of 'shooting'; and that it is a physical impossibility to control or govern the direction of the vibrations emanating from the explorations at the 'shot-point'; that these vibrations extend horizontally and vertically from the points of explosion, and that the extent thereof is governed by the [**5] intensity of the explosion, and also by the character of the earth's structure through which the vibrations go;

He found that there was no evidence that appellant suffered any physical damage to his land by reason of the explorations at the point of shooting near his land; and

That neither the General Geophysical Company nor the Skelly Oil Company or their agents acted with malice or were prompted by malice in making the explorations complained of by appellant.

The trial court found as conclusions of law:

That, there being no evidence of any trespass on plaintiff's land and no evidence of any damage to the physical structure either of the surface or the sub-surface thereunder, appellant was not entitled to recover damages, either nominal or actual;

That the appellees' action in determining by geophysical exploration of land so explored the depth-points under such land, cannot and does not form a basis for appellant's claim for actual damages, since it was not shown that the appellees trespassed on plaintiff's land or in any way injured his land in securing such information;

That the mere fact that appellees conducted geophysical operations on land adjacent to and in the vicinity [**6] of appellant's land and thereby obtained information which they considered of value in determining the probable presence or absence of oil, gas, or other minerals under the land explored, cannot form a basis for appellant's claim for the actual damages sought by him, it not being shown that any trespass of appellant's land was committed by appellees, or that any injury was done, to appellant's land by such geophysical operations on adjacent land.

The court found that the appellees were under no legal obligation to disclose to appellant any information obtained by them by reason of the geophysical operations on land that did not belong to appellant, and [*710] that appellant cannot recover for the withholding of such information;

That, it being shown that neither of the appellees in their operations complained of by appellant acted maliciously or were prompted in the acts done by them by malice, plaintiff was not entitled in any event to exemplary damages.

Only two witnesses testified on the trial of the case -- appellant C. W. Kennedy and John Clements, an employee of General Geophysical Company, who was the party chief of the exploration truck which conducted the geophysical [**7] operation. Mr. Clements testified that by such geophysical explorations they obtained 'depth-points' approximately directly beneath the 'receiving sets' or 'jugs.' There is no evidence in the record as to whether any information was secured in reference to the sub-surface structure and/or the problematical presence of oil, gas or other minerals.

Under appropriate points of appeal appellant contends that the trial court erred in finding as a matter of fact that appellees gained no information as to plaintiff's land. He contends that the court should have taken judicial notice of the scientific fact, in the absence of evidence to the contrary, that the slope, dip or trend of a given sub-surface formation continued with the same slope, dip or trend of the last point known, and that the court should have taken judicial notice of the scientific facts that appellees by the geophysical operations acquired information as to the sub-surface formation and the probable presence or absence of oil, gas, or other minerals in and under appellant's land and that such information was a valuable property right for the taking of which plaintiff should be entitled to damages.

There is no evidence [**8] in the record that, when a dip or slope of a sub-surface formation is determined in one locality, it will necessarily follow that the same dip or slope continues uniformly under adjoining land, and there is only one reference in the record to the value of information alleged to have been secured by appellees, for which appellant seeks damages, the testimony of appellant that he would not sell that information to his exclusion for $ 5000.

No testimony or evidence of any nature was introduced by appellant to dispute the statements by Mr. Clements that appellees gained no information in reference to appellant's land, nor was any evidence introduced tending to establish appellant's contention that the trial court should have taken judicial notice of the fact that the slope, or trend of a given sub-surface formation continues with the same slope, dip or trend past the last point definitely known.

In 3 Nichols, Applied Evidence, page 2741, it is said that '* * * Where it is sought to avoid or excuse production of evidence because the fact to be proven is one of general knowledge and notoriety, the test is whether the fact is one of common everyday knowledge in the particular jurisdiction, [**9] which everyone of average intelligence and knowledge of things about him can be presumed to know, and whether it is certain and indisputable.'

In 17 Tex.Jur., page 17, it is said that:

> 'The matter as to which judicial notice is taken is one of fact. But judicial notice implies the absolute truth of the fact known, and such fact being undisputed, its effect becomes a matter of law.'

At page 171 of the same volume, it is said:

> 'Care must be taken that the requisite notoriety exists, and every reasonable doubt on the subject should be resolved in the negative.'

In 31 Corpus Juris Secundum, Evidence, § 76, pages 659 and 660, it is said:

> 'Judicial notice will be taken of scientific facts known to all men of ordinary understanding and intelligence, or distinctly recognized in a domestic public statute; but such notice will not be taken of facts which, if known at all, are known only by a specfally informed class of persons.'

Under the above authorities, the trial court could not, we think, have taken judicial notice of the scientific fact that the slope, dip or trend of a given sub-surface formation continued with the same slope past the last point definitely known. Further we [**10] think that appellant wholly failed to sustain his burden of proof that the appellees, by the use of seismograph operations, [*711] obtained information regarding the sub-surface structure or the presence or absence of oil, gas or other minerals in or under appellant's land, and, appellant having made the gaining of such information an indispensable element of his cause of action, his failure to make proof of his allegations with regard thereto renders the question irrelevant.

And the trial court, we think, correctly concluded that no trespass was committed upon appellant's land.

In discussing the question as to whether concussive waves transmitted into the lands of another constitutes a legal wrong and a trespass, it is said in 63 Corpus Juris, page 898, that:

> 'Trespass may also be committed by shooting onto or over the land, by explosions, by throwing inflammable substances, by blasting operations, by discharging soot and carbon, but not by mere vibrations.'

In the case of New York Steam Company v. Foundation Company, 123 App.Div. 254, 108 N.Y.S. 84, 90 (reversed on other grounds, 195 N.Y. 43, 87 N.E. 765, 21 L.R.A.,N.S., 470), it is said:

> 'The judgment cannot be sustained [**11] upon the theory of trespass. Nothing was thrown upon or against the property of the plaintiff which would justify a recovery upon the theory of trespass without negligence. * * * The case in my opinion falls within the doctrine of Holland House Company v. Baird, 169 N.Y. 136, 62 N.E. 149, et cetera, where it is held that in the absence of negligence there is no liability for consequential damages incidently resulting from the vibrations of

the earth or air caused by the construction of a lawful improvement either in a public street or upon private property.'

In 35 Corpus Juris Secundum, Explosives, § 8, page 239, it is said:

'By some authorities the rule imposing liability for injuries occasioned without negligence is limited to cases of direct injury, and negligence must be established to impose liability for consequential injuries, as by concussion or vibration, to property * * *.'

On page 240 of 35 C.J.S., Explosives, § 8, it is said:

'Mere concussion of the air without other injury will not impose liability where blasting is lawfully conducted.'

In Hieber v. Central Kentucky Traction Company, 145 Ky. 108, 140 S.W. 54, 55, 56, 36 L.R.A., N.S. 54, it is said:

'Blasting [**12] upon one's own premises or upon the premises of another, with permission of the owner, if necessary for the improvement thereof, is not an unlawful act. Such blasting necessarily causes vibration of the earth and air to a greater or less extent. Such vibrations cannot be confined within inclosed limits. Hence it must follow that if rightfully and not negligently caused, even though consequential injuries result therefrom, the sufferer is without remedy. (Citing authorities) * * *.'

'It has been held that blasting which causes unpleasant concussions of the air and shaking of the ground, rendering adjoining property untenable, is a nuisance for which damages may be recovered. (Citing authorities) On the other hand, the general rule is that one engaged in blasting on his own property is not liable for mere concussion of the air not resulting in actual injury. Thus in Bessemer Coal, Iron & Land Co. v. Doak, 152 Ala. 166, 44 So. 627, 12L.R.A.,N.S., 389, the court said: 'We think that, according to the best-considered decisions, the rule is that if one, in blasting upon his own lands, invades the premises of his neighbor, by throwing stones and debris thereon, he is liable for the [**13] resulting injury; but for any other injury, such as may result from the mere concussion of the atmosphere, sound or otherwise, there is no liability, unless it is shown that the work was done negligently, and that the injury was the result of negligence, and not the result of blasting according to the usual methods and with reasonable care.'

In 4 Summers, Oil and Gas, § 661, at pages 68 and 69, it is said:

'It is submitted, therefore, that HN4 where one explodes a charge of dynamite to test his land for oil and gas purposes and thereby causes the earth to vibrate and as a proximate result of such vibration the personal property of a neighboring owner is injured, such injury should be compensated in damages. Taking into consideration the fact [*712] that the use of explosives is positively necessary for the discovery of mineral structure by this method (seismic exploration), that such operations are not continuous, and that damage by vibration is of occasional occurrence, a court should not enjoin the use of the seismograph but leave the injured party to his remedy in damages.

'It is unnecessary to place this liability for damage upon the ground that the explosives used in their [**14] nature or their use are inherently dangerous. Such a theory is only necessary to overcome the necessity of showing negligence in keeping explosives or establishing their use in certain localities as a nuisance per se. Nor does it seem advisable to attempt to base the liability upon the theory that the vibration amounts to an actual physical trespass. To constitute trespass there must be an entry upon the land. In many cases of injury by vibration the physical invasion might well be considered an entry upon the land, but certainly every vibration of a neighbor's land is not a trespass. Where is the line to be drawn? If at the point where the vibration causes appreciable physical injury, such a line coincides with the actor's liability for consequential injury.'

In the case of Comanche Duke Oil Company v. Texas Pacific Coal and Oil Company, Tex.Com.App., 298 S.W. 554, 560, the court in summarizing the law of this State with regard to the question under consideration in this appeal said:

'In a sense, one tract of land cannot be used unless there be also consequential user of neighboring tracts. This is sequent of that delicate relationship which Nature has imposed upon the tangible [**15] and intangible constituents of earth and air. There are ever present transmitters whereby a force set in motion on or in one tract may be, and probably will be, carried onto or into vicinal tracts. Ownership includes those tangibles and intangibles separately viewed and taken, also, as a congeries of related units. There may be an exceptional case of user of one tract unaccompanied by stirring of a force to be thus transmitted, but in most cases there will be a force set in motion, which, at the behest of natural laws, will communicate itself to the adjoining tract and, pro tanto, cut down a neighbor's possession and enjoyment. * * * If the purpose be lawful, physical trespass absent, primary use reasonable, and manner of that use duly careful, consequences are damnum absque; otherwise, injury within proximate causation is redressable. This would appear to have support in 'blasting' and 'explosion' cases (see Ft. Worth & D. C. R. Co. v. Beauchamp, 95 Tex. 496, 68 S.W. 502, 58 L.R.A. 716, 93 Am.St.Rep. 864; 11 R.C.L. 673, 674; 19 Cyc. 7, 8), in which liability for injuries produced through vibration and shock alone is made to turn upon use or omission of due care in starting the [**16] vibrative or concussive waves, * * *.'

In the case of Universal Atlas Cement Company v. Oswald et ux, Tex.Civ.App., 135 S.W.2d 591, 593, affirmed 138 Tex. 159, 157 S.W.2d 636, it is said:

'There is a conflict of authority as to whether one, who by blasting by powerful explosives produces severe concussions or vibrations in surrounding earth and air and so materially damages property belonging to others, is liable, irrespective of negligence on his part. All authorities hold that where there is an actual invasion of the premises of another by the throwing of dirt, stone or debris, proof of negligence is unnecessary to a recovery of damages. Others hold that in the absence of an actual physical invasion of the premises, no recovery can be had unless negligence is shown. 22 Amer.Jur. 180; 25 C.J. 192. There are some cases in Texas which seem to support this latter view.Comanche Duke Oil Co. v. Texas Pacific Coal and Oil Co., Tex.Com.App., 298 S.W. 554; City of Dallas v. Newberg, Tex.Civ.App., 116 S.W.2d 476. This theory seems to have some reasonable foundation in those cases where the damage or annoyance is caused solely by noise or concussion of the air, for in those cases there [**17] is in fact no physical invasion of the premises; * * *.'

It is the established law in this State that HN6 where a case has been tried without a jury and there was ample evidence in the record to support the findings of the trial court, such findings have the same force and effect as a verdict of the jury on the facts found, and a reviewing court must affirm the trial court's judgment in the absence of other substantial error. Carpenters [*713] and Joiners Union of America, Local No. 213 et al. v. Ritter's Cafe et al., Tex.Civ.App., 149 S.W.2d 694, writ of error refused, affirmed by Supreme Court of U. S., 314 U.S. 595, 62 S.Ct. 111, 86 L.Ed. 480; Id., 315 U.S. 722, 62 S.Ct. 807, 86 L.Ed. 1143, and cases there cited.

In the instant case the trial court found on what we deem to be ample evidence that appellees were in no way negligent in their operations; that on no occasion did General Geophysical Company set up a receiving set so near appellant's land that a straight line drawn on the surface of the ground from the one shot-point from which waves were to be received by the receiving set crossed any part of plaintiff's land.

The trial court further found that neither the appellees [**18] nor their agents acted with malice or were prompted by malice. Appellant was, therefore, not entitled to exemplary damages, since HN7 exemplary or punitive damages may only be recovered in an action of trespass where actual damage has been sustained. 41 Tex.Jur., P. 438; McCarthy v. Miller, Tex.Civ.App., 57 S.W. 973.

It follows from these conclusions that the judgment of the trial court must be in all things affirmed. It is so ordered. Judgment affirmed.

Questions:

1. Who has the right to shoot seismic (or grant the right) to shoot seismic?

2. Was the seismic company guilty of trespass in this case? Why or why not?

3. What if the seismic data reveals a trend that can be extrapolated to areas where the company did not have permission to shoot?

4. If the data indicates that the formation will not trap hydrocarbons making everyone's leases in the area less valuable is the seismic company liable for the decline in value?

5. What if the seismic data indicates a massive structure that might contain oil, and using the data the company goes out and obtains a large number of leases. Does the company need to tell the mineral owners about how good the structure looks from their data?

6. If the minerals and surface are severed, who has the right to shoot seismic?

7. If damage occurs, can the landowner sue using a negligence or nuisance theory? In Stanolind Oil & Gas Co. v. Giles, 197 F.2d 290 (5th Cir. 1952) a seismic company set off a charge 646 from a landowner's water well that was used to supply water to his residence and stock water for his farm animals. The water well immediately ceased producing. The court found that the seismic firm was liable for the damage based on circumstantial evidence.

8. Instead of using explosives it is much more common these days to use trucks to generate energy pulses to obtain seismic data. Many cities also outlaw the use of explosives inside the city limit. When explosives are used with shot holes for environmental and safety reasons the Railroad Commission requires that seismic shot holes be filled:

   RULE §3.100 Seismic Holes and Core Holes

(a) Definitions. The following words and terms, when used in this section, shall have the following meanings, unless the context clearly indicates otherwise.

(1) Seismic hole--Any hole drilled for the purpose of securing geophysical information to be used in the exploration or development of oil, gas, geothermal, or other mineral resources. . .

(b) Exemption. Any seismic hole or core hole drilled to a depth of 20 feet or less is not subject to the requirements of this section.

(c) Determination of protection depth. Before drilling any seismic hole or core hole in a project area, an operator shall obtain a letter from the Groundwater Advisory Unit of the Oil and Gas Division stating the protection depth or depths in the project area.

(d) Drilling permits.

(1) Holes that do not penetrate any protection depth. A seismic hole or core hole that does not penetrate any protection depth does not require a drilling permit.

(2) Holes that penetrate any protection depth. A seismic hole or core hole that penetrates any protection depth requires a drilling permit to satisfy the requirements for exploratory wells described in §3.5(g) of this title (relating to Application To Drill, Deepen, Reenter, or Plug Back) (Statewide Rule 5).

(e) Plugging.

(1) Holes that do not penetrate any protection depth. A seismic hole or core hole that does not penetrate any protection depth must be plugged in accordance with subparagraph (A) or (B) of this paragraph. Seismic holes must be plugged after the hole is loaded with explosives. Core holes must be plugged immediately after completion of coring the hole.

(A) The operator shall adequately plug the hole by filling it from total depth to a depth of no more than 16 feet below the surface with drill cuttings and/or bentonite. Immediately above the drill cuttings and/or bentonite, the operator shall place a bentonite plug no less than 10 feet in length. A plastic cap imprinted with the name of the operator shall be set above the bentonite plug no less than three feet below the surface. The remainder of the hole shall be filled with drill cuttings or native soil. All precautions should be taken to prevent bentonite from bridging over.

(B) Alternative plugging procedures and materials may be utilized when the operator has demonstrated to the commission's satisfaction that the alternatives will protect usable quality water.

(2) Holes that penetrate any protection depth. A seismic hole or core hole that penetrates any protection depth must be plugged in accordance with the requirements of §3.14 of this title (relating to Plugging) (Statewide Rule 14) and a plastic cap imprinted with the name of the operator shall be set in the hole no less than three feet below the surface.

(f) Physical requirements for bentonite plugging materials. Bentonite materials used to plug seismic or core holes shall be derived from naturally occurring, untreated, high swelling sodium bentonite that is composed of at least 85% montmorillonite clay and that meets the International Association of Geophysical Contractors (IAGC) recommended geophysical industry standard dated January 24, 1992, for the physical characteristics of bentonite used in seismic shot hole plugging.

(g) Reporting.

(1) Holes that do not penetrate any protection depth. Within 30 days of plugging the last hole in the project area, the operator shall submit a letter to the commission stating that each seismic hole or core hole in the project area has been plugged in accordance with subsection (e)(1) of this section. The letter must include the plugging date for each hole and the name and address of the operator. A plat of the project area identifying seismic or core hole locations, counties, survey lines, scale, and northerly direction must be attached. A United States Geological Survey map of the project area with hole locations marked will satisfy the plat requirement. In addition, a letter from the Groundwater Advisory Unit of the Oil and Gas Division stating the protection depth or depths must be attached.

(2) Holes that penetrate any protection depth. For any seismic or core hole that penetrates any protection depth, a plugging record shall be filed in accordance with §3.14 of this title (relating to Plugging) (Statewide Rule 14).

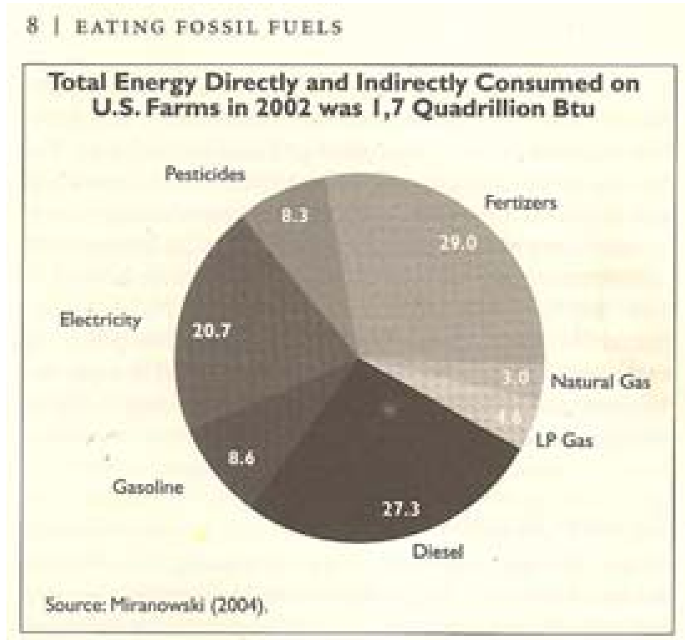
9. In addition to the State of Texas in some cases cities will have ordinances regulating seismic activities. In the City of Fort Worth ordinances regulate seismic testing. Their website notes as follows:

> Under regulations adopted in 2011, seismic operators must obtain a street-use permit and notify the city, affected school districts and homeowners associations 15-30 days in advance of testing. Affected property owners must be notified three to 10 days ahead of testing. Operators must describe the process of seismic surveying and testing and must provide:
>
> •When testing will start
> •Duration of testing
> •Telephone and email contacts for the contractor
> •A city contact and website address.
>
> Seismic testing is allowed only from 7 a.m. to 6 p.m. Monday-Friday and 9 a.m. to 6 p.m. Saturday. Testing is not allowed on Sundays or city holidays.

Eating Fossil Fuels: The Haber-Bosch Process

While the agricultural system and methods used to grow food in the Western world have become very efficient, few people realize how energy intensive the agriculture sector has become. Some experts claim that it takes 10 calories of fossil fuel to make 1 calorie of food using modern production techniques

That said, the increase in agricultural efficiency over the years has been nothing less than amazing. During the U.S. Civil War era the average yield for corn in United States was around 20 to 25 bushels per acre. Last year in the United States the average yield for corn was around 160 to 170 bushels per acre.



While this is a substantial increase in yield over a 150 year period, the increase in energy input was larger than the gain in yield per acre.

In the Civil War era the energy input was horse or oxen power, a plow, and seed. Today we use diesel powered tractors, plows, harvesters, fertilizer, genetically modified seed, herbicides, processors, dryers, and transport and packaging to grow the food and get it to market.

While crop yields increase at a pace of roughly 1% to 2% per year as genetics and farming methods improve, demand also increases as the global population grows and diets become more "Westernized".

Historically one of the major problems that agriculture has faced was the depletion of nitrogen in the soil due to farming activity. New cropland in the United States would have very good yields the first year or two, then yields would quickly decline, leaving the farmer to move on to new lands or to learn how to rotate crops that assist in replenishing nitrogen.

This replenishment of nitrogen, also referred to as the need to "fix" nitrogen back into the soil after a crop is harvested, led to one of the most important discoveries in the history of the human race. This is because the planet's carrying capacity using only organic farming methods like those used around the Civil War is around 3 billion people according to experts. Using inorganic chemistry to replenish nitrogen in the soil has increased the planet's carrying capacity to over 7 billion people.

The organic chemistry discovery that allows farmers to fix nitrogen back into the soil is referred to as the Haber-Bosch process after two of the early scientist who worked on perfecting the process. What these scientists discovered is that they could produce nitrogen rich ammonia which could be used to make an effective fertilizer that was cheap and easy to apply. The main feedstock for ammonia is natural gas.

Dr. Haber & Dr. Bosch
One of the scientists, Fritz Haber (1868 – 1934), was a German chemist who received the Nobel Prize in Chemistry in 1918 for his development for synthesizing ammonia. He also was known as the "father of chemical warfare" for his work developing and deploying chlorine and other poisonous gases that killed or permanently injured millions. It is an irony of history that Haber is also known for developing ammonia for use in fertilizers, saving millions from starvation. It is also ironic that Haber, who is Jewish, saw his chemical weapons used by the German government during World War II against his fellow Jewish citizens.

Carl Bosch transformed Fritz Haber's tabletop demonstration of a method to fix nitrogen using high pressure chemistry into an important industrial process to produce megatons of fertilizer and explosives. The fully developed system is called the Haber–Bosch process. The Haber–Bosch Process today consumes more than one percent of humanity's energy production and is responsible for feeding roughly one-third of its population. In 1931 Bosch was awarded the Nobel Prize in Chemistry

Essentially the produced ammonia captures the energy contained in natural gas, and as a result in some cases can be explosive. The recent destruction from the explosion of a fertilizer plant in West, Texas, and an earlier incident in the Houston Ship Canal when a fertilizer loaded ship burned and then exploded, illustrate the dangers.

The fact that natural gas prices in the United States are a fraction of those in Europe and Japan has given fertilizer manufacturers in the United States a substantial financial competitive advantage, and an incentive to locate their plants domestically.

Norman Borlaug
While nitrogen-rich fertilizer made from natural gas started the "Green Revolution" – a period of enhanced farm productivity – the agricultural miracle would not be complete without the input of American Norman Borlaug.

One of the problems with nitrogen-rich fertilizer is that it made the plants very productive and fast growing, hence the grains were much more developed. Because of the weight of the grain, especially for wheat, the plant stem would tend to fail or bend in high wind or heavy rain – reducing the yield and productivity.

Borlaug, who originally was rejected when he applied to the University of Minnesota to go to college, eventually earned a doctorate degree and won a Nobel prize for cross breeding wheat plants so that the stem was much stronger. With Borlaug's genetically enhanced seeds yields skyrocketed when nitrogen fertilizer was applied. Probably the most important American most have never heard of, Borlaug has been describes as "the man who fed billions".

[Chart above from "Eating Fossil Fuels" by Dan Pfeiffer (2006). Vaclav Smil's book entitled "Enriching the Earth" (2001) is a good over of the Haber-Bosch process, how it was developed, and how farmers globally now benefit from cheap ammonia and fertilizers. "The Man Who Fed The World" (2006) by Leon Hesser is a well written biography of Dr. Norman Borlaug and his efforts to enhance grain yields using genetics and cross-breeding.]

The Energy Sector & Wealth: Risk, Reward & Wealthy Texans

A number of researchers have conducted studies in America attempting to characterize the traits and attributes attributable to those who have become wealthy. Some have examined the ultra-wealthy, and some just the 'average millionaire'. Of interest since we are studying the energy sector that approximately 10% of the Forbes 400 richest individuals made their fortunes in the energy sector. From a much broader standpoint if we looked to those Americans that are in the top 10% by household assets in the U.S. we would find that many of the wealthy in Texas have connections to the energy sector.

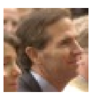
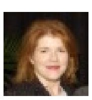
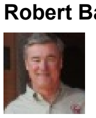
Several habits or behavioral traits are consistently present in those that accumulate excess wealth according to Dr. Thomas Stanley, author of The Millionaire Next Door:

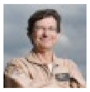
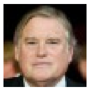
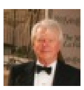
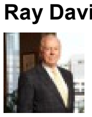
- The individuals live well below their means
- They allocate their time energy and money efficiently, in ways that are conducive to building wealth
- They believe that financial independence is more important than displaying high degrees of wealth indicative of a high social status
- They are proficient in targeting market and career opportunities
- They chose the right occupation
- A large proportion of these parties own or started their own business
- Most have developed a keen sense of risk and reward with regard to their business decisions and ventures
- Many have extraordinary drive and resolve, and enjoy working
- Many are physically fit, with few being overweight, with fewer smoking or abusing alcohol or other substances
- Many are very creative, which comes with enjoying what they do
- Many of the business owners claimed to see opportunities others did not notice, again weighing the risks and rewards
- Ownership of a business is the base upon which most people become independently wealthy Dr. Stanley concludes
- Those who accumulated wealth required them to have the courage to take risks. Dr. Stanley claims there is a clear and very significant correlation between willingness to take financial risk and net worth. Those that succeed have a well defined ability to evaluate risks and rewards, and clearly understand probability theory

Financial risk takers often have a special sensitivity and see business opportunities that others do not. They recognize opportunities that others ignore.

The following is a list of Texans on the Forbes billionaires list who made their fortune in the energy sector:

Net Worth Calculated March 2012

Rank	Name	Net Worth	Age	Source	Country of Citizenship
110	 **Richard Kinder**	$8.2 B	68	pipelines	United States
193	 **Jeffrey Hildebrand**	$5.3 B	53	Oil	United States
205	 **Ray Lee Hunt**	$5 B	70	oil, real estate	United States
221	 **Robert Rowling**	$4.8 B	59	investments	United States
270	 **Dannine Avara**	$4.1 B	48	pipelines	United States
270	 **Scott Duncan**	$4.1 B	30	Pipelines	United States
270	 **Milane Frantz**	$4.1 B	43	Pipelines	United States
270	 **Randa Williams**	$4.1 B	51	Pipelines	United States
304	 **Robert Bass**	$3.6 B	65	oil, investments	United States
304		$3.6 B	61	Oil & Gas	United States

Rank	Name	Net Worth	Age	Source	Country of Citizenship
418	**Trevor Rees-Jones** 	$2.8 B	59	natural gas	United States
442	**Rodney Lewis** 	$2.7 B	62	oil & gas, investments	United States
546	**Timothy Headington** 	$2.3 B	57	Pipelines	United States
578	**Kelcy Warren** 	$2.2 B	93	oil & gas	United States
601	**George Mitchell** 	$2.1 B	56	oil, investments	United States
601	**Lee Bass** 	$2.1 B	70	oil, investments	United States
854	**Sid Bass** 	$1.5 B	68	oil, investments	United States
854	**Edward Bass** 	$1.5 B	71	pipelines	United States
913	**Ray Davis** 	$1.4 B	84	oil & gas, investments	United States
1075	**T. Boone Pickens** 	$1.1 B	92	Oil	United States
	William Moncrief Jr				

Of course, evaluating risk and reward is not as easy as it might seem, as illustrated in the following article from the Huffington Post:

Warren Buffett's First Employee, Elizabeth Hanon, And Her Husband Declined Boss' Investment Offer

The Huffington Post | By Jillian Berman Posted: Updated: 12/12/2012 2:21 pm EST

Imagine you just inherited some money -- what would you do with it? Invest it in the stock market? Make a big purchase? Pay off some debts? What if your boss said you could trust him to invest it for you?

Decades ago, Harry Hanon and his wife, Elizabeth, did what many might do in that situation: They said "no, thanks" to investing their money with Elizabeth's boss.

The hitch: Her boss was Warren Buffett.
Passing up the Oracle of Omaha's offer turned out to be one of Harry Hanon's great regrets, according to Kent Hanon, his son. Harry Hanon passed away in 2004 at the age of 91, and though he may have missed out on the investment opportunity of a lifetime, he certainly didn't die a poor man, having built a few houses across the country and selling them at a profit. In addition, Hanon also took up casual investing later in life, which didn't make him a huge amount of money but did become a "valuable and interesting hobby," according to his son.

"Until the day he died, I reminded him of his thing with Warren Buffett," Kent Hanon, a 72-year-old retired school teacher living in Bellevue, Neb., told The Huffington Post. "We could have been well-known millionaires along with him."

Instead of turning his inheritance over to the future billionaire, Harry Hanon put the money into a pyramid scheme, losing the whole sum. Once Buffett became the people's billionaire -- recognizable in photos eating Dairy Queen ice cream, drinking Coca-Cola and hanging out with Jay-Z -- all Hanon's family could do was laugh, Kent Hanon said. They couldn't believe their mom's boss, whom they knew as "just a guy," had achieved such success.

"Everybody gave my Dad a hard time, deservedly so," Hanon said.

Hanon's father had access to Buffett's investing genius early on, thanks to his wife, who was one of the Oracle of Omaha's first employees, working as a "secretary/whatever," as Hanon described it.
One day Hanon's father came into the office to talk to Elizabeth about how to invest some money he had recently inherited.

"He was up there talking to my mother, and Warren Buffett joined in and he said, 'Give it to me and I'll put it into my company,'" Hanon said. "Of course, my dad didn't tell him to his face that he didn't think he was going to go anywhere."

For his part, Buffett told HuffPost that Elizabeth Hanon was one of his first two employees, starting in 1962. He couldn't confirm the rest of Hanon's tale, however: "Elizabeth Hanon was employed by my partnership, and also by my dad when we officed together in the early to mid-1960s (we split her salary)," Buffett wrote in an email.

> Buffett made his way from those humble beginnings, when he shared an office with his dad, to become the second-richest man in the country, now worth about $46 billion, according to Forbes.
>
> But Buffett isn't the only success story with a trail of would-be millionaires who passed up the chance to get in early on the next big thing. Joe Green, a college friend of Facebook founder Mark Zuckerberg, reportedly missed out on the opportunity to invest in the then-nascent social network, thanks to the advice of his father.
>
> Actor John Cusack told Jimmy Kimmel how he passed up an offer from Apple CEO Steve Jobs to star in a commercial for iTunes and the iPod back before anyone knew how those products would revolutionize music. Cusack's response: "I just didn't feel like doing a commercial."

^^^^^^

In a similar manner a well-known publisher of an investment newsletter bought stock in Warren Buffett's company Berkshire Hathaway (BRKA) when the stock was around $300 a share. As the value of the stock increased to reduce his 'risk' he sold his shares at what he considered more than 'fair value' – around $625 a share. His investment doubled, and he was pleased with the decision at the time.

Looking back on the transaction today he wonders how reasoned a decision that was, and how much risk he avoided, especially with Berkshire Hathaway stock selling at around $125,000 per share. On the other hand during that time period dozens of well known 'stable' blue chip firms of that era have had financial difficulty or gone bankrupt – like General Motors or Chrysler or any of the dozen airlines of the day.

Risk, reward, and luck all play a role in decision making. Investing in firms in a growing industry with vibrant margins helps reduce the risk of failure – as Buffett illustrated with his investments targeting the insurance and financial sectors. Munger, Buffett's partner, claims that a few big decisions really drove the success of their investment records, but these were only made after the risks and rewards were analyzed closely and hundreds of 'opportunities' rejected. They were willing to take risks, but they were well thought out investment decisions.

And, as contained in the notes from Dr. Stanley's work examining wealthy households set out above, Buffett understood probability theory well:

^^^^^^^^^^^^^

<u>The Moment When Warren Buffett Realized Getting Rich Would Be Easy</u>

Gus Lubin | May 15, 2012, 2:16 PM

A few weeks ago Warren Buffett shared some advice with MBA students at the Richard Ivey School of Business. We looked over a copy of the meeting notes from Market Folly.

Here's the moment when Buffett realized he could get rich:

> On my honeymoon I traveled out west. ***When I visited the casino and saw all these smart well-dressed people participating in a game with the odds against them, it was then that I realized I won't have a problem getting rich***!

He [Buffett] said there are plenty of opportunities today:

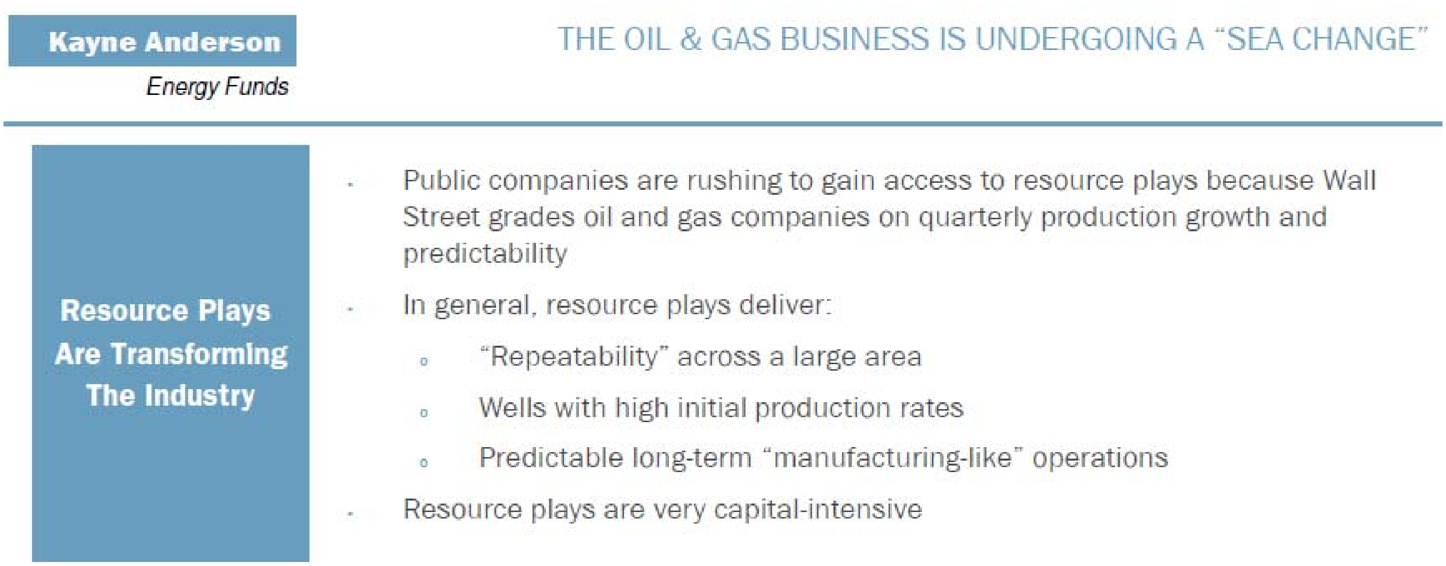
- Nowadays there are even more opportunities, we are living in a wealthier society, just think of the great development we had the last couple of decades.
- The luckiest person in the world is the baby born in US today, than any other time.
- The internet is a magnificent resource and it's free. I love my personal jet, but I would give it up first before I gave away access to internet.
- Think and measure your life versus the life your parents had. The world is no way a zero-sum game.
- There is a lot more opportunities today than it was many years ago, and young people today will have a lot more opportunities than young people yesterday.
- I always ay buy what you know, and focus on your circle of competence. It doesn't matter how big the circle is, but you have to know the perimeter.

^^^^^^^^^^

Capital allocation will be critical in the energy sector over the next decade. Directional drilling and hydraulic fracturing have re-invigorated many old hydrocarbon basins and fields. With a global market for crude oil, and to a lesser extent natural gas, the demand for energy should continue to increase in a robust manner. A 'sea change' is occurring in the energy sector (see slide below).

An individual or employee in the energy sector should have a stable, and relatively low-risk, spring board from which to jump.

From January, 2013 presentation by Kayne Anderson private equity funds:

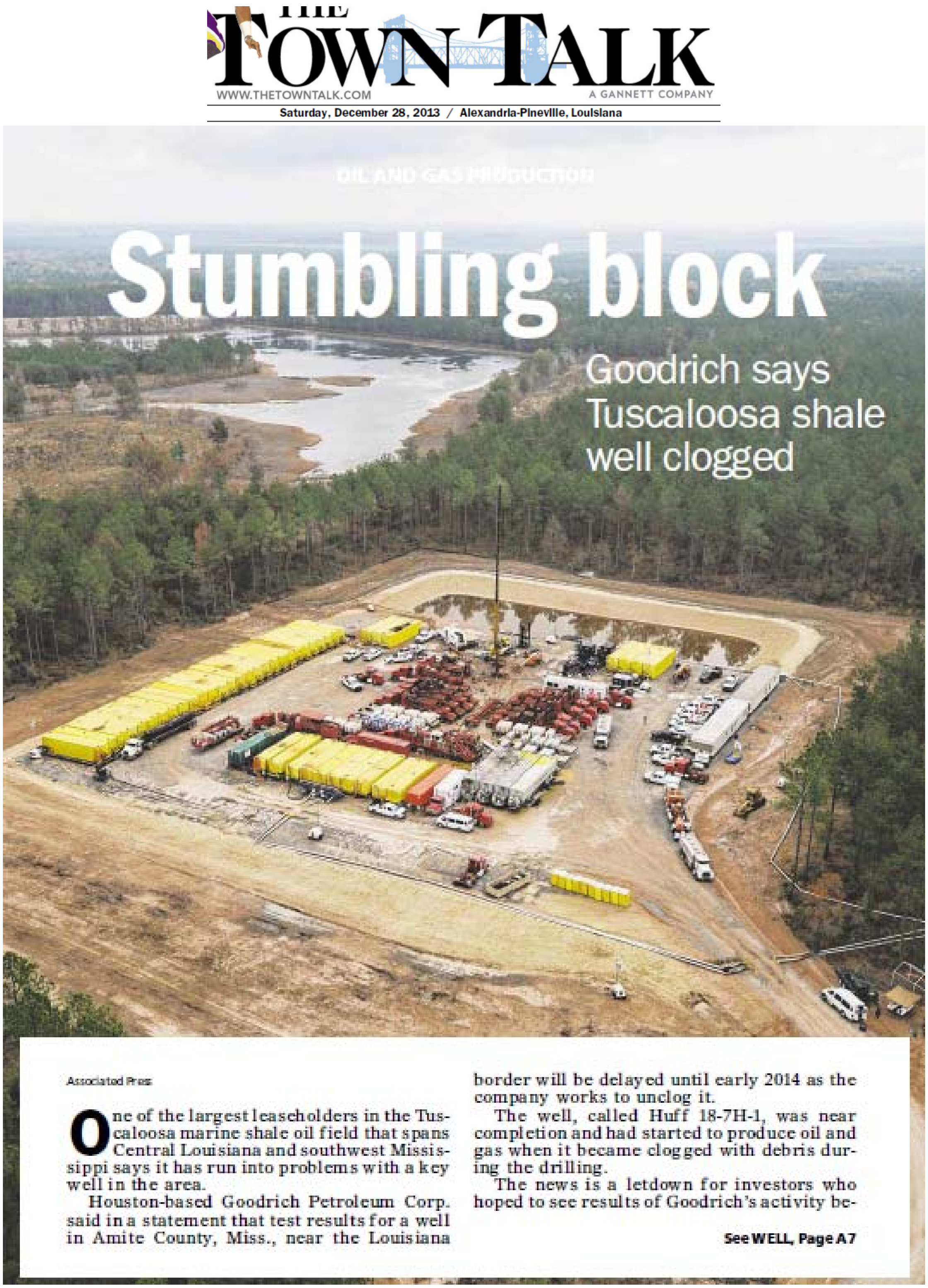


PART II

DRILLING & OPERATIONAL ISSUES

“Reasonable Use” Doctrine and Oil & Gas Development

Conflicts with the surface owner are one of the most common issues operators face when they develop the minerals. In the picture below, courtesy The Town Talk newspaper (Alexandria, La.) note the roads, berm, water pit, pipelines, flare, trucks, engines, etc. The rules and regulations that have evolved around the use of the surface are the subject of the following materials.



THE TOWN TALK

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A GANNETT COMPANY

Saturday, December 28, 2013 / Alexandria-Pineville, Louisiana

OIL AND GAS PRODUCTION

Stumbling block

Goodrich says Tuscaloosa shale well clogged

Associated Press

One of the largest leaseholders in the Tuscaloosa marine shale oil field that spans Central Louisiana and southwest Mississippi says it has run into problems with a key well in the area.

Houston-based Goodrich Petroleum Corp. said in a statement that test results for a well in Amite County, Miss., near the Louisiana border will be delayed until early 2014 as the company works to unclog it.

The well, called Huff 18-7H-1, was near completion and had started to produce oil and gas when it became clogged with debris during the drilling.

The news is a letdown for investors who hoped to see results of Goodrich's activity be-

See WELL, Page A7

Drilling, producing, processing, transporting, and refining hydrocarbons in many cases uses a substantial amount of land. Keep in mind that in many areas the surface estate has been 'severed' from the mineral estate – meaning the surface owner in most cases receives no befit from any well or equipment placed on their land.

Even when the surface owner retains mineral rights and will obtain benefits from mineral development on their lands the drilling and production of oil and natural gas is noisy, dusty, dangerous, intrusive, and commonly interferes with ongoing surface use – especially in areas utilized for agricultural production and more recently in residential areas where shale formations are being developed.

Historically the law has evolved where the mineral owner has the 'dominant' estate and can use a 'reasonable amount' of the surface estate in drilling and production activities. Some of the issues involved in determining what is reasonable will be discussed in the cases below. In Texas we have also adopted a land use concept called the "Accommodation Doctrine" which we will also examine in the <u>Getty Oil v. Jones</u> case.

Prior to examining the law, it might be useful to discuss some of the major problems faced by surface owners and mineral owners in the development of their property. The following articles and discussion is a good summary of common surface use issues.

<u>Pollution Prevention Opportunities in Oil and Gas Production, Drilling, and Exploration</u>

Pacific Northwest Pollution Prevention Research Center

Funded by a grant from the Pollution Prevention Office of the Alaska Department of Environmental conservation

. . .

Industry Waste Streams

Produced water. *<u>Produced water, water produced in association with crude oil, is by far the largest waste stream in most oil fields, accounting for up to 95 percent of total wastes</u>*. It is composed of natural underground saline formation brines combined with water injected into the formations from the surface to enhance recovery of the oil in a process called "waterflooding."

In mature fields like those of Alaska's North Slope, the amount of this water produced often exceeds the amount of oil. For the North Slope, that means more than 42 million gallons of produced water is generated daily. However, operations at second-generation oilfields such as the Kuparuk River Field reuse much of their produced water for enhanced oil recovery.

Presently as much as 60 percent of most, Alaska oil fields' produced water is treated to remove solids and traces of oil and then returned to the formation to be reused in water-flooding. The solids are removed during treatment, as their reinjection might plug the subsurface formation. Not all produced water is treated for continued waterflooding; some is only cleaned up sufficiently to reinject it for disposal in highly permeable zones at depths of several thousand feet. It was suggested that other industries may be able to provide improved technologies for handling produced water. . . .

'PRODUCED' WATER & ENVIRONMENTAL DANGERS

Damage to fresh water aquifers or to surface lands from produced water disposal, injection, or secondary recovery projects account for a large portion of current oil and gas environmental litigation.

Studies have indicated that produced water in the mid-continent area has a total dissolved solids ("TDS") content of approximately 50,000 parts per million (ppm) on average. As a comparison of water quality, the average TDS level of produced water (50,000 ppm) exceeds the solids content of seawater (approx. 34,500 ppm). The high TDS concentration of most produced waters can result in a relatively small amount of produced water contaminating a large fresh water aquifer or surface reservoir.

While varying widely the elements found in produced water from oil and gas operations, as compared to seawater, can be summarized as follows:

	CONCENTRATIONS IN PARTS PER MILLION ("ppm")		
CONTAMINANT	SEAWATER	DRINKING WATER	PRODUCED WATER
Sodium	10,600	-	12,000 to 150,000
Potassium	400	-	0 to 4,000
Calcium	400	-	1,000 to 120,000
Magnesium	1,300	-	500 to 25,000
Chlorides	19,000	250	20,000 to 150,000
Bromides	65	-	50 to 5,000
Iodine	0.05	-	1 to 300
Sulfate	2,700	250	0 to 3,600
Carbonate	0	-	0 to 1,200
Tot. Dissolved Solids	34,500	500	50,000 avg.

Source: 40 CFR Sec. 141.11; 10 CFR Sec. 143.3; Reid, Brine Disposal Treatment Practices Relating to the Oil Production Industry, Kerr Environmental Research Laboratory (1974).

Where fresh ground water has been contaminated the presence of bromides and iodines in water are an indication that the contamination originated from oil field activities. As can be seen from the chart, the average level of total dissolved solids in produced water from the mid-continent region is approximately twice that of seawater.

Produced water is generally not fit for consumption by either humans or animals. Fresh water fit for human consumption has been defined as having less than 250 parts per million ("PPM") chlorides, less than 250 parts per million sulfates, and in no event more than 500 parts per million total dissolved solids ("TDS").

In general, the upper limits of contamination are 2,500 parts per million for poultry, 4,300 parts per million for swine, 6,000 parts per million for horses, and 10,000 parts per million for cattle. See generally: Case, Water Problems In Oil Production, The Petroleum Publishing Co., (1971); Donaldson, Environmental Aspects of Enhanced Oil Recovery, presented to the Department of Energy's Environmental Control Symposium (November, 1978)

Salt is toxic to plant life, interfering with the ability of the plant to extract water from the soil. Plants differ in their ability to tolerate salts. Soils will also have an impact on whether a plant will be able to tolerate salt intrusions, with clay soils generally retaining more moisture which will dilute the salt concentrations making it easier for plants to survive. Sandy soils on the other hand retain little moisture, and are more difficult to revegetate. See: Ward, Reclamation of Saline Damaged Alkalid Soils, Oklahoma State University. (note dried salt patch on surface of picture – a sure sign of severe contamination problems).

Salt water spills also affect the ability of the soil to resist erosion. Salt damaged soil can lose the ability to bind together, and is more susceptible to being eroded. The lack of plant life in damaged areas also contributes to the erosion potential. In older fields where salt water was diverted to nearby streams, aerial photographs will many times reveal severe erosion problems from the wellhead (or where the wellhead used to be located) to the nearest stream (see accompanying picture of severe erosion).

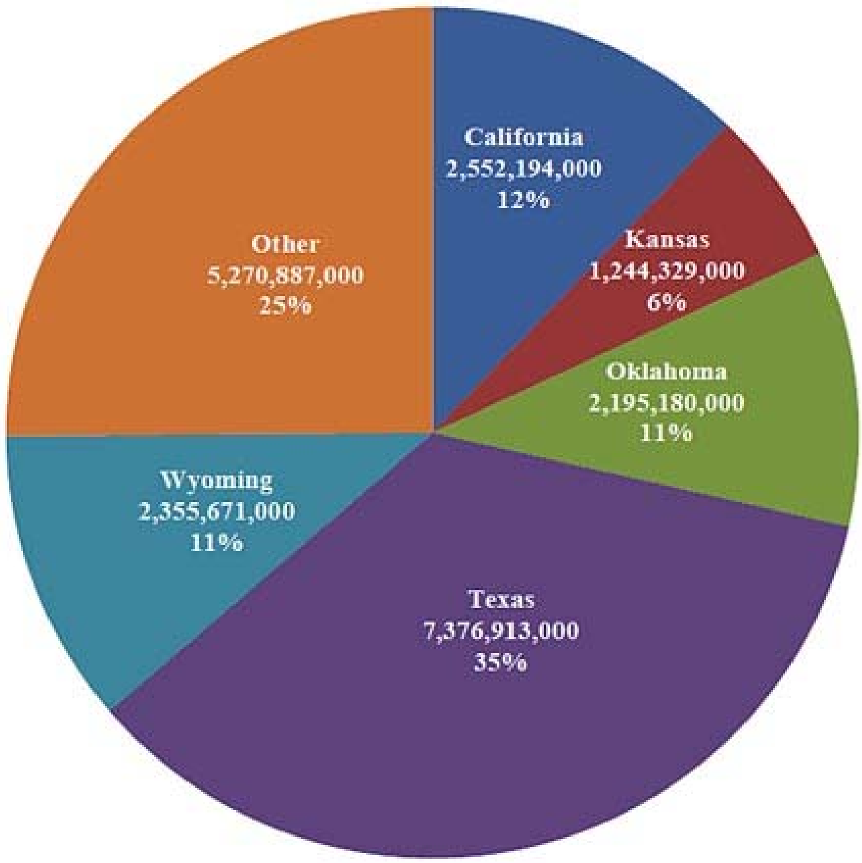
When reclaiming lands damaged by salt water, certain plants that are more salt tolerant can be used. In general, when water is less than 700 PPM TDS it will not harm plant life, between 700 PPM and 2,000 PPM TDS certain salt sensitive plants will be affected, and above 2,000 PPM TDS plant life will be adversely affected.

Produced water can intrude into fresh water formations from salt water disposal wells, secondary recovery injection wells, migrate via improperly plugged wells, or seep from unlined evaporation pits (not currently permitted in most jurisdictions). Due to the corrosive nature of produced water leaks or spills are not uncommon, and the contaminants can percolate down into the water table over time. Surface leaks or spills also damage the soil's ability to resist erosion. See generally: Dancy & Dancy, Environmental Constraints on Crude Oil Production in the United States, presented to the 9th Annual International Conference of the International Association of Energy Economics, Caracus, Venezuela (1989).

Once a fresh water aquifer is damaged, in most instances it is economically impossible to restore that aquifer to its original condition in any meaningful time period. Damages awarded for such contamination can therefore be substantial.

Produced Water by State

As noted above produced water is one of the major environmental problems that operators face. Most produced water is associated with crude oil production, less so with natural gas. Those states with the most produced water, hence potential environmental issues, are led by the state of Texas:



PRODUCED WATER – 2007 VOLUMES

Volume flows for the lower 48 US States is
4.8 million barrels/day of oil, 128 million barrels/day of brine

(almost 25 barrels of water per barrel of oil produced!)

USE OF THE SURFACE FOR OIL AND GAS DEVELOPMENT

When a dispute arises between the surface owner and mineral owner or mineral lessee many times the parties will settle the issue before litigation for reasons we will talk about after the following cases.

But if the dispute cannot be settled the surface owner in a lawsuit generally alleges that the operator (1) is using more of the surface than is reasonable, (2) created a nuisance, (3) has been negligent, or (4) is trespassing.

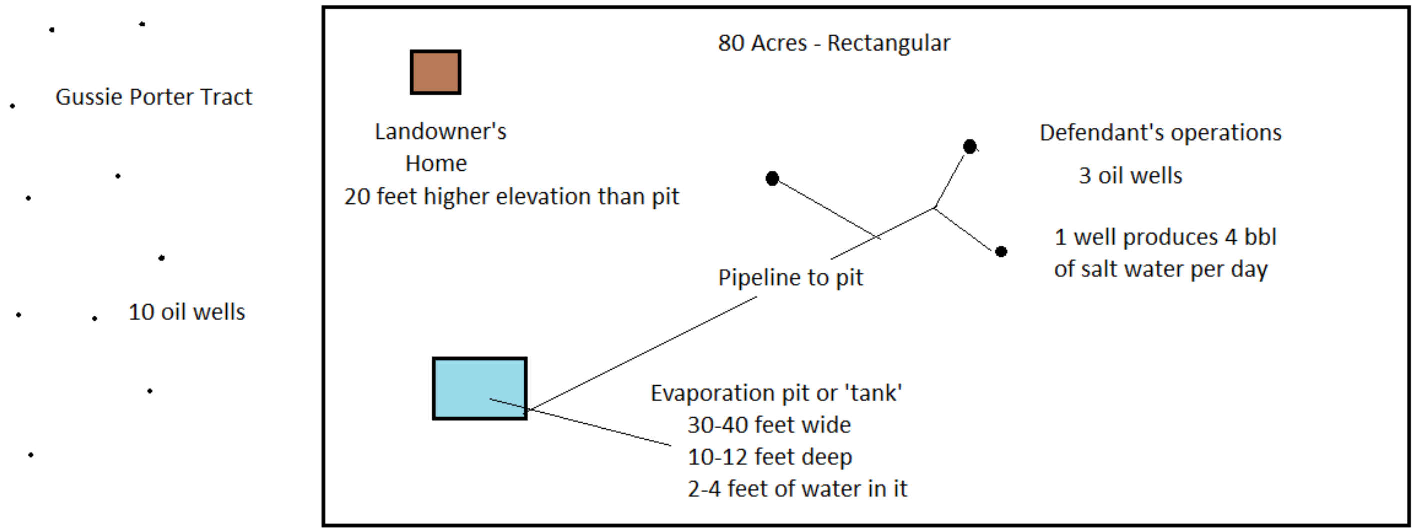
The landowner generally asks for monetary damages for the environmental problem, and rarely asks for specific performance to remediate the property. See: Marshall v. El Paso Natural Gas Co., 874 F.2d 1373 (10th Cir. 1989) ($5.4 million award for oil field pollution to lands in Beckham Co., Oklahoma); Gould v. Tenneco, unreported (Payne Co., Okla. Dist. Ct. Case C-84-129) ($4.2 million for contamination to a single water well from a salt water evaporation pit which had been closed in accordance with Corporation Commission regulations); Fischer et.al. v. Atlantic Richfield, unreported (Woods County, Oklahoma, District Court) ($3.6 million for contamination from a 75 year old oil field); Cole v. Phillips Petroleum Co. et.al., Dist. Ct. of Harris Co., Texas, Case No. 90-17888 (landowners were asking over $100 million in damages for groundwater contamination).

Question:

Why would a landowner pursue a common law claim when so many federal and state environmental statues are applicable to oil and gas operations?

Reasonable Use Doctrine: Oil & Gas Production Activities

POWELL BRISCOE, Inc. v. PETERS
Supreme Court of Oklahoma
269 P.2d 787; 3 Oil & Gas Rep. 1364
April 6, 1954



O'NEAL, Justice. This is an action in which plaintiffs sought a permanent injunction against the defendants restraining them from using an earthen pit, or tank, for the impounding of salt water produced in the operation of certain oil wells upon land under an oil and gas lease owned and operated by the named defendant and two of its employees. From the granting of a permanent injunction, defendants appeal.

It was alleged in plaintiffs' amended petition that they owned the surface rights in 80 acres of land in Seminole County, Oklahoma; that the defendants Powell Briscoe, E. F. Briscoe, R. O. Reynolds and J. C. McKinney are the owners of an oil and gas lease upon plaintiffs' land, upon which the named defendants have drilled three oil wells; that the defendants Joe Collins and Bill Ennis are pumpers and employees of the defendant owners and operators of the lease; that the defendants, in the operation of the properties have constructed an earthen tank, or pond, upon the premises, and that the soil is of a sandy character and the brine in the pit, or tank, will seep into or permeate the surrounding soil and will destroy the vegetation and pollute the fresh water upon plaintiffs' land. It is alleged that the said acts constitute a private nuisance and will prevent plaintiffs from using and enjoying their property.

Defendants, by answer, plead the ownership of certain oil and gas leases upon plaintiffs' land, which leases were executed prior to plaintiffs becoming the owners of the surface rights of the land, and defendants specifically plead the rights so acquired under said leases; they operated plead that the leases have been operated with due and reasonable care and in the usual and customary practice prevailing in the Mid-Continent area, as well as that of the Seminole area; they alleged that no damage has been done plaintiffs, and that their claim is a speculative possibility of damages.

The lands involved in this case are located in Eastern Oklahoma. What issues does that present?

The evidence tends to support a finding that the soil on plaintiffs' land, as well as lands in the area thereof, is of a loose sandy loam, and a large number of wells have been drilled and operated in the general area of plaintiffs' land.

Plaintiff, as a witness, testified at length with reference to oil production on lands lying to the west of his property. He identified that tract as the Gussie Porter land upon which there were ten producing oil wells. The soil upon that land was described as being perhaps a little more sandy than his land. Photographic exhibits of the Gussie Porter lease were introduced, which reflects the exterior and interior of a salt water pond upon that land. He testified as to the location of a lease south of the Kight school and another lease designated as the Jack Wade farm; that the soil on these lands was of a sandy loam formation; that from the condition of the soil near the salt water pits upon those leases, there was indication that salt water had destroyed the vegetation in the immediate vicinity of the pits.

He testified at length as to the methods employed by the Cities Service Company in disposing of their brine by emptying it into Little River, and that many producers in the oil field disposed of brine by emptying it into Little River, or the South Canadian River. With reference to the operation of the three wells on his land he stated that salt water produced upon the lease was conveyed in a pipeline to a pond situated in the southwest corner of his land. He did not testify that any salt water thus produced ever escaped from the pit or flowed over his land.

The Little River during spring season. During summer the flow is about one-quarter of this amount. The Little River flows into the South Canadian River which ultimately flows into the Gulf of Mexico. What are the legal implictions?

Plaintiff introduced the testimony of five additional witnesses, some of whom worked as pumpers on leases in the Sasakwa area. Their testimony is to the effect that some operators use intake wells to dispose of brine, some run their brine into Little River, or the South Canadian river, and others impound it in pits or tanks upon their respective leases; they expressed an opinion that salt water in pits in the area involved would seep causing some injury to vegetation near the pits. One witness stated that as defendants' wells were in close proximity to Little River, that no pumping equipment was necessary to dispose of the brine into Little River.

Plaintiff's last witness stated that the soil on plaintiff's farm is composed of three layers; the top soil is sandy loam soil; underneath is a soft friable clay, the bottom is stiff hard clay; that the pit on plaintiffs' land is located on the southwest ten acres of the eighty acre tract; that plaintiffs' house and improvements are located on the northwest ten acres of the farm, and upon higher land than the pit. He described the pit as between thirty and forty feet wide, ten to twelve feet deep and containing approximately three to four feet of salt water.

Defendants' testimony discloses that one well upon the land produced some salt water; that plaintiffs' land slopes to the east and north of the salt water pit, which is located on the southwest corner of the farm; that plaintiffs' house and improvements are located in the northwest corner of the land, upon an elevation of approximately fifteen to twenty feet above the pit; that the pit has never been filled with salt water, and that no salt water has escaped therefrom; that one well upon the lease produced approximately four barrels of brine a day; that if oil wells thereafter made enough salt water to fill the pits the owners were willing to dig an additional pit below the present one to catch any salt water that might seep out of the pit; that an intake well for the disposal of salt water would cost the defendants approximately $ 30,000.

It was stipulated that the defendant owners of the lease were financially able to respond in damages for any injury to plaintiffs' land arising out of their oil operations. Upon the submission of the case the trial court made a finding as follows:

'The Court further finds that at the time of the hearing herein there were three producing oil wells owned by the defendants located upon the property of the plaintiff, and that in all probability there will be additional wells drilling upon this 80 acre tract of land. The evidence discloses that one well is now producing some salt water. There is the probability that this well will increase its production of salt water and that possibly other wells will produce salt water, and if such is allowed to drain and flow into the tank constructed by the defendants it will constitute a nuisance which can be abated by the expenditure of money or labor,' and upon said finding entered an order and judgment that the temporary restraining order or injunction be made permanent.

The lease contract authorizes the operator for oil and gas development to lay pipelines, build tanks and structures upon the land to produce, save and take care of said products. The oil and gas lease here involved is the ordinary lease employed in the operation of oil and gas wells in the Mid-Continent field.

In Pure Oil Co. v. Gear, 183 Okl. 489, 83 P.2d 389, 390, we held:

> *'Under the ordinary oil and gas lease, the lessee in developing the premises in the production of oil and gas, is entitled to the possession and use of all that part of the leased premises reasonably necessary in producing and saving the oil and gas, including space to construct tanks and ponds, in which to confine salt water and other waste matter coming from the wells, and also including the space necessary to transport such waste matter from the wells into such tanks or ponds in a reasonably prudent manner.'*

In the case of Mary Oil & Gas Co. v. Raines, 108 Okl. 222, 235 P. 1085, it is said:

> *'In an oil and gas lease the lessee is entitled to the possession of the land so leased to the extent reasonably necessary to perform the obligations imposed on him by the terms of the lease, and the annoyances caused by production of oil and gas under a lease providing for the use of the surface for that purpose, in the absence of negligence on the part of the lessee, do not constitute a nuisance, and, where the same is being operated in the ordinary way and all precautions customarily prevailing in the oil and gas industry are being used to protect the rights of the surface owners, the incidental annoyances accompanying same offer no grounds for relief by injunction.'*

Construing the allegations of plaintiffs' petition and the proof submitted in support thereof in its most favorable light, we are of the view that the evidence wholly fails to sustain plaintiffs' contention that defendants in the operation of the lease by the impounding of salt water in the pit described, have created a private nuisance.

It will be observed that the court based its judgment upon a finding that additional wells may be drilled on the land, and further, that there is a probability that the present well, which is making four barrels of brine will, in the future, increase its salt water production, and that possibly other wells will produce salt water, and that if it is allowed to flow in the pit the salt water will constitute a nuisance. That finding, as its reading indicates, is based upon speculation and conjecture and it is without basis in the record. The salt water pit upon plaintiffs' land was constructed in the manner employed by all other producers in the field who impounded salt water upon their leases. Furthermore, there is no evidence that defendants have permitted any salt water to flow over plaintiffs' land. Concededly, plaintiffs admit no present injury, for no proof was submitted as to present damage.

To sustain the judgment for injunction under the facts here submitted, would result in depriving defendants of a substantial right under their oil and gas lease, and, in effect, deprive them of their property rights without plaintiffs having shown any present injury. As this court said in its opinion in Tidal Oil Co. v. Pease, 153 Okl. 137, 5 P.2d 389, 392.'To hold that operators could not flow salt water over the surface of land owned by them or leased by them for that purpose, or to deposit same in pools or tanks on their own land, would in many cases render impossible development for oil and gas in fields where salt water is produced.'

Salt from an old pit on the surface after the water evaporates. Does the salt evaporate with the waste water when left onsite? If we covered the area with 16 inches of topsoil would that remediate the problem?

The denial of injunctive relief does not deprive plaintiffs of their action at law if and when they establish injury to their land by reason of defendants' operation under its oil and gas lease. Fairfax Oil Co. v. Bolinger, 186 Okl. 20, 97 P.2d 574.

Moreover, the record here discloses that plaintiffs have a plain, speedy and adequate remedy at law for the recovery of damages in the event damages are sustained.

In Harris v. Smiley, 36 Okl. 89, 128 P. 276, we held:

> 'If it appears from the petition that plaintiff has a plain, speedy, and adequate remedy at law, equity will not grant him relief by injunction.'

In Sunray Oil Co. v. Cortez Oil Co., 188 Okl. 690, 112 P.2d 792, we held:

> 'An injunction will not issue to protect a right not in esse and which may never arise, or to restrain an act which does not give rise to a cause of action.'

In the case of Marshall v. Homier, 13 Okl. 264, 74 P. 368, we held:

> 'Where, in an action for an injunction, the alleged contemplated injury is such that can be fully compensated in money damages, and the defendants are wholly and unquestionably solvent, a temporary injunction should not be granted, and, where granted upon proper motion, should be dissolved, and the plaintiffs left to their adequate remedy for damages.'

Plaintiffs rely upon certain Oklahoma cases as follows: Gulf Pipe Line Co. v. Pawnee-Tulas Petroleum Co., 34 Okl. 775, 127 P. 252, 41 L.R.A.,N.S., 1108; Pulaski Oil Co. v. Conner, 62 Okl. 211, 162 P. 464, L.R.A.1917C, 1190; Phillips Petroleum Co. v. Mangan 189 Okl. 166, 114 P.2d 454; and Carter Oil Co. v. Kerley, 109 Okl. 69, 234 P. 737. The Gulf Pipe Line Co. case, supra, holds that the lessee of an oil and gas lease cannot arbitrarily locate a well in a place where it will endanger the property and lives of others when another location is equally advantageous to him.

In the Pulaski Oil Co. case, supra, the action at law was to recover damages arising out of defendants' operation of oil properties in which a default judgment was entered against defendants. The syllabus of the case discloses that the court held that the petition stated a cause of action to sustain the default judgment rendered.

The Phillips Petroleum Co. case, supra, was an action at law for the recovery of damages arising out of the pollution of a stream resulting in injury to plaintiff's land and plaintiff's water supply. The Carter Oil Co. case, supra, holds that under the provisions of section 7969, Comp.Stat.1921, Title 52 O.S.1951 @ 296, it is unlawful to permit oil or salt water to run over the land. We are of the view that the findings and conclusions of the trial court are not supported by the record.

The judgment granting a permanent injunction is reversed. The further contention made involving the question of venue need not be considered.

Judgment reversed.

JOHNSON, V. C. J., and WELCH, CORN, ARNOLD and WILLIAMS, JJ., concur.
BLACKBIRD, J., dissents.

<u>Briscoe v. Peters</u>

Notes and Discussion

1. Disposal of produced salt water is a major environmental problem for operators of oil wells, and to a lesser extent natural gas wells. Briscoe (circa 1954) notes that operators routinely dispose of the produced water in creeks and local rivers, as well by injecting the water underground.

   What environmental impact would be expected when produced waters are disposed of in creeks and streams? Would you expect that this practice is still utilized today? How would you expect that produced waters are disposed of today?

2. Briscoe deals with the application of the reasonable use doctrine to the drilling and operation of oil wells. The case summarizes the doctrine as follows:

   In Pure Oil Co. v. Gear, 183 Okl. 489, 83 P.2d 389, 390, we held:

   > 'Under the ordinary oil and gas lease, the lessee in developing the premises in the production of oil and gas, is entitled to the possession and use of all that part of the leased premises reasonably necessary in producing and saving the oil and gas, including space to construct tanks and ponds, in which to confine salt water and other waste matter coming from the wells, and also including the space necessary to transport such waste matter from the wells into such tanks or ponds in a reasonably prudent manner.'

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   > 'In an oil and gas lease the lessee is entitled to the possession of the land so leased to the extent reasonably necessary to perform the obligations imposed on him by the terms of the lease, and the annoyances caused by production of oil and gas under a lease

providing for the use of the surface for that purpose, in the absence of negligence on the part of the lessee, do not constitute a nuisance, and, where the same is being operated in the ordinary way and all precautions customarily prevailing in the oil and gas industry are being used to protect the rights of the surface owners, the incidental annoyances accompanying same offer no grounds for relief by injunction.'

Would such a doctrine apply to a pipeline? Compressor station located on a pipeline? Natural gas processing plant or refinery? What if the lease is silent as to use of the surface?

3. Under the reasonable use doctrine, can an oil and gas lessee install pipelines to the wellhead? Oil storage tanks on the property? Salt water storage tanks? Run electrical lines onto the property? Build roads to the well site?

4. Under the reasonable use doctrine, does the oil and gas lessee need to compensate the landowner for the use of the surface (i.e., yearly rentals, etc.)? If so, how are the yearly rentals calculated?

5. Would you expect a practice, such as disposing of salt water into creeks, which was considered reasonable at the time of Briscoe to also be considered a reasonable use of the surface today? How does this impact the operator?

6. The plaintiffs in this case ask the court to issue a permanent injunction against the defendants. What must they show the court?

7. The reasonable use doctrine has its origin in the Common Law, where the courts determined that a mine could use a reasonable amount of the surface for the mine workings, tailings piles, and ingress and egress purposes since the minerals were the "dominant" estate.

8. The court notes that one of the oil wells produces four barrels of salt water per day. How many gallons are in a barrel of oil or produced water? Until the 1960’s salt water pits were common in the oil and gas extraction industry.

How Do We Value Oil or Gas Reserves?

When we have producing properties with a production history as we did in the Briscoe v. Peters case the question frequently arises as to what the value of those reserves and assets are for transactional purposes. Add to the mix the new drilling and development technology that has been introduced into the energy sector over the last decade oil and gas professionals have been busy dealing with project acquisition, evaluation, merger, and property divestiture projects.

One of the questions that arises during the deal-making process, especially for a public company subject to SEC regulations, is how are the reserves in question valued? An energy professional should at least understand the basic classification of reserves, and each type of property will have different requirements with regard to due diligence and the regulations that might be applicable.

A good summary of valuation and reserve determination was recently published online by Mark Kaiser and Yunke Yu of the Center for Energy Studies, Louisiana State University, which in part notes as follows:

> The primary value of any company is its cash flows and earnings, which is dependent upon the quantity and quality of the product that it provides, and the sales price. Production is derived from reserves and the inventory of capital assets, production equipment, infrastructure, and acreage.
>
> Reserves lie below the surface and have not yet been produced but are economically and technically viable to extract. In North America, the United States Securities and Exchange Commission (SEC), the Ontario Security Commission (OSC), Toronto Stock Exchange (TSE), and Canadian Security Administration (CSA) provide guidelines on resource classifications and company requirements to list on their stock exchanges.
>
> Any member of society with enough money can buy shares of a public company, but a private company has only a few owners whose shares are not offered to the public. To estimate the value of a public company, there are four basic valuation techniques commonly employed – book value of assets, discounted cash flow, price earnings multiple, and market value – which can vary considerably depending on the assumptions used. For a private company, the first three methods are not an option because detailed financial information is not publicly released, but market comparisons are frequently utilized.
>
> Proved reserves
>
> The primary assets of oil and gas companies are their entitlements to future production from reserves, and one of the distinct features of the industry is its depleting asset base and need for replacement through drilling and acquisition. The physical attributes of the asset class – located miles under the ground in rocks with variable properties and uncertain boundaries, relying on indirect measurements that are expensive to perform – means that reserves estimates and deliverability are uncertain, and because future production is subject to variable production rates, unknown prices and cost, and is impacted by regulatory and fiscal uncertainty, the value of reserves are uncertain.
>
> ***Proved reserves*** are defined as the estimated remaining quantities of oil and gas anticipated to be economically producible, as of a given date, by application of development projects to known accumulations under existing economic and operating conditions. In addition, there must exist, or

there must be a reasonable expectation that there will exist, the legal right to produce or a revenue interest in the production, installed means of delivering oil and gas to market, and all permits and financing required to implement the project. Proved reserves estimates must be made with "reasonable certainty" and are defined conservatively in the sense that the reserves estimates are met. Engineering and geological data are needed to make the estimates, and generally speaking, the knowledge offered by greater amounts of engineering and geological data will improve the quality of the estimation.

The relative uncertainty of reserves is characterized by reference to deterministic categories – ***proved, P1 ("much more likely than not"); probable, P2 ("as likely than not"); and possible, P3 ("possible, but not likely") – or in probabilistic terms. If probabilistic methods are used, there should be at least a 90% probability that the quantities of proved reserves actually recovered will equal or exceed the estimate. For probable and possible reserves, the exceedance probabilities are 50% for probable and 10% for possible reserves***.

Proved reserves may be developed or undeveloped and are classified into Proved Developing Producing (PDP), Proved Developed NonProducing (PDNP), and Proved Undeveloped (PUD) categories. PDP reserves are expected to be recovered from completion intervals that are open and producing. PDNP reserves are expected to be recovered from completion intervals that are open at the time of the estimate but are not producing (shut-in) or completion intervals that are not yet open but behind existing wells (behind-pipe). PUD reserves are expected to be recovered from new wells on undrilled acreage or existing wells in new formations. Reserves that are undeveloped require significant capital expenditures to convert into producing fields and cash flow generating assets. PDP is the least risky and the most certain proved reserves class; conversely, PUD is the most risky and least certain proved reserves class.

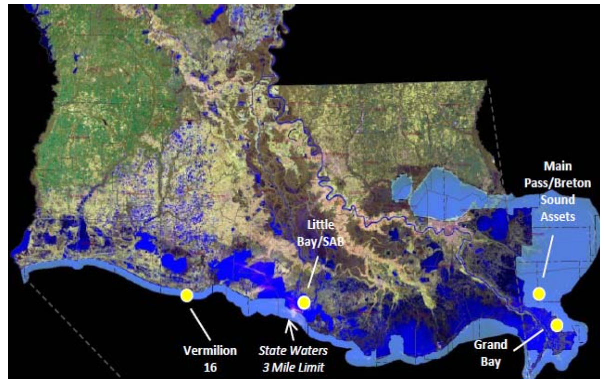
Based on SEC rules with regard to classification methodology, companies report their reserves annually in required SEC filings. They also report the discounted present value ('PV10') of their proven reserves made under certain assumptions mandated by the SEC rules. These estimates are prepared by third party registered professional engineers who rely on technical data provided by the company.

'Proved' reserves are those with a 90% chance of recovery (sometimes designated '1P' in corporate presentations), 'probable' reserves are those with a 50% chance of recovery, and 'possible' reserves are those with a 10% chance of recovery. In many cases investors will just look to the proved reserves in attempting to place a value on the transaction, although in some instances they will look at both proved and probable (together sometimes designated as '2P').

As noted above reserve estimates are actually an educated guess, and what is considered a reserve at $105 a barrel might not be considered a reserve at $45 a barrel. Price assumptions in the model are dictated by SEC rules, and generally are a function of historical prices.

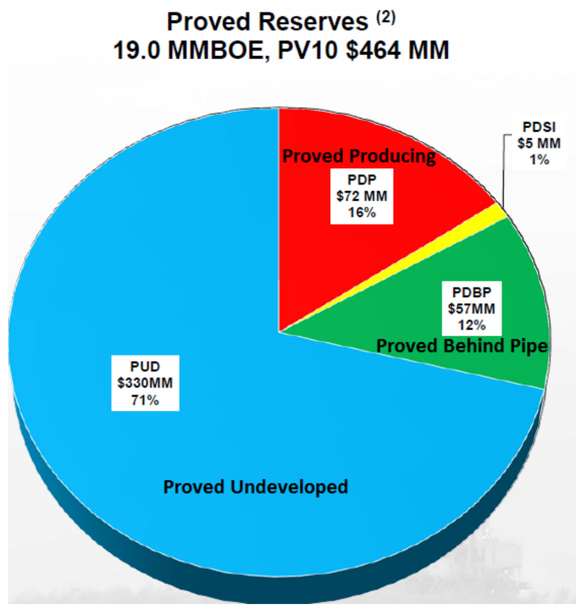
Saratoga Resources Inc. (SARA) is an example of a public company that has to report reserves under SEC mandated rules. The company is an exploration and production company with their main producing assets located in Louisiana. Much of the company acreage is held-by-production from relatively shallow formations in fields that have been producing for decades.

Saratoga's production is around 65% oil and liquids and around 35% natural gas. The company receives a premium price for their crude oil production (Brent pricing) as compared to mid-continent wells that are mostly priced on the discounted West Texas Intermediate grade.



The company in 2012 reported that the discounted present value of the company's proved reserves (PV10) increased 46% year over year – a good jump in the value of the proved reserves. Remember proved reserves are those that have been "estimated with reasonable certainty, from the analysis of geologic and engineering data, to be recoverable from well established or known reservoirs with the existing equipment and under the existing operating conditions".

A chart of the company's proved reserves from their website is set out at right. Note "PDP" stands for proved developed producing reserves. "PDBP" stands for proved developed behind pipe reserves. "PUD" stands for proved undeveloped reserves that most likely will require drilling activities to access (the other reserves can be produced through existing well bores).



Questions:

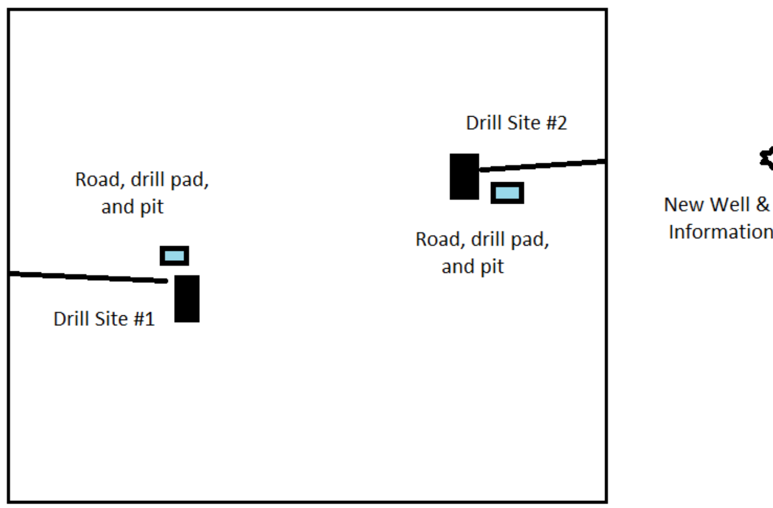
1. While most of Saratoga's assets are designated as 'proven' reserves, that is there is a 90% chance they will be recovered, what risks exists that might disrupt production? (hint: look at the location of their assets) What risks exist with regard to their PV10 valuation?

THOMPSON v. ANDOVER OIL CO.
Court of Appeals of Oklahoma, Division Two
691 P.2d 77; 83 Oil & Gas Rep. 141
October 30, 1984

The Thompsons, as surface owners, brought this action against Andover Oil Company, an oil and gas lessee, for the recovery of surface damages resulting from oil and gas operations. Andover and its subsidiary Honeymon Drilling, appeal from a jury verdict and award of attorney's fees in this action based on nuisance. Having reviewed the record and applicable law, we affirm in part and modify in part.

Andover held a number of oil and gas leases for the land on which the Thompsons owned the surface. In August 1981, in order to preserve its leases, Andover approached Thompson about drilling on his farm. At that time Andover stressed that it needed to begin work immediately, and it began preparations for drilling the day after its agent spoke to Thompson. An area of approximately six acres was utilized in preparation for drilling. This preparation included construction of a road, pad, and pit site.

On the day prior to the actual spudding of the well, Andover abandoned this location in favor of a site on the opposite side of the farm. At the time it began preparations of the initial site Andover did not have access to certain geological data which later became available. When this information was released it moved operations to a site where the possibility of successful drilling was greater. As a reasonable prudent operator Andover was required to drill in an area where recovery of oil and gas was more likely to occur.



Andover cited the immediate availability of a drilling rig as the reason for its haste in preparing the first site and then abandoning it hurriedly and moving to another location. The location of the initial site was not used for any purpose toward Andover's oil and gas operations, and was substantially restored to its former condition the next summer.

The preparation of the second well site was similar to the first. Andover utilized an area of a little more than eight acres in the construction of a road, a reserve pit, and a pad. However, this second site was on sloping terrain and construction of the pad necessitated moving a large quantity of earth in order to create a level area. Andover restored the area surrounding the site and at the time of trial was using a total of 2.2 acres for the life of the well.

Prior to its restoration efforts, Andover consulted with the Soil Conservation Service and followed its recommendations. Andover also had discussions with Thompson concerning the restoration efforts at both sites. At the abandoned site, Andover removed most of the gravel used for the pad and road but was unable to remove all of the substance. In grading the abandoned location, the grade was changed slightly so that water occasionally stands in this particular area, thus making it unsuitable for certain crops, such as alfalfa.

After restoration attempts were completed the Thompsons brought suit against Andover and Honeymon for permanent and temporary injury to their land and the maintenance of a nuisance as a result of drilling operations. The Thompsons alleged that Andover had abused their rights by using more of their property than was reasonably necessary. They further alleged that Andover failed to restore the property to its original condition. The Thompsons asked for actual damages and punitive damages, contending that Andover's actions were willful and done in wanton disregard of their property rights.

At trial the jury heard conflicting evidence concerning the extent of the damage to the Thompsons' farm. The Thompsons' evidence of damage included the gravel which remained on the land, erosion, burial of drilling muds, and irregular grading. Although Thompson could place no monetary value on his nuisance claims, he also asserted that damage had occurred due to annoyance and inconvenience of drilling operations. This included the fact that he was sometimes required to remove his cattle from certain fields.

After viewing the property, the jury awarded the Thompsons $50,000 in actual damages, but awarded no punitive damages. At the hearing on attorney's fees, the Thompsons were awarded $15,750. Andover had appealed both the jury verdict and the attorney's fee award.

As its propositions of error, Andover argues that (1) the award is not supported by competent evidence, (2) the court erred in refusing to admit certain oil and gas leases into evidence, (3) the court erred in instructing the jury on punitive damages, and (4) the award of attorney's fees is not supported by the evidence.

I

In cases involving alleged damages to the surface, the legal principle which this court must use as a starting point for the determination of the appropriate remedy is that an oil and gas lease creates and vests certain rights and responsibilities. In Oklahoma, the surface estate is servient to the dominant mineral estate for the purposes of the oil and gas lease. Wellsville Oil Co. v. Carver, 206 Okla. 181, 183, 242 P.2d 151, 154 (1952). An ordinary or conventional oil and gas lease carries with it the incidental or implied right to enter, possess, and use the surface to the extent and in such a manner as is reasonably necessary to enable the lessee to perform all the legitimate obligations imposed upon him by the lease, and to effectuate the purpose of the lease. As stated in Wilcox Oil Co. v. Lawson, 341 P.2d 591, 594 (Okla. 1959) (emphasis added):

[*82] The holder of a valid oil and gas lease has the right and privilege to go on the land and do all those things necessary and incidental to the drilling of wells, including the right to the use of the surface, and in the absence of a provision that lessee would be liable for growing crops, the only basis for recovery of damages is proof of wanton or negligent destruction, or that damages were to portion of land not reasonably necessary for oil and gas development.

Underlying the question of what constitutes reasonable use of the surface in the development of oil and gas is the concept that the right of an oil and gas lessee to reasonably necessary surface use must be exercised with due regard to the right of the owner of the surface. Consequently, a lessee has the duty to protect the surface as to those areas where an implied incidental necessity does not exist. Pulaski Oil Co. v. Conner, 62 Okla. 211, 214, 162 P. 464, 466 (1916).

Thus, it is clear that the only basis for recovery of damages by the Thompsons is proof of wanton or negligent destruction of the surface, or that damages were to a portion of the land not reasonably necessary in the drilling operations. Cities Service Oil Co. v. Dacus, 325 P.2d 1035, 1036 (Okla. 1958). Where a surface owner purchases his property subject to a valid oil and gas lease his right to any recovery, in the absence of negligence, must be predicated upon proof that the lessee used more land than it was entitled to use under the terms of the lease. Lone Star Producing Co. v. Jury, 445 P.2d 284, 286 (Okla. 1968).

Of course, the surface owners cannot recover damages due to the mere presence of oil and gas operations on their land, but must prove either Andover's negligence, or that Andover used more of the surface than was reasonably necessary. The Thompsons neither alleged nor proved negligence, nor was the jury instructed on negligence theories, and the case below was tried on the contention that Andover used more of the surface than was reasonably necessary for operations. We note that the burden of proving unreasonableness, that Andover used more of the surface than was necessary, was on the Thompsons as plaintiffs. Davon Drilling Co. v. Ginder, 467 P.2d 470, 473 (Okla. 1970).

The extent to which the use of the surface is reasonably necessary for oil and gas operations is a question of fact for the jury. Davon Oil Co. v. Steele, 186 Okla. 380, 383, 98 P.2d 618, 621 (1940).

Normally, the plaintiff is required to prove the unreasonable use before he can recover. However, at the trial below, Andover conceded that it was responsible for some extent of damage to the Thompson farm. Thus, the only issue to be determined by the jury was the amount of damages.

II

On appeal Andover asserts that the award of $50,000 is excessive and contrary to law. In examining the award, this court must look to the record to determine if there is any evidence reasonably tending to support the verdict. First National Bank of Amarillo v. LaJoie, 537 P.2d 1207, 1211 (Okla. 1975).

In cases involving surface damages, the alleged damages will normally be either permanent damage, temporary damage, or damage caused from the maintenance of a nuisance. Although all three are related somewhat, the measure of damage is calculated differently for each.

Permanent injury to property occurs when it "may not be successfully repaired so that it will be substantially in as good a condition as it was before the injury." Keck v. Bruster, 368 P.2d 1003, 1005 (Okla. 1962). The court in Keck established the standard for measuring damages as:

"Where damages are of a permanent nature, the measure of damage is the difference between the actual value immediately before and immediately after the damage is sustained." It has been consistently held that the diminished value is the diminished value of the entire unit and not the difference in the value of the specific land which is harmed. Sunray DX Oil Co. v. Brown, 477 P.2d 67, 69-70 (Okla. 1970).

A temporary injury to property is one which can be cured or repaired by restoration. The Keck court defined it as: "Where property can be repaired and substantially restored to its former condition, the measure of damage is the reasonable cost of repairing the damage and restoring it to its former condition." Keck v. Bruster, 368 P.2d at 1004. However, the cost of restoration cannot exceed the depreciated value of the land itself. Peevyhouse v. Garland Coal & Mining Co., 382 P.2d 109, 114 (Okla. 1962), cert. denied, 375 U.S. 906, 11 L. Ed. 2d 145, 84 S. Ct. 196 (1963).

The final theory of recovery found in cases of this type is based on the private nuisance concept. Title 50 O.S. 1981 @ 1, defines "nuisance" as "unlawfully doing an act, or omitting to perform a duty, which . . . . annoys, injures or endangers the comfort, repose, health, or safety of others; or . . . . in any way renders other persons insecure in life, or in the use of property." Generally, liability does not depend upon the negligence of a defendant and may exist although there was no negligence.

Negligence is not an essential element of a cause of action for nuisance and need not be proved. Cities Service Oil Co. v. Merritt, 332 P.2d 677, 684 (Okla. 1958). Thus, in order to maintain a cause of action for nuisance, the plaintiff must prove an unlawful act or omission of duty which either injured or endangered his use of his property.

The personal inconvenience, annoyance, and discomfort to a property owner caused by the maintenance of a nuisance is a separate and distinct element of damage. The measure of damage is the reasonable compensation for the injury. Phillips Petroleum Co. v. Ruble, 191 Okla. 37, 38, 126 P.2d 526, 527 (1942). A cause of action based on nuisance may include both permanent and temporary injury to property as well as damages for annoyance. The appropriate measure of damage in a nuisance action was stated in Tenneco Oil Co. v. Allen, 515 P.2d 1391, 1392 (Okla. 1973), as:

Damages adjudged in an action predicated on a nuisance theory may include clean-up costs of oil and gas lessee's surface impediments not necessary for its operation, damages for use of land by lessee for more than a reasonably necessary period of time for its operations, for lessee's unnecessary use of land area in its operations, and for temporary and permanent injury to the land.

As the case was submitted to the jury on nuisance theories, this court must examine the record to see if the award "reasonably compensates" for the injury. The Thompsons presented evidence of permanent injury caused by Andover's burial of drilling muds on the land. Although Andover disputed both the harmful effects of this practice and the reasonableness of its action, there was other testimony before the jury to show that the land had been permanently damaged.

The Thompsons' evidence of temporary injury included erosion, silting of their pond, and irregular grading. Although all can be corrected by restoration, there was considerable difference in the testimony presented by both sides as to the cost. Thompson could not put a value on his claims for annoyance and inconvenience, but noted that he had numerous difficulties caused by Andover's leaving gates open and other acts.

Thompson testified that the difference in the fair market value of his property before and after the injury was $50,000. Andover attacks this as being incompetent evidence, pointing out that Thompson's own expert witness testified that the difference in value was only $24,330.

Thompson asserts that a property owner is competent to testify as to the value of his land, citing H. D. Youngman Contractors v. Girdner, 262 P.2d 693, 696 (Okla. 1953), where the court held that the owner of the property is competent to testify as to the value of his land regardless of his expertise concerning property values. In Cities Service Oil Co. v. Merritt, 332 P.2d 677 (Okla. 1958), the plaintiff's testimony was that she thought her land had depreciated by $40,000 while her own expert testified that it had been harmed only to the extent of $28,000. The court upheld the jury's verdict of more than $30,000, finding that it was within the bounds of the evidence.

Here, we note also that the testimony concerning the costs of restoration was as high as $70,000. While the award for damages for restoration cannot exceed the depreciated value of the land, the $50,000 award is clearly within the bounds of the evidence presented. The award is supported by competent evidence and is affirmed. Cities Service Oil Co. v. Merritt, 332 P.2d at 679.

III

Andover asserts that the court erred in failing to admit into evidence the oil and gas leases covering the property in question. However, these leases were executed with the mineral owners after the Thompsons had purchased their land, and the Thompsons were not a party to any of the leases.

Andover contends that the leases limit its liability to payment for destruction of growing crops. Neither the terms of the leases, nor the law limits such liability. Wilcox Oil Co. v. Lawson, 341 P.2d 591, 594 (Okla. 1959), stated that if the lease contained a provision for damage to growing crops, the plaintiff could recover damages for his crop, as well as damage for unreasonable use of the surface.

Such a provision in a lease thus allows the surface owner to recover for damage to growing crops even when the lessee's actions and use are reasonable. In the absence of such a provision, the surface owner can only recover if the use is unreasonable or negligent. As the Thompsons did not ask for damages to their growing crops, but merely contended unreasonable use of the surface, the leases were totally irrelevant.

IV

Andover also contends that the court erred in giving instructions on punitive damages. However, as the jury returned no punitive damage award the instruction is not reversible error. Errors in the admission of evidence or in the giving or refusing to give instructions will not be cause for reversal if the jury was not misled by them. Missouri-Kansas-Texas R.R. v. Harper, 468 P.2d 1014, 1017-18 (Okla. 1970).

V

As its final proposition of error, Andover asserts that the court erred in awarding an attorney's fee of $15,750. This court agrees. In State ex rel. Burk v. City of Oklahoma City, 598 P.2d 659 (Okla. 1979), the court set forth factors to be considered in determining the amount of attorney's fees. The Burk court determined that an attorney seeking compensation over that amount necessary to compensate him on an hourly basis must justify the excess by establishing several factors. Among these are the difficulty of the case, the expertise of counsel, the risks involved, and the results achieved.

Thompsons' counsel testified that he had completed forty hours of work in this case and that he normally charged $75 per hour for legal work outside of trial time and $150 per hour for time in court.

He stated that the case was "not too much different from others." There were no unique factual issues nor research problems. According to his own testimony, he would be entitled to $4,200 based on his hourly fee schedule. However, the trial court awarded a "bonus" of $11,500. It is quite possible that the court awarded this "bonus" because counsel testified that he had an arrangement with his clients whereby any attorney's fee would be added to the jury verdict and the contingency fee would be one half of the combined total. Thus, based on the award of $15,700, counsel would receive a fee of $32,875 rather than $25,000.

We note that the presence of a contingency fee is a matter between the client and his attorney and is not binding on the court in awarding an appropriate fee. Burk established that after arriving at a figure for the hourly rate, the court must consider if it is appropriate to award additional compensation.

Among the factors to consider in determining this "incentive fee or bonus" are the benefits conferred on the prevailing party, the difficulty of the issues, and the attorney's expertise in dealing with them. Burk, 598 P.2d at 661.

Here, counsel for the Thompsons testified that he spent forty hours on the case and that he did not consider the case difficult. He made reference to the issue of punitive damages; however, as we have previously stated, he was unsuccessful in this endeavor. He indicated that there were no complicated legal issues and did not hold himself out to be an expert in this type of litigation.

Furthermore, the award of $50,000 which the jury returned for his clients is less than twenty percent of the amount which the Thompsons prayed for. None of these factors justify an incentive bonus of nearly three times the amount of hourly compensation.

Based on the evidence presented at the hearing on attorney's fees, this court finds that a reasonable fee for the work done in this case is the hourly compensation of $4,200 plus an incentive bonus of $5,800 for a total of $10,000. The attorney's fee is thus modified to bear a reasonable relationship to the pertinent standards used in determining such fees.

REIF, J., concurs, and BACON, J., concurs in part and dissents in part.

Thompson v. Andover Drilling Co.

Notes and Discussion

1. What are the types of damages available to the surface owner here? How were they calculated?

2. If the surface use was ‘reasonable’ did the drilling company owe the surface owner any damages?

3. Was it reasonable to build a new drill site after getting the new geologic information after building the first drill site? Why did they build the first drill site if they knew that new information from a new well might be forthcoming?

4. Is the determination of reasonable use a fact question or a question of law? Why does it matter?

5. Most of the trials for surface damage occur in the county where the land is located. Is this a good fact in most cases from the company’s standpoint?

6. Why would you think most disputes regarding surface use settle before trial?

7. Is there a cap on temporary damages? Why? Does this cap essentially let the developer "condemn" the property paying only the decline in market value?

NATURALLY OCCURRING RADIOACTIVE MATERIALS (NORM)

Naturally Occurring Radioactive Materials, or "NORM", is a relatively recently discovered issue. Radioactive scale can accumulate over time in certain oil field equipment. In general, the more dissolved solids that are contained in the waters or liquids that are being handled, the higher the probably NORM may be a problem. NORM tends to concentrate in pipe or equipment scale, and is most commonly a problem with processing plant pumps, tubulars, and any scale encrusted equipment.

Many NORM problems become apparent when equipment is moved, repaired, or when a property is sold. In Louisiana certain restrictions are imposed on sellers to test certain equipment or property for NORM before title passes. Most NORM contaminated equipment is removed when production stops, so we have not seen a large amount of 'reasonable use' lawsuits involving NORM (proof of proximate cause of any damages to the surface owner is also difficult).

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From the Texas Railroad Commission Website:

NORM in the Oil and Gas Field

NORM encountered in oil and gas exploration, development and production operations originates in subsurface formations, which may contain radioactive materials such as uranium and thorium and their daughter products, radium 226 and radium228. NORM can be brought to the surface in the formation water that is produced in conjunction with oil and gas. NORM in these produced waters typically consists of the radionuclides, radium 226 and 228. In addition, radon gas, a radium daughter, may be found in produced natural gas.

Because the levels are typically so low, NORM in produced waters and natural gas is not a problem in Texas unless it becomes concentrated in some manner. Through temperature and pressure changes that occur in the course of oil and gas production operations, radium 226 and 228 found in produced waters may co-precipitate with barium sulfate scale in well tubulars and surface equipment. Concentrations of radium 226 and 228 may also occur in sludge that accumulates in oilfield pits and tanks. These solids become sources of oil and gas NORM waste. In gas processing activities, NORM generally occurs as radon gas in the natural gas stream. Radon decays to Lead-210, then to Bismuth-210, Polonium-210, and finally to stable Lead-206. Radon decay elements occur as a film on the inner surface of inlet lines, treating units, pumps, and valves principally associated with propylene, ethane, and propane processing streams.

Workers employed in the area of cutting and reaming oilfield pipe, removing solids from tanks and pits, and refurbishing gas processing equipment may be exposed to particles containing levels of alpha-emitting radionuclides that could pose health risks if inhaled or ingested.

State Regulation: Railroad Commission Regulations for Disposal of Oil and Gas NORM

The Commission regulates the disposal of oil and gas NORM under Environmental Protection, Subchapter F, Oil and Gas NORM. Subchapter F establishes the requirements for oil and gas NORM waste disposal for the purpose of protecting public health and the environment.

Oil and gas NORM waste is defined as any solid, liquid, or gaseous material or combination of materials (excluding source material, special nuclear material, and by-product material) that spontaneously emits radiation in its natural physical state, is discarded or unwanted, constitutes, is contained in, or has contaminated oil and gas waste, and exceeds the exemption criteria specified in 25 Texas Administrative Code §289.259(d)(1)(B) and (d)(2) prior to treatment or processing that reduces the radioactivity concentration.

Subchapter F contains exclusions from certain activities, exemptions for certain disposal activities, and prohibitions against certain activities. Subchapter F also authorizes certain disposal methods and requires a permit for others.

The activities excluded from Subchapter F are activities that are regulated by the Texas Department of State Health Services (DSHS). These excluded activities include: recycling activities, decontamination of equipment unless the contamination is only as a result of disposal activities, and possession use, transfer, transport, and/or storage unless this occurs at a disposal site and occurs to facilitate disposal.

The disposal activities prohibited by Subchapter F include disposal of produced water by injection into a well permitted by the Commission or by discharge to surface waters in accordance with Commission regulations. In addition, disposal of equipment that has been decontaminated by a specific licensee in accordance with the DSHS regulations for decontamination and that meets the exemption criteria of §289.259 is exempt.

The disposal methods prohibited by Subchapter F include discharge of oil and gas NORM waste other than produced water, spreading of oil and gas NORM waste on public or private roads, and any other method that is not specifically provided for by Subchapter F.

The disposal options for NORM-contaminated solids differ from the options for NORM-contaminated equipment. NORM-contaminated solids, such as pipe scale, may be disposed of on the site where they were generated by burial or placement in a well that is being plugged and abandoned. Contaminated soil may be landspread under certain conditions. Subchapter F also authorizes disposal of oil and gas NORM waste at a licensed facility and injection of NORM treated by a DSHS specific licensee provided the operator complies with specific requirements contained in the rule. NORM-contaminated equipment that is waste, i.e., equipment that is no longer wanted, may be recycled as scrap metal under DSHS regulations or disposed of.

The equipment must be decontaminated if it is to be released for unrestricted use (e.g., used for some purpose other than for oil and gas activities). Subchapter F does not allow the burial of NORM-contaminated equipment. Buried flow lines that contain NORM, however, may remain buried contingent on the lease agreement. NORM-contaminated tubulars and other equipment may also be placed in a plugged and abandoned well.

The Commission's Statewide Rule 14 (§3.14), relating to well plugging, require equipment to be removed from a lease when the last well on the lease is plugged. Rule 14(d)(12) requires all tanks, vessels, related piping, and flow lines be emptied, and requires all tanks, vessels, and related piping to be removed in 120 days.

Scrap metal dealers routinely screen for gamma radiation and reject scrap at their selected μR/hr settings. This factor in combination with the requirements of Subchapter F and rule 3.14 and necessitate that NORM-contaminated equipment be decontaminated and that NORM waste and equipment be properly disposed when a lease is abandoned. . . .

With regard to NORM waste, apparently the massive amounts of water used in hydraulic fracturing can create radioactivity issues, as discussed in this recent Bismarck Tribune article:

Radioactive oil patch waste on the loose in N.D.
By LAUREN DONOVAN | Bismarck Tribune

Rick Schrieber says radioactive waste from the oil patch does not belong in his landfill. And if a trucker tries to sneak it in, he's going to wish he hadn't.

Schrieber is the manager of the McKenzie County solid waste landfill near Watford City. He recently wrote $110,000 in fines to truckers who brought in fabric filter socks that are banned from landfills because they're potentially coated with radioactive waste.

Tainted filters


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Details, 10C
SUNDAY, JANUARY 20, 2013
The Bismarck Tribune
www.bismarcktribune.com
$2.00

A Next Generation Solutions container for potentially radioactive waste is inundated with other types of garbage at this site in North Dakota's oil patch. (Submitted photo)

RADIOACTIVE waste on the loose

Oil patch waste winding up in landfills

By LAUREN DONOVAN
Bismarck Tribune

Rick Schrieber says radioactive waste from the oil patch does not belong in his landfill. And if a trucker tries to sneak it in, he's going to wish he hadn't.

Schrieber is the manager of the McKenzie County solid waste landfill near Watford City. He recently wrote $110,000 in fines to truckers who brought in fabric filter socks that are banned from landfills because they're potentially coated with radioactive waste.

Tainted filters

The filters — about the size of a long butterfly net — are used to strain the toxic saltwater and hydraulic fracture water that comes from oil wells while it's being injected into deep disposal wells.

Not all saltwater is "hot," but radioactive particles will accumulate on the filters if they're used long enough, or in certain areas of the Bakken.

There are some 511 injection wells out in the oil patch and filters can be changed multiple times every day, meaning there are potentially thousands generated every week.

A serious problem of poorly managed radioactive waste is only going to get worse, said Steve Tillotson, assistant director of the state's solid waste management program.

Tillotson

It will get worse because of increased oil drilling, for one, he said. And it will get worse because the longer oil field equipment, like pipelines and oil storage tanks, is in use, the more naturally-occurring radioactivity will build up.

Rhea

Kurt Rhea is chief executive officer for Next Generation Solutions, a Colorado company that collects some

Continued on 8A

"Things can't go on like this."
Steve Tillotson, assistant director of the state's solid waste management program

Derek Hall, with the state Health Department's hazardous waste program, holds up a filter sock, typically used at disposal wells in the oil patch and potentially coated with radioactive waste after use. (LAUREN DONOVAN/Tribune)

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Kurt Rhea is chief executive officer for Next Generation Solutions, a Colorado company that collects some radioactive waste in the Bakken and transports it to approved disposal sites in other states.
He said it isn't handling nearly as much as it should be, leaving him to wonder where most of it is going. Rhea said radioactivity is prevalent.

"Everything we've tested in the Bakken, it all exceeds 5 pCi per gram, virtually every sample," he said. The number is the state's minimum threshold for radioactivity and stands for Picocuries, a unit of measurement for elements like radium and uranium.

Typically, filter socks' radioactive levels range from 5 to 80, though one tested at 374. Tests on tank bottoms and retention ponds at oil wells routinely run significantly higher numbers, around 200 pCi, Rhea said.

Rhea said if even low-level radioactive waste is buried in a typical solid waste landfill, "You've got a problem that doesn't go away." Exposure, depending on duration and intensity, can cause radiation poisoning, nausea and vomiting, up to cancer-causing cell changes or birth defects in humans and wildlife. Basic precautions, like not eating or smoking around the material and wearing gloves, are advisable.

"The average oil field worker with even basic safety precautions is not at risk," Rhea said. But everyone, over the course of a lifetime, should keep radioactivity exposure as low as possible, he said. . . .

Safe disposal

Where the waste should go, if it is radioactive, is to an approved waste disposal facility — and there are none in North Dakota, Tillotson said. The closest are in Colorado, Utah and Idaho. Next General Solutions has about 30 sites where it has set up lined and sealed containers to collect such materials as filter socks that are then transported to approved facilities. Most of those sites are at saltwater disposal wells.

Rhea figures maybe 20 percent of the radioactive waste is being handled the way it should be by conscientious companies.That other 80 percent? Good question, he said. Tillotson said the department knows some radioactive waste is properly handled. "Where the rest of it is going, we have no idea," he said.

Rhea said it costs a company about $8,000 per container to have waste transported to an approved facility. His company provides a certificate of disposal. "They get proof that it went where we said it would go," he said. It isn't cheap, he acknowledges, "but the bigger issue is them trying to sneak it into the landfill."

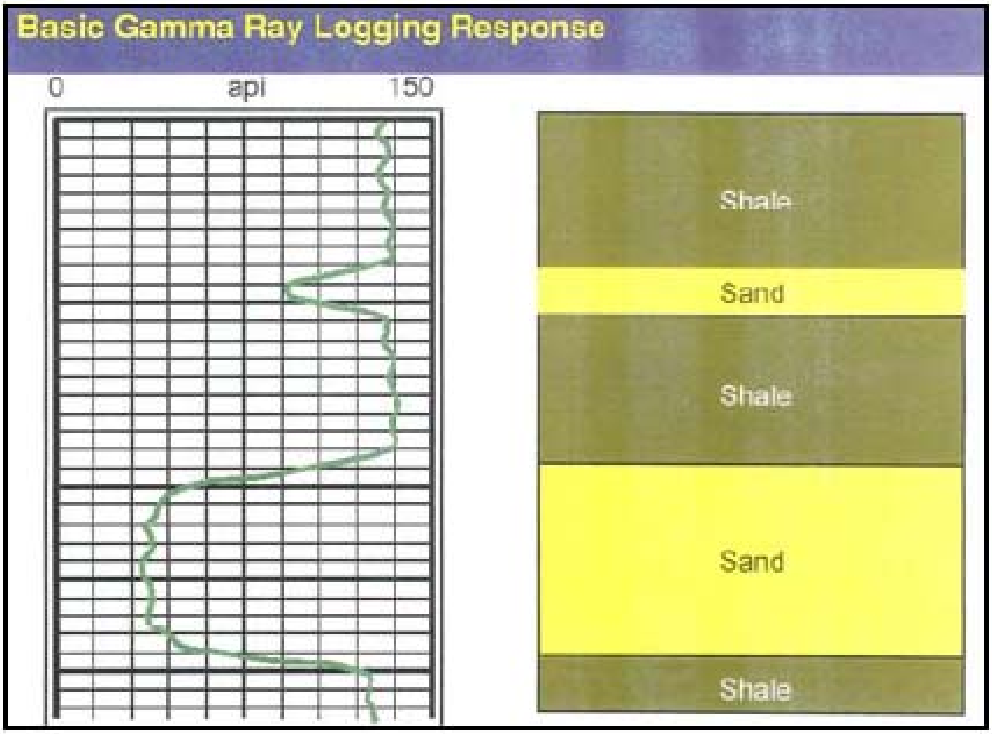
Tillotson said if it seems like the department isn't going far enough or fast enough with radioactive waste, that's partly because the problem is still so new.

Derek Hall, who's with the department's hazardous waste program, said he's sent fair warning to every company that shows up on the rejected load report. Some are big transport companies and show up over and over again.

Repeat violators are being sent registered letters of apparent violation that could lead to enforcement action, Tillotson said. "Things can't go on like this," he said.

Gamma Ray Logging: Using Radiation as a Tool

Radioactivity also has some positive oil field applications. Since shale formations are by nature low level radioactive a measurement device can be lowered into the well. By taking ongoing radiation measurements the operator can identify the depths of the shale formations, which helps in the completion process. This process is called "gamma ray logging", and has been described as follows:



GAMMA RAY LOG

- Gamma Rays are high-energy electromagnetic waves which are emitted by atomic nuclei as a form of radiation
- Gamma ray log is measurement of natural radioactivity in formation verses depth.
- It measures the radiation emitting from naturally occurring U, Th, and K.
- It is also known as shale log.
- GR log reflects shale or clay content.
- Clean formations have low radioactivity level.
- Correlation between wells,
- Determination of bed boundaries,
- Evaluation of shale content within a formation,
- Mineral analysis,
- Depth control for log tie-ins, side-wall coring, or perforating.
- Particularly useful for defining shale beds when the sp is featureless
- GR log can be run in both open and cased hole

Accommodation Doctrine

Getty Oil Co. v. Jones
Supreme Court of Texas
470 S.W.2d 618; 14 Tex. Sup. J. 372; 53 A.L.R.3d 1;
39 Oil & Gas Rep. 657
May 26, 1971

John H. Jones, respondent, the surface owner of a tract of land in Gaines County, Texas, sued for an injunction to restrain Getty Oil Company, petitioner, an oil and gas lessee, from using vertical space for pumping units that prevent the use by him of an automatic irrigation sprinkler system, and for damages.

Upon trial, the jury found that it was not reasonably necessary for Getty to install pumps that prevented the operation of the irrigation system; and that by doing so Getty decreased the market value of the land $117,475, and decreased the value of the use of the land from the time of erection of the pumps until the trial by $19,000. The trial court granted Getty's Motion for Judgment Non Obstante Veredicto on the ground there was no evidence that Getty used more lateral surface than reasonably necessary. Upon appeal, the court of civil appeals reversed the judgment of the trial court, holding that vertical as well as lateral space was restricted to that which is reasonably necessary.

The court remanded the case, however, on the further holding that the trial court had erroneously instructed the jury. One Justice dissented. 458 S.W.2d 93. Both parties have filed applications for writ of error. We affirm the judgment of the court of civil appeals.

In 1955 Jones purchased the 635 acre tract of land in question, which was subject to prior mineral leases in which he acquired no interest. Getty holds an oil, gas and mineral lease covering 120 acres in the west half of the tract; Amerada Petroleum Corporation holds a similar lease covering the remainder of the western half of the tract.

The lease for the eastern half of the tract is held by Adobe Oil Company. Jones has drilled seven irrigation wells since 1955, five of which are used to irrigate this tract of land. Prior to 1963, he used hand-moved, and later power roll, irrigation equipment to irrigate the tract. In 1963 he installed a self-propelled sprinkler irrigation system known as the "Valley System." This system consists of 1,300 feet of pipe supported at a height of seven feet above the ground by a series of steel towers which rotate in a clockwise direction around a pivot point. The system can negotiate most obstacles which are less than seven feet in height. The pivot points are connected by underground pipes to the irrigation wells. Labor is required only to move the system from one pivot point to another. There are six pivot points which provide for irrigation of the entire tract except for a few corner areas. At the time Jones installed the system Getty had one producing oil well in the northwest corner of the tract. This well had a beam-type pumping unit considerably over seven feet in height; however, the unit was outside the circumference of the closest pivot point and did not interfere with operation of the sprinkler system.

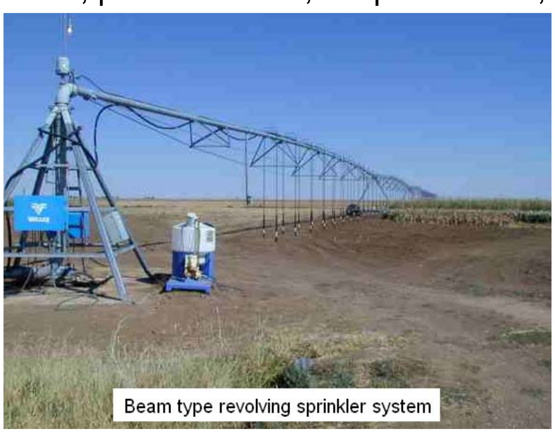
In December of 1967 Getty drilled two additional wells on its 120 acres which produced but would not flow. Getty installed two beam-type pumping units, one of which is seventeen feet high at the top of its upstroke, and the other thirty-four feet high.

Because of this height, the pumps preclude the use of four pivot points of Jones' irrigation system with a consequent depreciation in the value of the land because of the reduction in its production potential. Getty also has battery tanks placed on the land that are outside the circumference of the irrigation system and do not interfere with it.

Prior to the time Getty developed its two new wells, Adobe had drilled four wells on the eastern half of the Jones tract and had installed beam-type pumping units on each of the wells. Two of these wells were outside the circumference of the closest pivot points of the sprinkler system; the others would have interfered with the system and were placed in concrete cellars to provide clearance. In addition, the cellars were placed so that the support towers of the sprinkler system would pass around them. In its portion of the tract Amerada also has two wells within the circumference of the irrigation system but both utilize hydraulic pumping units which are less than seven feet in height at the well head and hence do not interfere with the irrigation system.

A pump-jack is sized based on the depth of the well and the expected fluid volumes. Many wells produce both crude oil and produced water, with the water making up the majoring of the fluid stream. Some can get quite large - and will interfere with irrigation equipment

The power unit for these hydraulic pumps is also located so as not to interfere with the system. The oil and gas lease grants Getty the land "for the purpose of investigating, exploring, prospecting, drilling and mining for and producing oil, gas and all other minerals, laying pipe lines, building roads, tanks, power stations, telephone lines, houses for its employees, and other structures thereon to produce, save, take care of, treat, transport, and own said products." The lease obligates the lessee to bury all pipe lines below ordinary plow depth when required by the lessor. The lease contains no specific provision concerning the vertical usage of the land.



Beam type revolving sprinkler system

Jones does not charge Getty with negligence nor deny Getty's right to determine the location of its wells and to install some type of pumping equipment when necessary for production. His position is that under the facts and circumstances it was not reasonably necessary for Getty to install pumping units in the manner which denies him the use of his irrigation equipment.

Getty's principal contention is that it has a right to exclusive use of the superadjacent airspace above the limited surface area occupied by the pumps and that only the lateral surface of the land should be subject to the established rule of reasonably necessary surface usage. We disagree. It has long been recognized that ownership of real property includes not only the surface but also that which lies beneath and above the surface. The use of land extends to the use of the adjacent air. See United States v. Causby, 328 U.S. 256, 66 S.Ct. 1062, 90 L. Ed. 1206 (1946); Broughton v. Humble Oil & Refining Co., 105 S.W.2d 480 (Tex. Civ. App. -- El Paso 1937, writ ref'd); Schronk v. Gilliam, 380 S.W.2d 743 (Tex. Civ. App. -- Waco 1964, no writ).

Although the earlier cases were generally limited to a consideration of the lateral surface, we held in Brown v. Lundell, 162 Tex. 84, 344 S.W.2d 863 (1961), that the rule of liability of the mineral lessee for negligently and unnecessarily damaging the surface estate includes the subsurface. This decision implicitly recognized that there are vertical as well as lateral boundaries to the use of the surface estate by the oil and gas lessee. We now hold explicitly that the reasonably necessary limitation extends to the superadjacent air space as well as to the lateral surface and subsurface of the land.

Getty further says that if it has acted in a reasonable manner in accomplishing the purposes of the oil and gas lease, its right to so use the surface and the air above is absolute, and that the consequences to the owner of the surface estate are of no legal effect. The expert witnesses agreed that the beam-type pumping units used by Getty were more economical than the hydraulic pumping units; and there was no evidence of any intrinsic value to Getty from the extra expense of constructing below-surface cellars to house the beam-type units. So, Getty argues that their placement of the beam-type pumping units on the surface was authorized by the lease as a matter of law. The question to be resolved, then, is whether evidence may be entertained to show the effect of Getty's manner of surface use upon the use of the surface by Jones, together with the nature of alternatives available to Getty, in resolving the issue of reasonable necessity.

It is well settled that the oil and gas estate is the dominant estate in the sense that use of as much of the premises as is reasonably necessary to produce and remove the minerals is held to be impliedly authorized by the lease; but that the rights implied in favor of the mineral estate are to be exercised with due regard for the rights of the owner of the servient estate. Humble Oil & Refining Co. v. Williams, 420 S.W.2d 133 (Tex.Sup. 1967); General Crude Oil Co. v. Aiken, 162 Tex. 104, 344 S.W.2d 668 (1961); Brown v. Lundell, 162 Tex. 84, 344 S.W.2d 863 (1961); see Keeton & Jones, Tort Liability and the Oil and Gas Industry, 35 Texas L. Rev. 1 (1956); Comment, Land Uses Permitted an Oil and Gas Lessee, 37 Texas L. Rev. 889 (1959); Lambert, Surface Rights of the Oil and Gas Lessee, 11 Okla. L. Rev. 373 (1958); Davis, Selected Problems Regarding Lessee's [*622] Rights and Obligations to the Surface Owner, 8 Rocky Mt. Min. L. Inst. 315 (1963). In another context we recently gave recognition to the surface soil as a natural resource in Acker v. Guinn, 464 S.W.2d 348 (Tex. Sup. 1971): "[the mineral estate] owner is entitled to make reasonable use of the surface for the production of his minerals. It is not ordinarily contemplated, however, that the utility of the surface for agricultural . . . purposes will be destroyed or substantially impaired."

The due regard concept defines more fully what is to be considered in the determination of whether a surface use by the lessee is reasonably necessary. There may be only one manner of use of the surface whereby the minerals can be produced. The lessee has the right to pursue this use, regardless of surface damage. Kenny v. Texas Gulf Sulphur Co., 351 S.W.2d 612 (Tex. Civ. App. -- Waco 1961, writ ref'd). And there may be necessitous temporary use governed by the same principle.

But under the circumstances indicated here; i.e., where there is an existing use by the surface owner which would otherwise be precluded or impaired, and where under the established practices in the industry there are alternatives available to the lessee whereby the minerals can be recovered, the rules of reasonable usage of the surface may require the adoption of an alternative by the lessee.

The only evidence regarding reasonable means of irrigating this land is found in the testimony of witnesses presented by Jones. It was their testimony that a critical shortage of labor available to farms in the area necessitates the use of automatic sp nkling equipment in irrigating the land. Indeed, Jones testified that the decreasing availability of labor was the controlling factor in his installation of the self-propelled sprinkler system in 1963.

Getty sought by cross examination of the witnesses to establish that manual irrigation would suffice, or that a reversible automatic sprinkler would be an adequate alternative for Jones; all, however, rejected manual irrigation as a realistic alternative because of the labor shortage. Neither did the witnesses consider the reversible system a suitable substitute since it would require supervision night and day to avoid collision with the pumps; and that, even if supervisory labor is available, loss of a day's watering would result from moving the system to its proper position by the reversal procedures.

Although disputed by Getty, there was evidence to show that it had reasonable alternatives for obtaining its oil. A petroleum engineer presented by Jones testified that the construction of cellars adequate for the two pumping units required by Getty would have cost less than $12,000 when the pumps were initially installed, and that natural air circulation would alleviate the danger of hydrogen sulfide gas collecting in the cellars. He further testified that installation of large hydraulic pumps would have initially cost less than $5,000 more than the present pumps and would have annual operations costing from $350 to $1,000 more per year.

Another witness for Jones was a contract pumper for Adobe who was currently operating two beam-type pumps in cellars, together with twenty-five beam-type pumps on the surface. He testified that less maintenance was necessary on the units in the cellars than on the ones on the surface and that there was less leakage of hydrogen sulfide gas; he also testified that the prevailing winds ventilated the cellars.

The record thus indicates that the irrigation system currently in use affords Jones the most advantageous, and perhaps the only reasonable means of developing the surface for agricultural purposes. It is also indicated that there is available to Getty the two types of pumping installations -- the beam-type pumps in cellars or the hydraulic pumps on the surface -- which are reasonable alternatives to its present use of the surface; and that Getty's use of an alternative method of producing its wells would serve the public policy of developing our mineral resources while, at the same time, permitting the utilization of the surface for productive agricultural uses.
Under such circumstances the right of the surface owner to an accommodation between the two estates may be shown, dependent, of course, upon the state of the evidence and the findings of the trier of the facts. Here, the trial court submitted the following special issue and accompanying instruction:

> "Do you find from a preponderance of the evidence that Getty Oil Company's erection of the pumping units in question at its Numbers One and Two Wells at such excess in height so that Plaintiff's sprinkler system will not pass over the same constituted a use of the surface of the land in question in a manner which is not reasonably necessary?
>
> "In answering the foregoing Special Issue, you are instructed that a determination of whether the erection of such pumping units by Getty Oil Company constitutes a use of the surface of the land in question in a manner which is not reasonably necessary involves weighing the degree of harm or inconvenience, if any, such pumping units cause to John H. Jones against the utility, if any, of such pumping units to Getty Oil Company and the suitability of other measures, if any, which would substantially serve the purpose of such pumping units to Getty Oil Company at less or no inconvenience or harm, if any, to John H. Jones."

We agree with the court of civil appeals that inclusion of the phrase "at such excess in height" in the issue was erroneous as a comment upon the weight of the evidence.

Additionally, and as also recognized by the court of civil appeals, the accompanying instruction erroneously calls for a weighing of harm or inconvenience to Jones against the considerations pertaining to Getty. This is not the proper test, particularly in the suggestion that inconvenience to Jones may be a controlling element. There must be a determination that under all the circumstances the use of the surface by Getty in the manner under attack is not reasonably necessary.

The burden of this proof is upon Jones, the surface owner. Cf. Humble Oil & Refining Co. v. Williams, 420 S.W.2d 133 (Tex. Sup. 1967). Jones sought to discharge this burden by showing that the use which Getty is making of the surface is not reasonably necessary because of non-interfering and reasonable ways and means of producing the minerals that are available to Getty, the use of which will obviate the abandonment by Jones of his existing use of the surface, and that the alternatives available to Jones would be impractical and unreasonable under all the conditions. These are the elements to be considered by the trier of facts and the jury should be so instructed in resolving the issue of the reasonable necessity of the surface use by Getty, the mineral lessee.

We further hold, as urged by Getty, that in event it is ruled that Getty is making an unreasonable surface use, Getty will have the right to install non-interfering pumping units; and in such event Getty will not be liable in damages beyond the decrease in the value of the use of the land from the time the interfering pumps were installed to the time of their removal.

The judgment of the court of civil appeals is affirmed.

Dissenting opinion by Associate Justice McGee in which Associate Justice Pope joins.

DISSENT: McGee, Associate Justice
I respectfully dissent. . . . .[discussion omitted]

<u>Getty Oil Co. v. Jones</u>

Notes and Discussion

1. How does the accommodation doctrine set out in Getty impact the reasonable use doctrine?

2. To apply the accommodation doctrine must there be a pre-existing use of the surface?

3. What if there is no reasonable alternative to the oil and gas operator that would not interfere with the use of the surface?

4. Can an oil and gas operator drill a second well on the landowners property to dispose of salt water from an oil well producing on those lands? Dispose of salt water from wells located off the landowners property? Can the surface owner stop the use of their lands for salt water disposal if they are concerned about environmental harm? See: <u>TDC Engineering v. Dunlap,</u> 686 S.W.2d 346 (Tex 1985).

5. When determining whether the operator has violated the reasonable use doctrine or the accommodation doctrine, is it a question of law or a question of fact? Would this be advantageous to the landowner or to the oil and gas operator in most situations?

6. It is not uncommon to have oil wells and pumping units installed on agricultural lands. Notice that many pumps do not have fences in place to keep livestock away, many are powered by electricity so need an electric line to be run to the site, and a road will be required so the pump can be serviced.

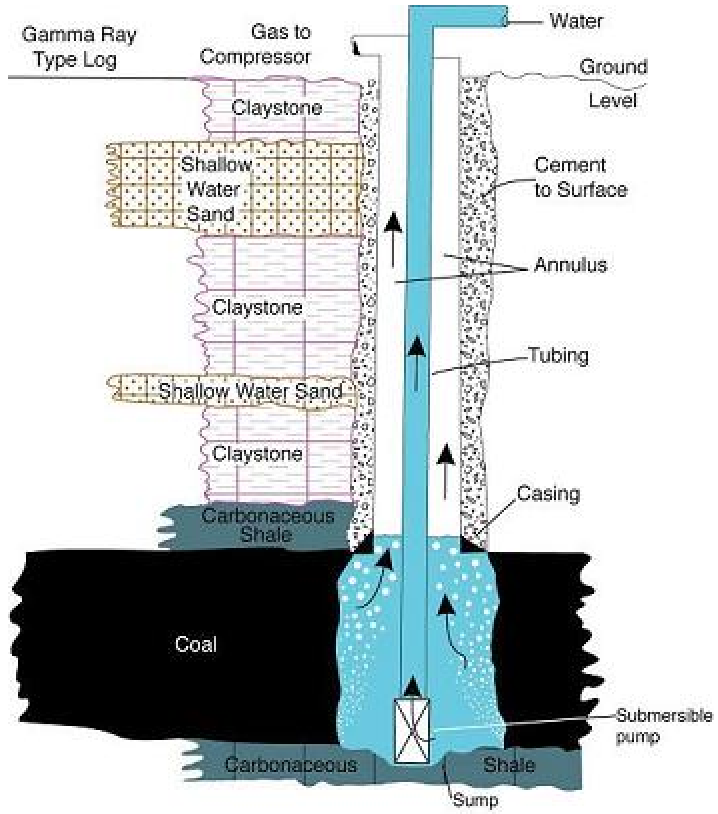
The road in most cases will wind through the agricultural field and crops. A pipeline or storage tank for the oil and produced water will also be required. Harvest and planting most likely will be impacted to some degree. How does the reasonable use doctrine apply, especially if the agricultural property is located in Texas where the accommodation doctrine is in play?

7. Pennsylvania attorney Robert J. Burnett, Esq. published the following note on the Accommodation Doctrine and other courts that have adopted the reasoning:

> *. . . Under the Accommodation Doctrine, the surface owner must generally show that the particular surface activities are not "reasonably necessary" to extract the oil or gas. Haupt Inc. v. Tarrant County Water, 870 S.W.2d 350 (Tex. App. Waco 1994). The surface owner can satisfy this threshold burden by showing that the mineral owner has available other reasonable means of production that will not interfere with the surface owner's use. "[I]f reasonable alternative drilling methods exist that protect [the surface owner's existing use], then an accommodation by the mineral owner would be required." Tarrant County Water v. Haupt Inc., 854 S.W.2d 909, 912-913 (Tex. 1993).*
>
> *Texas courts recognize, however, that "if there is but one means of surface use by which to produce the minerals, then the mineral owner has the right to pursue that use, regardless of surface damage." See, Texas Genco LP v. Valence Operating Co., 187 S.W.3d 118, 122 (Tex. App. Waco 2006). As such, the burden is on the surface owner to introduce evidence that the mineral owner has alternative means of access and production and that the current surface usage is not "reasonably necessary" because a reasonable and cost-effective alternative exists.*
>
> *Since the landmark Getty Oil decision, a number of other jurisdictions have adopted some version of the Accommodation Doctrine and have attempted to strike a delicate yet defined balance between the rights of the surface owner and the mineral owner. See, Amoco Production Co. v. Carter Farms, 703 P.2d 894 (N.M. 1985) ("Amoco's surface rights and the servitude it holds, however, must be exercised with due regard for the rights of the surface owner"); Hunt Oil Co. v. Kerbaugh, 283 N.W.2d 131 (N.D. 1979) ("...the owner of the mineral estate must have due regard for the rights of the surface owner and is required to exercise that degree of care and use which is a just consideration for the rights of the surface owner..."); Flying Diamond Corp. v. Rust, 551 P.2d 509 (Utah 1976) (mineral owner and surface owner "each should have the right to use and enjoyment of his interest..."); Diamond Shamrock Corp. v. Phillips, 511 S.W.2d 160 (Ark. 1974) (mineral owner must make reasonable usage of the surface and is liable for damages caused by any unreasonable use); Buffalo Mining Co. v. Martin, 267 S.E.2d 721 (W.Va. 1980) (mineral owner's use of surface must be "reasonably necessary for the extraction of the mineral" and "without substantial burden to the surface owner"). . . .*

Coal Bed Methane (CBM) Production & Surface Use

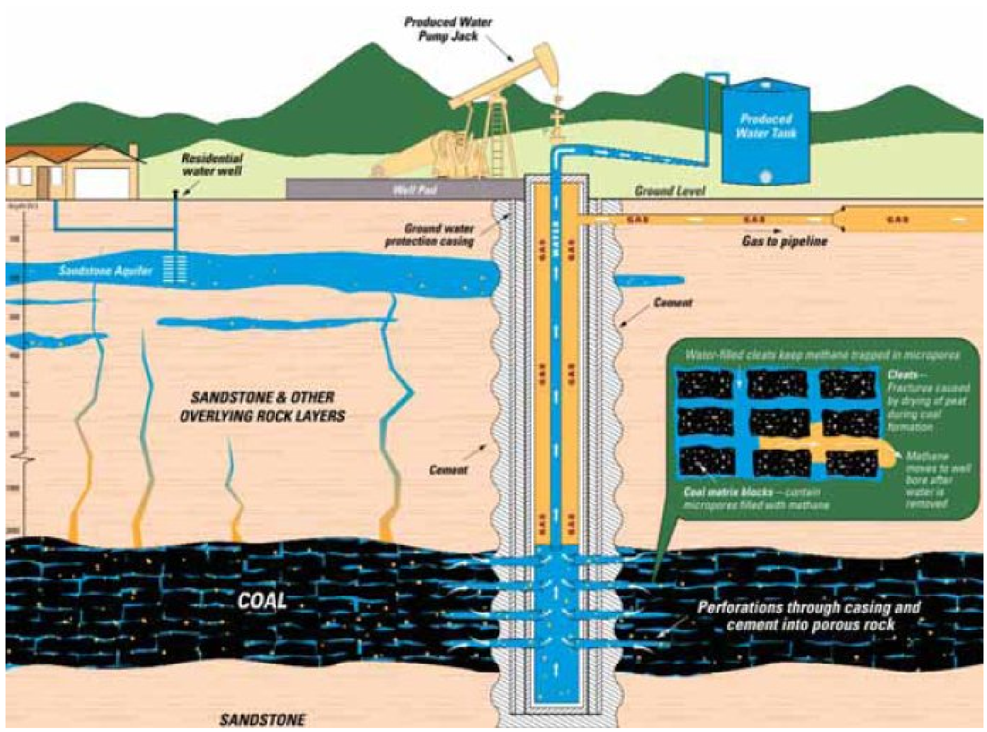
The oil and gas exploration and development industry is 150 years old in the U.S., yet procedures and operations are driven to a large extent by new technological developments. We will talk about 'horizontal drilling' and 'hydraulic fracturing' later in the course, as well as other technologies that have enhanced our ability to economically produce oil or gas resources.



Until the last couple of decades most natural gas wells were drilled vertically, straight down into the ground, and tapped into porous sands or limestone, and in some cases shale, to produce the natural gas in place. It has been recognized for centuries that natural gas also is commonly present in coal – in fact in England many miners wore a candle on their hat for light and would ignite the methane (natural gas) in the mine works, many times with fatal results.

About 25 years ago two unemployed drilling engineers in Wyoming decided to start a business to drill water wells until the oil and gas industry recovered. In drilling the water wells they found that as they produced the water in many cases natural gas also began to be produced – and sometimes in such quantities to create safety hazards at the surface.

Over a beer they devised an idea: drill shallow water wells into coal seams with the intent of producing the natural gas. Major companies had no interest – the amount was too small to make a difference in their production or reserves.



Professor Clayton Christensen wrote a book entitled "The Innovator's Dilemma" about this type of 'disruptive technology' – generally these technological advances start by being cheaper, simpler, smaller, more convenient, with lower profit margins and initially with worse performance (which is why most of the established companies will overlook the advance).

Over time the technology improves as it is implemented, with a learning curve. Due to the nature of this process thee disruptive technologies are ideally suited for smaller firms.

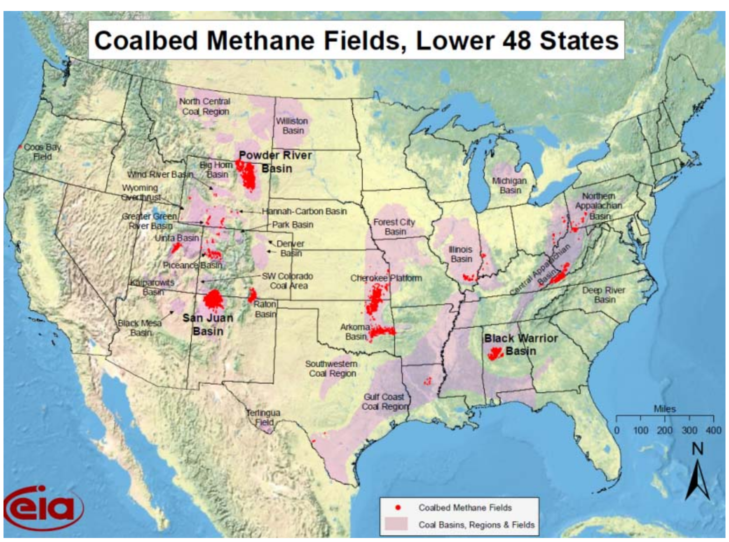
The engineers started a small firm to drill into coal seams and produce natural gas – termed “coal bed methane” – and did very well financially as they perfected their process. Comparing the drilling of a conventional well to a coal bed methane well illustrates the differences – and opportunties:

	Traditional Well	Coal Bed Methane Well
Well cost	$500,000	$30,000
Initial production	1 to 4 million cubic ft/day	0.1 to 0.2 million cubic ft/day
Time to drill	2 – 4 months	2 days
Depth	6,000 to 14,000 feet	100 to 500 feet
Life of well	3 to 10 years	10 to 75 years
Dry holes	1 in 5	1 in 25
Rig	oil and gas drilling rig	water well rig

****

By their nature CBM wells create special problems for the surface owner – they are generally drilled on a high density basis, many produce water or require the water table to be lowered to enhance production, and produce small amounts of low pressure natural gas (methane) for long periods of time (the CBM well generally has a life longer than the “normal” gas well. The EIA’s map of coalbed methane fields in the US is set out below.

Note the number of coal bed methane (CBM) wells that need to be drilled to recover the natural gas from the coal formation, along with the roads and pipelines.



Question:
Under the Accommodation or Reasonable Use Doctrine how far must an oil and gas operator go to satisfy a surface owner’s demands, especially in light of the fact that coal bed methane wells are generally spaced very close together, produce a lot of water, require the natural gas to be ‘compressed’ into the pipeline using an engine, and require a lot of pipeline infrastructure to gather the produced gas?

City Ordinances vs. State & Federal Regulation

Historically many oil and gas fields were discovered in areas that were rural and had low population densities. Land use and developmental activities were limited, and most fields were physically located well outside of cities and towns.

In more recent times, with the discovery of shale production under more populated areas, concerns about the interference with surface use by oil and gas developmental activity has increased. As a result many smaller towns and cities have proposed ordinances that restrict oil and gas drilling and production activity within their boundaries.

While there have not been a lot of published opinions directly on point with regard to these ordinances, the basic legal principles involving local regulation of oil and gas drilling and well development have been well established. Ordinances involving the regulation of land use have also established rules regarding the restrictions regulations may place on land use.

Constitutionally Protected Property Right

Owners of the mineral interest have an interest in real property, and as such those rights are protected by the Constitution. The government cannot take such property without reimbursement, but can regulate and restrict the use of such property in certain situations.

Police Power of the State

While privately owned real property cannot be taken by the government without compensation, its' use can be regulated for the health, welfare, and safety of the public at large. The courts will generally look at balancing the potential public harm with the potential interference with the property right, and the impact on the valuation of the restrictions, to determine if a taking has occurred.

An example of the use of the police power to restrict drilling activity was illustrated when oil and gas was discovered under Oklahoma City in the 1920s. The City adopted a drilling ordinance limiting drilling to only one well per city block, but all the mineral owners or lessees in that block could participate in the drilling of the well.

Challenged, the court found it was not a taking because all the mineral owners in that city block shared in the benefits of the well, and drilling needed to be limited to protect the public from blowouts, fires, and to insure the resource was developed without waste. So while the ordinance restricted drilling, drilling was restricted in a reasonable manner with the public interest protected, and the mineral owners all obtained a financial benefit from any development that occurred.

Likewise, the courts early on allowed states to regulate natural gas flaring, prohibiting such activity to protect the public safety. In addition to creating a safety hazard, the flaring of gas also reduced the ultimate recovery of oil in many fields, so was a conservation concern also. While restrictions on flaring impacted the mineral owner's rights, the court has upheld these ordinances and regulations as being a valid exercise of the police power.

Modern Ordinances

Modern ordinances that require setbacks, limited well density, noise controls, and blowout preventer's are also likely considered reasonable in light of the interest in protecting public health and safety.

On the other hand, an ordinance that prohibits drilling or hydraulic fracturing in all situations would essentially destroy the value of the mineral rights, and arguably would constitute a taking that would require compensation to the private party.

While there is no bright line between what is a taking and what is a reasonable restriction under the police power, numerous cases have adopted a balancing act when looking at oil gas and mining operations and the associated restrictions adopted under the ordinances.

Preemption Doctrine

Another concept that has come into play with regard to the regulation of drilling activity is the concept of preemption. Generally, federal law prevails over state law, which prevails over local ordinances.

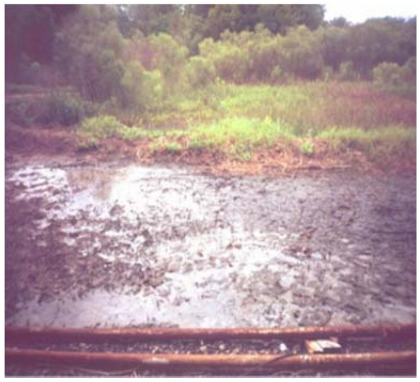
Where the state has delegated oil and gas regulatory authority to an oil and gas commission, arguably any local ordinances that conflict with the state regulatory authority or federal authority would be preempted - that is the state and federal licensing and permitting and regulations would take priority. If a conflict existed the local ordinance would arguably be deemed invalid by a reviewing court.

Because of the drilling boom in the United States, and the controversy with regard to hydraulic fracturing and the environmental and health impact, the adoption of ordinances by cities and towns is becoming much more common.

Each ordinance is unique reflection the facts and situation involved. As a result over the next decade expect to see more litigation on this area as courts better define how far localities can go when regulating and restricting mineral development.

Duty to Restore The Surface

The following production related equipment may be on a lease when it ceases production. How would you advise the operator with regard to their responsibility to the surface owner?


Over years of operations, many times an area will have dozens of pipelines buried – or on the surface. What responsibility does the operator have? What if the pipes are NORM contaminated? (mildly radioactive)

Generally an operator will remove the pumpjack and take it to another location, but the cement base the equipment sits on remains at the site.

If the surface is used for agricultural purposes these cement bases can damage plows, and interfere with agricultural activities.

Wellhead equipment, even storage tanks, might be left by the operator. Note the berm around the tanks.

Does an operator have to remove this equipment, and do they have a duty to contour the land to remove berms and any drainage ditches or roads they might have built?

What about underground pits? Do they need to be dug up and emptied? Or can you "plow them under" and cover them with dirt?

In Oklahoma the oil and gas regulatory agency has adopted the following regulations with regard to surface restoration:

165:10-3-17. Well site and surface facilities

. . . .

(c) Removal of surface trash. All surface trash, debris, junk, and scrap or discarded material connected with the operations of the property shall be removed from the premises. With written permission from the surface owner, the operator may, without applying for an exception to 165:10-3-17(b), bury all nonhazardous material at a minimum depth of three feet; cement bases are included.

. . . .
(k) Well site cleared. Within 90 days after a well is plugged and abandoned, the well site shall be cleared of all equipment, trash, and debris. Any foreign surface material is to be removed and the location site restored to as near to its natural state as reasonably possible, except by written agreement with the surface owner to leave the surface in some other condition. If the location site is restored but the vegetative cover is destroyed or significantly damaged, a bona fide effort shall be made to restore or reestablish the vegetative cover within 180 days after abandonment of the well.

(l) Restored surface. Within 90 days after a lease has been abandoned, surface equipment such as stock tanks, heater, separators, and other related items shall be removed from the premises. The surface shall be restored to as near to its natural state as reasonably possible, except by written agreement with the surface owner to leave the surface in some other condition. If the surface is restored but the vegetative cover is destroyed or significantly damaged, a bona fide effort shall be made to restore or reestablish the vegetative cover within 180 days after abandonment of the lease.

(m) Leasehold roads. All leasehold roads shall be kept in a passable condition and shall be made accessible at all times for representatives and field inspectors of the Commission. At the time of abandonment of the property, the area of the road shall be restored to as near to its natural state as reasonably possible, except by written agreement with the surface owner to leave the surface in some other condition. If the road area is restored but the vegetative cover is destroyed or significantly damaged, a bona fide effort shall be made to restore or re-establish the vegetative cover within 180 days after abandonment of the property.

(n) Extension of time.

(1) An operator may request an extension of time required in (k), (l), and (m) of this Section for not more than six months by applying to the District Office and showing that there is no imminent danger to the environment and that one of the following conditions exists:

(A) That an agreement with the surface owners is not possible.
(B) That adverse weather conditions exist or existed.
(C) That the equipment needed to conform to (k), (l), and (m) of this Section was not or is not available.

(2) If approved by the District Manager, the extension shall be granted and the surface owner shall be notified by the operator. Any extension beyond six months shall require application, notice and hearing pursuant to OAC 165:5-7-41.

Hydraulic Fracturing & Production

"Just as the discovery of oil at Spindletop near the Texas coast in 1901 launched a new chapter in the development of the American petroleum industry, a century later the opening of massive natural gas production in north Texas from a geological formation called the Barnett Shale has begun a new era in world energy" according to Diana Hinton, professor at the University of Texas. In her paper entitled "The Seventeen-Year Wonder: George Mitchell and Unlocking the Barnett Shale" she notes:

> Drilling in the Barnett Shale since 2000 touched off an urban gas boom throughout the greater Fort Worth metropolitan area. Far more significant, however, the Barnett Shale bonanza has revealed the incredible petroleum potential in shale formations throughout the United States.
>
> "Shale booms" have materialized in places as far flung as south Texas, North Dakota, and Pennsylvania, as well as overseas. Shale production could offer the United States far greater energy independence than anyone could have anticipated a decade ago, but the technology essential to it has also generated environmental apprehensions and controversy.
>
> As is so often true in the history of American petroleum exploration, the pioneer wildcatter to open the Barnett Shale was an independent prospector, the Houstonian George Mitchell, who spent seventeen years and millions of dollars to obtain natural gas from the formation. His story demonstrates how independent oilmen do business and why they remain important in an industry best known for its giant players.

Mitchell, now in his 90's, is on the Forbes wealthiest 400 list, having sold his energy company to Devon energy in 2002 for $3.5 billion. Financial columnist John Mauldin also discussed Mitchell in a note he published on December 10, 2012:

> **It Takes an Entrepreneur: George Mitchell**
>
> . . . I have to take you back to Wise County, Texas, about 60 miles west of Fort Worth. A Greek goat herder named Savas Paraskivoupolis (who changed his name to Mitchell) came to Galveston in 1905. His son George Mitchell worked his way through Texas A&M and got a degree in petroleum engineering. After the war, George teamed up with his brother Johnnie and Merlyn Christie.
>
> They drilled their first well in 1952, in what became known as the Boonesville Field in Wise County, near Bridgeport where I grew up. They went on to drill hundreds of gas wells but had to shut them down because they had no way to deliver the natural gas they found in abundance. The work was done at serious financial risk, but they just kept drilling and plugging those wells. Finally a contract for a pipeline was financed by an Illinois utility, and those wells went into production.
>
> What started as Christie, Mitchell and Mitchell soon became a major employer in my little hometown and a powerful spur to the local economy. The future father-in-law of my childhood best friend was first permanent North Texas employee, back in the early 1950s, and he was eventually joined by the fathers of many of my friends.
>
> Over the coming years Mitchell would drill over 10,000 wells, with over 1000 of them being wildcat or exploratory wells. He is a legend. His story is reminiscent of that of Walt Disney, who also lived constantly on the edge of crisis in the early days of his business. In the late

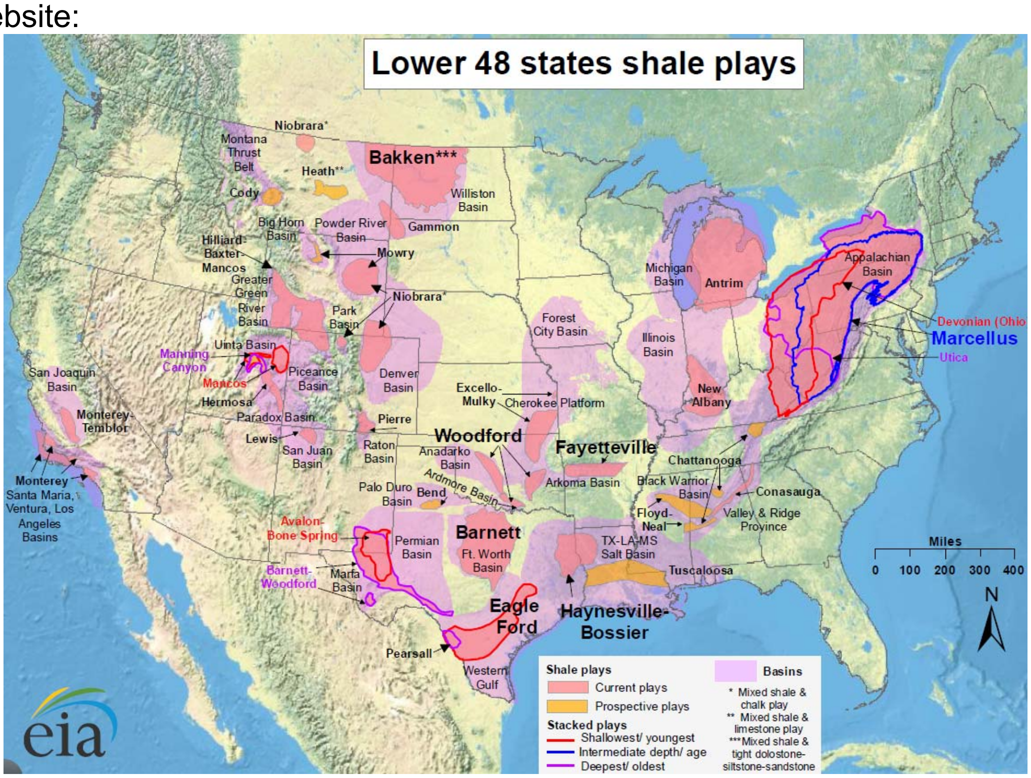
’80s and early ’90s Mitchell pioneered a new drilling method called horizontal drilling. It is still hard for me to imagine, that there is a small amount of flexibility in what seems like rigid steel pipe. Over hundreds of feet of drilling, they can turn a pipe inch by inch until it describes a 90° arc.

Everyone knew there was more gas deeper in the ground, but it was trapped in very tight shale formations. Mitchell and his engineers figured out how to put water under pressure back into the earth to create very minute fractures that allowed the gas and oil to be freed. This is the process known as hydraulic fracturing, or fracking.

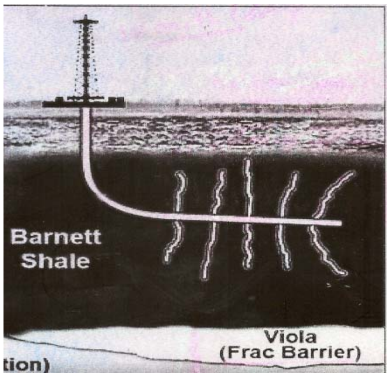
In the ’90s and especially the last decade, there has once again been an oil and gas boom in Wise county, in what is called the Barnett Shale. Except, the Barnett Shale is a far more massive formation than the original Boonesville field. Once again Texas was at the center of US energy production. The new technology opened up vast new reserves that were impossible to get to just a few years ago. . . .

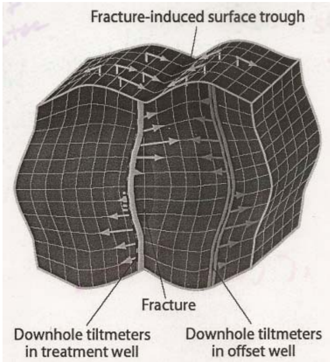
It was known for decades that the Barnett shale was a source of natural gas – the problem was the permeability of the host rock, in this case shale, was very poor. So while in place, the natural gas did not move toward the well bore as it did in many other formations. Knowing the gas was in place Mitchell, over more than a decade, developed the expertise to extract the gas in place from this difficult environment by massive injections of water and chemicals (hydraulic fracturing) and by directionally drilling horizontally into the formations using high-technology to guide track the bit as it drilled a mile or more underground.

With the technology upgraded with development in the Texas Barnett field producers moved on to other shale formations across the country, and due to pricing moved from a focus on natural gas to a focus on crude oil. Some of the shale basins in North America as set out in the following map from the US EIA website:

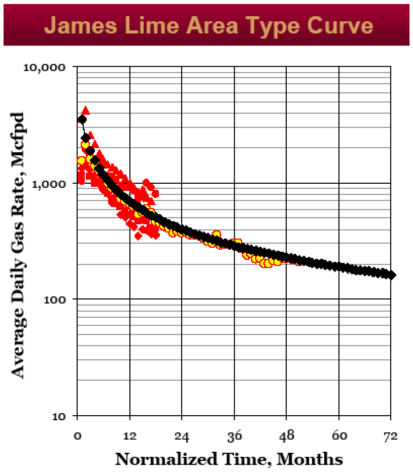


Depending on the location and drilling plan, a horizontal well usually costs between $3 to $15 million to drill and complete, injecting hundreds of millions into the Texas economy and creating jobs. The illustrations below show how the well is horizontally deviated, and 'tilt meters' can actually measure deformation due to the massive amount of water injected:





These operations can have substantial environmental impacts. Massive amounts of water are injected into the shale formations to 'fracture' the formation so the oil or gas can flow back to the wellbore. A massive amount of water is recovered from this operation and the return water can become quite salty. Pipelines have to be built. Drilling wastes must be managed. Air quality and air toxic issues arise. Noise and dust are also issues. Surface owners are usually not pleased with operations near their property. Groundwater can become contaminated.



One of the issues that arises with these wells is the massive 'decline curve' exhibited by the well, which creates valuation and reserve estimation issues. Every natural gas well will produce near maximum capacity when is has been completed, then generally production slowly declines with reservoir pressure as the well is produced and depleted. The decline curve at right was from a well drilled in the Haynesville shale in East Texas by Crimson Exploration.

For hydraulically fraced horizontally drilled wells into shale this decline in production is much higher than for a conventional vertically drilled well. For many of these wells a large proportion of the recoverable reserves is produced over the first 18 months or production – which means to keep a field's production level drilling has to be more or less continuous.

Engineers study the decline curve to estimate reserves and valuation, and some controversy arises as to how long these wells will produce. The 'tail' of the well might result in the well producing a relatively small amount of gas for years – and discounted to present value could impact the estimated valuation. Public companies have to report reserves and discounted present value of their proved reserves annually according to SEC rules, so there are legal implications involved with the engineering estimates.

Natural Gas Fracing With Nuclear Weapons

One of the more interesting – and early - oil and gas well fracturing experiments occurred in the 1960's under the 'Atoms for Peace' initiative. The U.S. government used nuclear weapons to attempt to frac several tight gas sand formations in Colorado.

While the fracturing process was a success, the natural gas was too radioactive to utilize. In 2010 several natural gas producers in the areas of the tests requested an exemption allowing them to drill for natural gas (using conventional drilling technology) closer to the test sites than allowed by regulation. A description of the nuclear project, from DOE information online, was posted at the site set out at the end of the note:

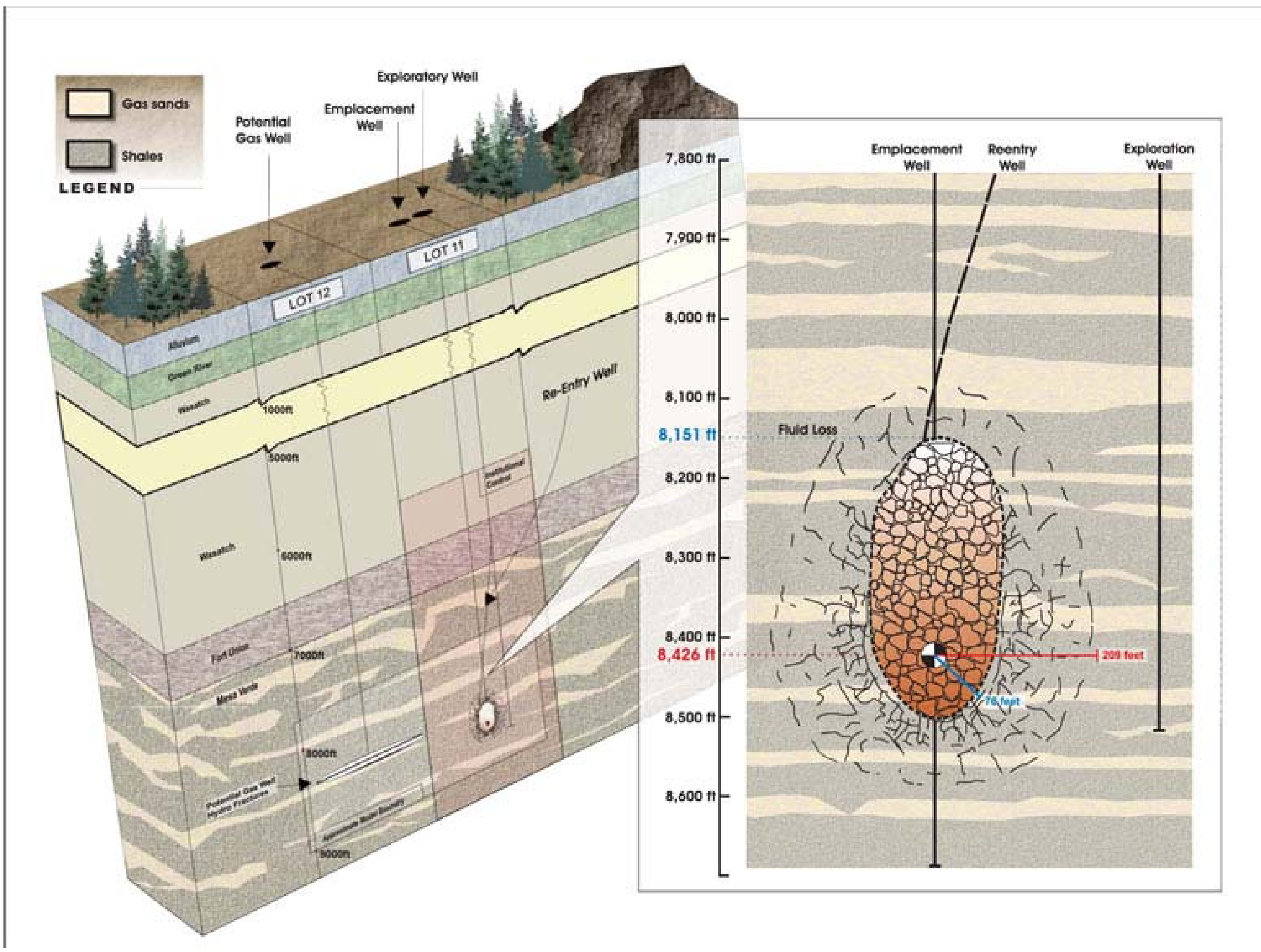


Image Rulison Site: DOE

"With the recent controversy surrounding fracking to release natural gas I found it interesting to learn that the Atomic Energy Commission (AEC), the predecessor agency to the Department of Energy (DOE) had actually tested three nuclear weapons for the purposes of natural gas stimulation - similar to fracking back in 1967.

“Testing was completed under the US Plowshare program. In all three tests, conducted in 1967, 1969, and 1973, they were able to successfully free the gas from the surrounding rock, however the gas was too radioactive to be commercially distributed to public utilities. So why did it take 3 separate tests and 5 nuclear weapons to come up with this conclusion?

The Plowshares program was initiated by President Eisenhower and announced as part of his Atoms for Peace speech at the UN calling for "more than the mere reduction or elimination of atomic materials for military purposes...that this capability [referring to nuclear weapons] would rapidly be transformed into universal, efficient, and economic usage." This speech opened the door for the Plowshare Program and the possibility to explore the US of nuclear weapons for projects pursuing economic develop not just for military applications.

Fracking is defined as:

- Hydraulic fracturing or fracking is a means of natural gas extraction employed in deep natural gas well drilling. Once a well is drilled, millions of gallons of water, sand and proprietary chemicals are injected, under high pressure, into a well. The pressure fractures the shale and props open fissures that enable natural gas to flow more freely out of the well.

While a nuclear blast does not use water, sand, and proprietary chemicals it does pressure the fractures and open fissures that enable the natural gas to flow more freely. Therefore perhaps we can say that it was a predecessor to today's fracking.

The three tests are described below:

Test 1: Gasbuggy Nuclear Test, December 10, 1967
On December 10, 1967 Project Gasbuggy, a project under US AEC Operation Plowshare Program, exploded a 29 kiloton nuclear device at a depth of 4222 ft or close to a mile underground in an effort to release natural gas trapped in the rocks. Lawrence Livermore National Laboratory (then Lawrence Radiation Laboratories) called "gas stimulation," the technique has been used employing conventional explosives, and it was hoped that a larger nuclear explosion would be capable of opening up gas deposits which are not otherwise economically viable.

The test called for a **29-kiloton nuclear device** to be placed at the bottom of a 4,240-foot deep shaft drilled in a "tight" shale formation known to contain natural gas. To a large degree the experiment went as planned: the underground cavity produced by the explosion, 80 feet wide and 335 feet high, filled with natural gas from the fractured surrounding rock. **However the gas was too radioactive to be commercially distributed by public utilities**.

Test 2: Rulison Nuclear Test, September 10, 1969
The Rulison test, part of the Operation Mandrel Weapons Test Series. Operation Mandrel was a series of 53 nuclear test explosions conducted in 1969 and 1970. This test series included a 1.2 megaton "calibration shot" code-named Milrow, which was detonated 1,220 metres (4,000 ft) underground at Amchitka Island, Alaska, and the 40 kiloton gas stimulation experiment code-named Rulison, detonated near Grand Valley, Colorado.

The Rulison underground nuclear detonation took place in Colorado in 1969, to investigate the possibility of using nuclear explosions to extract natural gas from low grade deposits. The test, a Plowshare Program experiment called Project Rulison, was performed by the Atomic Energy Commission and two corporate partners, CER Geonuclear and the Austral Oil Company, using a **43 kiloton bomb (greater than 2x the Nagasaki bomb)**, at the bottom of an 8,426 foot deep shaft. The blast was marginally successful in causing the gas to collect in the cavity and fissures produced by the bomb, however the gas was too radioactive to be sold commercially.

Following the initial production test, three intermittent gas-flaring tests followed. These tests showed that production of natural gas stimulated by the detonation was less than anticipated. Although approximately 455 million cubic feet of natural gas was produced, **elevated levels of radioactivity in the gas made it unacceptable for use at that time**.

Over 40 years later – The federal government prohibits drilling and extracting below 6,000 feet within a 40-acre zone surrounding surface ground zero.

Test 3: Rio Blanco Nuclear Test, May 17, 1973
Conducted under the Operation Toggle series 75 miles north of Grand Junction, Colorado

An underground nuclear test took place the Rio Blanco site in 1973, to investigate the possibility of using nuclear explosions to extract natural gas from low grade deposits. The test, the last in the Plowshare Program, was performed by the AEC and two corporate partners, CER Geonuclear and the Equity Oil Company, using **three simultaneously detonated 30 kiloton bomb**s, each at the bottom of a shaft more than a mile deep. The blast was marginally successful in causing the gas to collect in the cavity and fissures produced by the bombs, however **the gas was too radioactive to be sold commercially.**

The purpose of the Rio Blanco test was to stimulate the flow of natural gas in low-permeability geologic formations. The detonations were designed to create three blast cavities, each with a diameter of about 150 feet. The explosions were expected to create a rubble chimney above each cavity, and the three chimneys were expected to join. Each downhole explosive package had two major parts: the nuclear device assembly, which was encapsulated in a 30-foot-long canister, and a cooling system, which consisted of one 33-foot-long water tank and three absorber tanks, each about 36 feet long.

The detonations initially stimulated gas flow from the upper chimney in above-average quantities, but the pressure dropped 40 percent during post-detonation tests. The natural gas produced was also radioactive.

The three sites are now under the DOE Office of Legacy Management.

While I was familiar with the US Plowshares program I never realized that the US AEC had three nuclear tests for what is similar to what we would today call fracking.

According to a report by Princeton:

- "the most significant radiological concern was the incorporation of tritium produced by the nuclear explosive into the gas produced from the stimulated region.

- To reduce emplacement costs and tritium levels to the lowest possible levels, the Plowshare Program developed a special nuclear explosive less than 200 mm (7.8 in) in diameter that produced an extremely small amount of tritium (0.2 g), primarily by neutrons in the medium surrounding the explosive...

- Although project public radiation exposures from commercial use of stimulated gas had been reduced to less than 1% of background, it became clear in the early 1970s that public acceptance within the US of any product containing radioactivity, no matter how minimal, was difficult if not impossible.

- In addition, the economic viability of nuclear gas stimulation would require the stimulation of hundreds of wells over several decades, a prospect that proved daunting to potential industrial sponsors in light of growing public concerns about environmental quality.

- Following completion of the post-shot gas production testing of Rio Blanco in December, 1974, the gas stimulation program, together with the studies of other potential Plowshare applications, was rapidly phase down and the US Plowshare Program was terminated in 1977.

In comparison, the Soviet Union completed a total of 128 peaceful nuclear tests of which 9 were for gas stimulation.

Just for the record I'm not calling for the return of nuclear weapons to be used to liberate natural gas from rock formations rather I just think it is important to remember some of the things we tried that at the time seemed to make sense but in hindsight really don't seem like such a great idea. I wonder if we will do the same regarding some aspects of current day fracking."

Article source: http://www.nucleardiner.com/archive/item/natural-gas-fracking-with-nuclear-weapons Published online: Tuesday, 23 October 2012.

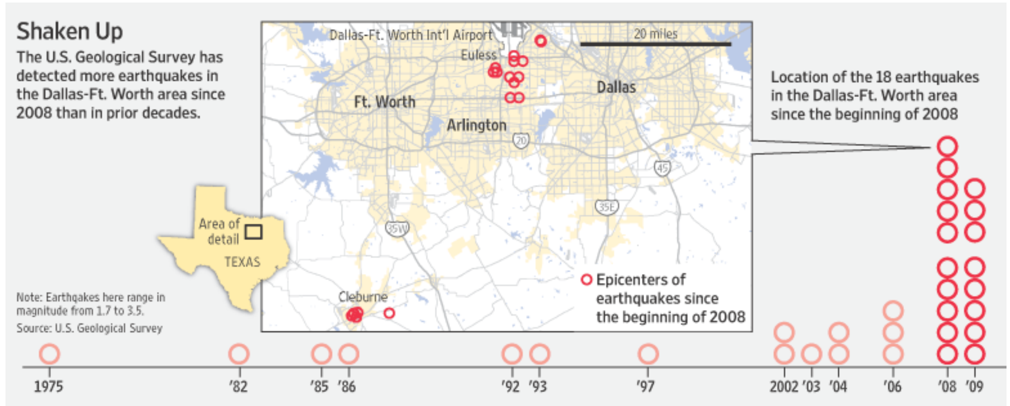
Earthquakes in Texas: Fracing Related?

The Wall Street Journal published the attached chart in a recent article discussing the correlation between hydraulic fracturing activities and earthquakes in Texas. Studies have been done in other areas also.

Industry notes that 'correlation does not prove causation' – and that injection wells may or may not have a role to play in the seismic activity.

Historically it is not uncommon for human activity to cause seismic activity. For example after the Hoover Dam was built seismic activity increased substantially as the dam filled and the water pressure impacted underground formations and faults. More recently China's Three Gorges Dam also has seen seismic activity spike as the dam filled.

Earthquakes in Texas are rare, and generally are very small. The problems establishing legal liability for any damages from earthquakes alleged to have been caused by hydraulic fracturing would be substantial, although circumstantial evidence might be introduced. Ultimately it would be a fact question to be determined by a jury.



Bloomberg.com

Chesapeake Waste Wells May Have Caused Earthquakes (Update2)

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By Thomas Korosec and Jim Polson

Aug. 14 (Bloomberg) -- Chesapeake Energy Corp. wells drilled through the Barnett Shale, the biggest Texas natural-gas field, may have caused earthquakes in the Dallas-Fort Worth area, the company and university scientists said.

Oklahoma City-based Chesapeake shut both wells, used to dispose of saltwater that is a byproduct of gas production, as a precaution after university seismologists told executives June 29 that the center of some quakes lay near the base of one of the wells, Steven Turk, vice president of the company's southern operations, said in an interview.

The wells were drilled as part of Chesapeake's exploration in the Barnett Shale, a band of rock under Texas that accounts for about 5 percent of U.S. natural-gas output. Both were drilled near known geological faults, or breaks in the underground rock, the company said.

"There is a relationship," Cliff Frohlich, senior research scientist and associate director of the University of Texas Institute for Geophysics, said in an interview. "We have not proven it with scientific certainty, but we're looking at these as induced earthquakes."

The well scientists linked to the minor quakes was drilled on the south end of Dallas-Fort Worth International Airport, the world's third-busiest. Studies of the second well and a possible link are continuing. The airport tremors and the base of the disposal wells are twice as deep as wells that produce gas from the shale layer itself.

ENERGY NEWS 21 CC

Studies Link Earthquakes to Wastewater from Fracking

The link between a recent rise in earthquakes and wastewater disposal from shale gas wells grows stronger, though skeptics remain.

By Jessica Leber on December 14, 2012

At the American Geophysical Union meeting in San Francisco last week, scientists presented the latest evidence tying the disposal of wastewater from shale gas hydrofracking to increased earthquakes.

Some U.S. states, including Oklahoma, Texas, and Colorado, have experienced a significant rise in seismic activity over the last few years, coinciding with a boom in fracking – a process that forces gas from hard-to-reach underground deposits by injecting water and chemicals into shale rock. Fracking produces huge quantities of wastewater that is typically disposed of in deep wells. But the degree to which the disposal of wastewater from fracking operations has caused the unusual seismic activity is still up for debate among scientists.

The question matters because most states don't consider earthquake risk when allowing gas drilling companies to dispose of large volumes of chemical-

Hydraulic Fracing and Water Use

Completing a horizontally drilled well by hydraulic fracturing can take thousands of gallons of water. In many areas water is in short supply – Western Texas, Oklahoma, North Dakota are three areas that come to mind. As a result conflicts can arise between the surface owner (who owns the fresh water), agricultural uses, and companies developing the area for oil and gas. Several recent articles have noted the conflict:

THE DICKINSON PRESS

www.thedickinsonpress.com — Sunday, March 17, 2013 — 30 Pages • $1.75

N. Dakota oil field is thirsty

5.4 billion gallons of water used in 2012

H_2O usage by oil industry

2012: At least 5.4 billion gallons

2011: 3.1 billion gallons

2010: 1.9 billion gallons

Source: State Water Commission

By Amy Dalrymple
Forum News Service

WILLISTON — The oil industry used at least 5.4 billion gallons of water in North Dakota in 2012, a record high and at least a 75 percent increase over 2011, according to preliminary figures from the State Water Commission.

About 70 percent of the water was used for hydraulic fracturing, with at least 2 million gallons of water pumped into the ground at each well, said Mike Hove, water resource manager with the State Water Commission.

The State Water Commission has permitted a total of 18.9 billion gallons of water for use by the oil industry, and has millions more gallons that are being considered for approval, Hove said.

WATER/A3

FNS Photo by Amy Dalrymple
A line of water trucks waits to unload in Williams County on Feb. 6.

Bob Shaver, a hydrologist with the State Water Commission, said while it may seem like a lot of water, his agency is taking a conservative approach when it comes to approving water permits. Water sources are not being depleted, he said. "Our management goal is to accommodate as much development as we can on a sustainable basis," Shaver said. "But we don't know what that sustainable amount is."

Because hydrologists need three or more years to know how an aquifer will respond, the commission tries to limit the amount of water drawn from an aquifer at first, Shaver said. After evaluating the aquifer, more water use may be permitted. . . . Trucking the water to well sites is destroying Oil Patch roads, particularly the township roads, said Dan Kalil, Williams County Commission chairman. . ..

The oil industry is just as eager to reduce that water truck traffic, said Monte Besler of Williston, an industry consultant who specializes in hydraulic fracturing . . . .Some individual frac jobs used 8 million to 11 million gallons of water per well, but the vast majority used between 2 million and 3 million gallons, according to data compiled by Hove.

One of the limitations of recycling frac water in the Bakken is the high salinity of the water that returns to the surface, said Beth Kurz, senior research manager with the Energy and Environmental

Research Center at the University of North Dakota. There is some recycling of water occurring, including companies that are using a blend of freshwater and recycled water, Kurz said. Other companies are working hard to develop a fracking technique that can use high salinity water, she said. “They are very motivated both economically and environmentally at the same time to do it,” Kurz said.

Another challenge with reusing that high salinity water is that companies have to store it on location, Besler said. A tank that leaks freshwater is not big deal, but storing recycled water brings environmental risks, he said. . . .

The amount of water being used by the oil industry may seem like “an inordinate or crazy amount of water,” but it should be considered in the context of other water consumption, Steadman said. For example, North Dakota used 37.9 million gallons of water in 2011 for irrigation, a wet year when less irrigation was needed, Hove said. Typical daily water use of a Midwestern city with 50,000 people is 10 million gallons, Kurz said.

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San Antonio Express-News

mySA.com | Wednesday, March 13, 2013 | The voice of South Texas since 1865

Enough water is seen for oil shale

Carrizo-Wilcox Aquifer examined

By Vicki Vaughan
STAFF WRITER

The 24-member Eagle Ford Task Force released a report Tuesday that answered the controversial question of whether there's enough water available for hydraulic fracturing and other uses such as agricultural.

Yes, there is.

After hearing from experts, the task force “concluded that the Carrizo-Wilcox Aquifer appears to contain sufficient water resources to support oil and gas drilling” in the Eagle Ford, including for hydraulic fracturing, along with other uses.

Most of the report, however, underscored the economic benefits of the shale play, outlined “best industry practices” and offered a handful of suggestions to deal with the boom's oil-and-gas downside.

Water continues on A12

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The New York Times
nytimes.com

October 15, 2008

EDITORIAL

Where Water Trumps Energy

Deep beneath the Earth's surface from New York to West Virginia sits the Marcellus Shale, an enormous geological deposit of natural gas. Natural gas is one of the cleanest fuels available — if you can extract it without ruining the water around it.

Retrieving Marcellus natural gas requires hydraulic fracturing with horizontal drilling, a process that shoots millions of gallons of water deep underground to break the rock and unlock the gas. Now that prospectors are using this process increasingly in Pennsylvania and hoping to begin soon in New York, there are two important questions: Where will all that water come from? And what happens to it when it is no longer needed?

New York officials are exploring whether it's possible to drill safely without poisoning water supplies. High on our list of concerns is whether the used water — some of it tainted with toxic chemicals — will later seep into streams, rivers and deep water wells, placing New York City's municipal water supply at risk. Before the state allows exploration, there should be a clear agreement on how the used water will be dealt with safely.

Energy companies have already signed so many new leases for drilling rights with landowners in New York and Pennsylvania that one farmer called it a "modern-day gold rush." Nobody wants to deprive these landowners of the money they can make, but the price of their good fortune cannot be the contamination of water supplies for everyone else.

Pete Grannis, the New York State environmental commissioner, promised at a recent hearing that, "we will not permit any drilling to take place that presents any threat to the city's drinking-water supply." That is an important commitment, but Mr. Grannis and Gov. David Paterson should take the safest course. While they search for ways to encourage drilling in less-sensitive areas, they should ban drilling anywhere near water supplies, and especially the city's watershed.

Proppants and Frac Sand

A proppant is a solid material, typically treated sand or man-made ceramic materials, designed to keep an induced hydraulic fracture open, during or following a fracturing treatment. It is added to a fracking fluid which may vary in composition depending on the type of fracturing used, and can be gel, foam or slickwater-based. In addition, there may be unconventional fracking fluids.

Fluids make tradeoffs in such material properties as viscosity, where more viscous fluids can carry more concentrated proppant; the energy or pressure demands to maintain a certain flux pump rate (flow velocity) that will conduct the proppant appropriately; pH, various rheological factors, among others.

The development of horizontal drilling and fracturing has increased the demand for frac sand, so much so numerous 'sand mines' have been opened in Minnesota, Wisconsin, and Texas. Each sand will have different qualities – hardness, size, shape – that are unique and will allow the operators to choose between them to most effectively treat a given formation. Sand mines also create dust, noise, and transportation issues for the parties, and reclamation and water use issues at the mine site.

25/9
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Bakken ripples outward

Need for sand stretches into Black Hills, Minn. river towns

By LAUREN DONOVAN
Bismarck Tribune

The Black Hills gold rush could turn into a latter-day sand rush aimed at the Bakken.

South Dakota is the latest of states that may turn its quartz sand deposits into cash just like it turned its hills into gold a century ago.

Millions of tons of sand are used in the Bakken every year to prop open deep hydraulic fractures to force oil to flow. All of that sand is imported by truck and train into the oil patch, where it's huge business.

Cambrian Enterprises, of South Dakota, has registered silica sand mining claims in three counties encompassing Deadwood, Rapid City and Custer.

The company's attorney, David Ganje, said the claims contain a conservative estimate of 80 million tons of silica sand.

"This is the closest known claim to the Bakken. I think this is an excellent idea for participating in the economic event called the Bakken," Ganje said.

South Dakota could mine sand out of the Black Hills at the same time Minnesota is talking about a one-year moratorium on new sand mining permits.

Minnesota Sen. Matt Schmit, D-Red Wing, introduced the legislation and said the timing is right for a moratorium because the industry is still small in Minnesota and the demand and price for silica sand are down now.

To meet industry standards, quartz sand has to be a consistent size and

Continued on 8A

ABOVE: A wide angle aerial view of a frack sand mining operation in Wisconsin. (Photo courtesy of Jim Tittle) **LEFT:** As many as 450 semi trucks will be hauling sand across this interstate bridge through the town of Wabasha, Minn., to a railroad transload in a residential area. The sand is being mined across the Mississippi River in Wisconsin. The town council imposed a moratorium on more frack sand facilities pending further study. (Photo courtesy of Mike Smith/Wabasha Herald)

South Dakota is latest on the frack sand scene after Wisconsin, which is a primary Bakken source. Wisconsin has more than 60 sand mines and 12 million tons were mined last year. The state's sand mining industry developed for glass manufacture and expanded in recent years for frack sand. In between is Minnesota, where sand mining is in its infancy, with 15 sand mines and operations and about a dozen permits pending, according to Schmit.

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BUSINESS

Sand mines boom along with fracking

Fracking has a mining industry in Central Texas booming.

BY VICKI VAUGHAN
VVAUGHAN@EXPRESS-NEWS.NET
: SEPTEMBER 13, 2011 : Updated: September 13, 2011 7:14pm

VOCA — Ron Jordan picked up a handful of damp sand as it cascaded off a broad conveyor belt, eventually bound for trucks or railcars that will take it to eager buyers in South Texas and around the country.

"This is the good stuff," Jordan said as he fingered the golden-colored sand. "This is what everybody wants."

The sand felt more grainy than the sand on your average Texas beach.

It was beach sand, though, that two days earlier had been mined from sandstone formed from an ancient sea that lapped what was shoreline here more than 500 million years ago.

MORE INFORMATION

More about Frac Tech Services: http://www.fractech.net
More about IHS/CERA: http://www.ihs.com

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Sand mining is booming in Central Texas, as drilling companies are demanding tons of it. Sand aids in getting the best production from wells drilled in the Eagle Ford shale of South Texas and other tight rock formations.

The sand near tiny Voca in south McCulloch County is prized because of its strength and purity. It's also plentiful and relatively easy to mine.

Jordan was showing off the sand at a mine and processing plant owed by Proppant Specialists LLC, an affiliate company of Frac Tech Services LLC of Fort Worth and Cisco.

It's one of several companies operating in McCulloch County, 140 miles northwest of San Antonio, that are seeing increasing demand for sand by companies for use in hydraulic fracturing, or fracking.

In fracking, a mixture of fluids and "proppants" are pumped at high pressure into a perforated well pipe to create small fractures in tight shale rock. The small fractures allow oil and natural gas to escape and flow out of the well.

hoto By SAN ANTONIO EXPRESS-NEWS

1 of 6

he building on the left is used for drying sand and the building under construction on the right is a resin coating lant where sand grains are coated with resin for use in hydraulic fracturing. The buildings are on the grounds of ne Frac Tech Services sand mining operation near Brady, Texas. (Wednesday August 31, 2011) JOHN AVENPORT/jdavenport@express-news.net

Photo By SAN ANTONIO EXPRESS-NEWS

6 of 6

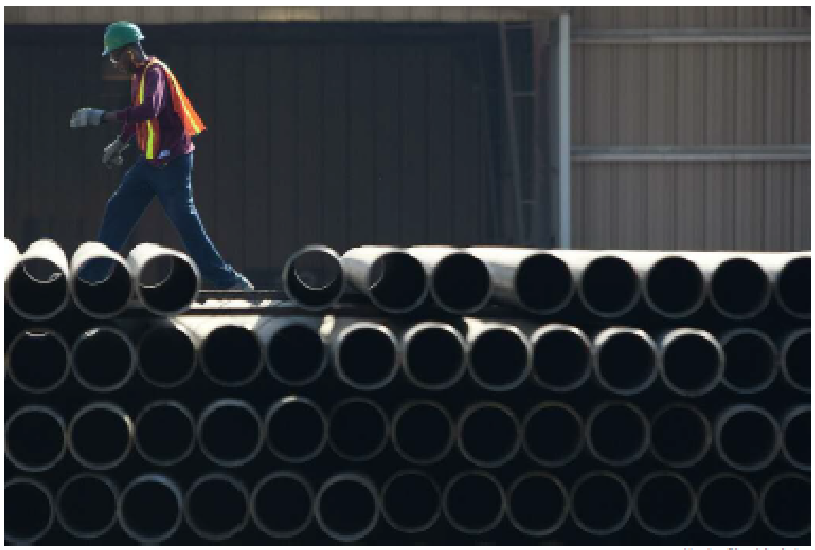
A mining truck (bottom, right) heads out after being loaded with sand and sandstone Wednesday August 31, 2011 at the Frac Tech Services sand mining operation near Brady, Texas. Sand from the mine is a high quality slica sand that is in demand for hydraulic fracturing operations in the oil and gas industries in areas like the Eagle Ford shale formation in south central, Texas. JOHN DAVENPORT/jdavenport@express-news.net

In addition to the boom in sand mining, each well needs tons of pipe to case the hole, drilling pipe, equipment, drilling, and related material. The result has been an incredible boom for the business community as evidenced the by following article – but also an increase in the environmental impact of all these developmental and support operations.

San Antonio Express-News

MYSA.COM | Saturday, February 16, 2013 | THE VOICE OF SOUTH TEXAS SINCE 1865

$1.5 billion plant set for Eagle Ford work



Houston Chronicle photos

A Tenaris employee lines up a stack of pipes so a forklift can pick it up. The piping made in Matagorda County will be used in shale drilling operations throughout the United States.

Matagorda County manufacturing site will produce pipe

By Jeannie Kever

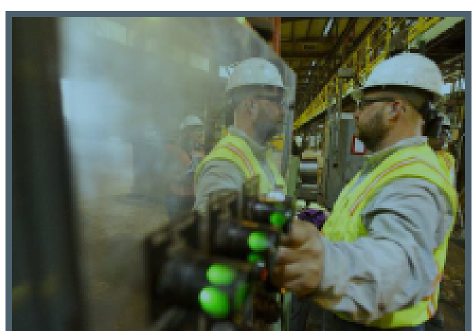
BAY CITY — An international manufacturing company with operations around the globe said Friday it will build a $1.5 billion plant in Matagorda County — near the bustling Eagle Ford Shale — to produce piping for use in shale drilling operations throughout the United States.

Germán Curá, president of North American operations for Tenaris, said the company was convinced by the incentives offered by Gov. Rick Perry and local economic development officials — including a $6 million grant from the state's Texas Enterprise Fund — and by the workforce and infrastructure in Matagorda County, about 90 miles southeast of Houston.

The county's proximity to the Eagle Ford oil and gas play was a plus.

"It is one of the most promising fields in the industry," Curá said. "The Eagle Ford has a lot to produce."

Plant continues on A16



Tenaris employee David Duroy stops operations so he and other workers can do a quality check on a line of pipe.

Coming Sunday

- The Eagle Ford Shale boom has drawn thousands of workers, but it has also brought tragic, on-the-job deaths. A1
- Also, an all-new Business Sunday with a focus on Eagle Ford.

Harold Hamm: Capital Allocation & Decision Making in the Bakken

As we noted in our introductory comments to this course, a basic understanding of the basic legal and regulatory framework surrounding the energy sector is essential to make informed decisions with regard to the allocation of capital for mineral development. In addition to this knowledge of the regulatory structure, over the last few years a number of studies have been conducted addressing the decision making process involved in capital allocation or investment.

In addition to the decision making and behavioral studies we have some real-life examples of energy executives who have make astute decisions with regard to the allocation of capital in the development of the shale resource. George Mitchell, Aubrey McClendon, Tom Ward, and Harold Hamm come to mind – all executives with companies that have been leaders of companies in the energy sector.

Harold Hamm, CEO of Continental Resources, grew up in the energy sector – but has no college degree – and is worth $8 billion mostly due to the performance of the company's stock. His firm is a large developer in North Dakota's Bakken Field.

The following article on Hamm and how he allocated capital to the development of the Bakken field was recently published in the Washington Post. We follow the article with a summary of recent studies on decision making, risk, evaluation, and luck – which offer a guideline as to issues that face an energy sector executive making capital expenditure decisions.

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A driller's unshakeable faith: Harold Hamm
An unabashed champion for the oil economy that made him rich

Washington Post
By Steven Mufson August 12, 2012

Harold Hamm sat in a corner of the Railhead Diner, having polished off a plate of meatloaf and savored a bite of the fried pie with chocolate filling.

Hamm, who grew up just across the tracks, has a lot to savor these days. As the youngest of a sharecropper's 13 children, Hamm spent his earliest years nearby picking cotton until the first snowfall or Christmas, whichever came first. Then he would scramble to catch up in school. Later, after the family moved to this small town, he delivered newspapers and played baseball in a lot that's still here. Since his home had no television, he would go across the street to watch with neighbors. His surviving sister, Fannie, still lives in a modest home here.

Billionaire oilman Harold Hamm pays a quick visit to the humble home in Lexington, Okla., where he'd lived in as a boy. Hamm, CEO of Continental Resources in Oklahoma, is a proponent of the Keystone XL pipeline project and backed Mitt Romney for the presidency. (Michael S. Williamson/The Washington Post)

Today, the 66-year-old Hamm is a multibillionaire who could buy the entire town several times over. An early believer in the notion that the techniques of horizontal drilling and hydraulic fracturing could be merged to unlock new layers of oil, he is the chief executive of Continental Resources, the leading exploration company in the booming Bakken Formation, which stretches across Montana, North Dakota and Saskatchewan. His 68 percent stake in the company is currently worth $7.7 billion, and Forbes recently ranked him the world's 76th-richest person. . . .

Most of all, Hamm promotes a vision of oil plenty. "There are two separate camps," Hamm said. "One of them is that the oil and gas resource is very scarce and running out; that the glass is not half full; that it is drying up. And the other [camp] being one of abundance and what's really here."

He said, "The one of scarcity, that's just wrong. It's been overtaken basically by the technology that's gone on with horizontal drilling."

Not everyone shares Hamm's optimism. Oil output in North Dakota has jumped sixfold over the past seven years, perhaps the biggest single increase in oil output worldwide, but that hasn't stopped prices from soaring. Hamm believes that the Bakken area holds 24 billion barrels, nearly as much as the proven reserves in the rest of the country put together — seven times as much as the most recent U.S. Geological Survey report (now being revised) and more than Prudhoe Bay. By 2020, similar geologic formations and drilling techniques could push U.S. oil production to 6.7 million barrels a day, a level not seen since 1994, says Barrington Research.

Even that wouldn't be enough to quench U.S. consumption and fulfill Hamm's vision of energy independence for America. . .

Striking it rich

Optimism and hard work are what made Hamm a quintessential American success story. His public relations person jokes that once people talk to the upbeat, personable oilman, they're "Hammanized." Even many of his political foes say he's hard not to like.

After leaving Lexington, Hamm moved to Enid, a town north of Oklahoma City that was experiencing a small oil boom. He did a joint work-study program, pumping gas while finishing high school. It took up to 60 hours a week, and he wrote a paper about the Oklahoma oil industry success stories of the century. Inspired, he went to work for an oil service company and then for Champlin Petroleum, a major oil company at the time. Oil workers were, he recalls, "a different breed . . . charismatic, uninhibited." After a few months, he went into the oil service business himself in 1966, starting out with one truck.

Although he was of draft age, with an A1 physical rating, he wasn't called to serve in Vietnam. "I guess the Lord didn't mean for me to go," he says.

In 1971, he lined up his first exploration deal. He was lucky. The first well he drilled produced oil. The second produced at a rate of 75 barrels an hour, "a very, very nice well," he recalls. The field ended up producing 6 million barrels, enough for Hamm to take college classes in geology and chemistry, though he did not earn a degree.

The sharp price increases that hit with the oil shocks of 1974 and 1979 created new demand for exploration in the United States. That helped Hamm's service company, which then had 11 rigs, some of which could drill as deep as 20,000 feet.

Companies were beginning to learn how to do "directional drilling," a precursor to today's horizontal drilling. Suddenly, urban mineral rights were valuable. "We drilled 16 wells under the city of Enid between 1983 and 1985," Hamm says.

What set Hamm apart from other moderately successful independent oil companies was the Bakken Formation and more effective drilling techniques. Horizontal drilling can snake a pipe through a two-foot wavy layer of oil-rich rock, and hydraulic fracturing, or fracking, can create more fissures over greater distances than before. Instead of tapping 15 or 20 feet vertically, oil companies can now tap miles of oil-bearing rock horizontally.

Hamm turned to North Dakota before most oilmen. Mineral rights were a fraction of what they cost now, and Hamm said he had "a gut feeling" that he would find a lode there. In 2004, Continental Resources drilled what Hamm calls "the first commercially successful well in the North Dakota Bakken to be both horizontally drilled and fracture stimulated."

The North Dakota rush was on. The number of rigs drilling in North Dakota has increased tenfold since then, and production has jumped sevenfold. And it has turned Hamm, who was already a rich man, into a very, very rich man. . . .

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Decision Making & Behavioral Studies

Recent behavioral and decision making studies related to the role of emotions and the impact of skill and luck in the decision making process. The following is our summary of the major research findings and how they impact the decision making process:

- **Risk, Fear & Courage** - Due to the 'hardwiring' of the human brain, a result of evolution, we place a great deal of value in avoiding danger and loss, reducing risk and fear, and averting harm.[3] Financial losses are processed in the same area of the brain that responds to mortal danger, therefor risk makes many individuals and investors uncomfortable.[4] Many decision makers consciously or unconsciously seek to avoid risks, or attempt to substantially reduce exposure to risk.

When making decisions scientists find that in day to day activities most individuals rely on a fast, intuitive, and emotional based decision making process. This thought process exposes them to the risk-adverse hardwired biases. But the studies tend to find an odd fact – successful investors generally have bold personalities and have generally made bold decisions to assume selective risks that most individuals would have avoided.

Timid individuals are generally more likely to consider themselves unlucky according to the surveys. Hence the studies conclude that to obtain any type of substantial gain on an investment or wealth, risks must be incurred – at the very least an individual will need to put capital, time, or effort at risk.

- **Decision Making** - The risk adverse nature of the brain's hardwiring creates common errors in the investment decision making process. One reason investors avoid risk is that losses are very painful - three times as painful as gains are pleasurable according to behavioral scientists.[5] As a result many investors will subconsciously focus on reducing the risk of loss versus maximizing expected returns. Over time their risk adverse investments decisions tend to substantially underperform the markets or their benchmark.

Further, studies indicate that due to the risk adverse predisposition of most individuals many investors will hesitate to sell an investment at a loss due to the psychological pain. Studies of investor behavior

[3] Kahneman, Thinking, Fast and Slow (2012) discusses the common methods most individuals use to process information.
[4] Zweig, Your Money & Your Brain (2007) is a good overview of recent studies dealing with the biology associated with investment decision making and the implications for investors.
[5] DiSalva, What Makes Your Brain Happy and Why You Should Do The Opposite (2012)

in actual brokerage records indicate investors are much more likely to sell appreciated stocks than stocks that have lost value – a behavioral means to avoid the pain of loss.[6] Likewise business decision makers commonly avoid the 'sunk cost' concept and 'throw good money after bad' when an investment concept turns sour.

Studies also indicate that for most of the population there is an inverse relationship between taking financial risks and measures of analytical intelligence such as a SAT or IQ scores.[7] This fact would predict that professionals (doctors, lawyers, accountants, and engineers) may be especially predisposed to risk avoidance.

- **Learned Behavior From Investment Gains or Losses** - While losses are painful, studies have also indicated that immediate or unexpected investment gains are very powerful behavioral events due to brain chemistry and the reward process – and they can be addictive, like nicotine. "The neural activity of someone whose investments are making money is indistinguishable from that of someone who was high on cocaine for morphine" according to a recent study.[8]

This can severely distort the decision making process. These immediate gains tend to produce a 'day trader' or 'gambler' type mentality, which ultimately is not ideal for building wealth since few short term traders or gamblers make substantial returns over the longer term. Excess investment optimism and expectation of immediate investment gain favor decisions based on emotions, with little detailed analysis, situations where the risks incurred are not commensurate with the potential reward.

Unexpected or immediate investment gains cause the brain to released dopamine according to scientists, a substance that produces a natural high or state of general euphoria.[9] While the pain associated with losses is a powerful tool to 'teach' the brain to avoid similar investment mistakes in the future, the euphoria from the dopamine released when investment gains are realized is likewise a powerful tool which teaches the brain to accept risk and to repeat the decisions that created the gain.

The dopamine-induced general euphoria arising from investment gains can be used to explain the technology bubble, the real estate bubble, and the statistical fact that stocks that have increased in price over the last year are much more likely to continue to increase in price over the next twelve months compared to the market (a trait referred to as 'relative strength', 'persistence', or 'momentum').

The fact that the relative strength characteristic is seen in historical data across markets and across time periods adds weight to the premise this is a biologically-based behavioral response.

The intense pain associated with investment losses can explain why investors have fled the stock market into the 'safe' bond market since 2008 (money flow chart courtesy Financial Times). It can also explain the decline of trading volume at retail brokerages, and the meager equity mutual fund inflows (volume chart courtesy Josh Brown).

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[6] Zweig, Your Money & Your Brain

[7] Thomas J. Stanley, The Millionaire Mind, Andrews McMell Publishing (2000) is a good overview of the behavioral attributes of financially successful individuals.

[8] Zweig, Your Money & Your Brain

[9] Kuhar, The Addicted Brain: Why We Abuse Drugs, Alcohol, and Nicotine (2012) discusses the impact of dopamine n behavior.

Generally, when an asset class falls out of favor due to a severe correction, it tends to stay out of favor for some time as investors seek to avoid a re-occurrence of a painful loss.[10] This finding was confirmed by a survey of 1,000 U.S. households last year in which Prudential Financial found that 44% of those surveyed said they would 'never' invest in the stock market - ever.

- **Data Evaluation** – Successful investors tend to make decisions only after conducting extensive due diligence, weighing the risks and rewards associated with various opportunities, according to the studies.[11] One example is investor Charles Munger, who notes that one must look at dozens of opportunities in detail before finding one where the risk is commensurate with the reward.[12] But in an age of databases and worldwide connectivity no-one can know all the facts needed to make a decision – and the future cannot be predicted.

The human brain has evolved in a manner where it has not been programmed to deal with all the data it currently receives. Studies have shown that when an individual is given too much data the decision making process becomes very difficult. An example is a batter deciding in a fraction of a second whether to swing at a pitch in a baseball game – it is difficult to determine the type of pitch, where it will go, if it will be a strike, and if you can hit it based on the data input to the brain from the visual cues. A party can overanalyze a complex situation - and end up 'frozen' - unable to make a decision or perform (picture a batter taking a third strike).

Where an individual is subject to data overload, a common occurrence when dealing with investments, after conducting a basic analysis of the risks and reward studies indicate the individual is best to go with their experience (gained from 'defined practice') and their emotions (educated 'hunches') in making the decision. This means an individual will by necessity rely on past experience - and this takes time to develop.

A number of the studies and books note that experienced decision makers, when faced with difficult and complex decisions, form 'hunches' as to whether an investment will work or not. They may not be able to verbalize why they like (or dislike) the opportunity. Lucky people, and good investors, tend to conduct substantial due diligence - but in the end also rely on their 'gut instinct' developed from past experience.

- **Risk Management** - A study of wealthy households in *The Millionaire Mind*[13] discussed the findings of the role of risk and decision making for these successful individuals. While they in general had a fear of risk, the study found 'a clear and significant correlation between willingness to take financial risk and net worth'.

The risks assumed by these wealthy individuals were not wild gambles. The authors found that successful investors and business owners understood the relationship between risk and return.

[10] Coxe, The New Reality of Wall Street (2004)
[11] Lehrer, How We Decide (2010) discusses how the brain processes information and makes decisions.
[12] Lowe, Damn Right (2000) is a good overview of strategies used by Charles Munger and Warren Buffett to generate excess returns
[13] Thomas J. Stanley, The Millionaire Mind

They conducted due diligence and tend to invest in those areas where risks are minimized and returns are substantial. In addition, the wealthy households 'do many things to increase the odds of winning'.[14]

Wealthy households have addressed the hardwired behavioral tendency to avoid risk and have modified this tendency by engaging in strategies to reduce the fear of loss. Although the studies and advice vary, a number of common strategies are suggested for investors wishing to reduce risks while maintaining the opportunity for gains:

Invest in a profitable business niche – One of Warren Buffett's main investment maxims is to invest in a 'good investment boat' – that is one with good margins and growth potential.[15] Good management will not be able to counter a stagnant, low growth, low margin, highly competitive business in a way that substantially increases the value of the enterprise. A good business niche, and healthy growth and margins, are very important. Ideally the business should be scalable, that is can be grown without substantial capital infusions.

Utilize the 'Kelly Formula' – The Kelly Formula is a methodology to maximize investment gains by only investing when the probabilities are heavily weighted in your favor.[16] Avoiding fast, emotional-based decisions, successful investors take the time to analyze the odds and probabilities – to the extent they can be ascertained.[17] Once a good business niche has been identified, and the Kelly Formula is used to identify investment opportunities, the most successful investors tend to concentrate their bets to maximize expected returns.

When problems arise cut your losses - The strategy of selling quickly when problems arise assists in preserving capital. Selling quickly when the investment premise changes, or unforeseen business difficulties arise, is a difficult decision to make because of the fear of investment loss, regret, and the recognition that one has mis-analyzed the opportunity.[18] Good investors expect small losses as part of the investment business and accept the risks. Large gains should over time exceed the small losses.

- **The Role of Luck** – In *The Millionaire Mind* the researchers found that most millionaires surveyed did not attribute their success to luck – but surprisingly four of ten of the very wealthy millionaire households said luck was important or very important to the degree of their success. Their definition of luck was not taking a blind gamble, but a bet that the probabilities would reward them for the risks they incurred. Successful and lucky individuals are very good at examining situations and determining the odds of success given the potential risks and rewards.

There are numerous books and studies published on the topic of luck and on the question of why some individuals or investors seem to be lucky and others are not. The findings tend to be diverse, and are difficult to summarize. Many draw the conclusion that behavioral attributes can increase the probability that one becomes 'lucky'.

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[14] Stanley, Ibid.; See also Gunther, The Zurich Axioms (2005), discusses twelve strategies used by successful investors to manage investment risk

[15] Cunningham, The Essays of Warren Buffett: Lessons for Corporate America, Second Edition (2008)

[16] Poundstone, Fortune's Formula: The Untold Story of the Scientific Betting System That Beat the Casinos and Wall Street (2006)

[17] Rosenthal, Struck By Lightning: The Curious World of Probabilities (2006)

[18] Gunther, The Zurich Axioms (2005)

Some of the major themes we found from studies on the topic of luck include the following:[19]

Recognize opportunity - Bits of potential luck drift past most individuals constantly, but only the observant and bold take advantage of them. In *The Millionaire Mind* the researchers note their studies show wealthy households could see an investment opportunity that others ignored or otherwise did not recognize. One author stated it as follows: "Lucky people create, notice, and act upon chance opportunities where others do not."

Take reasonable risks – "Successful people, by being open to opportunity and exposing themselves to chance, take new directions that prove more fruitful than anyone could have predicted" according to one author of a book on luck.[20] Lucky people are bold, not rash, when exploiting opportunities provided the probabilities are in their favor.[21]

Persistence & positive attitude – Lucky individuals tend to work hard at developing their skills and are persistent in the face of failure. Bad luck is treated as a learning experience. Mistakes are analyzed in detail then discarded, and where appropriate new strategies are adopted. Many individuals who are lucky have a belief that they are subject to good fortune, which helps them persist during difficult times.

Hunches and experience – Numerous decision making experiences allow individuals to compile a set of subconscious facts and decision making rules which can be used to evaluate an investment or business idea. The lucky also work at developing their skills, some of which are very intricate but overlooked and difficult to explain to the unskilled (try explaining or teaching a new driver how to use a manual transmission).

Utilize contacts – Many lucky individuals have developed many professional and personal contacts. These contacts have created opportunities – many times unexpectedly. The lucky are curious and observant and engage those around them. These contacts also have skill sets that the lucky tend to utilize.

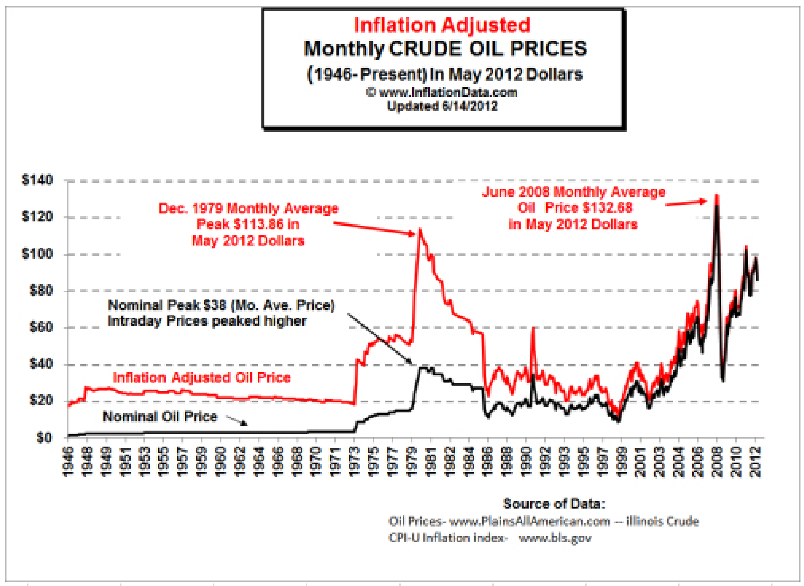
[19] See: Smith, Luck: What it Means and Why it Matters (2012); Gunther, The Luck Factor: Why Some People are Luckier Than Others (1977); Fitzgerald, Lucky You (2004); Myers, How to Make Luck (1999); Wiseman, The Luck Factor (2003).
[20] Smith, Luck: What it Means and Why it Matters
[21] In Damn Right, Charles Munger's biography, he claims a handful of bold decisions made when the odds were in their favor explains much of the excess returns he and Warren Buffett generated over the last five decades.

Enhanced Recovery Methods & Issues

Over time, crude oil production from fields naturally declines. Studies indicated that globally the 'depletion rate' for the average oil reservoir is around 4% to 6% per year – meaning that producers need on average to find 4% to 6% more oil each year just to keep production level.

Pressures forcing the oil in place to the wellbore deplete with time and production, leaving the majority of oil remaining in place – unrecovered. To exploit this asset producers need to add reservoir pressure or force to squeeze the remaining oil through the formation to the well bore. They did this using produced water in many cases, with surprisingly good results. Later carbon dioxide, nitrogen, fresh water, and other substances were used (for example steam).

While effective in recovering oil left in place a number of problems can arise. First, the re-injected water is usually very salty, therefore very corrosive. Leaks from tanks or pipelines are not uncommon as they corrode. By definition these projects are in older producing fields that are depleted, and improperly or unplugged wells are not infrequent. These wells create 'salt springs' on the surface, or can contaminate groundwater.



With the decline in production many of these fields become marginal, producing much more salt water than crude oil, which increases the potential environmental issues faced by an operator who might want to attempt an enhanced recovery project.

These fields before an enhanced recovery project can be quite marginal economically. Even without spending the capital needed for enhanced recovery a jump in oil prices can make a field much more attractive from a valuation standpoint – a ticket to fortune if the oil price moves upward. Oil prices have been extremely volatile over the last decade.

The leveraged effect of higher oil prices can be seen in the following example which uses the prices in the chart (above).

If this property was valued on the sum of the cash flow from existing production note it would go from worthless to quite valuable, all a function of future crude oil prices.

A Ticket To Fortune?

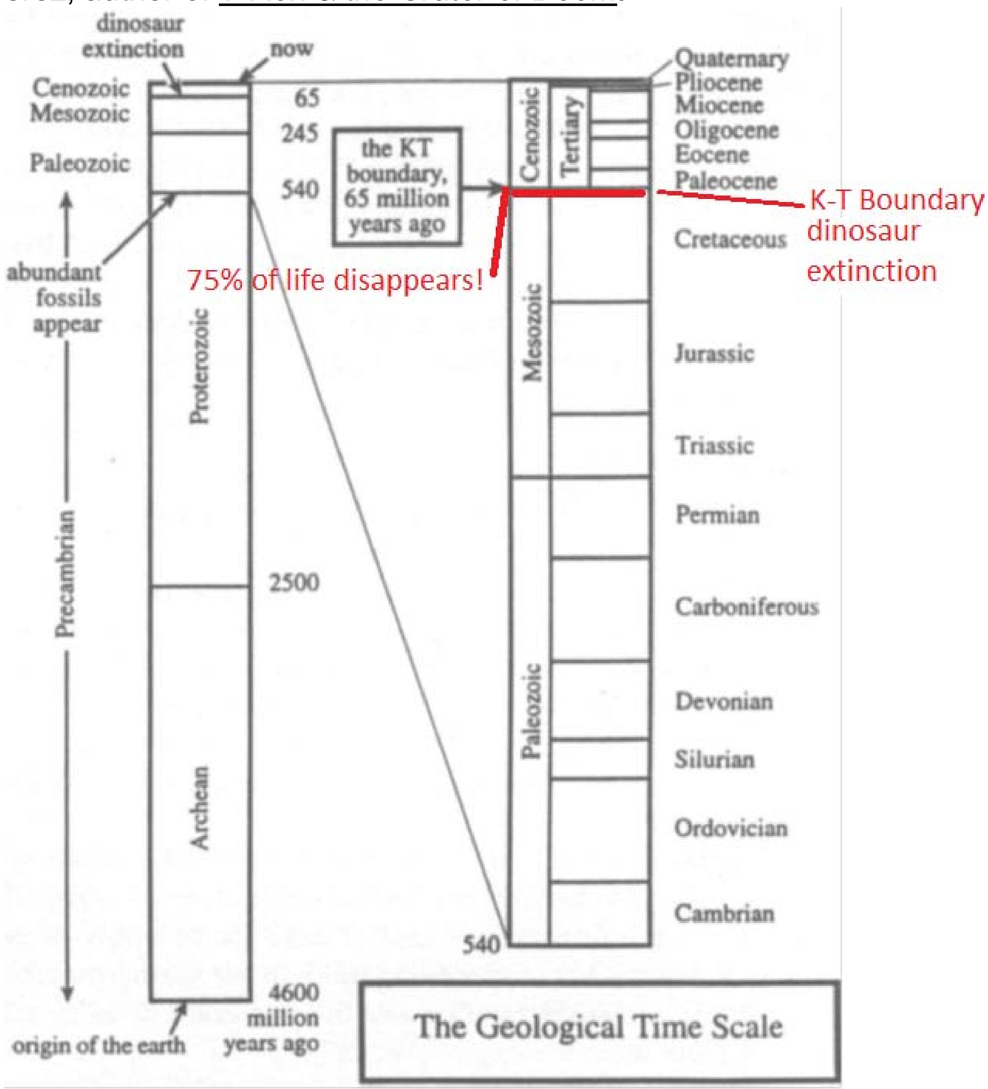
Marginal oil field economics: Case 1 - 5 year life of well with oil price constant								
	0	1	2	3	4	5	6	
	2002	2003	2004	2005	2006	2007	2008	
Revenues	$25	$25	$25	$25	$25	$25	$0	(well is depleted)
Expenses	$24	$24	$24	$24	$24	$24	$10	(well is plugged)
cash flow	$1	$1	$1	$1	$1	$1	($10)	
sum of cash flow:	($4)	(undiscounted)						
Marginal oil field economics: Case 2 - 5 year life of well with price of crude oil increases								
	0	1	2	3	4	5	6	
	2002	2003	2004	2005	2006	2007	2008	
Revenues	$25	$25	$30	$40	$50	$55	$0	(well is depleted)
Expenses	$24	$24	$24	$24	$24	$24	$10	(well is plugged)
cash flow	$1	$1	$6	$16	$26	$31	($10)	
sum of cash flow:	$71	(undiscounted)						

Of course for enhanced recovery projects product pricing is only part of the model. Hundreds of thousands if not millions of capital expenditures might be required to increase production, and the formation's response to such stimulation is never a sure bet.

The Crater of Doom & Mexico's Oil Production

If we go back 65 million years ago in geologic time, a mere fraction of the 4.6 billion year old age of the earth, we find an incredibly violent event occurred. Overnight, somehow 75% of all living species disappeared from the face of the earth never to be seen alive again. Included in those extinctions were the dinosaurs.

Numerous theories were proposed as to what caused this event, as scientists tried to piece together clues from the natural world. The extinction occurred at the end of the Cretaceous period – and started the Tertiary period. This point in time, 65 million years ago, has been named the 'K-T' boundary after a thin layer of clay found in many parts of the world. Chart of the earth's history below courtesy Dr. Alverez, author of _T-Rex & the Crater of Doom_.



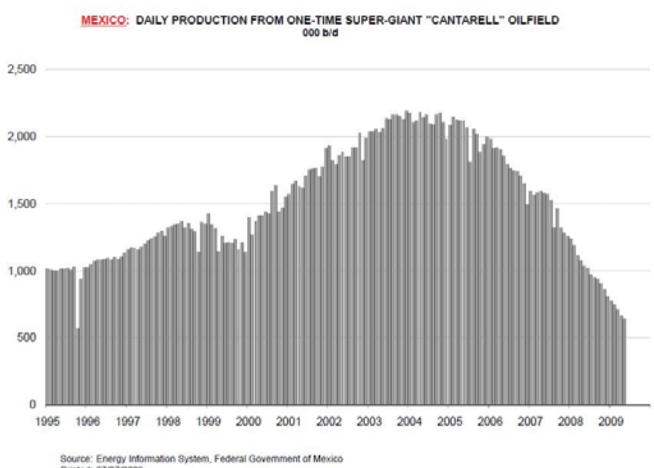
What was of intense interest about the K-T boundary was that it was found around the world, and had very high levels of iridium. Iridium does not naturally occur globally, and not at a specific period of history (here 65 million years ago), so scientist theorized that a meteor crashed into earth 65 million year ago, laden with iridium, and the massive dust cloud covered the earth – and killed off most life.

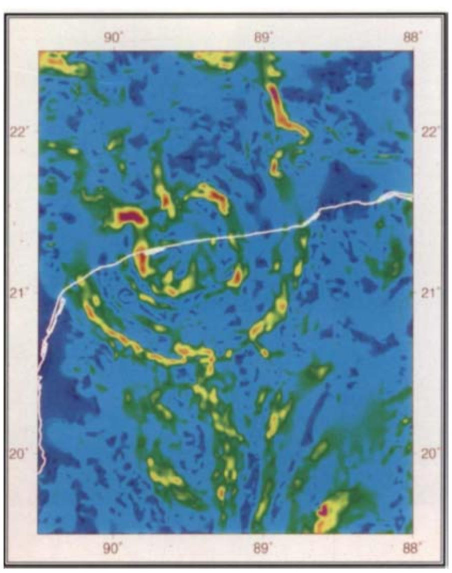
An example of the clay layer is set out in Dr. Alvarez' book, with a picture of Dr. Chuck Pillmore pointing to the thin white band of KT crater debris deposited above sea level that he discovered at Clear Creek, in the Raton Basin of Colorado and New Mexico.

The problem with this theory was that such a massive impact would leave a massive impact crater, and no such impact crater of the size required was found.

In the 1970's and 1980's scientists began to get assitance from NASA and other governmental agencies, using satellite imagry in an attempt to find the elusive 'crater of doom'.

Meanwhile in Mexico several fisherman were complaining to the government about massive oil spills in the Gulf of Mexico that were fouling their nets. The government investigators assumed that the oil was from tankers dumping their loads as they cleaned their bilges. On further investigation they found a natural seep of oil – and government run Pemex began to drill into what became one of the largest producting oil fields in the world – the famous Cantarell field in the Gulf of Mexico.





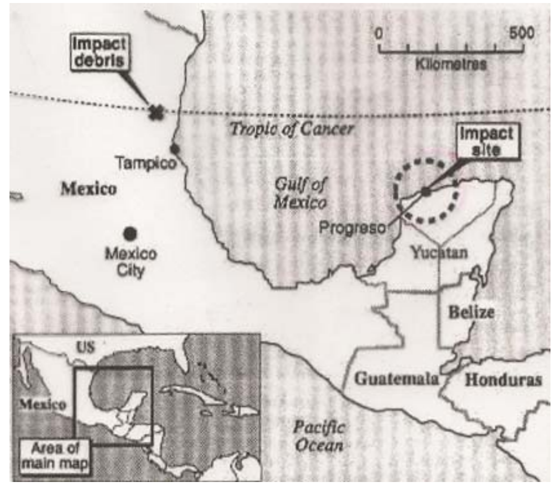
As development proceeded the Cantarell field became the second largest producer by volume in 2004-5, second only to the Gahwar field in Saudi Arabia. It truly was a 'super-giant' field.

Meanwhile scientists, with data from NASA satellites and varous surveys determined that there were some serious anolmolies around the Cantarell field – so much so that further investigation was needed to determine if this was an impact crater. The scientists referred to the area as the Chicxulub crater. Amazingly a map of the gravity gradient at Chicxulub was 'the smoking gun' (see above) that indicated this was a massive impact crater, and further tests indicated it was formed around 65 million years ago!

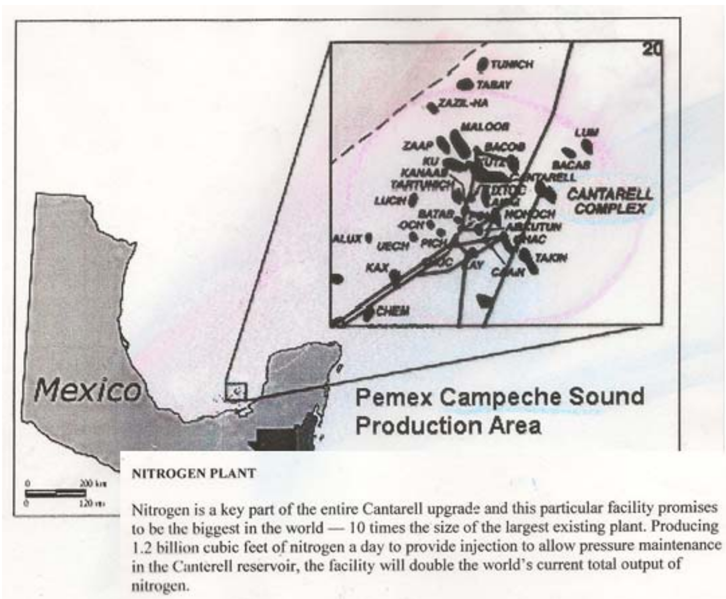
So one of the largest oil fields in the world was essentially ‘fraced’ by a massive impact crater 65 million years ago. Sometime between then and 1990 the structure filled with high quality crude oil, making Mexico a major oil exporter.

<u>Enhanced Oil Recovery – Nitrogen Injection</u>

The problem Mexico faced was that the impact crater formed a very effective pathway to wells drilled into the field. In order to increase the rate of production and recovery rates an enhanced oil recovery program was proposed. After looking at water injection, carbon dioxide injection, as well as other substances it was determined that nitrogen would be the ideal substance to maximize the economics of the field.



The problem was that nitrogen on this scale was not available. So Pemex built the largest nitrogen plant on the face of the earth, along with a generating station to generate the required power for such a large plant, and piped the produced nitrogen offshore for injection.



The results were astounding – production rocketed upward from 2000 to 2005 – from roughly 1.2 million barrels per day to around 2.2 million barrels per day. The problem then became the massive drop off of production – the nitrogen had been very effective in increasing production but the natural decline rate was also accelerated.

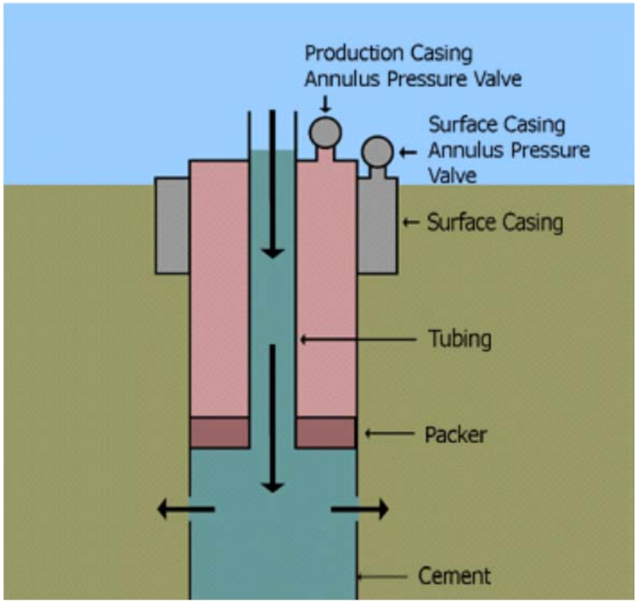
Today the Cantarell field is well past its’ peak, and Mexico is no longer the major oil exporter that it was a decade ago. Enhanced recovery had a major role to play here, in a field that was created on the day the dinosaurs went extinct.

UIC Wells & Regulation of Underground Injection

Many enhanced recovery operations use injected water, usually produced water, in their operations. Injected water is pumped under pressure into underground injection ("UIC") wells regulated under the provisions of the Safe Drinking Water Act. The Safe Drinking Water Act ("SDWA") focuses on the protection of groundwater that may be used for public drinking water supplies. 42 USCA Sec. 300h et. seq.

The EPA has designated five categories of injection wells under the SDWA:

Class I - Hazardous Waste Disposal Wells;
Class II – Oil & Gas Injection/Disposal Wells;
Class III - Mining & Power Generation Wells;
Class IV - Disposal Wells for Radioactive Wastes; and
Class V - Brine Mining Wells.



Class II injection/disposal wells dispose of non-hazardous oil and gas production waste (usually produced water), and are used in enhanced recovery and pressure maintenance projects. The SDWA contemplates that each state will take the lead in permitting and regulating UIC wells in accordance with certain minimum requirements that have been set out by the EPA.

Texas, Oklahoma, and Louisiana all have EPA approved state run UIC programs for Class II wells. Contamination resulting from the injection of salt water and other oil and gas production waste is also of concern to Texans. These injection operators are regulated by the Railroad Commission of Texas rather than the EPA.

The Railroad Commission of Texas has jurisdiction over injection wells used to inject oil and gas wastes -- mainly saltwater -- injection wells to be used for secondary recovery and those used to store hydrocarbons underground.

As of December of 2002, the Railroad Commission reported that it had permitted 51,338 so-called Class II injection wells, 33,026 of which were active. The vast majority of these consisted of secondary recovery wells (about 25,000), while there were about 8,000 saltwater disposal wells and some 500 active hydrocarbon and gas storage wells. Two confirmed cases of groundwater contamination resulting from injection wells have been documented in the past few years, though both have since been cleaned up.

Most officials agree that waste disposal through properly constructed and operated injection wells is safer and less likely to contaminate surface water or potable ground water than are landfills and other forms of land treatment. For example, injection of hazardous wastes into aquifers that serve or could serve as groundwater supplies for communities is not allowed.

Underground Injection - Texas Statewide Rule 46
Texas Railroad Commission Rule 46 authorizes the subsurface injection of produced water into underground injection wells, and sets out the monitoring and testing requirements for such wells. Water disposal wells are regulated under Texas Railroad Commission Rule 9 and injection wells under Rule 46. Both rules are basically the same except for the type of well being regulated.

Disposal wells can be used to dispose of salt water or other non-hazardous waste by injection into porous formations not productive of oil or gas. Special surface facility requirements apply if the well is a commercial disposal well.

The strata into which the fluids are injected must be porous and permeable enough to accept the amount of fluids proposed to be injected, and such strata must effectively confine or isolate the injected fluid to that formation. Areas that are faulted or fractured may not assure the isolation of the injected substance.

Injection wells can be used to inject salt or fresh water, gas, or other materials into porous reservoirs to produce oil or gas. Usually injection wells are used in secondary or enhanced recovery projects. Special requirements apply if fresh water injection is proposed. A water injection well, as can be seen by the picture at right, can be quite simple and small in stature on the surface.

Notice of the application for a injection permit must be given to the surface owner, offset operators, and the county and city clerks, and must be published in a newspaper of general circulation in that county.

The operator must review all abandoned wells within a 1/4 mile radius and prove that they have been plugged in a manner that will prevent fluid migration in these wellbores. Injection pressures and volumes must be monitored and records kept, and any changes that would tend to indicate a failure must be reported to the TRRC within 24 hours.

Maximum pressures and volumes, and limitations on the injected substances, will be set out in the individual permit. Yearly reports are required to be filed with the TRRC on Form H-10.
Under most state agency regulations UIC wells are to be tested every five years. In Texas and
In addition, before a permit is issued the placement of the packer, injected water volumes, injected water pressures, addition of corrosion inhibitors, addition of surfactant, behind pipe cement integrity, etc., will be reviewed by the regulatory agency.

Oklahoma and Texas UIC wells must be tested for mechanical integrity ("MIT tests") once every five years, although due to the configuration of some wells they may be required by permit to be tested annually. See: TRC Rule 9(k); TRC Rule 46(j)(2); OCC-OGR Rule 3-305(c)1.

In addition, before a permit is issued the placement of the packer, injected water volumes, injected water pressures, addition of corrosion inhibitors, addition of surfactant, behind pipe cement integrity, etc., will be reviewed by the regulatory agency.

Evolution Petroleum: Enhanced Recovery Case Study

As we noted in the above discussion of enhanced recovery the economics and returns involved can be quite impressive. Evolution Petroleum (symbol: EPM) is a public oil company based in Houston. They bought the mostly depleted Delhi field in 2003 and have spent around $6.8 million to date on the investment.

Farming the property out to Dallas based Denbury Resources to develop, the current discounted present value of the Evolution Petroleum's interest is $326 million for proved developed reserves, another $409 million for proved undeveloped reserves, and an additional $103 million for probable reserves. Not a bad return on investment from an engineering project – which is why engineers will say the best place to find new oil is in an old oil field.

Company slides, and a description from their website, is set out below:

FOUNDATION ASSET FOR FREE CASH FLOW

"Cash Annuity" to Fund Growth

Gross cum production	192 MMBO
Current production	5,057 gross BOPD (qtr ended 9/30)
6/30/2012 Reserves	7.5 MMBO Proved Developed (PV10: $326MM) 11.0 MMBO Proved (PV10: $409MM) 5.8 MMBO Probable (PV10 $103MM) 61% of 2P is developed 29% of 2P from royalty interests
Projected EOR recovery	13% Proved (% of Original Oil in Place) 4% Probable
Unit size	13,366 acres
Tax preferences	Severance tax holiday until mid-FY17
Acquired by EPM in 2003	Total investment 2003-06 of $6.8 MM
Farm-out to DNR in mid-2006	Received $50 MM + DNR pays for EOR Development + Reversionary interest
Upside Potential	• Original Oil in Place (OOIP) may be much greater – 3D seismic results • Higher EOR % recovery – high quality reservoir + residual secondary bbls • Accelerated development of smaller reservoirs now scheduled for decade-end and totally categorized as Probable Reserves

Delhi Field

The Delhi Holt Bryant Unit in the Delhi Field in Louisiana is currently our most significant asset.

- The Delhi Holt Bryant Unit is currently being redeveloped with an EOR project utilizing CO2 technology by a subsidiary of Denbury Resources Inc. as Operator;
- As of November, 2009, the Operator reported that CO2 injection had begun in Phase I of the Delhi Field EOR project;
- As of March 2010, the Operator publicly announced that first oil production had begun as a result of the Phase I CO2 injection and EPM began receiving its 7.4% royalty interest from the EOR production, net of operating costs.
- As of December 31, 2010, the Operator began first CO2 injection in Phase II of the EOR project.
- The Operator installed Phase III in 2011, out of a total of six phases, with Phases II-VI all significantly larger than Phase I in scope. First response from 2011 work was obtained in late 2012.

- The Operator began installation of Phase IV in 2012 and announced that 2013 capital expenditures would be focused on expanding the project in newly identified reservoirs within the currently developed portion of the project (Phases I-III).

We believe that the Delhi Holt Bryant Unit is a strong candidate for a CO2-EOR project due to its favorable rock characteristics, large unproven reserves remaining in place, low cost of drilling due to a relatively shallow depth and relatively close location to naturally occurring CO2 reserves approximately 100 miles east of the Delhi Field. We base our belief on (i) our internal analyses of CO2 pilot tests successfully completed in the Delhi Holt Bryant Unit by a prior field operator, (ii) our analysis of favorable analogous comparisons to successful full scale projects in the same or similar geological formation, (iii) a competitive offering process, wherein we solicited multiple major participants with CO2-EOR expertise, funding and operating abilities, leading to two confidential competitive offers made to us in writing, (iv) our qualitative assessment that the competitive offers were based on the CO2-EOR potential of the Unit and not on the relatively minor associated proved reserves existing at that time, and (v) the buyer's willingness to commit a portion of its proved CO2 reserves and substantial investment in a CO2 project in the Unit.

According to published reports and field records, the Delhi Field was discovered in the mid-1940's and was extensively developed by various operators including the Sun Oil and Murphy Oil companies through the drilling and completion of approximately 450 wells, most within the first few years after discovery. According to DeGolyer & MacNaughton ("**D&M**"), the independent reservoir engineering firm engaged by the Operator and by us to review the project, the Delhi Field has produced approximately 192 million barrels of crude oil and substantial amounts of natural gas to date. Much of the natural gas production was processed to remove natural gas liquids and re-injected for pressure maintenance. Beginning in the late 1950's, the field was unitized to conduct a pressure maintenance project through the injection of water into the producing reservoir in down dip injection wells (unitization is the process of combining multiple leases into a single ownership entity in order to simplify operations and equitably distribute royalties when common operations are conducted over multiple leases). Drilling operations resulted in primarily 40-acre spacing across the unit's 13,636 acres. A few wells were drilled below the targeted Tuscaloosa and Paluxy formations. The water injection pressure maintenance operations did not utilize a more traditional and effective five spot flood pattern water flood that generally results in a more complete reservoir sweep and oil recovery.

At the time we began our oil and natural gas operations in late September 2003, we purchased essentially all of the working interests and an 80% net revenue interest in the Delhi Field (from the surface to the top of the Massive Anhydride formation, but excepting the Mengel Unit), for approximately $2.8 million, including the assumption of a plugging and abandonment reclamation bond. All but 43 Delhi Field wells in Richland, Franklin and Madison Parishes, Louisiana had been plugged and abandoned and production averaged approximately 18 BOPD with no natural gas being sold due to a lack of natural gas processing and transportation facilities. The best producing well was immediately lost during a periodic sand wash work-over when water from a lower reservoir broke through along the casing exterior and into the producing reservoir.

In October of 2003, we applied an unproven lateral re-entry technology that resulted in no increase in production. In December 2003, we initiated a conventional development program based on re-completion of wells to other reservoirs and restoring non-producing wells to producing status. During 2004, we refurbished a gas injection line, converting it to a gas gathering and sales line, and placed a gas processing plant in the field to begin natural gas production in July of 2004. During 2005, we began a five well development drilling program aimed at reaching mostly proved undeveloped reserves left in primary “attic” positions. The culmination of these activities caused production to increase from 18 BOPD to a monthly average rate of 145 BOEPD during our peak production month in late 2005.

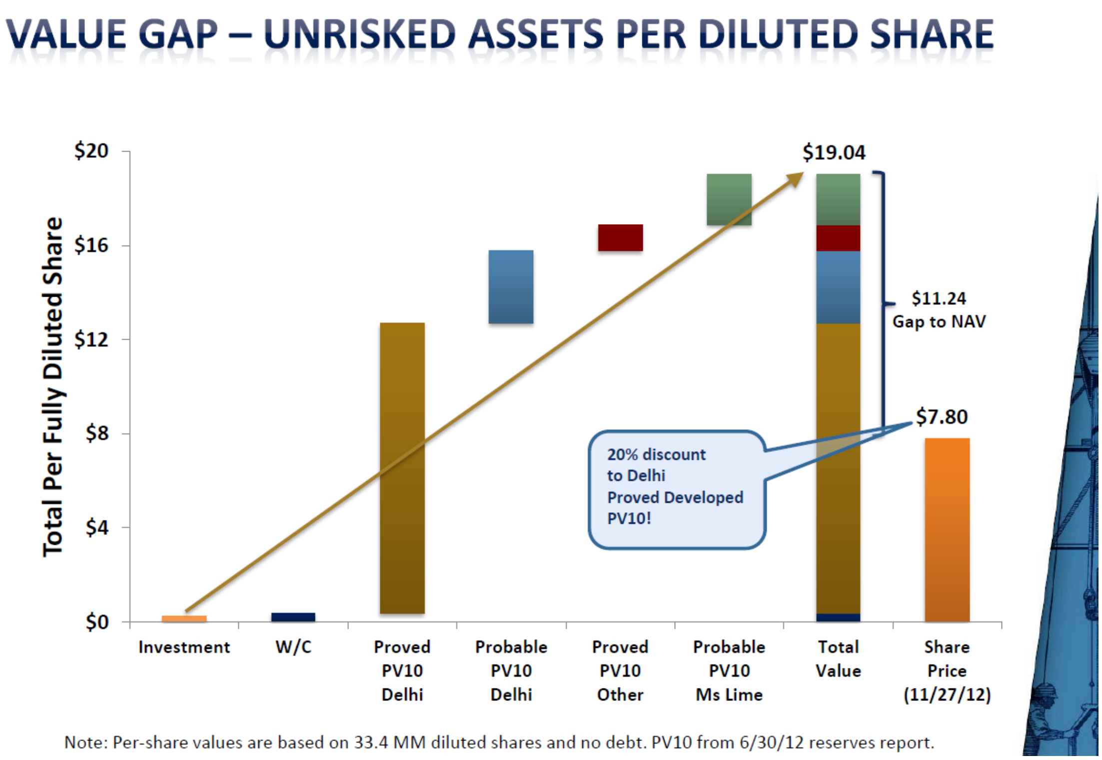
Concurrent with these activities, we completed internal studies indicating that the reservoirs in the Delhi Holt Bryant Unit, the dominant oil producing reservoirs, had substantial remaining recoverable oil in place. Based on positive CO_2 pilots conducted by Sun Oil in 1985, and favorable rock characteristics shown in multiple cores taken throughout the Delhi Field, we began discussions in late 2004 with potential industry partners skilled in CO_2-EOR recovery methods. During this time we also began to acquire royalty and overriding royalty interests that ultimately aggregated 7.4%. With positive industry reception, and following extended negotiations with three candidates as prospective partners, we accelerated our redevelopment plan in June 2006 by selling a major portion of our Delhi Field interests, in the form of a Farmout, to Denbury Onshore LLC, a subsidiary of the Operator for all of our working interests in the Delhi Holt Bryant Unit and its proved reserves and 75% of our working interests in certain other depths of the Delhi Field (the “Delhi Farmout”). Important aspects of this transaction include:

- We received approximately $50 million in cash (pre-tax) to redeploy to other projects and repay all of our then outstanding debt.
- We retained significant participating interests through a reversionary working interest of 23.94% (19.15% revenue interest net to us). We expect the value of these interests (along with the separately acquired royalty and overriding royalty interests aggregating 7.4%) will substantially exceed the $50 million cash component of the Delhi Farmout, subject to future oil prices, operating expenses, anticipated EOR performance and project completion by the Operator.
- The Operator committed to install a CO_2-EOR project in the Holt Bryant Unit and expend a minimum additional $100 million on the project over the first 6-1/2 years, subject to penalty payments to us for shortfalls in such expenditures. All capital expenditures related to the project are borne by the Operator prior to payout.
- The Operator is the dominant CO_2-EOR operator on the Gulf Coast, currently operating a large number of CO_2-EOR projects and owns naturally occurring CO_2 reserves that we believe to be sufficient to meet the needs of the Delhi project and which have been dedicated to the Delhi project.
- Our reversionary working interest in the CO_2-EOR project is based on a defined $200 million threshold, subject only to expansion of the project through acquisitions, and our reversionary working interest occurs when cumulative project revenues less direct operating costs in the field reach the threshold.
- We further retained a 23.94% working interest (19.15% net revenue interest) in certain other depths outside of the Holt Bryant Unit within the Delhi Field, and believe that additional development potential may exist in the shallower depths.
- Based on our independent engineering report, we will bear no capital expenditures for our proved reserves.
- Based on the project being approved by the State of Louisiana as a qualified tertiary recovery project, we do not expect to bear any severance tax on our net production until the full project reaches payout, including cost of capital.

As of June 30, 2010, our independent reservoir engineer assigned proved reserves for the first time, in the amount of 9.4 MMBO, plus 5.7 MMBO of probable reserves net to our interests at Delhi, with combined PV-10 of $275 million.

CO2 Recovery Potential at Delhi Field
The most logical method for recovering a large portion of this huge potential is through the injection of carbon dioxide in a miscible or immiscible gas flood. CO2 flooding is a commonly applied enhanced oil recovery method, used wherever CO2 is readily available to oil reservoirs similar to the Delhi Field. Naturally occurring reserves of CO2 are present in the Jackson Dome Field in northwest Mississippi, near to and east of the Delhi Field. CO2 flooding generally, but not always, follows water flooding. The CO2 aids oil recovery primarily by absorbing into the oil and reducing oil viscosity and surface tension to allow the oil to move more easily (improved mobility). The CO2 also causes the oil to swell, thereby increasing localized pressure. When the CO2 injection is continuous or combined with water injection to help move the oil, industry experience has shown that incremental recovery of an amount of oil of around 10% - 20% of the original oil in the reservoir can be attained, depending upon type of rock, original oil saturation, level of secondary recovery, amount of CO2 injected, reservoir depth and other factors.

Based on DNR's project plan, D&M is projecting proved and probable EOR gross recovery of 17% of swept OOIP, or approximately 60 million gross barrels out of the swept OOIP of 357 MMBO. Our independent reservoir engineer has further assigned an additional 8 MMBO of probable gross reserves through the addition to the project of four other reservoirs in the Unit. D&M further projects that our deemed payout will occur in late 2013, based on a flat field oil price of $113.



PART III

ENVIRONMENTAL REGULATION & LIABILITY

Common Law Liability & Source of Law

In Texas we have adopted what is called the "common law "from England. If statutes or regulations do not address an activity the courts can resort to this historical source of law to make a decision.

For example, the ‘rule of capture’ utilized in the oil and gas industry had its origins in the common law rules dealing with the capture of wild animals. A wild animal in England was not ‘owned’ until it was captured, and this rule was adopted for the energy sector. Title does not vest in crude oil until it is captured.

Torts, defined as a wrong or injury other than a breach of contract, is one example of common law concepts being adopted by Texas courts. A tort generally requires (1) a legal duty to the injured party, (2) a breach of that duty, (3) the injury was a direct or proximate cause of the action, and (4) generally the injury must be foreseeable by the parties.

Early cases where blowouts or explosions occurred saw the oil and gas operator claim that they did not foresee that an accident would occur, therefore tort liability should not attach to such accidents. The courts in short order realized that it is not uncommon for wells to blowout, for refineries to explode, and for hydrocarbons to catch fire. As such the courts held consistently that due to the nature of the industry it is foreseeable at explosions and blowouts occur – thankfully infrequently – but an operator is not relieved of tort liability using the ‘it was not foreseeable’ argument.

The torts most commonly encountered in the sector, and the ones we will study in the cases that follow, include:

Negligence – Doing something a reasonable and prudent person would not do.

With regard to negligence, what constitutes a ‘reasonable’ and ‘prudent’ course of action is a question of fact. If an energy producer is sued under the negligence theory, and if the practice being disputed is customary in the industry, the producer can argue that due to the fact the practice was customary and standard no negligence exists. They have acted in a ‘reasonable and prudent manner’. Some courts accepted this argument, so if the industry-wide practice was deficient liability for negligence might not arise.

Negligence per se – A violation of a rule or statute creates a presumption of negligence in some situations.

If a producer violates a rule or statute under the nuisance per se theory the presumption of negligence can be rebutted. Also, a plaintiff can only use the violation of a rule or statute if the issue being litigated is the one the legislature intended to protect. For example, a regulation prohibiting the dumping of oilfield wastewater into a stream has been held inapplicable when a driver accidently drove into a creek and drowned in the illegally dumped water. The lawsuit for wrongful death was dismissed.

Nuisance – An interference of a party's use and enjoyment of property.

A nuisance can be classified as "private" if a property owner can show they have suffered a specific harm. If the harm is to the public at large it will be deemed a public nuisance, and the remedy is a court injunction to stop the offending activity. For a private nuisance the party can ask for an injunction to stop the activity or can ask for money damages.

Trespass – An interference with a party's possession of property

Trespass is considered an intentional tort, and generally requires an invasion of someone's property interest to be actionable. For that reason trespass is not as commonly asserted as the other torts. For example a pipeline leak will generally not be intentional, since the oil is a valuable product that was intended to be sold. So even an invasion of leaked oil will not give rise to a trespass action.

Statutes & Regulations. In addition to the common law in Texas we also have federal statutes, federal rules and regulations, as well as state statutes, state rules and regulations, and local ordinances. The general rule is the federal statutes and rules are the "supreme law" of the land. State rules and regulations can supplement federal rules, or be more onerous then federal rules, but where conflicts exist the federal rule prevails. Oil and gas operators are subject to all three sets of rules – federal, state, and local - and have to abide by provisions of all three of these sources.

In Texas the agency most involved in oil and gas regulation is the Texas Railroad Commission. In some cases, especially dealing with air pollution issues, the Texas Council of Environmental Quality will be the agency involved. For the most part most oil and gas producers are exempt from air emission regulations, but refineries and pipelines may find themselves much more involved in air permitting and monitoring.

Case Law. Case law interpreting the federal, state, or local ordinances and regulations can be used as "precedent" for other similar cases. This allows operators and landowners to know with some certainty what the basic law provides with regard to a specific issue. Case law also interprets the common-law torts mentioned above, and can also be used as precedent for legal issues.

Not all cases are published, but those that are published generally have a unique legal issue that the court is attempting to clarify. From a business planning standpoint these rules, regulations, and case law decision can reduce the uncertainty involved in an energy venture. On the other hand if the rules or legal framework is disputed or undecided, the risk increases, which may reduce the ventures value - or require a different strategic plan of attack.

Questions:

1. Many times landowners will skip over the statutes and regulations when involved in a dispute with an energy company and have their attorney assert a common law tort. Why would the landowner want to file a negligence case, for example, when a Texas Railroad Commission rule might be on point?

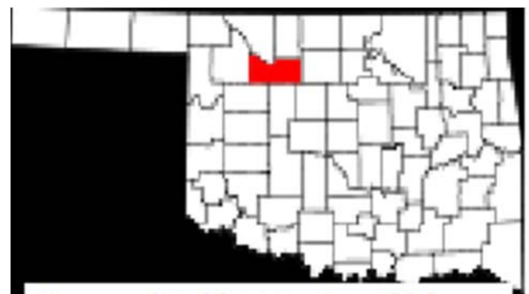
2. Both landowners and producers generally prefer to be regulated at the state level. Why might this be the case?

3. Can you use case law from another state, say Kansas, as precedent in Texas?

Negligence / Proof Requirements / Circumstantial Evidence

According to some commentators the essential elements of actionable negligence are the existence of a duty on the part of one person to protect another against injury, a breach of that duty, and an injury to the person to whom the duty is owed as result of the breach of duty. The potential harm should be foreseeable - a person of ordinary intelligence and circumspection, should reasonably have foreseen that their negligent act would imperil others. We will examine the claim of negligence, as it applies to environmental disputes, in the following cases.

Mazda Oil v. Gauley
The following case deals with developmental activities in the Ringwood Field, Major County, Oklahoma. The Field was discovered in the 1940's and was primarily focused on the Manning formation which contained crude oil. The crude oil from the Manning zone generally contained natural gas dissolved in the oil that escaped when the oil was brought to the surface. The natural gas which bubbled out of the oil was called 'casinghead' natural gas.


Ringwood Field, Major Co., Oklahoma

Later, in the 1950's, after a natural gas pipeline was installed in the area producers drilled for the shallower Cherokee formation that held high pressure natural gas reserves. The case deals with an operator that was drilling for the oil rich Manning formation – but the surface owner encounters problems with natural gas emissions allegedly due to the operator's negligence.

MAZDA OIL CORP. v. GAULEY
Supreme Court of Oklahoma
290 P.2d 143; 5 Oil & Gas Rep. 229
November 15, 1955

PER CURIAM. H. C. Gauley, defendant in error, brought action in the district court of Major County to recover damages to his farm occasioned by gas escaping from below the surface. Defendant claimed damage to growing crops and permanent damage to his real estate praying judgment for $ 32,020. The case was tried to a jury and a verdict returned awarding recovery in the sum of $ 14,852. The Mazda Oil Corporation, defendant in the trial court, against which judgment was rendered on the verdict by the jury, appeals.

For convenience the parties will be referred to as they appeared in the trial court. The defendant corporation as lessee under an oil and gas lease drilled a well on plaintiffs' farm. Drilling was completed on or about 11-3-48 and the well produced oil.

Plaintiff predicated his right of recovery from damages suffered to his property by reason of escaping gas from defendant's well and alleges negligence and want of care by defendant in one or all of several particulars, briefly stated as follows: Defendant was negligent in the manner of setting surface pipe in the well; in not taking proper precautions to prevent the escape of gas from the well to the upper structures and strata; in failing to properly cement the well to protect the upper strata from gas from producing sand; and negligence and want of care in failing to take proper action to prevent and stop escaping gas from the producing sands to the upper structures after the escaping of gas became known to the defendant.

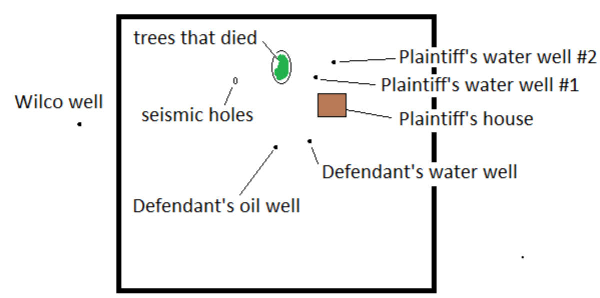
Briefly stated the defense was that defendant's well was not the proximate cause of the alleged damage, the well never produced gas and defendant was not guilty of any actionable negligence.

The record is voluminous. The testimony includes that of both laymen and those specially trained in their particular field of study and experience whose testimony was calculated to shed light upon the complex situation arising in the case. The testimony and exhibits revealed the use of scientific tests relative to the physical aspects of an oil well and the condition of the soil surrounding it.

The Ringwood Oil Field, in Major County, is large in area, covering several sections. The well drilled by the defendant on plaintiff's farm was one of the first in the field. At the time it was drilled, gas in any considerable amount had not been discovered. Later, gas from what is known as the [*145] Cherokee Sand was encountered at a depth of some 6,000 feet. It proved to be extensive in area and when released showed very high pressure.

Defendant denies that gas was produced from its well in any considerable amount at any time and that none came through or from it to plaintiff's damage. This constitutes a major issue in the suit.

Plaintiff's evidence in support of his claim reasonably tends to show that he had owned and lived on the farm involved since 1926 and conducted farming operations; that defendant had drilled a water well to a depth of 200 feet on plaintiff's farm for use in drilling the oil well, which water well was 40 feet north and 100 feet east of the oil well and some 50 or 60 feet from his home; the oil well was some 300 feet from the house; that when the drilling of the oil well reached 190 to 200 feet, a channel or fissure connecting the oil well and the water well was discovered; that such channel was large enough for cotton seed hulls used with the drilling fluid to pass through to the water well; that there were many manifestations of seeping and erupting gas on the farm.



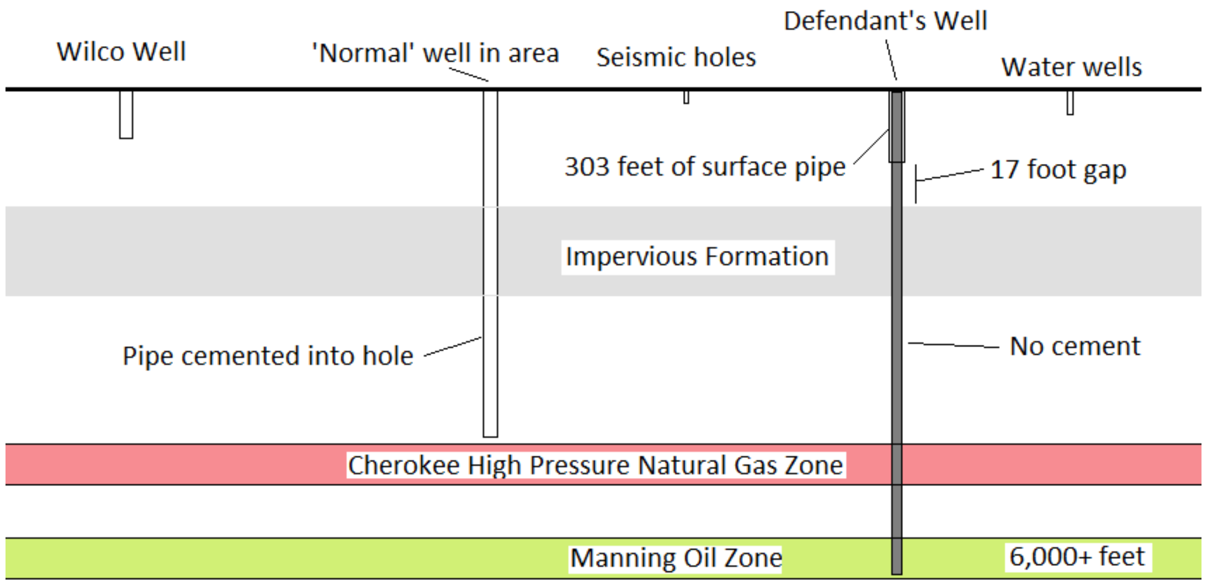
That in October or November of 1949 gas escaped from plaintiff's domestic water well located about 100 feet northeast of the defendant's water well; that the water from the domestic well came through pipes to plaintiff's home and at times had sufficient gas pressure to knock a glass from the hand; that this condition continued until spring of 1951; that gas and liquids erupted from a bradenhead valve on defendant's oil well; that drilling mud came into the domestic water well and it had to be abandoned and another drilled to a depth of 51 feet some 10 or 12 feet northwest; that it developed gas in the fall of 1950 and the following February, 1951, caught fire; that in June of 1950, defendant's water well was discovered to contain gas in sufficient amount to ignite; that on July 19, 1950, the defendant's water well started to erupt gas and water, the eruption at first reaching a height of some two feet and later increasing to approximately 200 feet, and continuing for a week.

That an oil well identified as the Wilco started drilling on the offset west, one-fourth of a mile from the defendant's well; that at 240 feet and 340 feet gas blew from this well with great force, which caused a subsidence in the eruptions of the water well; that after the disturbance in the water well and the Wilco well, a large eruption occurred through a seismograph hole, also on plaintiff's farm, which hole was about 100 feet northwest of the defendant's oil well and some 40 feet to the northeast of the

Wilco well; that on August 15, 1950, another eruption, southwest of the seismograph hole some 100 feet from the Wilco well, blew gas and other substances 15 feet in the air and affected an area 30 feet in diameter; that a similar eruption affecting an area 60 feet in diameter occurred southwest of the Wilco well, the last previous eruption subsiding as this one
began; that this last eruption was stopped when heavy rain and water ran into the holes created by the eruptions and disappeared.

That gas seepage killed a wind break of trees and other trees near plaintiff's house; that strips or spots of feed vegetation and later growing wheat began to die due to gas seepage first observed in the fall of 1951, the first such strip being some 45 feet from the oil well; that the area affected by gas seeping into the soil broadened, appearing in spots, eventually extending to 1600 feet.

That a soil analysis showed the soil to be in numerous places saturated with gas; that the soil contained carbon-dioxide 300 times that of normal soils and such condition is not found normally elsewhere in Oklahoma or in plaintiff's community; that there was a definite source of seepage coming from one point; that the seepage only appeared near defendant's well and from a visual examination of the area it was confined to the quarter section in which defendant's well is located; that there was a gassy smell very close to the well and the area around the well had such odor, which odor disappeared 20 yards from the well but reappeared from the holes dug for soil analysis; that the vegetation slopped out from the oil well; that a substance identified as oil well cement in the form of small granules was washed from the defendant's water well and deposited nearby in considerable quantity.



That it is necessary to set and adequately cement surface pipe in drilling an oil well to protect the upper porous fresh water area above the lower impervious structure from hydrocarbons or salt water and to contain and control contaminating or dangerous substances that may come from below the impervious structure; that the surface pipe is usually ten and three fourths inches in diameter and when it is set to the proper depth is cemented in place; that in cementing this pipe the cement is pumped under pressure through the pipe until it returns from the bottom through the annular space around it to the surface; that when so set any deleterious and dangerous substances that come into the hole are contained; that defendant drilled to a depth below 6,000 feet to the Manning zone, the known producing area of the field, and the well produced oil; that defendant set 303 feet of surface pipe and used 180 sacks of cement; that 500 sacks of cement were used in cementing the drill pipe at the bottom of the well.

That a mechanical test showed the surface pipe to be set in the impervious structure at an undetermined depth; that two reports of the defendant corporation to the Corporation Commission showed the bottom of the surface pipe to be 17 feet above the impervious structure; that the nearest previous drilling in the area was one half mile distant and accordingly little was known of the subterranean strata to be explored.

Previous wells in the area, according to Corporation Commission records, had set at least 2,000 feet of surface pipe; the 180 sacks of cement used by defendant in cementing the surface pipe was the least amount used in any of the area drilling; the channel between the defendant's oil well and water well was an inch thick, and it would take approximately 3,350 sacks of cement to fill it and there were other channels or fissures extending out from the oil well under plaintiff's farm; sufficient pressure on an adequate amount of cement should have been exerted to fill the known channels and fissures and the surface pipe should have been set through the impervious structure of some 1,500 feet thickness and cemented therein; the impervious structure, until perforated, was sufficient to contain gas of any pressure released below it; there were sands explored by defendant's well capable of containing gas.

Such sands are above the Cherokee sand and could carry gas from that zone to defendant's well if released from the Cherokee; the defendant's oil well and wells known to have penetrated the Cherokee zone were uncemented in an extended area below the impervious structure to the top of the cement extending from the bottom; gas could travel through lower porous strata from these wells to defendant's well; the bradenhead on the oil well was opened and showed a puff of gas indicating a gas leak; the oil well cement came from defendant's oil well. Plaintiff's farm was damaged by escaping gas.

Defendant's demurrer to plaintiff's evidence was overruled.

From plaintiff's evidence standing alone a reasonable inference can be drawn that gas escaped from defendant's well, coming from the explored subterranean area, that the defendant was negligent in setting and cementing the surface pipe and that the negligence of the defendant was the proximate cause of plaintiff's damage. The demurrer to the evidence was properly overruled.

The evidence of defendant reasonably tends to show that the setting of the surface pipe and cementing of the well were conducted in a prudent and careful manner; that no gas had at any time been produced or encountered in the well or had passed through it to the damage of plaintiff's farm or crops; that the well as completed and used effectually sealed off any gas from below the impervious structure and none escaped; that there were other wells in the field capable, from the manner of construction and operation, of producing through the escape of gas therefrom the damage to plaintiff and that even if gas had been released from a zone unexplored by its well and traveled through other changeable porous strata to defendant's well it could not have come to the surface through the confines of its well.

At the close of all the testimony defendant renewed its demurrer to the plaintiff's evidence and moved for a directed verdict. Both were overruled.

Three propositions of error are advanced by defendant as plaintiff in error on appeal. It is contended, first, that if a third party injected gas into its well and the gas escaped therefrom because of insufficient surface casing, such act of the third party was the proximate cause of the escape and defendant would not be liable; second, that there was no evidence of defendant's negligence in drilling, completing or operating its well, and, third, that the verdict and judgment are based on conjecture and speculation and not reasonably supported by the evidence.

We are unable to agree that the verdict and judgment were based on conjecture and speculation. While the evidence on behalf of plaintiff was circumstantial, it was sufficient to require the submission of the case to the jury and to sustain the verdict and judgment. From the verdict it is clear that the jury believed the witnesses produced by plaintiff. Although the evidence was conflicting, the jury was not compelled to accept that offered by the defendant. We have held this court would review a verdict founded on conflicting evidence only for the purpose of determining whether it was supported by competent evidence and that essential facts might be proved by circumstantial evidence, in which event it was not necessary that the proof rise to a degree of certainty which would exclude every other reasonable conclusion than the one reached by the jury. Wood Oil Co. v. Washington, 199 Okl. 115, 184 P.2d 116; Cities Service Gas Co. v. Eggers, 186 Okl. 466, 98 P.2d 1114, 129 A.L.R. 1278

Reasonable inferences sufficient to support plaintiff's case can be drawn from the evidence. A reasonable inference which may be drawn from circumstantial evidence is itself proof and does not fade away in the light of positive proof to the contrary. Great Lakes Pipe Line Co. v. Smith, Okl., 271 P.2d 1112; Gypsy Oil Co. v. Ginn, 152 Okl. 30, 3 P.2d 714.

The duty of the defendant under the facts in evidence was plain. It is a matter of common knowledge that the inner earth contains powerful gaseous forces frequently found in proximity to and in connection with deposits of oil. The defendant, by its act of boring the well, undertook the burden and responsibility of controlling and confining whatever force or power it uncovered. The jury found that the defendant was negligent in failing to guard against the escape of gas from its well. It follows that defendant is liable for damages proximately resulting from its negligence.

Defendant takes the position under its first proposition of error, that plaintiff failed to prove that gas ever was in or came through defendant's well and that its evidence clearly negatives the possibility; that even if it had been negligent and gas passed through its well, the negligence of a third party in allowing the gas to escape was the proximate cause of plaintiff's damage and that it had no liability.

The only matter left for consideration under such contention is that of proximate cause under the circumstances argued by defendant. At the time defendant started drilling operations, gas was a very probable substance of discovery. That such was not found on first exploration, as contended by defendant, does not relieve from the original duty or negative the element of required care predicated upon the probabilities as of the time the surface pipe was set, unless we are prepared to say that the injection of gas thereafter into the bore hole of the well, not through producing sands but through sands or porous areas capable of being charged therewith, may not reasonably be foreseen or anticipated, either by natural developments, negligent operation of other drillers, or by occurrences usual to the industry. It does not appear that the escape of gas through defendant's well must have, in the absence of production from the sands explored thereby, been through the negligent act of a third party.

Under the facts and circumstances of the case we cannot say that the jury adopted this theory to the exclusion of others supported by evidence reasonably tending to support them. However, under applicable rules of law, long established in this court, the verdict under the evidence accepted by the jury is sustained even if the gas escaped through defendant's well negligently drilled and operated although injected in defendant's well by the negligent act of a third party.

In the case of Oklahoma Natural Gas Co. v. Courtney, 182 Okl. 582, 79 P.2d 235, we held that one guilty of negligence or omission of duty is responsible for all the consequences which a prudent and experienced party, fully acquainted with all the circumstances which in fact exist, whether they could have been ascertained by reasonable diligence or not, would have thought at the time the negligent act as reasonably possible to follow, if they had been suggested to his mind.

We further held that assuming there was an intervening responsible agency which produced the injury, the question as to whether the original negligence is to be regarded as the proximate cause of the injury, or only a condition, or remote cause is to be determined by ascertaining whether the agency which intervened was of such character, and the circumstances under which it occurred were such, that it might have reasonably expected that such agency, or a similar one, would intervene in such a way as to be likely to produce an injury similar to the one actually caused, if under the circumstances, the intervention of such an agency in the manner stated might have been expected in the usual course of events, and according to common experience, then the chain of causation extending from the original wrongful act to the injury, is not broken by the independent, intervening agency, and the original wrongful act will be treated as the proximate cause.

Even though there were separate independent acts of negligence which combined to produce the damage to plaintiff and there was no concert between defendant and a third party, either or both would be responsible for the entire result even if defendant's negligence alone might not have caused the injury. Caesar v. Phillips Petroleum Co., 187 Okl. 559, 104 P.2d 429; Phillips Petroleum Co. v. Vandergriff, 190 Okl. 280, 122 P.2d 1020.

Tested by the rules of law above announced, we consider the evidence sufficient to present to the jury for determination the question of negligence and whether such was the proximate cause of plaintiff's damage. A general verdict on conflicting evidence presumably includes all the facts necessary to establish the prevailing party's claim. Johnson v. Jones, 39 Okl. 323, 135 P. 12, 48 L.R.A.,N.S., 547; Phelps v. Maline, 193 Okl. 239, 142 P.2d 849. This court will not overturn a verdict of a jury and a judgment in accordance therewith in a negligence action where the evidence tends to support them. Great Lakes Pipe Line Co. v. Smith, supra.

It follows that there was no error in overruling the demurrer and refusing to direct a verdict for defendant. The instructions of the trial court taken together and considered as a whole, fairly presented the law applicable to the issues. We find no error in the instructions given. The defendant does not challenge the verdict as being excessive.

On the entire record we are convinced that the defendant had a fair trial and that the verdict and judgment is reasonably sustained by the evidence. The judgment is affirmed.

The Court acknowledges the aid of the Supreme Court Commissioners in the preparation of this opinion. After a tentative opinion was written by Commissioner J. W. Crawford and approved by Commissioners Jean R. Reed and James H. Nease, the cause was assigned to a Justice of this Court for examination and report to the Court. Thereafter, upon report and consideration in conference, the foregoing opinion was adopted by the Court.

JOHNSON, C. J., WILLIAMS, V. C. J., and CORN, BLACKBIRD, JACKSON and HUNT, JJ., concur.

HALLEY, J., dissents.

Mazda Oil Corp. v Gauley

Notes and Discussion

1. Note the defendant had drilled a fresh water well on the plaintiff's land. Did they have the right to do that?

2. What elements must the landowner in Mazda establish for a negligence cause of action?

3. The evidence of any problems was 'hidden' underground, as it is for many energy and environmental cases. Does this create a problem for a landowner claiming they have been damaged by defendant's operations?

4. Can circumstantial evidence be used to prove pollution? Speculative evidence? In some recent cases natural gas has infiltrated drinking water, occasionally shortly after drilling and completion activities have been completed.

What problems will these homeowner's have in pressing a claim against an oil and gas operator for such contamination? Can you suggest what an owner might do before drilling to document drinking water quality?

5. What if separate independent acts by more than one party cause damage to the lands. Can a defendant use this as a defense to liability?

6. Note that the landowner's water wells were impacted by the defendants alleged activities such that they were not useable. In rural areas what alternative water sources are available for the landowner to replace the water from contaminated wells?

7. Did the defendant's well produce crude oil or natural gas according to the case? Why is this an issue in the case?

8. One of the elements of negligence is the requirement that the potential harm was foreseeable. Since this was a new field, can the operator make the argument that any potential harm from development was not foreseeable? What did the court say on this issue?

9. Note that prior to 1960 most wells were drilled for crude oil. Wells that discovered natural gas many times were considered failures, at least from a financial point of view. In fact, in the early years (1900-

1930) many states enacted statutes or regulations requiring natural gas wells to be plugged since operators were abandoning such wells as "dry holes" – in some cases they were continuing to vent natural gas to the atmosphere. Today, the value of production from natural gas wells exceeds the value of production from oil wells in Oklahoma and Texas.

The following case mentions the venting of natural gas in the Ringwood Field:

<u>W. D. GREENSHIELDS, Appellant, v. WARREN PETROLEUM CORPORATION</u>
248 F.2d 61
10th Cir. Sept. 3, 1957.

. . . The Ringwood Field produces both oil and gas from two zones, the Manning and the Cherokee. The Manning zone was first discovered in 1945 and 233 wells are still producing oil and casinghead gas from that zone. Prior to 1951, the date of the gas purchase contracts here in dispute, the wells were operated by the lessee defendants whose operating facilities saved only the oil produced. ***<u>Vast quantities of casinghead gas produced simultaneously with the oil were wasted by venting into the air.</u>***

The conservation problem so created was considered by the Oklahoma Corporation Commission and the possibility of authoritative capping of the wells was brought to the attention of those operating in the field. Faced with the possibility of a complete shutdown if the venting of casinghead gas continued the producers made an extensive survey of potential market outlets.

Approaches were made to Phillips Petroleum, Stearns-Rogers, Skelley, Sinclair, Continental and other companies capable of making the financial outlay necessary to gather and market the gas. None considered the investment economically sound, including Warren Petroleum Co. whose engineering survey was unfavorable as to the construction of both compression and extraction facilities.

However, in late 1950, Oklahoma Natural, a public utility, agreed to construct the gathering and compression facilities upon the terms ultimately included in the gas purchase contracts. Similarly, Warren agreed to construct and operate the gasoline extraction facilities. On January 17, 1951, Superior Oil and Mazda Oil entered into the gas purchase contracts with Warren and Oklahoma Natural and subsequently all other producers in the field executed identical agreements. After construction of the plants at a total cost of $5,500,000, Great Western, in 1953, contracted for the sale of its gas at a similar price but expressly limited to production from the Manning zone. . . .

Subsequent to the erection of the processing plant, commercial production from the Cherokee sand lying above the Manning zone was begun. The gas from the Cherokee zone contains distillate and is not produced with oil as is the casinghead gas from the Manning zone. It is different from that produced in the Manning zone in that its gathering would not ordinarily require the low pressure system necessary to channel Manning zone gas into the residue pipe line.

However, both gases require the reduction of liquifiable hydrocarbons before they can be introduced into the pipe line, and the trial court found that there are not sufficient daily volumes of Cherokee zone gas to maintain sustained pressure economically justifying the construction of a separate high pressure gathering system. Some wells were dually completed to produce from both zones without commingling the two substances; other wells, originally Manning wells, were later expanded to produce from the Cherokee zone.

With the exception of Cherokee gas produced by Great Western Producers, Inc., specifically excluded in its contract with the purchasers, the purchasers claim the right to all gas produced in the Ringwood Field under their contracts of purchase with the producers and the trial court has upheld their contention. Although no recovery of Cherokee gas was being made at the time of the execution of the gas purchase agreements, the granting clause in those agreements provides: '* * * the seller hereby grants, bargains and sells and agrees to deliver to buyer and buyer agrees to purchase and take from seller * * * all gas now or hereafter produced from the wells on the lands * * *'. The lack of ambiguity in this provision, fortified by evidence that the existence of gas in the Cherokee zone was commonly known, leads us to reject, as did the trial court, the contention of appellants that the gas purchase agreements do not include sale of Cherokee gas. . .

10. Natural gas flaring in areas where pipelines are not yet built out is something that occurs today also, and as in the instant case landowners are concerned about the health effects and safety issues (article courtesy WyoFile.com from their website).

Gas flaring riles homeowners in Converse County

Gas flaring at a gas-to-energy facility in King County, Washington. Smaller gas flares are becoming more numerous in Converse County as operators drill for shale oil. The flaring has become a source of concern for some nearby residents. (Courtesy of King County Solid Waste Division)

By Dustin Bleizeffer, WyoFile.com, December 11, 2012

Wyoming regulatory officials, and oil and gas operator Chesapeake Energy, are facing criticism from some Converse County homeowners over the flaring — or burning — of natural gas. Flaring is a big loss of private and public revenue (to the tune of millions of dollars). And for people who live close to the development, it's a major health concern.

"We have four wells that have been drilled and fracked around our home, and we are dealing with flares, and gardens dying, animals sick, kids sick," said Kristi Mogen, whose family lives in a rural neighborhood six miles east of Douglas.

One of Chesapeake's flares apparently burned improperly (usually a sign of petroleum liquids in the flare) for nearly three months this past summer, and it wasn't corrected until Mogen and her neighbors contacted the Wyoming Department of Environmental Quality (DEQ).

That's something Chesapeake officials say their crews should have caught, and they promise to be more diligent. John Dill, who manages Chesapeake operations in the Rockies, said the company is working to reduce the amount of flaring from its well sites. "We know that we are having an impact on the county, and we think most of what we do is a positive for the county," Dill said at a recent town hall meeting in Douglas hosted by Chesapeake. The meeting hall was packed with more than 200 people. . . .

The 'Lakeview Oil Company Gusher"

With regard to oil blowouts, many are under the mistaken belief that the recent British Petroleum blowout in the Gulf of Mexico was the worst spill in US history. To the contrary, the worst spill occurred about a century ago, onshore, in California:

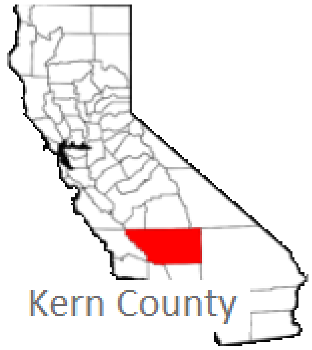
> The worst oil spill in US history, the Lakeview Gusher Number One that occurred 100 years ago in Kern County, California. The gusher, drilled by the Lakeview Oil Company, blew on March 14, 1910, when the drill reached the 2,440-foot level.
>
> This gusher shot oil more than 200 feet into the air for an astonishing 544 days, spewing more than 9 million barrels (378 million gallons/1.4 billion liters) of oil into the environment -- less than half of which was removed.
>
> The large flow created a creek of crude oil running downhill from the well site that was contained by walls built of sand bags, rock and even sage brush. The rest of that oil remains in place to this very day and even 100 years later, this oil-contaminated area is not good for anything, although there is a museum there describing the oil spill.
>
> Source: http://scienceblogs.com/grrlscientist/2010/06/the_worst_oil_spill_in_us_hist.php

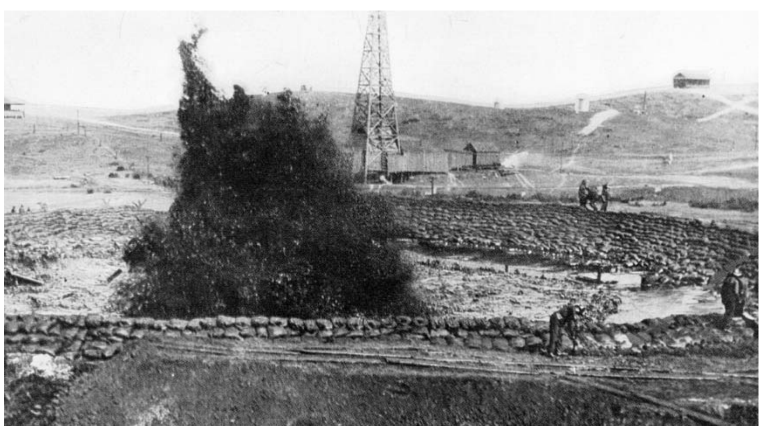
The California Historical Society has described the blowout as follows:

> Lakeview Gusher Number One was an immense out-of-control pressurized oil well in the Midway-Sunset Oil Field in Kern County, California, resulting in what is the largest single oil spill in [American] history, lasting 18 months and releasing 9 million barrels (1.4×106 m3) of crude oil. In what was one of the largest oil reserves in America, pressure built to an extreme due to the quantity of crude oil in the area. When drilling in the area began, primarily by the Lakeview Oil Company, it was expected to find natural gas and a small amount of crude oil; but there was a large blowout, resulting in an overload of storage tanks.
>
> The geyser of congealed crude oil amounted to nearly 9 million barrels (1.4×106 m3) of oil, or more than 1.2 million US tons, far more than any other on land or water. The site of the Lakeview oil geyser is located about a half-mile (800 m) east of the Taft-Maricopa Highway, State Route 33, and is marked by a Caltrans guide sign and a bronze plaque, and is designated as California Historical Landmark number 485.
>
> While modern well-drilling techniques have advanced safety features such as blowout preventers that reduce the chances of a gusher, early twentieth-century drilling technology could not contain the high pressures encountered at Lakeview. The gusher began on 14 March 1910, as the drill bit reached 2,440 ft (740 m).
>
> Drilling at Lakeview Number One well was started by the Lakeview Oil Company on 1 January 1909….[after the blow-out on March 14]… the gusher was brought under control 18 months later in September 1911.
>
> The initial daily flow from the gusher was 18,800 barrels (2,990 m3), peaking at approximately 90,000 barrels (14,000 m3), creating a downhill running river of crude oil from the well site, while

crews rushed to contain it with a system of improvised sand bag dams and dikes. During its 18-month duration, the gusher never caught fire.

The 1910-1911 Kern County, California, blowout literally created a lake of oil:





(note the men working around the sandbags compared to the size of the gusher)

While smaller in size, Pennsylvania and Ohio also experienced blowouts in the early years of exploration – in some cases when settlers were attempting to drill a water well on their property. Literature discusses how some property owners thought they 'had drilled all the way to hell'. A select few wanted to ban the practice of drilling for oil for religious reasons.

Negligence Per Se

To deal with some of proof problems we saw in the preceding case (underground natural gas blowout, provable using circumstantial evidence, possibility of third party contamination in a field due to the rule of capture and fact that they are all in a race to get wells on production, etc.) a number of landowners began using a legal concept to meet their burden of proof called “negligence per se”.

A common definition of negligence per se is as follows:

> The violation of a statute, ordinance, or administrative rule or regulation may constitute negligence as a matter of law. The court may accept the regulation as defining the standard of conduct for a reasonable person, therefore establishing the level of duty owed

The State of Oklahoma enacted one of the first statutes that addresses oil and gas wastes. Adopted right after statehood (1910) the statute provides as follows:

> § 296. Refuse from wells--Disposition
>
> *No inflammable product from any oil or gas well shall be permitted to run into any tank, pool or stream used for watering stock; and all waste of oil and refuse from tanks or wells shall be drained into proper receptacles at a safe distance from the tanks, wells or buildings, and be immediately burned or transported from the premises, and in no case shall it be permitted to flow over the land. Saltwater shall not be allowed to flow over the surface of the land.*

It should be no surprise that many early environmental cases utilizing the negligence per se theory originated in Oklahoma. In Texas we have Texas Railroad Commission Rule 20, since incorporated into Rule 8, that dealt with environmental contamination. Our next case, Gulf Oil Corp., deals with the negligence per se concept and TRRC Rule 20:

<u>Gulf Oil Corp. v. Alexander</u>
Court of Civil Appeals of Texas, Amarillo
291 S.W.2d 792; 6 Oil & Gas Rep. 457
June 4, 1956

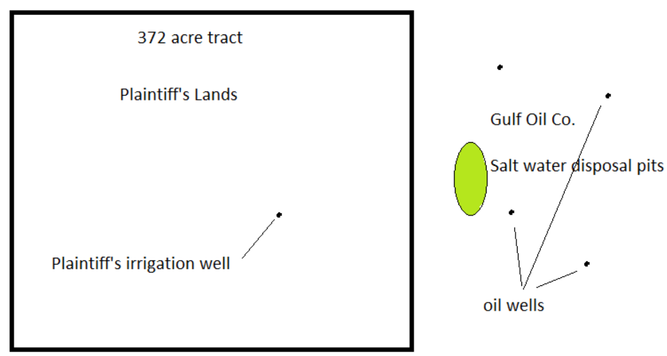
Appellee, Bob Alexander, owns a 372 acre farm adjoining the leasehold of appellant, Gulf Oil Corporation. The freshwater strata underlying appellee's farm and supplying his irrigation well was polluted by the seepage of salt water from a salt water disposal pit constructed and used by appellant in oil and gas operations on its leasehold adjoining appellee's farm land. Appellee sued for damages accruing to him by reason of the pollution of the freshwater strata as used by him in irrigating his farm lands and recovered judgment in the sum of $22,320. Appellant perfected its appeal based on three points of error.

The undisputed evidence reveals that appellant's disposal of its salt water polluted appellee's supply of irrigation water. But, appellant by its three points of error asserts that it is not liable for appellee's damages by reason of the fact that there is no evidence of any negligence in its disposal of the salt water and that appellee's cause of action is barred by the two year statute of limitations, Vernon's Ann.Civ.St. art. 5526. As to the issue of negligence, appellee asserts that the evidence sustains the jury findings on such issue and, further, that its pleading and proof that appellant violated Rule 20 as promulgated by the Railroad Commission renders appellant liable for the damage accruing to appellee.

Appellant's first point of error alleging there is no evidence to sustain the jury finding that appellants were negligent in disposing of the salt water requires an examination of the record in the light of the applicable rules. The record reveals that a large quantity of salt was deposited in the disposal pit on appellant's leasehold.

Appellee relies on this fact as supporting the jury finding of negligence. The evidence also reveals that the top layer of soil in the disposal pit was of a porous nature. On the issue of whether there is any evidence of negligence, the fact that a large quantity of salt was deposited in the disposal pit is not evidence of negligence in itself. The record is wholly silent as to whether this amount of salt was so excessive as compared to the amount of salt deposited in other disposal pits in the oil field as to require appellant to take additional measures to contain the same. There is also no evidence that the soil where the pit was constructed was more porous than the soil in other disposal pits in the oil field and required additional care as to construction of the pit.

The undisputed evidence reveals that appellant's method of disposal of the salt water was the universal method of disposal in the oil field in that territory. In fact, like disposal pits were located on appellee's tract of land. Since the uncontroverted evidence establishes that appellant's disposal of the salt water was wholly in conformity with the conduct of such business in that oil field there is no evidence in the cause establishing negligence in its usual sense. Houston & T.C.R. Co. v. Alexander, 103 Tex. 594, 132 S.W. 119.



The above ruling requires the examination of another principle of law as to liability or non-liability under the facts in the cause. Appellee pleaded and proved that Rule 20 as promulgated by the Railroad Commission of Texas makes the following requirement with reference to the disposal of salt water:

> "Fresh water, whether above or below the surface shall be protected from pollution, whether in drilling, plugging or disposing of salt water already produced."

It is apparent this rule specifically prohibits the pollution of fresh water by the disposal of salt water without any reference to negligence. Since appellant admits, as established by the undisputed record, that it polluted appellee's fresh water strata with salt water, appellant is liable for such pollution by reason of its violation of Rule 20 above set forth. This principle is recognized in Peterson v. Grayce Oil Company, Tex.Civ.App., 37 S.W.2d 367 (Syl. 3) in the following language: "It is our conclusion that there is no merit in the contention [*795] that the alleged violation of Rule 40 of the Railroad Commission could not be made the basis of plaintiffs' asserted right of recovery of actual damages on the ground that the delegation of authority to enact the rule was in violation of the Constitution."

This cause was affirmed on other grounds by the Supreme Court in 128 Tex. 550, 98 S.W.2d 781. The same case was likewise cited as an authority by the Supreme Court in Elliff v. Texon Drilling Company, 146 Tex. 575, 210 S.W.2d 558 (Syl. 2, 3), 4 A.L.R.2d 191. Turner v. Big Lake Oil

Company, 128 Tex. 155, 96 S.W.2d 221, 223, further substantiates the above principle by the following ruling: "'In the absence of some positive law forbidding or regulating the keeping or use of the thing, the fundamental question is one of negligence vel non'". (Italics added.)

In the light of the above authorities, it must be observed that the rule at issue in the cause here on appeal is not a legislative enactment but it is a rule duly promulgated by the Railroad Commission of Texas under express authority from the legislature. There is no proof of negligence in the cause other than might arise from the undisputed proof that appellant in polluting appellee's fresh-water strata violated a duty placed on it by Rule 20. Irrespective of any technical discussion of the principles of negligence, it is ruled that the violation of Rule 20 by appellant in polluting the fresh water supply of appellee's irrigation well gave right to the cause of action on the part of appellee for his damage suffered by reason of such violation.

On the issue of limitation, the jury found that salt water from appellant's salt water disposal pit invaded water bearing formations underlying a part of plaintiff's land more than two years prior to August 1954. (Italics added.) But, the jury further found that the appellee first discovered the invasion of the subsurface fresh-water strata by salt water on March 1, 1953. Plaintiff's original petition was filed on August 1, 1954. In support of the last finding by the jury the evidence reveals, without dispute, that appellee drilled his irrigation well and used the same for irrigation purposes without the same being polluted in any way by salt water until he discovered the same was first polluted on or about March 1, 1953. It is apparent that had the appellee continued the use of his irrigation well without any salt water ever having intruded the area of strata from which appellee was pumping irrigation water, he would have had no cause for complaint as to any damage to his irrigation water.

The two year statute of limitation is applicable to appellee's cause of action for pollution of the subsurface strata of water furnishing his irrigation well. Such statute of limitation began to run on March 1, 1953, the date on which the uncontroverted evidence reveals that appellee discovered that the water as pumped for irrigation was polluted by salt water.

The rule as applied here as to pollution of appellee's subsurface strata of water is that limitation ran from the time the injury complained of became apparent or should have been discovered by due diligence on the part of the appellee. Beck v. American Rio Grande Land & Irrigation Co., Tex.Civ.App. 39 S.W.2d 640; Wichita County Water Improvement Dist. No. 1 v. Pearce, Tex.Civ.App., 59 S.W.2d 183; Kolberg v. Hidalgo County Water Improvement Dist., Tex.Civ.App., 110 S.W.2d 961; Cities Service Gas Co. v. Eggers, 186 Okl. 466, 98 P.2d 1114, 126 A.L.R. 1278; Tennessee Gas Transmission Co. v. Fromme, 153 Tex. 352, 269 S.W.2d 336, and like authorities cited by appellant, are not applicable to an issue as to subsurface water pollution by salt water intrusion.

In the light of the court's application of Rule 20, appellant's first point is held to be without merit and overruled. Appellant's second and third points as to limitation are likewise overruled. The judgment of the trial court is affirmed.

Gulf Oil Co. v. Alexander

Notes & Discussion

1. Was Gulf Oil's method of disposal the customary method to dispose of produced water at the time of the case? Was Gulf Oil negligent in the customary sense - was their practice any different than what was customary in the industry?

2. What Railroad Commission rule did Gulf violate? Does it matter that this was a regulation and not a statutory provision?

3. How can an operator protect itself from liability for produced water contamination of fresh water irrigation wells?

4. In 1919 Statewide Rule 20 was adopted by the Texas Railroad Commission:

> *Fresh Water to be Protected - Fresh water, whether above or below the surface, shall be protected from pollution, whether in drilling or plugging.*

In 1933, Rule 20 was amended to require the protection of fresh water from oil and gas production activities. In 1964, Rule 20 was further amended and renumbered as Statewide Rule 8. Rule 8 has been amended at least five times since 1964 to prevent specific practices that may cause pollution.

5. The Texas Supreme Court reviewed this decision at 295 S.W.2d 901, and upheld the lower court decision with the following opinion:

> OPINION: Although both parties have filed applications for writs of error, it is evident that Bob Alexander, who was successful in both of the courts below, only seeks to preserve the judgment in his favor. We have concluded that there is evidence to support the jury findings of common law negligence and proximate cause, and both applications are denied with the notation "Refused. No reversible error."
>
> This order must not be taken as indicating either approval or disapproval of the views expressed by the Court of Civil Appeals as to the legal effect of Rule 20 promulgated by the Railroad Commission of Texas. 291 S.W.2d 792
>
> Opinion delivered October 24, 1956.

Why might the court want to affirm the lower court decision in this manner?

6. The State of Oklahoma enacted one of the first statutes that addresses oil and gas wastes. Adopted right after statehood (1910) the statute provides as follows:

> § 296. Refuse from wells--Disposition
>
> No inflammable product from any oil or gas well shall be permitted to run into any tank, pool or stream used for watering stock; and all waste of oil and refuse from tanks or wells shall be drained into proper receptacles at a safe distance from the tanks, wells or buildings, and be immediately burned or transported from the premises, and in no case shall it be permitted to flow over the land. Saltwater shall not be allowed to flow over the surface of the land.

If a party drove his truck off a bridge and drowned in a pool of salt water which was deposited there in violation of a statute such as 52 O.S. §296, would the operator be liable to the heirs? See: Sinclair Prairie Oil Co. v. Stell, 124 P.2d 255 (Okla. 1942).

7. In Rodriguez v. American Cyanamid Co., 858 F.Supp. 127 (D.C. Ariz. 1994) the court noted as follows:

> A statutory violation is negligence per se if the court allows the statute to stand in for the reasonable standard of conduct. The infraction then constitutes a deviation from the standard of care, and the plaintiff need not prove the existence of a duty and a breach. Arizona courts follow the rule set forth in the Restatement of Torts. See, e.g., Carrillo v. El Mirage Roadhouse, Inc., 164 Ariz. 364, 369, 793 P.2d 121 (App. 1990). Under the Restatement:
>
>> The court may adopt as the standard of conduct of a reasonable man the requirements of a legislative enactment or an administrative regulation whose purpose is found to be exclusively or in part:
>>
>>> (a) to protect the particular class of persons which includes the one whose interest is invaded,
>>> (b) to protect the particular interest which is invaded, and
>>> (c) to protect that interest against the kind of harm which has resulted, and
>>> (d) to protect that interest against the particular hazard from which the harm results.
>>
>> Restatement (Second) of Torts @ 286 (1965).

8. In Cleary Petroleum v. Copenhaver, 476 P.2d 327 (Okla. 1970), the court discussed 52 O.S. 1961, §296, noting:

> The statute by its terms prohibits pollution from oil and gas wells. Defendant cites two cases where the statute was held restricted in view of those terms to pollution from wells, but inapplicable therefore to pollution from refineries, or from pipelines. Johnson Oil & Refining Co. v. Carnes, 174 Okl. 599, 51 P.2d 811 (1935), and Gulf Pipeline Co. v. Alred, 182 Okl. 400, 77 P.2d 1155 (1938). Defendant also cites Tidal Oil Co. v. Pease, 153 Okl. 137, 5 P.2d 389 (1931), wherein this Court indicated that the statute was inapplicable to pollution confined to pits or ponds located on the operator's own premises. . . .

Why would this statute be inapplicable to pollution from refineries, pipelines, or from ponds located on the operator's own premises? Note that the express language of the statute defines what constitutes negligence per se.

Property Due Diligence & Sampling Issues

In many modern cases quantitative analysis of soil or water samples are presented by the landowner. The quality of water many times will be determined by testing for total dissolved solids - the more salts and other materials that are dissolved the higher the measurement and lower the quality of water.

When operating in an area where ground waters are used for irrigation, it may be advisable for the oil and gas operator to take water samples from existing wells or ponds before activities are commenced so as to have a "baseline" level of water quality should the landowner claim oil and gas activities have contaminated the water.

Soil samples will also yield data on the amount of total dissolved solids contained in such soils. Generally, the more dissolved solids in the soil the more difficult it is for plants to survive - too much salt will cause plants to dehydrate.

Radiation from pipe or equipment cannot be seen - it can only be measured using expensive measuring devices. Where radiation is present it is usually present at very low levels, although protective clothing is recommended when conducting sampling activities (see pictures).

Measuring instruments, called scintillation meters, need to be calibrated periodically, and standard measurement protocols have been established by regulation (probe is to be a set distance from the object, in some cases a pattern or grid survey is required versus random surveys at the location, etc.)

If samples are taken it is wise to prepare a chain of custody record to insure the samples represent the conditions on the property at the time they are taken, and that they are not contaminated, misplaced, or misidentified.

CHAIN OF CUSTODY RECORD

AMERICAN PROTEINS, CUTHBERT DIVISION
HWY 82E POB 528
CUTHBERT GEORGIA 31740-0528
912-732-2114 FAX 912-732-3896 or 732- 5594

TEST SAMPLES FOR:

Tracking identification: DATE______________,

Sampler: ______________________, #_______

	pH	Temp	Dissolved O2	Appearance	time	unique ID	Point Source Process Sample Description	BOD	COD	AMMONIA NH3	NITRATE NO3	OIL AND GREASE	Qty of Containers
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

CUSTODY TRANSFER	CUSTODY TRANSFER	CUSTODY TRANSFER	CUSTC
DATE____________ TIME ________	DATE____________ TIME ________	DATE____________ TIME ________	DATE____
FROM: ______________	FROM: ______________	FROM: ______________	FROM: __
ORGANIZATION__________________	ORGANIZATION__________________	ORGANIZATION__________________	ORGANIZA
TO: ______________	TO: ______________	TO: ______________	TO: _____
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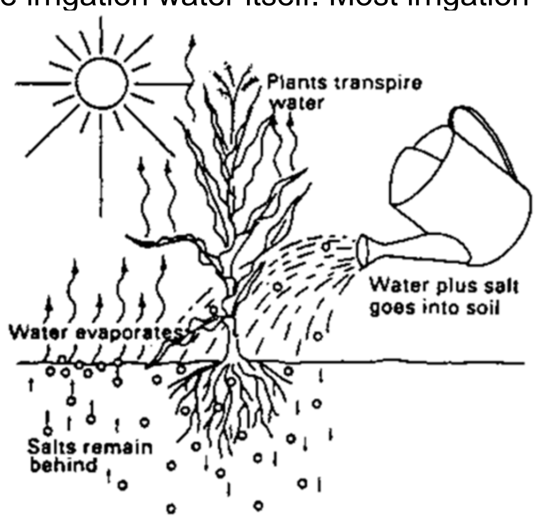
With regard to salt pollution a Berkeley environmental blog notes that when water evaporates from a salt pond the salt becomes much more concentrated – and a larger environmental danger. The blog notes:

> When salt ponds evaporate the salinity skyrockets. Sure enough, the salinity of the thin half-centimeter layer of water covering the wet mud shown in the photograph below of the Weep Site was 250-PPT [Parts per Thousand]. Sea water salinity is about 34-PPT, so this water was more than seven-times as salty. Few organisms can tolerate this intense salinity.

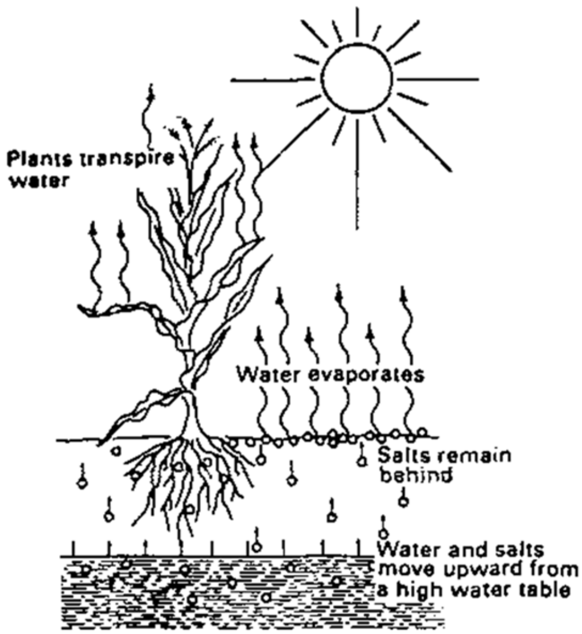
Source: http://arch.ced.berkeley.edu/hiddenecologies/

The United Nation's FAO corporate document repository had the following discussion on why salt is bad for crops and vegetation in their database:

> A soil may be rich in salts because the parent rock from which it was formed contains salts. Sea water is another source of salts in low-lying areas along the coast. A very common source of salts in irrigated soils is the irrigation water itself. Most irrigation waters contain some salts.



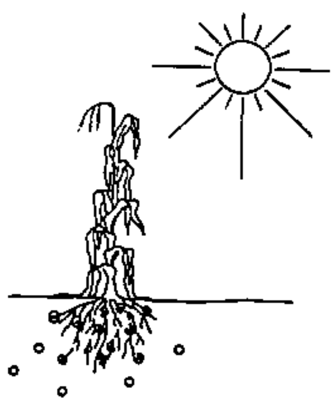
> After irrigation, the water added to the soil is used by the crop or evaporates directly from the moist soil. The salt, however, is left behind in the soil. If not removed, it accumulates in the soil; this process is called salinization (see Fig. 102). Very salty soils are sometimes recognizable by a white layer of dry salt on the soil surface.



Most crops do not grow well on soils that contain salts.

One reason is that salt causes a reduction in the rate and amount of water that the plant roots can take up from the soil (see Fig. 105). Also, some salts are toxic to plants when present in high concentration.

Salty groundwater may also contribute to salinization. When the water table rises (e.g. following irrigation in the absence of proper drainage), the salty groundwater may reach the upper soil layers and, thus, supply salts to the rootzone (see Fig. 103).
Soils that contain a harmful amount of salt are often referred to as salty or saline soils. Soil, or water, that has a high content of salt is said to have a high salinity.



Some plants are more tolerant to a high salt concentration than others. Some examples are given in the following table:

Highly tolerant	Moderately tolerant	Sensitive
Date palm	Wheat	Red clover
Barley	Tomato	Peas

Sugarbeet	Oats	Beans
Cotton	Alfalfa	Sugarcane
Asparagus	Rice	Pear
Spinach	Maize	Apple
	Flax	Orange
	Potatoes	Prune
	Carrot	Plum
	Onion	Almond
	Cucumber	Apricot
	Pomegranate	Peach
	Fig	
	Olive	
	Grape	

FAO CORPORATE DOCUMENT REPOSITORY

Some cases indicate that a landowner does not need to conduct scientific sampling to support their case. The can present evidence or testimony based on the effect of the pollution, with a qualified party testifying that the effect was caused by the alleged pollution.

For example, if trees die due to alleged salt water contamination from a nearby pit an expert in the field can testify that they are knowledgeable about trees and disease and the impact of oil field pollution, and in their opinion the symptoms of the fact situation involved was a classic case of salt water poisoning from oil field produced water. See: Magnolia Oil v McGeely, 223 P.2d 131.

Questions:

1. Why would a party want to sample lands for pollution if they can testify as to effect to meet their burden of proof?

2. Since samples of the alleged pollution are used to support claims of environmental contamination in many modern cases, what are the additional legal issues that may arise regarding such sampling and the use of the results?

Circumstantial Evidence & Hydraulic Fracturing

One of the difficulties landowners face when investigating potential oil field pollution is the fact that the details of many drilling operations are kept secret for competitive reasons. The initial review of well logs, drill stem tests, flaring volumes, downhole pressures, and other related data will give the operator a competitive advantage in a world where the ‘rule of capture’ prevails. Since the company is risking millions in drilling the well, the less information released to the public the better is the motto of many firms. As a result, determining if oil field operations was the cause of pollution is a challenge, as the following articles indicate.

SUNDAY, FEBRUARY 10, 2013

San Antonio Express-News

THE VOICE OF SOUTH TEXAS SINCE 1865 | MYSA.COM

Exact mix of fracking fluids remain a mystery

What's being put in ground stays buried.

By Jennifer Hiller

Updated 11:59 pm, Saturday, February 2, 2013

VIEW: Larger | Hide 1 of 9 ◄ PREV NEXT ►

A legal loophole that allows companies to withhold trade secrets means it's still largely unclear exactly which chemicals are being used in the fracking process. Photo: William Luther, San Antonio Express-News

It's been a year since the Texas oil and gas industry had to start disclosing the mix of water and chemicals it uses for hydraulic fracturing.

But thanks to a loophole in state law that allows companies to withhold trade secrets, it's still largely unclear exactly which chemicals are being pumped thousands of feet underground.

Of 12,410 instances of hydraulic fracturing in Texas between April 2011 and early December 2012, companies used terms such as “proprietary,” “secret” or “confidential” 10,120 times while reporting data on the FracFocus.org website, according to data collected through early December by the Houston-based Pivot Upstream Group and analyzed by the San Antonio Express-News.

Chemical trade secrets in the Eagle Ford

While the oil and gas industry is required by state law to report the chemicals it uses during hydraulic fracturing, there's also a trade-secret exemption companies can use to avoid complete disclosure.

Here are some of the counties in the Eagle Ford Shale region with high volumes of oil and gas production, and the number of times the trade-secret claim has been made there between April 2011 and early December 2012:

County	Trade secret claim
Dewitt	155
Dimmit	454
Gonzales	215
Karnes	339
La Salle	322
McMullen	160
Webb	283

Sources: PIVOT Upstream Resources, Express-News analysis

San Antonio Express-News

USA TODAY

NEWS SPORTS LIFE MONEY TECH TRAVEL OPINION

4 states confirm water pollution from drilling

Kevin Begos, AP   5:20 p.m. EST January 5, 2014

Associated Press review of complaints casts doubt on industry view that it rarely happens.

(Photo: John Heller, AP)

STORY HIGHLIGHTS

- AP requested data on drilling-related complaints in Pennsylvania, Ohio, West Virginia and Texas
- Extracting fuel from shale formations requires salt, chemicals, heavy metals and radiation
- Most common type of pollution involves methane gas, not other chemicals

PITTSBURGH (AP) — In at least four states that have nurtured the nation's energy boom, hundreds of complaints have been made about well-water contamination from oil or gas drilling, and pollution was confirmed in a number of them, according to a review that casts doubt on industry suggestions that such problems rarely happen.

The Associated Press requested data on drilling-related complaints in Pennsylvania, Ohio, West Virginia and Texas and found major differences in how the states report such problems. Texas provided the most detail, while the other states provided only general outlines. And while the confirmed problems represent only a tiny portion of the thousands of oil and gas wells drilled each year in the U.S., the lack of detail in some state reports could help fuel public confusion and mistrust.

The AP found that Pennsylvania received 398 complaints in 2013 alleging that oil or natural gas drilling polluted or otherwise affected private water wells, compared with 499 in 2012. The Pennsylvania complaints can include allegations of short-term diminished water flow, as well as pollution from stray gas or other substances. More than 100 cases of pollution were confirmed over the past five years.

Among the findings in the AP's review:

— Pennsylvania has confirmed at least 106 water-well contamination cases since 2005, out of more than 5,000 new wells. There were five confirmed cases of water-wel contamination in the first nine months of 2012, 18 in all of 2011 and 29 in 2010. The Environmental Department said more complete data may be available in several months.

— Ohio had 37 complaints in 2010 and no confirmed contamination of water supplies; 54 complaints in 2011 and two confirmed cases of contamination; 59 complaints in 2012 and two confirmed contaminations; and 40 complaints for the first 11 months of 2013, with two confirmed contaminations and 14 still under investigation, Department of Natural Resources spokesman Mark Bruce said in an email. None of the six confirmed cases of contamination was related to fracking, Bruce said.

— West Virginia has had about 122 complaints that drilling contaminated water wells over the past four years, and in four cases the evidence was strong enough that the driller agreed to take corrective action, officials said.

— A Texas spreadsheet contains more than 2,000 complaints, and 62 of those allege possible well-water contamination from oil and gas activity, said Ramona Nye, a spokeswoman for the Railroad Commission of Texas, which oversees drilling. Texas regulators haven't confirmed a single case of drilling-related water-well contamination in the past 10 years, she said.

In Pennsylvania, the number of confirmed instances of water pollution in the eastern part of the state "dropped quite substantially" in 2013, compared with previous years, Department of Environmental Protection spokeswoman Lisa Kasianowitz wrote in an email. Two instances of drilling affecting water wells were confirmed there last year, she said, and a final decision hasn't been made in three other cases. But she couldn't say how many of the other statewide complaints have been resolved or were found to be from natural causes.

Releasing comprehensive information about gas drilling problems is important becaus the debate is no longer about just science but trust, said Irina Feygina, a social psychologist who studies environmental policy issues. Losing public trust is "a surefire way to harm" the reputation of any business, Feygina said.

Experts and regulators agree that investigating complaints of water-well contamination is particularly difficult, in part because some regions also have natural methane gas pollution or other problems unrelated to drilling. A 2011 Penn State study found that about 40% of water wells tested prior to gas drilling failed at least one federal drinking water standard. Pennsylvania is one of only a few states that don't have private water-well construction standards.

While the oil and gas industry is frequently the target of pollution claims, keep in mind that regulators investigating environmental claims say that the broad majority are not supported by the facts – or alternative causes created the environmental issue, as the following article illustrates.

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North Dakota OKs spraying oil wastewater on roads

Posted 11/17/2008 8:27 PM | Comment | Recommend E-mail | Print |

By James Macpherson, Associated Press Writer

BISMARCK, N.D. — North Dakota's health department will allow salty oil field wastewater to be sprayed on roads as a deicer or for dust control even though oil companies and environmental groups have questioned the practice.

The Health Department said Monday that its studies found the briny water left from oil production was no more toxic than commercial road salt when applied to state highways.

But oil companies so far are reluctant to give away the water and government road crews are hesitant to use it, fearing liability issues, said Dave Glatt, director of the state Health Department's environmental health section.

"Applicators and oil companies are being cautious at this point, which is good," Glatt said.

State transportation director Francis Ziegler said there are no immediate plans to resume spraying salty wastewater on North Dakota highways.

But he said, "Never say never -- if the cost of road salt keeps going up, we may look at it again."

The Transportation Department had been using the oil well wastewater, 10 times saltier than sea water, to melt ice and snow on North Dakota roads -- mostly in the western part of the state -- since 1963. It stopped last year after The Associated Press reported on the practice. Some health officials had never heard of the practice until then.

The state Health Department has since conducted studies and found the salty oil well wastewater did not harm water or vegetation along roadsides, Glatt said.

Health officials tested about 10 oil wells, Glatt said. Some wells contained pollutants that would prohibit water from those wells to be dumped on the roads, but the water in others was as safe as commercial road salt, he said.

Under the Health Department rules, state, county or city governments could use oil wastewater on roads if it is comparable to commercial road salt, Glatt said. It would be up to the entities to test the wastewater through a private lab, and the health department would monitor the results, he said.

North Dakota Transportation Department spokeswoman Billie Jo Lorius said the price of road salt has jumped from about $40 a ton in 2004 to about $67 a ton this winter. The state spent about $1.6 million for 29,000 tons of road salt last year, Lorius said.

This winter, the state has been using a mixture of sugar beet pulp with commercial salt brine, officials said.

The oil wastewater had been given to the state at no cost.

The Sierra Club and the Dakota Resource Council, a Dickinson-based environmental and landowner group, say spraying the briny wastewater on roads is illegal, and they question the thoroughness of the state's study.

"It seems ridiculous that this is considered toxic when it is at the well and it's not when it's dumped on roads," said Wayde Schafer, a North Dakota spokesman for the Sierra Club. "I think that puts a kink in their line of reasoning."

Larry Melvin, mineral manager for the U.S. Forest Service in Bismarck, said if the briny water from oil wells is spilled on Forest Service land, it must be cleaned up and taken to an approved disposal site.

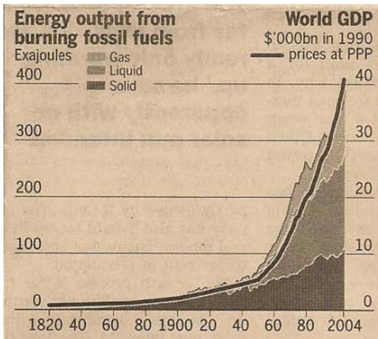
"It doesn't matter if it is oil or saltwater. If it's spilled, it has to be cleaned up, even if it's just a gallon," Melvin said. "Spills are not tolerated by the Forest Service."

Glatt said the state also requires oil field wastewater to be cleaned up if it is spilled on state or private land.

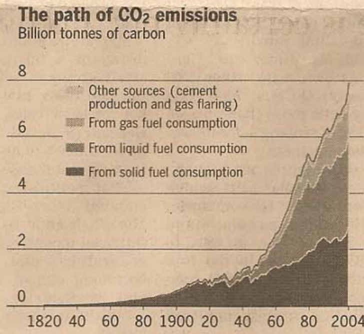
The wastewater can hurt the environment if it is concentrated in one spot, but its impact is diffused if spread out over large areas, such as roads, he said.

Will Economic Growth Destroy the Environment?

A well written analysis of economic growth, fossil fuel use, greenhouse gas emissions, and the future outlook for mankind – economic growth might be more important than many realize:



Sources: Carbon Dioxide Information Analysis Center; Angus Maddison



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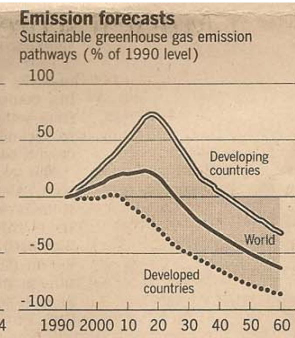

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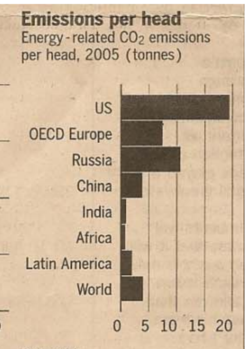

Source: IEA

The dangers of living in a zero-sum world economy

Martin Wolf

We live in a positive-sum world economy and have done so for about two centuries. This, I believe, is why democracy has become a political norm, empires have largely vanished, legal slavery and serfdom have disappeared and measures of well-being have risen almost everywhere. What then do I mean by a positive-sum economy? It is one in which everybody can become better off. It is one in which real incomes per head are able to rise indefinitely.

How long might such a world last, and what might happen if it ends? The debate on the connected issues of climate change and energy security raises these absolutely central questions. As I argued in a previous column ("Welcome to a world of runaway energy demand", November 14, 2007), fossilised sunlight and ideas have been the twin drivers of the world economy. So nothing less is at stake than the world we inhabit, by which I mean its political and economic, as well as physical, nature.

According to Angus Maddison, the economic historian, humanity's average real income per head has risen 10-fold since 1820.* Increases have also occurred almost everywhere, albeit to hugely divergent extents: US incomes per head have risen 23-fold and those of Africa merely four-fold. Moreover, huge improvements have happened, despite a more than six-fold increase in the world's population.

It is an astonishing story with hugely desirable consequences. Clever use of commercial energy has immeasurably increased the range of goods and services available. It has also substantially reduced both our own drudgery and our dependence on that of others. Serfs and slaves need no longer satisfy the appetites of narrow elites. Women need no longer devote their lives to the demands of domesticity. Consistent rises in real incomes per head have transformed our economic lives.

What is less widely understood is that they have also transformed politics. A zero-sum economy leads, inevitably, to repression at home and plunder abroad. In traditional agrarian societies the surpluses extracted from the vast majority of peasants supported the relatively luxurious lifestyles of military, bureaucratic and noble elites. The only way to increase the prosperity of an entire people was to steal from another one. Some peoples made almost a business out of such plunder: the Roman republic was one example; the nomads of the Eurasian steppes, who reached their apogee of success under Genghis Khan and his successors, were another. The European conquerors of the 16th to 18th centuries were, arguably, a third. In a world of stagnant living standards the gains of one group came at the expense of equal, if not still bigger, losses for others. This, then, was a world of savage repression and brutal predation.

The move to the positive-sum economy transformed all this fundamentally, albeit far more slowly than it might have done. It just took time for people to realise how much had changed. Democratic politics became increasingly workable because it was feasible for everybody to become steadily better off. People fight to keep what they have more fiercely than to obtain what they do not have. This is the "endowment effect". So, in the new positive-sum world, elites were willing to tolerate the enfranchisement of the masses. The fact that they no longer depended on forced labour made this shift easier still. Consensual politics, and so democracy, became the political norm.

Equally, a positive-sum global economy ought to end the permanent state of war that characterised the pre-modern world. In such an economy, internal development and external commerce offer better prospects for virtually everybody than does international conflict. While trade always offered the possibility of positive-sum exchange, as Adam Smith argued, the gains were small compared with what is offered today by the combination of peaceful internal development and expanding international trade. Unfortunately, it took almost two centuries after the "industrial revolution" for states to realise that neither war nor empire was a "game" worth playing.

ECONOMISTS' FORUM

A group of the world's most influential economists debate issues raised in Martin Wolf's regular Wednesday column in our online forum:
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Nuclear weapons and the rise of the developmental state have made war among great powers obsolete. It is no accident then that most of the conflicts on the planet have been civil wars in poor countries that had failed to build the domestic foundations of the positive-sum economy. But China and India have now achieved just that. Perhaps the most important single fact about the world we live in is that the leaderships of these two countries have staked their political legitimacy on domestic economic development and peaceful international commerce.

The age of the plunderer is past. Or is it? The biggest point about debates on climate change and energy supply is that they bring back the question of limits. If, for example, the entire planet emitted CO_2 at the rate the US does today, global emissions would be almost five times greater. The same, roughly speaking, is true of energy use per head. This is why climate change and energy security are such geopolitically significant issues. For if there are limits to emissions, there may also be limits to growth. But if there are indeed limits to growth, the political underpinnings of our world fall apart. Intense distributional conflicts must then re-emerge – indeed, they are already emerging – within and among countries.

The response of many, notably environmentalists and people with socialist leanings, is to welcome such conflicts. These, they believe, are the birth-pangs of a just global society. I strongly disagree. It is far more likely to be a step towards a world characterised by catastrophic conflict and brutal repression. This is why I sympathise with the hostile response of classical liberals and libertarians to the very notion of such limits, since they view them as the death-knell of any hopes for domestic freedom and peaceful foreign relations.

The optimists believe that economic growth can and will continue. The pessimists believe either that it will not do so or that it must not if we are to avoid the destruction of the environment. I think we have to try to marry what makes sense in these opposing visions. It is vital for hopes of peace and freedom that we sustain the positive-sum world economy. But it is no less vital to tackle the environmental and resource challenges the economy has thrown up. This is going to be hard. The condition for success is successful investment in human ingenuity. Without it, dark days will come. That has never been truer than it is today.

**Contours of the World Economy, 1-2030 AD, Oxford University Press 2007*

martin.wolf@ft.com

Texas Railroad Commission Oil & Gas Rules

The following rules address some of the more common environmental issues encountered in oil and gas operations. While Texas specific, every state with oil and gas production has rules that are very similar to those set out below.

The Resource Conservation and Recovery Act (RCRA) delegates regulatory authority over non-hazardous oil and gas production and exploration wastes to the states, provided the state has in place rules and regulations that effectively prevent environmental damage. As such, many states have adopted EPA approved rules and regulatory schemes with regard to waste management regulation – which creates consistency across state lines for oil and gas waste management.

Rule 3.7 Commentary – This rule provides that fluids in a well should not be allowed to infiltrate fresh water zones or other zones that might be encountered in drilling. When drilling a well high pressure natural gas zones and crude oil zones might be encountered. These high pressure fluids need to be controlled to minimize environmental damage from fluid migration up or down a well.

RULE §3.7 Strata To Be Sealed Off

Whenever hydrocarbon or geothermal resource fluids are encountered in any well drilled for oil, gas, or geothermal resources in this state, *such fluid shall be confined in its original stratum until it can be produced and utilized without waste. Each such stratum shall be adequately protected from infiltrating waters*. Wells may be drilled deeper after encountering a stratum bearing such fluids if such drilling shall be prosecuted with diligence and *any such fluids be confined in its stratum and protected as aforesaid upon completion of the well*. The commission will require each such stratum to be cased off and protected, if in its discretion it shall be reasonably necessary and proper to do so.

Rule 3.8 Commentary – This is the major Texas Railroad Commission Rule dealing with environmental issues related to pits, waste disposal, and record keeping.t

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RULE §3.8 Water Protection

(a) The following words and terms when used in this section shall have the following meanings, unless the context clearly indicates otherwise. . . .

[definitions of various pits, wastes, etc.]

(b) *No pollution. No person conducting activities subject to regulation by the commission may cause or allow pollution of surface or subsurface water in the state.*

(c) Exploratory wells. Any oil, gas, or geothermal resource well or well drilled for exploratory purposes shall be governed by the provisions of statewide or field rules which are applicable and pertain to the drilling, safety, casing, production, abandoning, and plugging of wells.

(d) Pollution control.

(1*) Prohibited disposal methods*. Except for those disposal methods authorized for certain wastes by paragraph (3) of this subsection, subsection (e) of this section, or §3.98 of this title (relating to Standards for Management of Hazardous Oil and Gas Waste), or disposal methods required to be permitted pursuant to §3.9 of this title (relating to Disposal Wells) (Rule 9) or §3.46 of this title (relating to Fluid Injection into Productive Reservoirs) (Rule 46), *no person may dispose of any oil and gas wastes by any method without obtaining a permit to dispose of such wastes. The disposal methods prohibited by this paragraph include, but are not limited to, the unpermitted discharge of oil field brines, geothermal resource waters, or other mineralized waters, or drilling fluids into any watercourse or drainageway, including any drainage ditch, dry creek, flowing creek, river, or any other body of surface water*.

(2) *Prohibited pits. No person may maintain or use any pit for storage of oil or oil products*. Except as authorized by paragraph (4) or (7)(C) or (8) of this subsection, no person may maintain or use any pit for storage of oil field fluids, or for storage or disposal of oil and gas wastes, without obtaining a permit to maintain or use the pit. A person is not required to have a permit to use a pit if a receiver has such a permit, if the person complies with the terms of such permit while using the pit, and if the person has permission of the receiver to use the pit. *The pits required by this paragraph to be permitted include, but are not limited to, the following types of pits: saltwater disposal pits; emergency saltwater storage pits; collecting pits; skimming pits; brine pits; brine mining pits; drilling fluid storage pits (other than mud circulation pits); drilling fluid disposal pits (other than reserve pits or slush pits); washout pits; and gas plant evaporation/retention pits*. If a person maintains or uses a pit for storage of oil field fluids, or for storage or disposal of oil and gas wastes, and the use or maintenance of the pit is neither authorized by paragraph (4) or (7)(C) or (8) of this subsection nor permitted, then the person maintaining or using the pit shall backfill and compact the pit in the time and manner required by the director. Prior to backfilling the pit, the person maintaining or using the pit shall, in a permitted manner or in a manner authorized by paragraph (3) of this subsection, dispose of all oil and gas wastes which are in the pit.

(3) *Authorized disposal methods*.

(A) *Fresh water condensate*. A person may, without a permit, dispose of fresh water which has been condensed from natural gas and collected at gas pipeline drips or gas compressor stations, provided the disposal is by a method other than disposal into surface water of the state.

(B) *Inert wastes*. A person may, without a permit, dispose of inert and essentially insoluble oil and gas wastes including, but not limited to, concrete, glass, wood, and wire, provided the disposal is by a method other than disposal into surface water of the state.

(C) *Low chloride drilling fluid*. A person may, without a permit, dispose of the following oil and gas wastes by landfarming, provided the wastes are disposed of on the same lease where they are generated, and provided the person has the written permission of the surface owner of the tract where landfarming will occur: water base drilling fluids with a chloride concentration of 3,000 milligrams per liter (mg/liter) or less; drill cuttings, sands, and silts obtained while using water base drilling fluids with a chloride concentration of 3,000 mg/liter or less; and wash water used for cleaning drill pipe and other equipment at the well site.

(D) *Other drilling fluid*. A person may, without a permit, dispose of the following oil and gas wastes by burial, provided the wastes are disposed of at the same well site where they are generated: water base drilling fluid which had a chloride concentration in excess of 3,000 mg/liter but which have been dewatered; drill cuttings, sands, and silts obtained while using oil base drilling fluids or water base drilling fluids with a chloride concentration in excess of 3,000 mg/liter; and those drilling fluids and wastes allowed to be landfarmed without a permit.

(E) *Completion/workover pit wastes*. A person may, without a permit, dispose of the following oil and gas wastes by burial in a completion/workover pit, provided the wastes have been dewatered, and provided the wastes are disposed of at the same well site where they are generated: spent completion fluids, workover fluids, and the materials cleaned out of the wellbore of a well being completed or worked over.

(F) Effect on backfilling. A person's choice to dispose of a waste by methods authorized by this paragraph shall not extend the time allowed for backfilling any reserve pit, mud circulation pit, or completion/workover pit whose use or maintenance is authorized by paragraph (4) of this subsection.

(4) *Authorized pits. A person may, without a permit, maintain or use reserve pits, mud circulation pits, completion/workover pits, basic sediment pits, flare pits, fresh makeup water pits, fresh mining water pits, and water condensate pits on the following conditions*.

(A) *Reserve pits and mud circulation pits. A person shall not deposit or cause to be deposited into a reserve pit or mud circulation pit any oil field fluids or oil and gas wastes, other than the following:*

(i) drilling fluids, whether fresh water base, saltwater base, or oil base;

(ii) drill cuttings, sands, and silts separated from the circulating drilling fluids;

(iii) wash water used for cleaning drill pipe and other equipment at the well site;

(iv) drill stem test fluids; and

(v) blowout preventer test fluids.

(B) Completion/workover pits. A person shall not deposit or cause to be deposited into a completion/workover pit any oil field fluids or oil and gas wastes other than spent completion fluids, workover fluid, and the materials cleaned out of the wellbore of a well being completed or worked over.

(C) *Basic sediment pits. A person shall not deposit or cause to be deposited into a basic sediment pit any oil field fluids or oil and gas wastes other than basic sediment removed from a production vessel or from the bottom of an oil storage tank*. Although a person may store basic sediment in a basic sediment pit, a person may not deposit oil or free saltwater in the pit. The total capacity of a basic sediment pit shall not exceed a capacity of 50 barrels. The area covered by a basic sediment pit shall not exceed 250 square feet.

(D) Flare pits. A person shall not deposit or cause to be deposited into a flare pit any oil field fluids or oil and gas wastes other than the hydrocarbons designed to go to the flare during upset conditions at the well, tank battery, or gas plant where the pit is located. A person shall not store liquid hydrocarbons in a flare pit for more than 48 hours at a time.

(E) Fresh makeup water pits and fresh mining water pits. A person shall not deposit or cause to be deposited into a fresh makeup water pit any oil and gas wastes or any oil field fluids other than water used to make up drilling fluid. A person shall not deposit or cause to be deposited into a fresh mining water pit any oil and gas wastes or any oil field fluids other than water used for solution mining of brine.

(F) Water condensate pits. A person shall not deposit or cause to be deposited into a water condensate pit any oil field fluids or oil and gas wastes other than fresh water condensed from natural gas and collected at gas pipeline drips or gas compressor stations.

(G) Backfill requirements.

(i) A person who maintains or uses a reserve pit, mud circulation pit, fresh makeup water pit, fresh mining water pit, completion/workover pit, basic sediment pit, flare pit, or water condensate pit shall dewater, backfill, and compact the pit according to the following schedule.

(I) Reserve pits and mud circulation pits which contain fluids with a chloride concentration of 6,100 mg/liter or less and fresh makeup water pits shall be dewatered, backfilled, and compacted within one year of cessation of drilling operations.

(II) Reserve pits and mud circulation pits which contain fluids with a chloride concentration in excess of 6,100 mg/liter shall be dewatered within 30 days and backfilled and compacted within one year of cessation of drilling operations.

(III) All completion/workover pits used when completing a well shall be dewatered within 30 days and backfilled and compacted within 120 days of well completion. All completion/workover pits used when working over a well shall be dewatered within 30 days and backfilled and compacted within 120 days of completion of workover operations.

(IV) Basic sediment pits, flare pits, fresh mining water pits, and water condensate pits shall be dewatered, backfilled, and compacted within 120 days of final cessation of use of the pits.

(V) If a person constructs a sectioned reserve pit, each section of the pit shall be considered a separate pit for determining when a particular section should be dewatered.

(ii) A person who maintains or uses a reserve pit, mud circulation pit, fresh makeup water pit, or completion/workover pit shall remain responsible for dewatering, backfilling, and compacting the pit within the time prescribed by clause (i) of this subparagraph, even if the time allowed for backfilling the pit extends beyond the expiration date or transfer date of the lease covering the land where the pit is located.

(iii) The director may require that a person who uses or maintains a reserve pit, mud circulation pit, fresh makeup water pit, fresh mining water pit, completion/workover pit, basic sediment pit, flare pit, or water condensate pit backfill the pit sooner than the time prescribed by clause (i) of this subparagraph if the director determines that oil and gas wastes or oil field fluids are likely to escape from the pit or that the pit is being used for improper storage or disposal of oil and gas wastes or oil field fluids.

(iv) Prior to backfilling any reserve pit, mud circulation pit, completion/workover pit, basic sediment pit, flare pit, or water condensate pit whose use or maintenance is authorized by this paragraph, the person maintaining or using the pit shall, in a permitted manner or in a manner authorized by paragraph (3) of this subsection, dispose of all oil and gas wastes which are in the pit.

(5) Responsibility for disposal. . . .

(e) Pollution prevention (reference Order Number 20-59,200, effective May 1, 1969).

(1) The operator shall not pollute the waters of the Texas offshore and adjacent estuarine zones (saltwater bearing bays, inlets, and estuaries) or damage the aquatic life therein.

(2) All oil, gas, and geothermal resource well drilling and producing operations shall be conducted in such a manner to preclude the pollution of the waters of the Texas offshore and adjacent estuarine zones. Particularly, the following procedures shall be utilized to prevent pollution. . . .

(g) Recordkeeping.

(1) Oil and gas waste. When oil and gas waste is hauled by vehicle from the lease, unit, or other oil or gas property where it is generated to an off-lease disposal facility, the person generating the oil and gas waste shall keep, for a period of three years from the date of generation, the following records:

(A) identity of the property from which the oil and gas waste is hauled;

(B) identity of the disposal system to which the oil and gas waste is delivered;

(C) name and address of the hauler, and permit number (WHP number) if applicable; and

(D) type and volume of oil and gas waste transported each day to disposal. . . .

Rule 3.9 Commentary – This rule provides details with regard to produced water disposal wells, testing, and permitting.

RULE §3.9 Disposal Wells

Any person who disposes of saltwater or other oil and gas waste by injection into a porous formation not productive of oil, gas, or geothermal resources shall be responsible for complying with this section, Texas Water Code, Chapter 27, and Title 3 of the Natural Resources Code.

(1) *General. Saltwater or other oil and gas waste, as that term is defined in the Texas Water Code, Chapter 27, may be disposed of, upon application to and approval by the commission, by injection into nonproducing zones of oil, gas, or geothermal resources bearing formations that contain water mineralized by processes of nature to such a degree that the water is unfit for domestic, stock, irrigation, or other general uses*. Every applicant who proposes to dispose of saltwater or other oil and gas waste into a formation not productive of oil, gas, or geothermal resources must obtain a permit from the commission authorizing the disposal in accordance with this section. Permits from the commission issued before the effective date of this section shall continue in effect until revoked, modified, or suspended by the commission.

(2) *Geological requirements. Before such formations are approved for disposal use, the applicant shall show that the formations are separated from freshwater formations by impervious beds which will give adequate protection to such freshwater formations*. The applicant must submit a letter from the Texas Commission on Environmental Quality or its successor agencies stating that the use of such formation will not endanger the freshwater strata in that area and that the formations to be used for disposal are not freshwater-bearing.

(3) Application. . . .

(8) Casing. *Disposal wells shall be cased and the casing cemented in compliance with §3.13 of this title (relating to Casing, Cementing, Drilling, and Completion Requirements) in such a manner that the injected fluids will not endanger oil, gas, geothermal resources, or freshwater resources*.

(9) Special equipment. . . .

(11) *Monitoring and reporting.*

(A) The operator shall monitor the injection pressure and injection rate of each disposal well on at least a monthly basis.

(B) The results of the monitoring shall be reported annually to the commission on the prescribed from.

(C) All monitoring records shall be retained by the operator for at least five years.

(D) The operator shall report to the appropriate District Office within 24 hours any significant pressure changes or other monitoring data indicating the presence of leaks in the well.

(12) *Testing.*

(A) Purpose. The mechanical integrity of a disposal well shall be evaluated by conducting pressure tests to determine whether the well tubing, packer, or casing have sufficient mechanical integrity to meet the performance standards of this rule, or by alternative testing methods under subparagraph (E) of this paragraph.

(B) Applicability. Mechanical integrity of each disposal well shall be demonstrated in accordance with provisions of subparagraph (D) and subparagraph (E) of this paragraph prior to initial use. In addition, mechanical integrity shall be tested periodically thereafter as described in subparagraph (C) of this paragraph.

(C) *Frequency.*

(i) Each disposal well completed with surface casing set and cemented through the entire interval of protected usable-quality water shall be tested for mechanical integrity at least once every five years.

(ii) In addition to testing required under clause (i), each disposal well shall be tested for mechanical integrity after every workover of the well.

(iii) A disposal well that is completed without surface casing set and cemented through the entire interval of protected usable-quality ground water shall be tested at the frequency prescribed in the disposal well permit.

(iv) The commission or its delegate may prescribe a schedule and mail notification to operators to allow for orderly and timely compliance with the requirements in clauses (i) and (ii) of this subparagraph. Such testing schedule shall not apply to a disposal well for which a disposal well permit has been issued but the well has not been drilled or converted to disposal.

(D) *Pressure tests.*

(i) Test pressure.

(I) The test pressure for wells equipped to dispose through tubing and packer shall equal the maximum authorized injection pressure or 500 psig, whichever is less, but shall be at least 200 psig.

(II) The test pressure for wells that are permitted for disposal through casing shall equal the maximum permitted injection pressure or 200 psig, whichever is greater.

(ii) Pressure stabilization. The test pressure shall stabilize within 10% of the test pressure required in clause (i) of this subparagraph prior to commencement of the test.

(iii) Pressure differential. A pressure differential of at least 200 psig shall be maintained between the test pressure on the tubing-casing annulus and the tubing pressure.

(iv) Test duration. A pressure test shall be conducted for a duration of 30 minutes when the test medium is liquid or for 60 minutes when the test medium is air or gas.

(v) Pressure recorder. Except for tests witnessed by a commission representative or wells permitted for disposal through casing, a pressure recorder shall be used to monitor and record the tubing-casing annulus pressure during the test. The recorder clock shall not exceed 24 hours. The recorder scale shall be set so that the test pressure is 30 to 70% of full scale, unless otherwise authorized by the commission or its delegate.

(vi) Test fluid.

(I) The tubing-casing annulus fluid used in a pressure test shall be liquid for wells that inject liquid unless the commission or its delegate authorizes the use of a different test fluid for good cause.

(II) The tubing-casing annulus fluid used in a pressure test shall contain no additives that may affect the sensitivity or otherwise reduce the effectiveness of the test.

(vii) Pressure test results. The commission or its delegate will consider, in evaluating the results of a test, the level of pollution risk that loss of well integrity would cause. Factors that may be taken into account in assessing pollution risk include injection pressure, frequency of testing and monitoring, and whether there is sufficient surface casing to cover all zones containing usable-quality water. A pressure test may be rejected by the commission or its delegate after consideration of the following factors:

(I) the degree of pressure change during the test, if any;

(II) the level of risk to usable-quality water if mechanical integrity of the well is lost; and

(III) whether circumstances surrounding the administration of the test make the test inconclusive.

(E) Alternative testing methods.

(i) As an alternative to the testing required in subparagraph (B) of this paragraph, the tubing-casing annulus pressure may be monitored and included on the annual monitoring report required by paragraph (11) of this section, with the authorization of the commission or its delegate and provided that there is no indication of problems with the well. Wells that are approved for tubing-casing annulus monitoring under this paragraph shall be tested in the manner provided under subparagraph (B) of this paragraph at least once every ten years after January 1, 1990.

(ii) The commission or its delegate may grant an exception for viable alternative tests or surveys or may require alternative tests or surveys as a permit condition.

<u>*(F) The operator shall notify the appropriate district office at least 48 hours prior to the testing. Testing shall not commence before the end of the 48-hour period unless authorized by the district office.*</u>

<u>*(G) A complete record of all tests shall be filed in duplicate in the district office on the appropriate form within 30 days after the testing.*</u>

(H) In the case of permits issued under this section prior to the effective date of this amendment which require pressure testing more frequently than once every five years, the commission's delegate may, by letter of authorization, reduce the required frequency of pressure tests, provided that such tests are required at least once every three years. The commission shall consider the permit to have been amended to require pressure tests at the frequency specified in the letter of authorization.

(13) Plugging. Disposal wells shall be plugged upon abandonment in accordance with §3.14 of this title (relating to Plugging).

(14) Penalties. . . .

Rule 3.13 Commentary – This rule provides that water and other zones should be isolated to avoid contamination.

RULE §3.13 Casing, Cementing, Drilling, and Completion Requirements
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(a) General.

(1) The operator is responsible for compliance with this section during all operations at the well. *<u>It is the intent of all provisions of this section that casing be securely anchored in the hole in order to effectively control the well at all times, all usable-quality water zones be isolated and sealed off to effectively prevent contamination or harm, and all potentially productive zones be isolated and sealed off to prevent vertical migration of fluids or gases behind the casing</u>*. When the section does not detail specific methods to achieve these objectives, the responsible party shall make every effort to follow the intent of the section, using good engineering practices and the best currently available technology. . .

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Rule 3.14 Commentary – This rule provides that wells should be o
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RULE §3.14 Plugging

(a) Definitions and application to plug. . . .

[definitions omitted]

(2) *<u>The operator shall give the Commission notice of its intention to plug any well or wells drilled for oil, gas, or geothermal resources or for any other purpose over which the Commission has jurisdiction</u>*, except those specifically addressed in §3.100(e)(1) of this title (relating to Seismic Holes and Core Holes) (Statewide Rule 100), prior to plugging. The operator shall deliver or transmit the written notice to the district office on the appropriate form.

(3*) The operator shall cause the notice of its intention to plug to be delivered to the district office at least five days prior to the beginning of plugging operations. The notice shall set out the proposed plugging procedure as well as the complete casing record*. The operator shall not commence the work of plugging the well or wells until the proposed procedure has been approved by the district director or the director's delegate. The operator shall not initiate approved plugging operations before the date set out in the notification for the beginning of plugging operations unless authorized by the district director or the director's delegate. The operator shall notify the district office at least four hours before commencing plugging operations and proceed with the work as approved. The district director or the director's delegate may grant exceptions to the requirements of this paragraph concerning the timing of notices when a workover or drilling rig is already at work on location, and ready to commence plugging operations. Operations shall not be suspended prior to plugging the well unless the hole is cased and casing is cemented in place in compliance with Commission rules. The Commission's approval of a notice of intent to plug and abandon a well shall not relieve an operator of the requirement to comply with subsection (b)(2) of this section, nor does such approval constitute an extension of time to comply with subsection (b)(2) of this section.

(4) *The surface owner and the operator may file an application to condition an abandoned well located on the surface owner's tract for usable quality water production operations*. The application shall be made on Commission Form P-13, the Application of Landowner to Condition an Abandoned Well for Fresh Water Production.

(A) Standard for Commission Approval. Before the Commission will consider approval of an application:

(i) the surface owner shall assume responsibility for plugging the well and obligate himself, his heirs, successors, and assignees to complete the plugging operations;

(ii) the operator responsible for plugging the well shall place all cement plugs required by this rule up to the base of the usable quality water strata; and

(iii) the surface owner shall submit:

(I) a signed statement attesting to the fact that:

(-a-) there is no groundwater conservation district for the area in which the well is located; or

(-b-) there is a groundwater conservation district for the area where the well is located, but the groundwater conservation district does not require that the well be permitted or registered; or

(-c-) the surface owner has registered the well with the groundwater conservation district for the area where the well is located; or

(II) a copy of the permit from the groundwater conservation district for the area where the well is located.

(B) The duty of the operator to properly plug ends only when:

(i) the operator has properly plugged the well in accordance with Commission requirements up to the base of the usable quality water stratum;

(ii) the surface owner has registered the well with, or has obtained a permit for the well from, the groundwater conservation district, if applicable; and

(iii) the Commission has approved the application of surface owner to condition an abandoned well for fresh water production.

(5) The operator of a well shall serve notice on the surface owner of the well site tract, or the resident if the owner is absent, before the scheduled date for beginning the plugging operations. A representative of the surface owner may be present to witness the plugging of the well. Plugging shall not be delayed because of the lack of actual notice to the surface owner or resident if the operator has served notice as required by this paragraph. The district director or the director's delegate may grant exceptions to the requirements of this paragraph concerning the timing of notices when a workover or drilling rig is already at work on location and ready to commence plugging operations.

(b) Commencement of plugging operations, extensions, and testing.

(1) The operator shall complete and file in the district office a duly verified plugging record, in duplicate, on the appropriate form within 30 days after plugging operations are completed. A cementing report made by the party cementing the well shall be attached to, or made a part of, the plugging report. If the well the operator is plugging is a dry hole, an electric log status report shall be filed with the plugging record.

(2) Plugging operations on each dry or inactive well shall be commenced within a period of one year after drilling or operations cease and shall proceed with due diligence until completed unless the Commission or its delegate approves a plugging extension under §3.15 of this title (relating to Surface Equipment Removal Requirements and Inactive Wells). . . .

(d) General plugging requirements.

(1) _Wells shall be plugged to insure that all formations bearing usable quality water, oil, gas, or geothermal resources are protected_. All cementing operations during plugging shall be performed under the direct supervision of the operator or his authorized representative, who shall not be an employee of the service or cementing company hired to plug the well. Direct supervision means supervision at the well site during the plugging operations. The operator and the cementer are both responsible for complying with the general plugging requirements of this subsection and for plugging the well in conformity with the procedure set forth in the approved notice of intention to plug and abandon for the well being plugged. The operator and cementer may each be assessed administrative penalties for failure to comply with the general plugging requirements of this subsection or for failure to plug the well in conformity with the approved notice of intention to plug and abandon the well.

(2) *Cement plugs shall be set to isolate each productive horizon and usable quality water strata*. Plugs shall be set as necessary to separate multiple usable quality water strata by placing the required plug at each depth as determined by the Texas Commission on Environmental Quality or its successor agencies. The operator shall verify the placement of the plug required at the base of the deepest usable quality water stratum by tagging with tubing or drill pipe or by an alternate method approved by the district director or the district director's delegate.

(3) Cement plugs shall be placed by the circulation or squeeze method through tubing or drill pipe. Cement plugs shall be placed by other methods only upon written request with the written approval of the district director or the director's delegate.

(4) All cement for plugging shall be an approved API oil well cement without volume extenders and shall be mixed in accordance with API standards. Slurry weights shall be reported on the cementing report. The district director or the director's delegate may require that specific cement compositions be used in special situations; for example, when high temperature, salt section, or highly corrosive sections are present. An operator shall request approval to use alternate materials . . .

Rule 3.16 Commentary – This rule requires details of the plugging operation should be filed with the regulatory agency.

RULE §3.16 Log and Completion or Plugging Report

(a) Definitions. The following words and terms, when used in this section, shall have the following meanings, unless the context clearly indicates otherwise:

(1) Basic electric log--A density, sonic, or resistivity (except dip meter) log run over the entire wellbore.

(2) Drilling operation--A continuous effort to drill or deepen a wellbore for which the commission has issued a permit.

(3) Operator--A person who assumes responsibility for the regulatory compliance of a well as shown by a form the person files with the commission and the commission approves.

(4) Well--A well drilled for any purpose related to exploration for or production or storage of oil or gas or geothermal resources, including a well drilled for injection of fluids to enhance hydrocarbon recovery, disposal of produced fluids, disposal of waste from exploration or production activity, or brine mining.

(b) *Completion and plugging reports. The operator of a well shall file with the commission the appropriate completion report within 30 days after completion of the well or within 90 days after the date on which the drilling operation is completed, whichever is earlier. The operator of a well shall file with the Commission an amended completion report within 30 days of any physical changes made to the well, such as any change in perforations, or openhole or casing records. If the well is a dry hole, the operator shall file with the commission an appropriate plugging report within 30 days after the well is plugged.*

(c) *Basic electric logs. Except as otherwise provided in this section, not later than the 90th day after the date a drilling operation is completed, the operator shall file with the commission a legible and unaltered copy of a basic electric log, except that where a well is deepened, a legible and unaltered copy of a basic electric log shall be filed if such log is run over a deeper interval than the interval covered by a basic electric log for the well already on file with the commission. In the event a basic electric log, as defined in this section, has not been run, subject to the commission's approval, the operator shall file a lithology log or gamma ray log of the entire wellbore*. In the event no log has been run over the entire wellbore, subject to the commission's approval, the operator shall file the log which is the most nearly complete of the logs run.

(d) Delayed filing based on confidentiality. Each log filed with the commission shall be considered public information and shall be available to the public during normal business hours. If the operator of a well desires a log to be confidential, on or before the 90th day after the date a drilling operation is completed, the operator must submit a written request for a delayed filing of the log. When filing such a request, the operator must retain the log and may delay filing such log for one year beginning from the date the drilling operation was completed. The operator of such well may request an additional filing delay of two years, provided the written request is filed prior to the expiration date of the initial confidentiality period. If a well is drilled on land submerged in state water, the operator may request an additional filing delay of two years so that a possible total delay of five years may be obtained. A request for the additional two year filing delay period must be in writing and be filed with the commission prior to the expiration of the first two year filing delay. Logs must be filed with the commission within 30 days after the expiration of the final confidentiality period, except that an operator who fails to timely file with the commission a written request under this subsection for an extension of the period of log confidentiality shall file the log with the commission immediately after the conclusion of the period for filing the request.

(e) Sanctions. If an operator fails to file a completion report or log in accordance with the provisions of this section, the commission may refuse to assign an allowable to a well, set the allowable for such well at zero, and/or initiate penalty action pursuant to the Texas Natural Resources Code, Title 3.

Rule 3.20 Commentary – This rule provides that the operator needs to notify the agency in the event of a leak or blowout.

RULE §3.20 Notification of Fire Breaks, Leaks, or Blow-outs

(a) General requirements.

(1) *Operators shall give immediate notice of a fire, leak, spill, or break to the appropriate commission district office by telephone or telegraph. Such notice shall be followed by a letter giving the full description of the event, and it shall include the volume of crude oil, gas, geothermal resources, other well liquids, or associated products lost.*

(2) *All operators of any oil wells, gas wells, geothermal wells, pipelines receiving tanks, storage tanks, or receiving and storage receptacles into which crude oil, gas, or geothermal resources are produced, received, stored, or through which oil, gas, or geothermal resources are piped or transported, shall immediately notify the commission by letter, giving full details concerning all fires which occur at oil wells, gas wells, geothermal wells, tanks, or receptacles owned, operated, or controlled by them or on their property, and all such persons shall immediately report all tanks or receptacles struck by lightning and any other fire which destroys crude oil, natural gas, or geothermal resources, or any of them, and shall immediately report by letter any breaks or leaks in or from tanks or other receptacles and pipelines from which oil, gas, or geothermal resources are escaping or have escaped*. In all such reports of fires, breaks, leaks, or escapes, or other accidents of this nature, the location of the well, tank, receptacle, or line break shall be given by county, survey, and property, so that the exact location thereof can be readily located on the ground. Such report shall likewise specify what steps have been taken or are in progress to remedy the situation reported and shall detail the quantity (estimated, if no accurate measurement can be obtained, in which case the report shall show that the same is an estimate) of oil, gas, or geothermal resources, lost, destroyed, or permitted to escape. In case any tank or receptacle is permitted to run over, the escape thus occurring shall be reported as in the case of a leak. (Reference Order Number 20-60,399, effective 9-24-70.)

(b) *The report hereby required as to oil losses shall be necessary only in case such oil loss exceeds five barrels in the aggregate. . . .*

Rule 3.36 Commentary – This rule provides that special precautions need to be taken in areas that might produce ‘sour gas’ – a potentially deadly substance.

RULE §3.36 Oil, Gas, or Geothermal Resource Operation in Hydrogen Sulfide Areas

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(a) Applicability. Each operator who conducts operations as described in paragraph (1) of this subsection shall be subject to this section and shall provide safeguards to protect the general public from the harmful effects of hydrogen sulfide. This section applies to both intentional and accidental releases of hydrogen sulfide.

(1) Operations including drilling, working over, producing, injecting, gathering, processing, transporting, and storage of hydrocarbon fluids that are part of, or directly related to, field production, transportation, and handling of hydrocarbon fluids that contain gas in the system

which has hydrogen sulfide as a constituent of the gas, to the extent as specified in subsection (c) of this section, general provisions.

(2) This section shall not apply to:

(A) operations involving processing oil, gas, or hydrocarbon fluids which are either an industrial modification or products from industrial modification, such as refining, petrochemical plants, or chemical plants;

(B) operations involving gathering, storing, and transporting stabilized liquid hydrocarbons;

(C) operations where the concentration of hydrogen sulfide in the system is less than 100 ppm. . . .

Rule 3.46 Commentary – Similar to rule 3.9 dealing with injection of produced water for disposal, this rule deals with injection of produced water into productive reservoirs to enhance oil recovery.

RULE §3.46 Fluid Injection into Productive Reservoirs

(a) Permit required. Any person who engages in fluid injection operations in reservoirs productive of oil, gas, or geothermal resources must obtain a permit from the commission. Permits may be issued when the injection will not endanger oil, gas, or geothermal resources or cause the pollution of freshwater strata unproductive of oil, gas, or geothermal resources. Permits from the commission issued before the effective date of this section shall continue in effect until revoked, modified, or suspended by the commission. . . . .

(i) Monitoring and reporting.

(1) *The operator shall monitor the injection pressure and injection rate of each injection well on at least a monthly basis.*

(2) The results of the monitoring shall be reported annually to the commission on the prescribed form.

(3) All monitoring records shall be retained by the operator for at least five years.

(4) The operator shall report to the appropriate District Office within 24 hours any significant pressure changes or other monitoring data indicating the presence of leaks in the well.

(j) Testing.

(1) *Purpose. The mechanical integrity of an injection well shall be evaluated by conducting pressure tests to determine whether the well tubing, packer, or casing have sufficient*

mechanical integrity to meet the performance standards of this rule, or by alternative testing methods under paragraph (5) of this subsection.

(2) Applicability. Mechanical integrity of each injection well shall be demonstrated in accordance with provisions of paragraphs (4) and (5) of this subsection prior to initial use. In addition, mechanical integrity shall be tested periodically thereafter as described in paragraph (3) of this subsection.

(3) Frequency.

(A*) Each injection well completed with surface casing set and cemented through the entire interval of protected usable-quality water shall be tested for mechanical integrity at least once every five years.*

(B) In addition to testing required under subparagraph (A), each injection well shall be tested for mechanical integrity after every workover of the well.

(C) An injection well that is completed without surface casing set and cemented through the entire interval of protected usable-quality ground water shall be tested at the frequency prescribed in the injection permit.

(D) The commission or its delegate may prescribe a schedule and mail notification to operators to allow for orderly and timely compliance with the requirements in subparagraph (A) and subparagraph (B) of this paragraph. Such testing schedule shall not apply to an injection well for which an injection well permit has been issued but the well has not been drilled or converted to injection.

(4) Pressure tests.

(A) Test pressure.

(i) The test pressure for wells equipped to inject through tubing and packer shall equal the maximum authorized injection pressure or 500 psig, whichever is less, but shall be at least 200 psig.

(ii) The test pressure for wells that are permitted for injection through casing shall equal the maximum permitted injection pressure or 200 psig, whichever is greater.

(B) Pressure stabilization. The test pressure shall stabilize within 10% of the test pressure required in subparagraph (A) of this paragraph prior to commencement of the test.

(C) Pressure differential. A pressure differential of at least 200 psig shall be maintained between the test pressure on the tubing-casing annulus and the tubing pressure.

(D) Test duration. A pressure test shall be conducted for a duration of 30 minutes when the test medium is liquid or for 60 minutes when the test medium is air or gas.

(E) Pressure recorder. Except for tests witnessed by a commission representative or wells permitted for injection through casing, a pressure recorder shall be used to monitor and record the tubing-casing annulus pressure during the test. The recorder clock shall not exceed 24 hours. The recorder scale shall be set so that the test pressure is 30 to 70% of full scale, unless otherwise authorized by the commission or its delegate.

(F) Test fluid.

(i) The tubing-casing annulus fluid used in a pressure test shall be liquid for wells that inject liquid unless the commission or its delegate authorizes use of a different test fluid for good cause.

(ii) The tubing-casing annulus fluid used in a pressure test shall contain no additives that may affect the sensitivity or otherwise reduce the effectiveness of the test.

(G) Pressure test results. The commission or its delegate will consider, in evaluating the results of a test, the level of pollution risk that loss of well integrity would cause. Factors that may be taken into account in assessing pollution risk include injection pressure, frequency of testing and monitoring, and whether there is sufficient surface casing to cover all zones containing usable-quality water. A pressure test may be rejected by the commission or its delegate after consideration of the following factors:

(i) the degree of pressure change during the test, if any;

(ii) the level of risk to usable-quality water if mechanical integrity of the well is lost; and

(iii) whether circumstances surrounding the administration of the test make the test inconclusive. . . .

Rule 3.57 Commentary – This rule provides for the reclamation of certain wastes.

RULE §3.57 Reclaiming Tank Bottoms, Other Hydrocarbon Wastes, and Other Waste Materials

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(a) Applicability. *<u>This section is applicable to reclamation of tank bottoms and other hydrocarbon wastes generated through activities associated with the exploration, development, and production (including transportation) of crude oil and other waste materials containing oil, as those activities are defined in §3.8(a)(30) of this title (relating to Water Protection). The provisions of this section shall not apply where tank bottoms or other hydrocarbon-bearing materials are recycled or processed on-site by the owner/custodian and are returned to a tank or vessel at the same lease or facility</u>*. This section is not applicable to the practice of recycling or reusing drilling mud, except as to those hydrocarbons recovered from such mud recycling and sent to a permitted reclamation plant.

(b) Definitions. . . .

(c) Permitting process.

(1) Removal of tank bottoms or other hydrocarbon wastes from any producing lease tank, pipeline storage tank, or other production facility, for reclaiming by any person, is prohibited unless such person has either obtained a permit to operate a reclamation plant, or is an authorized person. Applicants for a reclamation plant operating permit shall file the appropriate form with the commission in Austin.

(2) The applicant shall give notice by mailing or delivering a copy of the application to the county clerk of the county where the reclamation plant is to be located, and to the city clerk or other appropriate city official of any city where the reclamation plant is located within the corporate limits of the city, on or before the date the application is mailed to or filed with the commission.

(3) In order to give notice to other local governments and interested or affected persons, notice of the application shall be published once by the applicant in a newspaper of general circulation for the county where the reclamation plant is to be located, in a form approved by the commission. Publication shall occur on or before the date the application is mailed to or filed with the commission. The applicant shall file with the commission in Austin proof of publication prior to the hearing or administrative approval.

(4) If a protest from an affected person or local government is made to the commission within 15 days of receipt of the application or of publication, or if the commission determines that a hearing is in the public interest, then a hearing will be held on the application after the commission provides notice of hearing to all affected persons, local governments, or other persons who express an interest in writing in the application.

(5) If no protest from an affected person or local government is received by the commission within the allotted time, the director may administratively approve the application. If the director denies administrative approval, the applicant shall have a right to a hearing upon request. After hearing, the examiner shall recommend a final action by the commission.

(6) Applicants must demonstrate they are familiar with commission rules and have the proper facilities to comply with the rules. . . .

Rule 3.91 Commentary – This rule provides for the clean up of contaminated soil at wellsites.

RULE §3.91 Cleanup of Soil Contaminated by a Crude Oil Spill

(a) Terms. The following words and terms, when used in this section, shall have the following meanings, unless the context clearly indicates otherwise.

(1) Free oil--The crude oil that has not been absorbed by the soil and is accessible for removal.

(2) Sensitive areas--These areas are defined by the presence of factors, whether one or more, that make an area vulnerable to pollution from crude oil spills. Factors that are characteristic of sensitive areas include the presence of shallow groundwater or pathways for communication with deeper groundwater; proximity to surface water, including lakes, rivers, streams, dry or flowing creeks, irrigation canals, stock tanks, and wetlands; proximity to natural wildlife refuges or parks; or proximity to commercial or residential areas.

(3) Hydrocarbon condensate--The light hydrocarbon liquids produced in association with natural gas.

(b) Scope. These cleanup standards and procedures apply to the cleanup of soil in non-sensitive areas contaminated by crude oil spills from activities associated with the exploration, development, and production, including transportation, of oil or gas or geothermal resources as defined in §3.8(a)(30) of this title (relating to Water Protection). For the purposes of this section, crude oil does not include hydrocarbon condensate. These standards and procedures do not apply to hydrocarbon condensate spills, crude oil spills in sensitive areas, or crude oil spills that occurred prior to the effective date of this section. Cleanup requirements for hydrocarbon condensate spills and crude oil spills in sensitive areas will be determined on a case-by-case basis. Cleanup requirements for crude oil contamination that occurred wholly or partially prior to the effective date of this section will also be determined on a case-by-case basis. Where cleanup requirements are to be determined on a case-by-case basis, the operator must consult with the appropriate district office on proper cleanup standards and methods, reporting requirements, or other special procedures.

(c) Requirements for cleanup.

(1) Removal of free oil. To minimize the depth of oil penetration, all free oil must be removed immediately for reclamation or disposal.

(2) Delineation. Once all free oil has been removed, the area of contamination must be immediately delineated, both vertically and horizontally. For purposes of this paragraph, the area of contamination means the affected area with more than 1.0% by weight total petroleum hydrocarbons.

(3) Excavation. At a minimum, all soil containing over 1.0% by weight total petroleum hydrocarbons must be brought to the surface for disposal or remediation.

(4) Prevention of stormwater contamination. To prevent stormwater contamination, soil excavated from the spill site containing over 5.0% by weight total petroleum hydrocarbons must immediately be:

(A) mixed in place to 5.0% by weight or less total petroleum hydrocarbons; or

(B) removed to an approved disposal site; or

(C) removed to a secure interim storage location for future remediation or disposal. The secure interim storage location may be on site or off site. The storage location must be designed to prevent pollution from contaminated stormwater runoff. Placing oily soil on plastic and covering it with plastic is one acceptable means to prevent stormwater contamination; however, other methods may be used if adequate to prevent pollution from stormwater runoff.

(d) Remediation of soil.

(1) Final cleanup level. A final cleanup level of 1.0% by weight total petroleum hydrocarbons must be achieved as soon as technically feasible, but not later than one year after the spill incident. The operator may select any technically sound method that achieves the final result.

(2) Requirements for bioremediation. If on-site bioremediation or enhanced bioremediation is chosen as the remediation method, the soil to be bioremediated must be mixed with ambient or other soil to achieve a uniform mixture that is no more than 18 inches in depth and that contains no more than 5.0% by weight total petroleum hydrocarbons.

(e) Reporting requirements.

(1) Crude oil spills over five barrels. For each spill exceeding five barrels of crude oil, the responsible operator must comply with the notification and reporting requirements of §3.20 of this title (relating to Notification of Fire Breaks, Leaks, or Blow-outs) and submit a report on a Form H-8 to the appropriate district office. The following information must be included:

(A) area (square feet), maximum depth (feet), and volume (cubic yards) of soil contaminated with greater than 1.0% by weight total petroleum hydrocarbons;

(B) a signed statement that all soil containing over 1.0% by weight total petroleum hydrocarbons was brought to the surface for remediation or disposal;

(C) a signed statement that all soil containing over 5.0% by weight total petroleum hydrocarbons has been mixed in place to 5.0% by weight or less total petroleum hydrocarbons or has been removed to an approved disposal site or to a secure interim storage location;

(D) a detailed description of the disposal or remediation method used or planned to be used for cleanup of the site;

(E) the estimated date of completion of site cleanup.

(2) Crude oil spills over 25 barrels. For each spill exceeding 25 barrels of crude oil, in addition to the report required in paragraph (1) of this subsection, the operator must submit to the appropriate district office a final report upon completion of the cleanup of the site. Analyses of samples representative of the spill site must be submitted to verify that the final cleanup concentration has been achieved.

(3) Crude oil spills of five barrels or less. Spills into the soil of five barrels or less of crude oil must be remediated to these standards, but are not required to be reported to the commission. All spills of crude oil into water must be reported to the commission.

(f) Alternatives. Alternatives to the standards and procedures of this section may be approved by the commission for good cause, such as new technology, if the operator has demonstrated to the commission's satisfaction that the alternatives provide equal or greater protection of the environment. A proposed alternative must be submitted in writing and approved by the commission.

Federal Environmental Statutes

Numerous federal statutes and regulations impact oil and gas operations. The more common regulations impacting oil and gas production activities are set out below.

Federal Water Pollution Control Act / Clean Water Act

In 1972 Congress established a comprehensive program of federal regulation of water pollution by enacting the Federal water Pollution Control Act of 1972 (FWPCA). This Act was extensively amended in 1977 and renamed the Clean Water Act (CWA).

Prior to the FWPCA the Refuse Act of 1899 had been used to regulate discharges into navigable water. The Refuse Act was enacted primarily to protect navigation, and prohibited almost all discharges into navigable waters without a permit. See: 33 USCA Sec. 407. The Refuse Act contains one notable exception that allows discharges of stormwater runoff without a permit.

NPDES PERMITS

The main tool that is used by the Clean Water Act to regulate the discharge of pollutants into surface waters is the National Pollution Discharge Elimination System ("NPDES") permit. The NPDES permit is required for the discharge of any pollutant from any point source into the navigable waters of the United States. See: 33 USCA Sec. 1342.

A NPDES permit which is issued under the CWA will been deemed to fulfill the permitting requirements of the Refuse Act of 1899. U.S. v. Rohm & Haas Co., 500 F.2d 167 (5th Cir. 1974).

Under the CWA the term "point source" is defined to mean any discernible confined and discrete conveyance of a discharge, including, but not limited to, any pipe, ditch, channel tunnel, or conduit from which pollutants could be discharged. 33 U.S.C.A. Sec. 1362(14). The term "discharge" is defined as the addition of any pollutant to navigable waters. 33 USCA Sec. 1362(12).

"Pollutant" includes dredged soil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, rock, sand, industrial, municipal, and agricultural waste discharged into .water. 33 USCA Sec. 1362 (6).

Water, gas, or other material which is injected into a well to facilitate production of oil or gas, or water derived in association with oil or gas production and disposed of in a well, are not considered a "pollutant" for NPDES permitting purposes. 40 CFR Sec. 122.2.

"Waters of the united States" have been defined to include navigable waters, tributaries of navigable waters, interstate waters, intrastate waters used by interstate travelers or industry.

The EPA has been authorized to delegate regulatory responsibility to the states meeting certain minimum requirements. Where required an "individual", or site specific, NPDES permit can be obtained for the discharge of a pollutant from an oil and gas facility. 40 CFR Sec. 122.21. Where the facility is owned by one party and operated by another the operator has the duty to obtain the permit. 40 CFR Sec. 122.21(b).
Because of the large number of potential individual permits, "general" National Pollution Discharge Elimination System ("NPDES") permits are available from the EPA, versus the "individual" NPDES

permits for each facility. 40 CFR Part 122.28. Onshore E & P operations in Louisiana, New Mexico, Texas and Oklahoma can obtain NPDES general permits.

Waste water discharges can be classified into two categories: "process related" and "non-process" type discharges. Process related waste water includes produced water and sands, drilling muds, completion fluids, oil and condensate spills! well treatment fluids, refinery wastes, and equipment maintenance fluidso Non-process related waste water discharges generally include contaminated storm water runoff.

(a) permitting of "process related" waste water discharges

i. Petroleum Refining & other Source NPDES permits

Any discharge of pollutants into the waters of the United States is prohibited unless the discharge is authorized by a NPDES permit issued pursuant to section 402 of the CWA.

Section 402 of the CWA provides that any NPDES permit which is issued will incorporate new source performance standards (NSPS) and/or effluent guidelines that have been adopted. In addition, the NPDES permit must incorporate any state water quality or treatment guidelines in effect.

An applicant for a NPDES permit under the CWA who is proposing a new discharge into navigable waters should generally apply at least 180 days before the date on which the discharge is to commence. See: 40 CFR Sec. 122.21.

Generally an individual NPDES permit application will require that the following information be submitted: (1) outfall location, (2) name of receiving waters, (3) type of wastes, (4) flow rates, (5) effluent characteristics, etc. See: 40 CFR Sec. 122.21(g) & (h). Other information with regard to the discharge and applicant will also be required.

The NPDES permit application will need to be signed by a responsible corporate officer, defined as one who is the president, secretary, treasurer, or manager of one or more manufacturing facilities employing 250 persons or having gross annual sales in excess of $25 million. 40 CFR Sec. 122.2(a)(1). Reports that are required under the NPDES permit will also be required to be signed by the responsible corporate officer. 40 CFR Sec. 122.2(b).

ii. Exploration & production NPDES permits

Process discharges from oil and gas wells are categorized into "onshore", "offshore", "coastal", "stripper", and "agricultural" sub-categories. See: 40 CFR Part 435. For "onshore" operations which include production, field exploration, drilling, well completion, and well treatment activities the EPA's effluent guidelines provide as follows:

> *There shall be no discharge of waste water pollutants into navigable water from any source associated with production, field exploration, drilling, well completion, or well treatment (i.e., produced water, drilling muds, drill cuttings, and produced sand).*

In an environmental audit of onshore oil and gas wells, it should be determined that there are no discharges of waste water pollutants into navigable waters from any exploration and production activities since such discharges are prohibited under the Clean Water Act.

The Safe Drinking Water Act ("SDWA")

The Safe Drinking Water Act ("SDWA") focuses on the protection of groundwater that may be used for public drinking water supplies by regulating underground injection ("UIC") wells. 42 USCA Sec. 300h et. seq.

The EPA has designated five categories of injection wells under the SDWA:

Class I - Hazardous Waste Disposal Wells;
Class II - Oil & Gas Injection/Disposal Wells;
Class III - Mining & Power Generation Wells;
Class IV - Disposal Wells for Radioactive Wastes; and
Class V - Brine Mining Wells.

Class II injection/disposal wells dispose of non-hazardous oil and gas production waste (usually produced water), and are used in enhanced recovery and pressure maintenance projects.

The SDWA contemplates that each state will take the lead in permitting and regulating UIC wells in accordance with certain minimum requirements that have been set out by the EPA. Texas, Oklahoma, and Louisiana all have EPA approved state run UIC programs for Class II wells.

1. <u>MIT TESTS ON CLASS II UIC WELLS</u>
Under most state agency regulations UIC wells are to be tested every five years. In Texas and Oklahoma UIC wells must be tested for mechanical integrity (“MIT tests") once every five years, although due to the configuration of some wells they may be required by permit to be tested annually. See: TRC Rule 9(k); TRC Rule 46(j) (2); OCC-OGR Rule 3-305(c).

In addition, before a permit is issued the placement of the packer, injected water volumes, injected water pressures, addition of corrosion inhibitors, addition of surfactant, behind pipe cement integrity, etc., will be reviewed by the regulatory agency.
On the sale or purchase of a well the MIT test results and annual disposal/injection monitoring report should be reviewed to insure any UIC well on the property is mechanically sound. See: TRC Form H-10; TRC Form H-5; OCC Form 1012; OCC Form 1012A. Further, injection volumes and pressures should be reviewed to insure that they comply with any limitations set out in the UIC permit.

2. <u>SUBSTANCES PERMITTED FOR A CLASS II UIC WELL</u>
RCRA hazardous wastes cannot be disposed of in a Class II well. 40 CFR Part 144.6(b). Certain oil and gas wastes are exempt from classification as a "hazardous waste" under RCRA, and can be injected into a Class II well with agency approval.

These RCRA exempt wastes include produced water, drilling fluids, drilling cuttings, well completion fluids, as well as other materials. The state issued UIC permit may limit the substances that can be injected into the UIC well. Produced water is most commonly injected into Class II wells, and corrosion inhibitors, surfactants, or other chemicals may be added to the injected water.

On the purchase of a producing property, it should be determined that no non-exempt RCRA hazardous wastes have been injected into the Class II UIC well. Any additives to the injected water should be ascertained and noted in the assessor's report. The UIC permit should be reviewed to determine what substances have been approved for injection into the well.

3. RIGHT TO INJECT/DAMAGE TO OFFSET PRODUCTION
Where the surface and mineral estate have been severed several cases have addressed the issue of whether the mineral or surface owner has the right to inject salt water into the underlying formations. See: Sunray Oil Co. v. Cortez Oil Co., 112 P.2d 792 (Okla. 1941); Ellis v. Arkla, 450 F. Supp. 412 (E.D. Okla. 1978).

In Ellis, the court indicated that the surface owner owns the pore spaces in the formations, therefore the right to inject would be owned by the surface owner. Even if the surface owner has the right to inject water the law is clear that if the minerals are being developed the mineral owner can use a reasonable amount of the surface to develop the underlying minerals. Dunn v. Southwest Ardmore Tulip Creek Sand Unit, 548 P.2d 685 (ct. App. 1976); West Edmond Salt Water Disposal Association v. Rosecrans, 226 P.2d 965 (Okla. 1950). As such, the oil and gas operator can inject water produced from the property back into a UIC well on that property. TDC Engineering, Inc. v. Dunlop, 686 S.W. 2d 346 (Tex. App. 1985).

Where produced water is transported to a UIC well from off the lease the underlying minerals are not being developed, therefore the surface owner needs permission to inject such substances. Where water is injected into a UIC well the offset owners may have a cause of action for damage to their wells even if the injection is done in accordance with the permit issued by the state agency. West Edmond Hunton Lime unit v. Lillard, 265 P.2d 730 (Okla. 1954).

In some cases the owner of a UIC well will purchase the surface to avoid any conflicts over environmental damage from produced water spills. As owner of the surface, the producer can also inject water brought in from off the lease.

4. TEXAS UIC PROGRAM
Statewide Rule 9 and 46 - Underground Injection. Texas Railroad Commission Rule 9 and 46 authorizes the subsurface injection of produced water into underground injection or disposal wells, and sets out the monitoring and testing requirements for such wells. Disposal wells are regulated under Rule 9 and injection wells under Rule 46. Both rules are basically the same except for the type of well being regulated.

The Resource Conservation and Recovery Act ("RCRA")

The Resource Conservation and Recovery Act ("RCRA") of 1976, as amended by the Hazardous and Solid waste Amendments of 1984, established a comprehensive statute to regulate the disposal of "solid wastes". 42 USCA Sec. 6901 et seq.

Solid wastes by statutory definition can consist of solid, liquid, or gaseous materials, and mayor may not be classified as "hazardous". 42 USCA Sec. 2011. Prior to RCRA the disposal of solid wastes were generally regulated by the states under the provisions of the Solid Waste Disposal Act ("SWDA"), predecessor of RCRA.

RCRA was enacted by Congress to address three goals:

To provide a system of tracking and preserving a record of the movement of hazardous waste from origin to disposal. This "cradle to grave" concept is implemented with the manifest system.

To insure that the disposal of hazardous waste was accomplished by a method to prevent the escape of waste into the environment.

To provide an enforcement mechanism to insure that the first two goals are met.

Modern solid waste legislation began with the enactment of the Solid Waste Disposal Act in 1965 to assist states in the regulation of dump sites. This statute was amended in 1970 with the passage of the Resource Recovery Act which encouraged the recovery and recycling of solid wastes. In 1976 the Resource Conservation and Recovery Act was enacted to track hazardous waste disposal from "cradle to grave", and for the purposes set out above.

In 1984 the Hazardous Waste Amendments to RCRA were enacted which required landfills to be lined, regulated underground storage tanks, and restricted the materials that could be disposed of in a landfill without treatment (the "land ban"). In 1986 the Superfund Amendments and Reauthorization Act further amended RCRA to require owners of underground storage tanks carry certain financial insurance for leaking tanks, and established a clean up fund for the tanks.

RELATIONSHIP OF RCRA AND CERCLA (SUPERFUND)

The Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA") was enacted in 1980 to address "hazardous substances", while RCRA was enacted several years earlier to deal with "hazardous wastes". While the Acts are related, at least two major differences exist.

First, CERCLA addresses the clean up of existing sites contaminated with hazardous substances, while RCRA generally deals with the ongoing operations of generators, transporters, and the disposal of hazardous waste. CERCLA therefore generally deals with clean up of existing contamination, while RCRA deals with the prevention of future contamination.

Secondly, CERCLA regulates a much larger number of substances and materials than RCRA. RCRA addresses the handling and management of "hazardous wastes", while CERCLA addresses hazardous wastes as well as other compounds defined as "hazardous substances" in that Act.

From a waste management standpoint, the oil and gas facility operator/owner must address with both RCRA and CERCLA issues when managing oil field wastes and materials.

RELATIONSHIP OF FEDERAL AND STATE LAW

Hazardous waste management is regulated at both the federal and the state level. Under RCRA, states are not prohibited from establishing more stringent waste management 'procedures. See: 42

USCA Sec. 6929. The states can be delegated the authority to enforce RCRA provisions in lieu of the EPA.

In many cases states have adopted waste management programs that are very similar to the federal program or statutes. In Texas, the Solid Waste Disposal Act has been enacted to regulate solid wastes, and the Texas Water Commission has been delegated the responsibility to enforce most of the RCRA provisions dealing with hazardous and industrial wastes. Tex. Health & Safety Code, Sec. 361.001. The Texas Railroad Commission has authority to regulate non-hazardous oil and gas wastes, including pipeline operations and processing plants. Id. at Sec. 361.073.

RCRA HAZARDOUS WASTES

Definitions:

(a) "Solid wastes". RCRA regulates both "solid wastes" and a subcategory of solid wastes classified as "hazardous wastes". Solid wastes include those materials "discarded", which include abandoned or "inherently waste-like" materials. See: 40 CFR Sec. 261.2(a). Recycled materials that are used in a manner constituting disposal, burned for energy recovery, or are reclaimed can be hazardous wastes under RCRA. 40 CFR Part 261.2. If the material can be reused in its current state as an original ingredient to make a product, or returned immediately to the same industrial process in a closed loop process such recycled material may not considered a RCRA solid waste (see discussion on recycling below). American Mining Congress v. EPA, 907 F.2d 1179 (D.C. Cir. 1990); American Mining Congress v. EPA, 824 F.2d 1177 (D.C. Cir. 1987).

(b) Subtitle "C" "Hazardous wastes".Under RCRA a solid waste can be considered a "hazardous waste" if: (1) the material is "listed" by the EPA as hazardous, or (2) exhibits one of four "characteristic" attributes identified by the EPA which make it hazardous. Such materials are regulated under "Subtitle 'e'" of RCRA.

Listed Wastes. Three separate lists exist to define "listed" hazardous wastes: (1) non-specific sources, (2) specific sources, and (3) discarded commercial chemical products. See: 40 CFR Parts 261.31, 261.32, 261.33.

Listed wastes are assigned an EPA waste number; wastes from non-specific sources are "F-listed" wastes, that is their waste number will start with the letter "F". Hazardous wastes from specific sources are "K-listed" wastes, and discarded commercial chemical products are either "P-listed" wastes if they are "acutely hazardous" or "U-listed" wastes if they are "toxic" over a period of prolonged exposure.

Characteristic Wastes. The "characteristic" attributes of hazardous wastes include: (1) ignitability, (2) corrositivity, (3) reactivity, or (4) toxicity. 40 CFR Part 261 subpt. C. Toxicity testing procedures were revised in 1990, and many materials that would not have been considered hazardous under the previous test are now considered hazardous waste under the new test.

The Toxicity Characteristic Leaching Procedure ("TCLP"), is designed to test the mobility of contaminants present in the waste. 40 CFR Part 261 App. II. The original toxicity test concerned itself with the presence of eight metals, four insecticides, and two herbicides. Maximum benzene levels of 0.5 part per million will make many petroleum related wastes exceed RCRA TCLP toxicity standards, and these wastes should be treated as hazardous unless exempted.

RCRA E & P EXEMPTIONS

In 1980 RCRA was amended so as to exclude several major categories of waste materials until the EPA could conduct special studies of the wastes to determine if they needed to be covered by a stringent waste management program. This amendment, named the "Bevill Amendment", required a study of high volume·low toxicity wastes generated in oil and gas operations. See: 42 USCA Sec. 6921(b) (2) and 6982(m).

(a) E & P Exempted Materials

As a result of such studies the EPA determined that an exemption from the hazardous waste management provisions of RCRA Subtitle C should exist for wastes associated with the exploration, development, or production of crude oil or gas. The EPA has determined that the following wastes'are included in the statutory exemption:

produced waters drilling fluids drill cuttings rig wash
geothermal production fluids
well completion and stimulation fluids basic sediment and water
pit sludges and sludges from storage and disposal of
exempt wastes
workover wastes
gas plant dehydration wastes
gas plant sweetening wastes for sulphur removal cooling tower blowdown
spent filters, filter media
packing fluids
produced sand
pipe scale and other deposits removed from piping and
equipment
soil containing hydrocarbons
pigging wastes from gathering lines constituents removed from produced waters
liquid hydrocarbons from the production stream gases from the production stream
materials ejected during blow down
waste crude oil from field operations

The following oil and gas wastes are subject to regulation under Subtitle C of RCRA, and can be considered a RCRA hazardous waste:

painting wastes
unused fracturing fluids or acids
gas plant cooling tower cleaning wastes oil and gas service company wastes refinery wastes
used equipment lubrication oils waste compressor oil and filters
used hydraulic oil
waste solvents
waste in transportation pipeline pits caustic or acid cleaners
pesticide wastes
sanitary wastes
boiler cleaning wastes, drums, insulation
pigging wastes from transportation lines

Because regulated wastes must be disposed of properly, in an environmental audit special care should be taken to examine the property for the presence of such non-exempt wastes. Where hazardous wastes are transported off the lease premises for disposal, a waste manifest must be prepared.

Nuisance, Trespass & Strict Liability

Nuisance has been defined as an unreasonable interference with the use and enjoyment of property owned by another. It can be classified as a private nuisance, as in the Wales Trucking case, or public, as in the following Transcontinental Pipeline case.

Wales Trucking Co. v. Stallcup
Court of Civil Appeals of Texas, Second District, Fort Worth
465 S.W.2d 444; 2 ERC (BNA) 1382
March 5, 1971

Louis Stallcup and wife initiated this suit against the Wales Trucking Company, a Texas corporation, for dust damages sustained by them as the result of an alleged nuisance created and maintained by Wales through its unreasonable use of the unimproved public county road which runs in front of their rural home. Based on a jury verdict, judgment was rendered for the Stallcups for damages in the amount of $5,000.00. Wales has appealed.

Wales was engaged in hauling heavy concrete water pipe from the Gifford-Hill plant located in the Fort Worth-Dallas area to the site of the right-of-way of the water pipeline being constructed to bring water from Lake Arrowhead in Clay County to the City of Wichita Falls. The limit of Wales' responsibility was to haul the water pipe. For a period of about four (4) months between April 15 to September 1 of 1968, Wales made commercial use of the roadway in front of the Stallcup home seven days per week by transporting about 825 truckloads of pipe over such road and returning an equal number of empty trucks over the same route. (Approximately 1650 truck trips during the 4 month period.)

The center of the roadway was 75 feet from the front wall of the Stallcup home. A majority of the loaded trucks weighed 58,000 pounds. A few grossed 72,000 pounds.

The loaded trucks traveled 25 to 30 miles per hour and the empty ones about 45 to 50 miles per hour. Because of weather conditions or the production schedule of the water pipe the deliveries thereof varied between zero and 20 during any one day.

Wales' commercial use of the roadway, as above indicated, was extensive and for the period of approximately four months converted the seldom used country road in front of the Stallcup home to a heavily traveled thoroughfare. ". . . they (Wales) were just beating the road up and it just got like ashes." Dust from the dirt and graveled surface drifted onto the Stallcups' premises and into their home causing discomfort and irritation.

On May 7, 1968, after a week or more of the dust Mr. Stallcup called the Grand Prairie office of Wales. He talked to its President. Stallcup complained to the President of Wales about the dust and its effect upon him and his family. In this connection he said, "'They have got our road just powdered up, . . . We just can't stand it. We just can't live with it.'" Later Mr. Stallcup talked with the supervisor of Wales who was on duty at the site of the pipeline.

A few days later the Wales' trucks commenced to use an alternate route. This lasted about a week or ten days. Because of complaints by a County Commissioner concerning use of the alternate route

Wales again routed its trucks in front of the Stallcup home and continued its use of such road the remainder of the period. The roadway in question was used as access to the pipeline right-of-way during about 5 miles of its construction. Most trucks hauled two joints of pipe which were each 16 feet long.

An average of six to eight loads per day were hauled. When Wales resumed its hauling in front of the Stallcup home after its brief use of the alternate access road it did so with notice and knowledge of the dust problems affecting the Stallcups which it had in the past and would again cause.

The Stallcups pleaded a cause of action based upon both nuisance and negligence, however, at the time of trial they abandoned any claim based upon negligence and no issues were submitted on this theory. The only relief sought was by way of damages for the nuisance.

In its charge to the jury the court defined "nuisance" in substantially the same words as the definition approved in Columbian Carbon Co. v. Tholen, 199 S.W. 2d 825 (Galveston Tex. Civ. App., 1947, writ ref.).

The word, "unreasonable," was substituted in lieu of the word "unusual". Other slight changes were made in the Tholen definition to adapt it to the use made of the public road. Substantially the same definition was approved in the more recent case of Collins Construction Company of Texas v. Tindall, 386 S.W. 2d 218 (Eastland Tex. Civ. App., 1965, ref. n.r.e.).

In the case at bar the jury in answering Special Issues 1 through 8, respectively found: (1) Wales' use of the roadway caused substantial amounts of dust to be deposited on Stallcup's property; (2) such depositing of dust was the result of a nuisance, i.e., the unreasonable and excessive use of the roadway; (3) as a proximate cause of such nuisance the Stallcups suffered damage for (a) the temporary loss of enjoyment of their dwelling house and (b) for temporary physical discomfort; (4) $2,500.00 in damages was awarded for (a) temporary loss of enjoyment and $2,500.00 for (b) temporary physical discomfort; (5) Wales had notice of damage resulting to the Stallcups from such nuisance; and (6) continued the nuisance after having such notice. (The matters involved in Special Issues 5 and 6 relating to notice were undisputed.)

By its first five points Wales contends that the court erred in overruling its motions for instructed verdict and for judgment non obstante veredicto because its use of the road was neither negligent nor unlawful, was not a nuisance as a matter of law and there was no finding of negligence in its use of the public road. By its points 6 and 7 Wales asserts the court erred in submitting Special Issues Nos. 2 and 3 and in failing to disregard the answers thereto because there was no evidence or insufficient evidence making its use of the public road a nuisance.

The seven points of error presented, briefed and argued by Wales on this appeal are singly and collectively based upon the sole proposition that there can be no right of recovery against it in the absence of pleadings, proof and findings of either negligent or unlawful conduct on its part.

Wales in its reply brief says: "The primary issues on appeal as highlighted by the two prior opposing briefs are whether either negligence or unlawful use must be plead and proven in establishing as a nuisance the use of a public roadway.

"Appellant contends that one or both of these elements must be present. Appellee contends that it is sufficient to establish that use of the roadway was 'unreasonable'."

Wales makes it clear that its no evidence and insufficient evidence points are based solely on the proposition that there is no evidence or that the evidence is insufficient to establish that it was guilty of either negligent or unlawful conduct and that therefore as a matter of law its conduct did not constitute a nuisance.

The Stallcups contend that an abutting property owner who sustains damage caused by a nuisance which is created by a member of the public in making an unreasonable use of a public road is liable to such abutting property owner for the damage caused him by such nuisance.

We have concluded from our analysis of Wales' briefs that it in effect admits that at common law and therefore in Texas that an abutting property owner does have a cause of action such as is described in the preceding paragraph. The only difference in the contentions of the parties to this appeal is that Wales contends that a showing of conduct of an unlawful or negligent nature is an essential element of such a cause of action.

Stallcups take the position that the elements of negligence and unlawful conduct are not essential elements of their cause of action. "As a general rule, proof of negligence is not essential to imposition of liability for the creation or maintenance of a nuisance. This is so though the nuisance complained of may be the consequence of negligence. A nuisance does not rest on the degree of care used, but on the degree of danger or annoyance existing even with the best of care. Consequently, if a nuisance exists, the fact that due care was exercised against its becoming a danger or annoyance is no excuse.

However, where the act or condition in question can become a nuisance only by reason of the negligent manner in which it is performed or permitted, no right of recovery is shown independently of the existence of negligence." 41 Tex. Jur. 2d 591, @ 17.

The general rule above enunciated is supported by Columbian Carbon Co. v. Tholen, supra; King v. Columbian Carbon Co., 152 Fed. 2d 636 (Cir. Ct. of App., 5th Cir., 1945); Collins Construction Company of Texas v. Tindall, supra; and a host of other cases cited in 41 Tex. Jur. 2d 591, @ 17 and pocket parts, supra. See also 46 C.J., "Nuisances", @ 28, "F. Negligence - 1. In General."
Further, as a general rule, proof of unlawful conduct is not essential to the imposition of liability for the creation or maintenance of a nuisance. The fact that an act is lawful does not prevent it from being a nuisance. Generally nuisances arise from violation of the common law rather than violation of a statute. 39 Am. Jur., "Nuisances", p. 301, @ 20, "Lawful Acts. --", and @ 21, "Unlawful Acts. --." To the same effect see King v. Columbian Carbon Co., supra, at page 639 (5); 39 Am. Jur. 325, @ 44; 41 Tex. Jur. 2d 588; 46 C.J., @ 24, "2. Unlawful - a. In General"; and 46 C.J., @ 25, "b. Violation of Municipal Ordinance", and p. 675, @ 43, of same text.

In the King case, supra, the sole question presented was whether or not a landowner is without recourse for damages caused to his land in a case where the parties were agreed that defendant's operation was lawful, fulfilled a necessary public purpose, was not a nuisance per se, was not negligent and that damages would have resulted from defendant's operation without regard to the manner in which it was conducted.

While there is no agreement as to the facts in the present case, it is accurate to state that the elements above referred to in the King case are present here and are undisputed. We submit that regardless of whether or not Wales' vehicles were properly licensed, did not exceed load limits, had proper permits from the Railroad Commission and were operated within permissive speed limits would not have altered the damages sustained by the Stallcups.

The law "does not allow anyone, whatever his circumstances or condition may be, to be driven from his home, or to be compelled to live in it in positive discomfort, although caused by a lawful and useful business carried on in his vicinity." 39 Am. Jur. 327, @ 45, p. 328. This passage was quoted with approval in King, supra, at page 639 (6).

In applying the above stated general rules of law to the facts of this case we find and hold that pleadings and proof of either negligent or unlawful conduct or both are not necessary or essential elements of the cause of action here involved.

The Supreme Court of Iowa in Shannon v. Missouri Valley Limestone Company, 255 Iowa 528, 122 N.W. 2d 278 (1963) said: "We are compelled to agree with the trial court that a common law nuisance is created by the dust raised by the trucks hauling crushed rock from the quarry." See also Loosian v. Goudreault, 335 Mass. 253, 139 N.E. 2d 403 (1957); Gronn v. Rogers Construction, Inc., 221 Ore. 226, 350 P. 2d 1086 (1960); Cater v. Northwestern Tel. Exch. Co., 60 Minn. 539, 63 N.W. 111, 113 (1895); Yale University v. City of New Haven, 104 Conn. 610, 134 A. 268 (1926).

"Every person has the right to have the air diffused over his premises, whether located in the city or the country, in its natural state and free from artificial impurities. However, by air in its natural state [*448] and free from artificial impurities is meant pure air consistent with the locality and character of the community. The pollution of the air so far as is reasonably necessary to the enjoyment of life and indispensable to the progress of society is not actionable. But this right of pollution must not be exercised in an unreasonable manner so as to inflict injury on another unnecessarily. Any business, though in itself lawful, that necessarily impregnates large volumes of the atmosphere with disagreeable, unwholesome, or offensive matter may become a nuisance to those occupying adjacent property, in case it is so near and the atmosphere is so contaminated as to substantially impair the comfort or enjoyment of adjacent occupants. Thus smoke, dust, noxious fumes or gases, or stenches or smells may constitute a nuisance under some circumstances." 41 Tex. Jur. 2d 608, @ 33, and pocket parts.

In our opinion the facts in the Collins case, supra, involving dust from a rock crushing operation near the Tindall home which continued for about three months are very similar to the facts here involved. The testimony concerning the problems arising from the dust was similar to the testimony received in the instant case. In Collins the court in applying the general rules above set forth held that the dust caused by the operation of the rock crusher created a nuisance regardless of the degree of care exercised by the operator and thus it was not necessary to plead and prove negligence on his part. The same rule is applicable here.

The dust caused by the operators of the trucks created a nuisance regardless of the care exercised by such operators and regardless of the lawful manner in which the trucks were operated. Thus it was unnecessary to plead and prove negligence or unlawful conduct on the part of such operators.

The Stallcups in the case at bar and the Tindalls in the Collins case were subjected to the same nuisance, i.e., dust. In varying degrees they sustained the same type of damages. In Collins the dust nuisance was caused by a rock crusher which apparently was in a fixed, immobile position on private property. Here the dust nuisance was caused by mobile equipment, i.e., moving trucks making unreasonable use of a public road.

Does the difference between mobile and immobile equipment operating on public or private property, respectively, require that different rules be applied in connection with responsibility for the creation of a nuisance? We think not. We so hold. The same general rules apply in both cases.

We have examined the entire record in this case. We have concluded the evidence was sufficient to support the answers of the jury to each of the special issues submitted to it.
All points of error are overruled. The judgment of the trial court is affirmed.

Wales Trucking Co. v. Stallcup
Notes and Discussion

1. Does the nuisance cause of action require bad faith, breach or care, or an intentional act by the defendant?

2. Does the fact that a business is legally conducted preclude it from becoming a nuisance?

3. Is the degree of proof easier for nuisance or negligence, or are they equally difficult to prove?

4. Does the plaintiff generally need to prove negligence to establish a nuisance cause of action?

5. The distinction between a public and private nuisance have been described by one court as follows:

> Defendant contends that plaintiffs have not alleged that they suffered harm different in kind from that suffered by the public in general, a necessary element of a private action for public nuisance under both New York and Vermont common law. Roy v. Farr, 128 Vt. 30, 37, 258 A.2d 799, 803 (1969); Gibbons v. Hoffman, 203 Misc. 26, 115 N.Y.S.2d 632 (1952); Restatement (Second) of Torts @ 821C at 94 (1979). Plaintiffs allege in their complaint, however, that the discharges from defendant's mill "interfere with Plaintiffs' use and enjoyment of their property and have decreased the market value and rental value of their property." Such an allegation is sufficient to state a private cause of action for a "nuisance" which might generally be classified as "public." See Hazen v. Perkins, 92 Vt. 414, 421-22, 105 A. 249 (1918) (where variations in lake depth caused by defendant's dam "accentuated" adverse effects upon plaintiffs' shore properties, injury was "special and distinct", though injury was not substantial); see also W. Prosser, The Law of Torts @ 88, at 588 (4th ed. 1971); 58 Am. Jur. 2d, Nuisance @ 111, at 675 (1971) ("Interference with the enjoyment and value of a person's private property rights is a special injury [allowing] recovery from a public nuisance . . ."); Restatement (Second) of Torts @ 821C, comments d and e (1979) ("When the public nuisance causes . . . physical harm to [plaintiff's] land . . ., the harm is normally different in kind from that suffered by other members of the public . . ."). See: Ouellette v. International Paper Co., 602 F. Supp. 264; 22 ERC (BNA) 1682; (U.S.D.C.Vermont 1985).

6. The following article illustrates the issues with dust and noise and vibration from oil field development is still a current issue in many areas:

THE DICKINSON PRESS
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Thursday, February 7, 2013
18 Pages • $1.00

Dunn Co. dust control

Forum News Service File Photo

Dust flies as trucks drive down rural roads around Williston on April 24. Dunn County Commission is seeking an answer to better help dust remain where it's supposed to be, namely on the road.

Commissioners OK further research using $97K leftover from grant

By Betsy Simon
bsimon@thedickinsonpress.com

MANNING — The Dunn County Commission decided during its meeting Wednesday at the Dunn County Courthouse in Manning to pursue research into dust control methods.

The research will be conducted using the $97,000 in funding that is left over from a grant from the North Dakota Industrial Commission Oil and Gas Research Program.

Francis Schwindt, a former state chief of environmental health and principal investigator for the study, told the commission that he spoke to North Dakota Industrial Commission after meeting with the commissioners last month.

He said the Industrial Commission would consider further research into dust control if the Dunn County Commission chose to pursue it.

"We would have to reapply for more grant funding if you decide that the $97,000 remaining isn't going to be enough," Schwindt said.

Dunn and McKenzie counties applied in April 2011 for $220,000 each through the North Dakota Industrial Commission Oil and Gas Research Program to conduct a study on dust control methods on unpaved roads with heavy traffic from September 2011 through January.

Schwindt told the commission last month that magnesium chloride, which Dunn County uses to treat gravel roads, is the most popular way to deal with dust control.

In addition to magnesium chloride, the grant request states that other test substances selected by county personnel included flake calcium chloride enzymatic soil stabilizers and geotextiles.

The substances in the test were evaluated for effectiveness, application, costs and longevity in controlling dust levels, according to the request.

The findings could also be used in other areas of the state or locations near the oil fields the experience dust issues.

"I don't see a need for (McKenzie County) to be involved further," Dunn County Commissioner Daryl Dukart said. "We can do research over the period of another year and see what the results are."

Dukart also asked if Schwindt had conducted research on dust control methods using drill cuttings — the material removed from a borehole while drilling petroleum wells.

"The issue is that that stuff is really wet," Schwindt said about the drill cuttings. "How would you haul it? The consistency is too wet."

Although the commission agreed to not include drill cutting research in their latest study, Commissioner Donna Scott suggested that if the commission decided to study drill cuttings as a possible aggregate for dust control at some point, they could see whether it would be possible for the oil companies to assist in drying them.

Public Nuisance – In some cases the nuisance created is considered a public nuisance. In this case a natural gas compressor station was installed near Baltimore, Maryland. The lower court described the interference with use and enjoyment of the homeowner's property as follows:

> The effects of the noise and vibration resulting from the plant have been testified to by all of the plaintiffs. It is perhaps most clearly explained and expressed as to its effects by Mr. and Mrs. Zoller whose residence recently constructed at a cost of $ 35,000, is situated about 1650 feet southeast of the plant. They describe the noise and vibration as 'intolerable' whereby the windows rattle, there is a 'hum' in the air, a heart-palpitating sensation and interference with sleeping. The particular complaint is that the noise and vibration is incessant, practically 24 hours a day. Mr. Zoller has been obliged for comfortable reading and quiet to spend his evenings in the basement of the house as he cannot sit in comfort in his living room or den on the ground floor.
>
> The noise seems to increase at night as compared with the day time. Occasionally there is very annoying smoke and soot which apparently emanates from the burning of surplus gas or oil from the premises on or near the compressor plant. The noise is also described as like that emanating from a railroad train going over a trestle, as a percussion sound or a rumbling as of an approaching airplane. When the wind is from the southeast, that is blowing toward the plant and not away from it, there is some relief. The noise and vibration was so annoying last summer that the Zollers spent the summer at a small residence property that they own on the Severn River, but which they had expected to sell when their new home was constructed in Howard County.
>
> Mrs. Zoller described the sensation of the vibration in the ears as like that experienced on an ocean liner. Other witnesses gave similar descriptions of the effect of the noise and vibration such as the rattling of windows and at times of metal dishes in the kitchen. Another plaintiff described the general effect of the noise and vibration as that of a never-ending freight train of empties. The plaintiffs agree that since the changes were made at the plant there has been some lessening of the noise but the effects of the vibration are still experienced without material change. The sense of vibration is said to be due to a very low pitch of sound emanating from the plant which can be personally felt by the body but not of itself perceptible to the ear.

The Appellate Court issued this opinion on the dispute:

TRANSCONTINENTAL GAS PIPE LINE CORP. v. GAULT
UNITED STATES COURT OF APPEALS FOURTH CIRCUIT
198 F.2d 196; 1 Oil & Gas Rep. 1213
June 16, 1952, Argued
July 29, 1952, Decided

The owners and occupants of substantial residence and farm properties in Howard County, Maryland, situated about fifteen miles from Baltimore and five miles from Ellicott City, the county seat, sought an injunction in this case to restrain Transcontinental Gas Pipe Line Corporation from operating a compressor gas station located in the nearby country side in such a manner as to constitute a public nuisance. The corporation is a natural gas company engaged in the transmission of natural gas from Texas to New York and the compressor station with nineteen others of like character is necessary to secure the flow of the gas in its interstate journey. The station was erected with the authority of the Federal Power Commission at great cost on a twenty-four acre tract of land acquired for the purpose.

The complainants are owners of nearby residences of substantial character and cost, which were erected some years prior to the erection of the 'booster' plant; and the noise and vibration proceeding therefrom have greatly disturbed them in the enjoyment of their homes. The District Judge found after an extended hearing that their complaints were justified. See Gault v. Transcontinental Gas Pipe Line Corp., D.C.Md., 102 F.Supp. 187.

The company defended on the ground that the station was necessary to the performance of an important public service and that it had been designed and constructed under the direction of experienced and efficient engineers and that it was being operated in a prudent careful manner and without unnecessary noise and vibration. Nevertheless the corporation made a careful investigation of the complaints when they first arose and at some additional expense made certain changes in the plant which reduced somewhat the annoying effects of the operation.

The witnesses for the complainants testified from their personal experience as to the noise and vibration and they were corroborated to some extent by the testimony of an engineer who had had experience in testing air craft engines and in the erection of a super-sonic wind tunnel. The corporation, on its part, undertook to estimate the annoyance by the use of sound measuring instruments and depended in great part upon the readings of the instruments to support their contention that the noise from the plant was not of the intensity described. The corporation also offered testimony tending to show that the plant was constructed in the most approved manner and that no further improvement was possible with the expenditure of any reasonable sum of money.

After careful consideration of the evidence, the judge reached the conclusion that the personal experiences of the occupants of the neighboring properties were much more weighty and persuasive than the mechanical sound measuring devices, and also that further changes and improvements in the plant to eliminate the harmful effects could be made without undue expense.

Specifically, the judge made the following ultimate findings of fact:

> '8. As an ultimate fact I find that the noise and vibration emanating from the defendant's plant has substantially and materially and prejudicially affected the plaintiffs' reasonable and comfortable enjoyment of their residence properties and has also materially diminished their marketable value.
>
> '9. I also find from the evidence that there are additional improvements and changes which can reasonably and without comparatively undue cost, be made by the defendant which, considering the expert evidence as a whole both for the plaintiffs and the defendant, can reasonably be expected to result in a material diminution of the noise and vibration nuisance experienced by the plaintiffs.'

We are in accord with these findings of fact and approve of the judgment of the court that the complainants were entitled to an injunction on certain definite conditions, to wit: (1) that the injunction be not operative until June 1, 1952 on condition that the defendant promptly and with all due diligence make further improvements and changes in the plant in order to lessen the noise, vibration and other harmful effects; and (2) that if by May 1, 1952 the defendant should conclude that it had exhausted all reasonable efforts to accomplish these results, it could report to the court and ask for a hearing to determine the fact, and if the court should then find that the harmful effects could not be materially reduced and still constitute a substantial impairment of the complainants' rights, consideration could be given to a determination of what other relief, such as pecuniary damages, should be awarded in lieu of injunction.

From this judgment the present appeal was taken.

Upon the facts found by the District Judge this judgment was in accordance with the law of Maryland which in an ordinary case permits an injunction against noise, lights and other annoyances, but is subject to the important exception that a quasi public corporation cannot be subjected to an injunction for the performance of acts necessary to the exercise of its lawful authority, even though, in the absence of such authority, an injunction would lie. In such case, however, money damages may be awarded injured parties for the damages suffered by them from the continuance of the operations of the corporation. Five Oaks Corp. v. Gathmann, 190 Md. 348, 58 A.2d 656, Meadowbrook Swimming Club v. Albert, 173 Md. 641, 197 A. 146; Northern Central R. Co. v. Oldenburg & Kelley; 122 Md. 236, 89 A. 601.

The judgment of the District Court will therefore be affirmed; but in order that the public interest may not suffer, the operative effect of the injunction will be stayed and the case remanded for further proceedings, in which at such time and place as the District Judge may prescribe, the corporation may have an opportunity to present additional testimony to show that it has taken all reasonable steps to correct the annoyances resulting from the operation of its plant; and if it is shown that such steps have been taken, the injunction will be dissolved and the court shall proceed to take testimony to determine the actionable damages, if any, suffered by the complainants under the law of Maryland and render a judgment accordingly; but if the company fails to make the showing indicated, then the injunction shall be reinstated and made effective and in addition such damages may be awarded the complainants as may be proper under the law of Maryland.

Affirmed and remanded for further proceedings.

<u>Transcontinental Pipeline Corp. v. Gault</u>

Notes and Discussion

1. The remedy for a public nuisance in many cases will include an injunction to abate the activity causing the nuisance. Is such an injunction allowed by this court?

2. If a party buys property on which a public nuisance exists (such as unplugged wells or leaking pits), does the purchaser have a duty to clean up or abate the nuisance even though they had no interest in the property at the time the nuisance was created? See: Nassr v. Commonwealth, Supreme Judicial Court of Massachusetts, 477 N.E.2d 987 (May 9, 1985):

> . . . . a. The plaintiffs' duty to abate the nuisance. The trial judge found that the unlicensed hazardous waste operation on the plaintiffs' land created a public nuisance. He also found that the plaintiffs did not create this nuisance. The plaintiffs assert ownership and control as of April, 1979, of the premises which previously had been let to Mathews. We assume, therefore, that Mathews's leasehold interest terminated in April, 1979. Thus, as of April, 1979, the plaintiffs had full ownership and control of the real estate. The judge's finding that the plaintiffs did not create this serious public nuisance does not insulate the plaintiffs from the duty to abate the nuisance.

> It is a well-established rule that "[i]t is the duty of the owner to guard against the danger to which the public is thus exposed, and he is liable for the consequences of having neglected to do so, whether the unsafe condition was caused by himself or another." Gray v. Boston Gas Light Co., 114 Mass. 149, 153 (1873). Put more succinctly, "[O]ne who continues a nuisance is liable as well as he who establishes it." Fuller v. Andrew, 230 Mass. 139, 146 (1918). Thus, even though the plaintiffs did not create the hazardous waste dump, the fact of their ownership of the land exposes them to potential liability for the hazardous conditions on their land, at least as of April, 1979. See Restatement (Second) of Torts @366 (1965); n7 2 F. Harper & F. James, Torts @@ 27.19, 27.20 (1956). n8 See also[*776] Hunt v. Lane Bros., 294 Mass. 582, 586-587 (1936) (landowner had duty to inspect premises after work done by independent contractor "to ascertain whether any objects of peril to persons on the street" were left by the independent contractor); Franchi v. Boulger, 12 Mass. App. Ct. 376, 378 (1981) (successors in title, "although they did notcreate the nuisance, are liable for knowingly allowing it to continue"). Cf. Maynard v. Carey Constr. Co., 302 Mass. 530, 533 (1939); Abruzzese v. Arlington, 7 Mass. App. Ct. 882 (1979).

In light of this rule, what legal advice might be given to a purchaser of real estate?

3. In some states, a public nuisance will toll the statute of limitations by statue. In Fischer v. Atlantic Richfield Co., 774 F. Supp. 616 (W.D. Okla. 1989), the court stated:

> ARCO also seeks summary judgment on the basis that plaintiffs' claims are barred by the 2 year statute of limitations in 12 O.S. 95(3). Summary judgment on this ground must be denied for several reasons. . . . Third, the statute of limitations does not run against a public nuisance. 50 O.S. 7 (1981). Pollution of waters of the state constitutes a public nuisance under Oklahoma law. 82 O.S. 926.2 (1981). Therefore, to the extent that ARCO's activities have polluted state waters, ARCO may not plead the statute of limitations as a defense. Issues of fact are present as to whether ARCO has created a public nuisance.

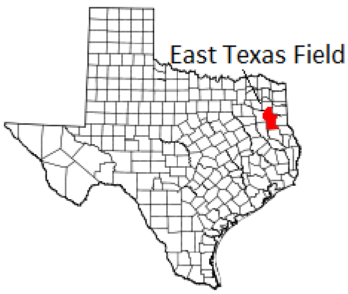
4. In states without specific statutes, a public nuisance may still toll the statute of limitations:

One important advantage of the action grounded on the public nuisance is that prescriptive rights, the statute of limitations, and laches do not run against the public right, even when the action is brought by a private person for particular harm. Smejkal v. Empire Lite Rock, Inc., 547 P.2d 1363 (Ore. 1976) quoting Restatement of Torts 2d, §821C.

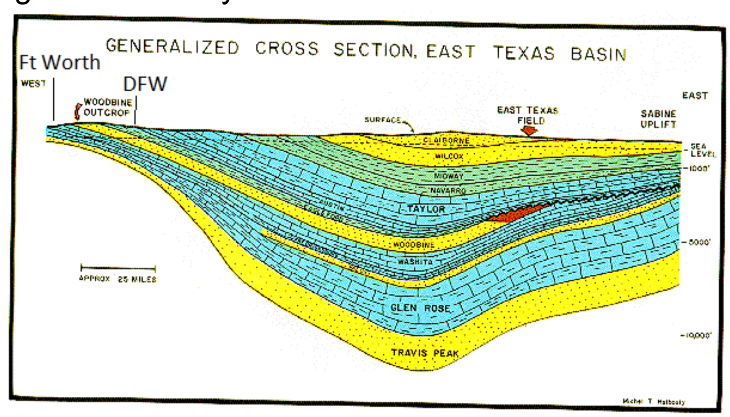
Goldsmith & Powell v. State and the East Texas Oil Field

Since its discovery in 1930 the East Texas field is the largest in the U.S. lower-48 in terms of volume of oil recovered. Located mainly in Rusk and Gregg Counties the development – and waste – is astounding. The following is a description from Julia Smith of the Texas State Historical Association:

> EAST TEXAS OILFIELD. The East Texas oilfield, located in central Gregg, western Rusk, southern Upshur, southeastern Smith, and northeastern Cherokee counties in the east central part of the state, is the largest and most prolific oil reservoir in the contiguous United States. Since its discovery on October 5, 1930, some 30,340 wells have been drilled within its 140,000 acres to yield nearly 5.2 billion barrels of oil from a stratigraphic trap in the Eagle Ford-Woodbine group of the Cretaceous. The source of its primary recovery was a strong water drive. Because the field is so large geographically the first wells, located several miles apart, were originally regarded as discovery wells in separate fields. After the spaces between the first wells were drilled, it was revealed that all sectors drew oil from the same Woodbine sands. The giant field was named for its geographic region. . . .



> By early spring of 1931 the widely-spaced discoveries revealed the vastness of the field as hundreds of small operators began its unconventional development. Unlike earlier fields, such as Big Lakeqv or Yates, which were controlled by one or a few operators who developed them by an orderly plan, East Texas field had no plan and no governor. Many landowners carved their holdings into small mineral leases that could be measured in feet, offering them to the highest bidder and realizing from $1,800 to $3,000 per acre. As the leasing frenzy seized the five counties of the field, Kilgore became the center of the boom. In that small town, wells were drilled in the yards of homes and derrick legs touched those of the next drilling unit. One city block in Kilgore contained forty-four wells.



> Whether in town or on farms, independent operators were compelled to drill wells as quickly as possible to prevent neighboring producers from sucking up their oil. This principle, known as the rule of capture, guided the development of oilfields since the 1889 Pennsylvania Supreme Court decision gave ownership of oil to the one who captured it, even if part of that oil migrated from an adjoining lease. However, rapid development of a field signaled its early decline, because it decreased field pressure and damaged its gas or water drive mechanism. As a result, wells in such fields stopped flowing and were placed on pump. Adequate depletion of a field after its drive and pressure were damaged was nearly impossible, but as the East Texas field faced this peril in the spring of 1931, its operators gave little attention to that fact.

> Another ignored fact in East Texas field was the economic law of supply and demand. Crude sold for ninety-nine cents per barrel when the Bradford No. 3 began production, but the price was cut to forty-six cents in 1931. Oilmen responded to the lower price by increasing production, which

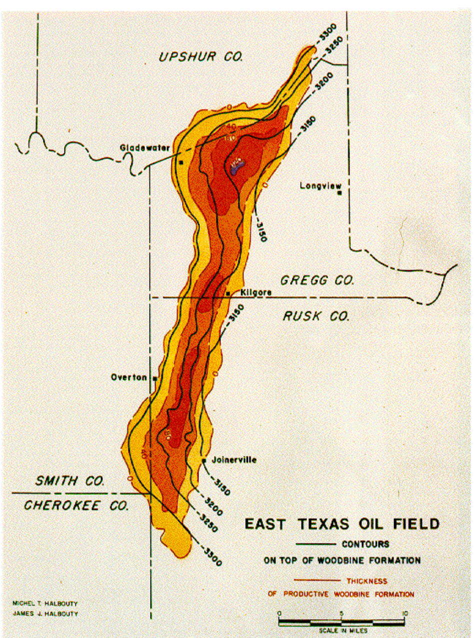
sent prices even lower. No help came from the weak state regulatory agency, the Railroad Commission, because it had no authority to restrict production to the market demand. . . .

On July 14, 1931, when overproduction had driven the price of crude to thirteen cents per barrel, had reduced reservoir pressure by 130 pounds per square inch, and had made water encroachment a serious problem in the field, Governor Ross S. Sterling called a special session of the legislature. A bill was introduced there to limit East Texas production to market demand, a measure to preserve the reservoir and to stabilize the price of crude. However, on July 28 a three-judge federal court ruled that the proration order of April 4, 1931, was invalid because it was an attempt to solve production glut and to fix prices. In compliance with the court decision, the legislature passed a law that prohibited the Railroad Commission from regulating production to meet the demand of the market.

A group of hundreds in East Texas who wanted proration in the field appealed to the governor to declare martial law. On August 17, 1931, the governor ordered the Texas National Guard and Texas Rangersqv into the ten-month-old field to shut in all of its 1,644 wells and to maintain order. The field resumed production on September 5, 1931, under a new proration order that limited its production to 400,000 barrels of oil per day, permitting each well 225 barrels and giving no consideration to its potential or to the characteristics of the lease. New wells came on line, and by October allowables were reduced for each one to 165 barrels per day.

East Texas Oil Field

Disgruntled operators filed lawsuits in protest. Others protested by shipping hot oil, or crude produced above the legal limit, out of the field. Because the military still maintained watch, hot-oil smuggling demanded creative maneuvers involving truckers as well as bribed railroad and pipeline employees. As 1931 ended, East Texas field reported its yearly legal production as 121,670,485 barrels of oil and 627,000,000 cubic feet of gas. . . .



In March 1972 the Railroad Commission set allowables at 100 percent, but the East Texas field and the Kelly-Synder were restricted to 86 percent. When reservoir engineers examined the field in 1983, they estimated that it would ultimately produce 5.6 billion barrels of oil or about 85 percent of the volume originally in place when the first discovery was made. This high productivity was credited to the strong water-drive mechanism, which has been preserved by reinjection of produced salt water, by early pressure maintenance regulated by the Railroad Commission through proration, and by successful polymer-augmented waterfloods established on a local basis in later years. At the end of 1990 the East Texas field completed its sixtieth year of operation and reported a yearly production of 35,559,769 barrels of oil. In January 1991, after a series of court hearings, the Railroad Commission calculated the East Texas field at 100 percent production factor. By January 1, 1993, cumulative production from East Texas field was reported as 5,145,562,000 barrels of oil. . . .

Several things to note in the discussion. First, because this field was water driven the recoveries of oil in place was very high. Second, for the same reason a lot of water was produced with the crude oil – and this water had to be disposed of. In addition, the water was salty (this was an ancient sea at one point). Keep in mind that in Texas, the pollution of a public watercourse is a public nuisance by statute, as illustrated by the Goldsmith & Powell case which deals with water disposal in the prolific East Texas Oil Field.

GOLDSMITH & POWELL ET AL. v. STATE.
Court of Civil Appeals of Texas, Dallas
159 S.W.2d 534; 1942 Tex. App. LEXIS 85
Jan. 23, 1942, Decided

OPINION: This suit was instituted by the State of Texas, through its Attorney General, Gerald C. Mann, against one hundred and fifty-five separate defendants, to enjoin them from polluting the waters of the Neches River. It is alleged that the defendants are the owners of oil wells along the watershed of the river, and are permitting salt water to flow from their respective wells into the river, thus polluting it, destroying fish and vegetation, and rendering the water unfit for domestic purposes by individuals, and by the public generally.

The cause went to trial before a jury, as to ten of the defendants only, and, on specific finding that the Neches River was polluted by salt water, or chlorides, rendering the water injurious to fish and other aquatic life, unfit for agricultural, domestic and industrial use, and that each of said defendants was permitting salt water, or chlorides, to escape into the river and its tributaries, thus contributing to its polluted condition, judgment was [**2] entered perpetually enjoining each defendant from allowing salt water and other deleterious substances to flow from his tanks, pits, reservoirs, ditches, or other receptacles on his premises, into the Neches River or any of its tributaries. Only five of the ten defendants enjoined have appealed, namely: Goldsmith & Powell, H. W. Donnell, W. H. McMurray, McMurray Corporation, and the Overton Refining Company.

The primary questions involved in this appeal are: The rights of the State to maintain the suit, and the sufficiency of the evidence to sustain the findings of the jury, that appellants are contributing to the noxious condition of the waters of Neches River and its tributaries.

The waters of all natural streams of this State and of all fish and other aquatic life contained in fresh water rivers, creeks, streams and lakes, or sloughs subject to overflow from rivers or other streams within the borders of this State, are declared to be the property of the State; and the Game, Fish and Oyster Commissioner has jurisdiction over and control of such rivers and aquatic life. Arts. 4026 and 7467 R.C.S. The ownership is in trust for the people (Hoefs v. Short, 114 Tex. 501, 273 S.W. [**3] 785, 40 A.L.R. 833); and pollution of streams and water courses is condemned by both the civil statutes. Art. 4444 and Vernon's Annotated Penal Code Arts. 697, 698 and Art. 698a. [HN1] The Constitution of Texas, Art. 16, § 59a, Vernon's Ann. St., designates rivers and streams as natural resources, declares that such belong to the State, and expressly invests the Legislature with the preservation and conservation of such resources.

The fact that the Legislature has provided punishment, by fine and imprisonment, for pollution of water courses, Art. 4444, R.C.S., and Art. 697 et seq. P.C., does not affect the power of the State to seek injunctive remedy when the provisions of law are inadequate to effect the purposes intended; nor is a conviction on a criminal charge a prerequisite to the issuance of an injunction (Cardwell v. Austin, Tex. Civ. App., 168 S.W. 385); nor is the district court deprived of jurisdiction to enjoin a public nuisance, where such nuisance is an injury to the property or civil rights of the public at large. 31 Tex. Jur. 450, §37.

Pollution of a public water course is a public nuisance (State v. Patterson, 14 Tex. Civ. App. 465, 37 S.W. 478; City of Corsicana v. King, [**4] Tex. Civ. App., 3 S.W.2d 857); and while the pollution of water courses in this State is expressly condemned by statute, yet, being a public nuisance, the right to abate such nuisance is lodged in the district courts, independent of any statute; and, where several persons contribute to the creation of such nuisance, they may be joined in a common action, an action in equity for injunction, against the defendants whose separate and individual acts resulted in the same general consequence of wrong. Sun Oil Co. v. Robicheaux, Tex. Com. App., 23 S.W.2d 713; Bartholomew v. Shipe, Tex. Com. App., 251 S.W. 1031.

In this case there has been a definite showing that a high degree of saline pollution has been attained in the waters of Neches River, that all aquatic life is extinct in the river, that near and adjacent lands are unfit for agricultural pursuits, individual enterprises and animal life; and that there is a definite threat that the present condition will become worse as the production of salt water increases in the East Texas field.

It is evident that as the oil reserve in the field is depleted, the production of salt water will increase, finally resulting in 90 or 100% salt water. [**5] There [*536] are approximately 4,336 wells in the East Texas field producing salt water, and about 1,445 of these are located on the watershed of the Neches River and its tributaries.

Appellants own a large number of these wells, many producing salt water, and the water therefrom is allowed to flow into earthen pits, seep into the ground and out onto the surrounding lands, to be washed by rainfall into the Neches River and its tributaries, thus contributing to the salinity of the water of the river and its injurious effect. The evidence is not clear as to how much of the salt water from appellants' wells seeps into the river, but it is evident that the manner of storing the salt water in earthen pits and the condition of the land about the pits and wells are calculated to, and evidently did, contribute to the pollution of the river, and this will continue unless abated.

The evidence is abundant, we think, to support the jury's findings that the wells, in their total combination, are polluting the waters, and that considerable quantity of salt water from appellants' wells had, in conjunction with other salt water, aided in the pollution, and that appellants' means of taking care [**6] of the salt water in earthen pits threatens further pollution of the public water course. There is no evidence that the defendants intend to do more in caring for the salt water produced from their wells than they have been doing in the past, thus injury to the State's property is imminent and should be prevented by injunction.

There are many trial errors assigned which we have considered and, finding no reversible error, they are overruled. The judgment of the court below is affirmed.

Trespass Actions

Historically trespass required a physical invasion of a possessory right and must be intentional. The second requirement many times made the tort unavailable for oil and gas actions – few companies intentionally spill or allow a valuable product like oil to leak. Modern trends in trespass law have modified the physical invasion requirement, as discussed in the Mock V. Potlatch Corp case (USDC IDAHO), 786 F. Supp. 1545 (1992):

> The traditional common law requirements for recovery for trespass to land include (1) an invasion (2) which interferes with the right of exclusive possession of the land, and (3) which is a direct result of some act committed by the defendant. Historically, an invasion must constitute an interference with possession in order to be actionable as a trespass. This requirement still persists today, and forms the basis of the distinction between the tort of trespass and the tort of private nuisance. n3 The tort of trespass applies to wrongful interference with the right of exclusive possession of real property, while the tort of private nuisance applies to wrongful interference with the use and enjoyment of real property.
>
> Generally, an interference with the exclusive right of possession involves an entry onto the land. An entry may take the form of the defendant personally intruding on the land, causing another to intrude upon the land, or causing some tangible thing to intrude upon the land. See Restatement (Second) of Torts @ 158(a) (1965). Thus, the discussion returns to the primary issue at hand--whether the noise created at the Potlatch plant in Lewiston and heard on the nearby property of the plaintiffs constitutes a wrongful "entry."
>
> The court must consider whether the noise constitutes an entry as defined under Idaho Code @ 6-202A, and/or whether it constitutes an entry as it is generally defined at common law. "Entry" as defined in Section 6-202A means "going upon or over real property, either in person or by causing any object, substance or force to go upon or over real property." Idaho Code @ 6-202.
>
> The plaintiffs argue that the noise created by Potlatch constitutes a "force" entering upon the land. The plaintiffs offer no authority for their position. "Force" is not defined in the statute, and there are no Idaho cases interpreting the meaning of "force." Therefore, the court feels compelled to look elsewhere to determine if there is any support for the proposition that noise can constitute an "entry."
>
> The court finds the following passage from Prosser and Keeton on The Law of Torts to be particularly instructive:
>
>> While it is generally assumed and held that a personal entry is unnecessary for a trespass, the defendant's act must result in an invasion of tangible matter. Otherwise, there would be no use or interference with possession. Thus, it is not a trespass to project light, noise, or vibrations across or onto the land of another. These acts may give rise to liability because of a private nuisance resulting from intentional interference with the use and enjoyment of property, or because of harm attributable to negligence, or because of liability for harm caused by an abnormally dangerous activity. It is, however, reasonably clear that the mere intentional introduction onto the land of another of smoke, gas, noise, and the like, without reference to the amount thereof or other factors that are considered in connection with a private nuisance, is not actionable as a trespass. Id. @ 13, at 71 (5th ed. 1984) (emphasis added) (footnotes omitted).

Potlatch has cited Maddy v. Vulcan Materials Co., 737 F.Supp. 1528 (D.Kan. 1990). In this case, Vulcan Materials Co. was sued by a neighboring property owner for personal injuries, emotional distress, trespass, nuisance, and absolute liability based upon alleged emission and migration of airborne gases. The court held that the neighboring property owner could not recover for trespass in the absence of actual and substantial damage implicating the right to exclusive possession of the property. Id. at 1541.

Maddy provides an excellent discussion of the central issue involved in the instant Motion for Partial Summary Judgment. The court first cited the traditional rule relating to trespass which states that a defendant's actions must cause an invasion of the plaintiff's property by some tangible matter. Id. At 1539. The court then went on to note that smoke, gas, and noise are not generally actionable as a trespass because there is no actual physical invasion by some tangible matter. Id. The court then noted a recent trend in the law relating to trespass.

However, a modern trend has emerged under which airborne pollution may constitute a trespass, where the plaintiff can demonstrate physical damage to his property. . . . The modern trend departs from the traditional rule by finding that intangible invasions of the plaintiff's property may constitute a trespass. However, the modern trend also departs from traditional trespass rules by refusing to infer damage as a matter of law, thereby eliminating the right to nominal damages. The plaintiff claiming trespass must prove that the intangible invasion resulted in substantial damages to the plaintiff's land. Id. (citations omitted) (emphasis added).

The court then cited Borland v. Sanders Lead Co., 369 So.2d 523 (Ala. 1979), as a leading case in this area. In Borland, the alleged trespass was based on the intrusion of lead particulates and sulfoxide gases onto the plaintiff's property. The trial court in Borland dismissed the case under the traditional rules of trespass. The Alabama Supreme Court reversed based on the following analysis.

Under the modern theory of trespass, the law presently allows an action to be maintained in trespass for invasions that, at one time, were considered indirect and, hence, only a nuisance. In order to recover in trespass for this type of invasion [i.e., the asphalt piled in such a way as to run onto plaintiff's property, or the pollution emitting from a defendant's smoke stack, such as in the present case], a plaintiff must show 1) an invasion affecting an interest in the exclusive possession of his property; 2) an intentional doing of the act which results in the invasion; 3) reasonable foreseeability that the act done could result in an invasion of plaintiff's possessory interest; and 4) substantial damages to the res. Maddy v. Vulcan Materials Co., 737 F.Supp. at 1540 (quoting Borland v. Sanders Lead Co., 369 So.2d at 529) (brackets in original).

Illustrating the intent requirement, if a driver on an icy street slides off into someone’s yard an invasion has clearly occurred. But a trespass claim may not be actionable because the action was not intentional. Likewise a golfer slicing a ball into a house would create an invasion, but it would not be intentional.

In many cases a defendant will have the possessory right to use a property also, usually via the oil and gas lease provisions, so trespass would not lie. Nuisance and negligence actions are much more commonly asserted in oil field disputes than trespass claims.

Strict Liability & Nuisance per se

Strict, or absolute, liability holds a party responsible for any damage that has occurred regardless of how prudent they were or how many precautions they took to avoid harm. Generally this theory is applicable in situations involving the use of high explosives, for example, or for the handling of a wild animal like a tiger in populated areas.

The Texas Supreme Court in Turner v. Big Lake Oil Co., 96 S.W.2d 221 (1936) made it very clear that this theory did not apply to oil and gas activities in Texas. The court noted the theory, as it evolved under English law, was based on facts that could be distinguished here in Texas. In the Rylands v. Fletcher, L. R. 3 H. L. 330 case in England a mineshaft was flooded when an offsetting landowner ponded water that escaped causing damage. The English court found that impounding a dangerous substance created liability if it escaped regardless of the care used to contain it.

The Turner court noted that unlike England, Texas is an arid area. Water is required to be retained to keep agricultural lands growing and animals alive. Also, Texas has oil wells that produce water, something that the English case did not.

The Rylands case really has evolved into two separate theories in the U.S.: (1) if you keep a dangerous substance on your property and it escapes you are liable regardless of care, and (2) if you use your property in a 'non-natural' manner that you are responsible for any damages regardless of care. The Texas courts have rejected both theories with regard to oil and gas activities. Most states follow the Texas holding, however cases in Kansas have allowed strict liability to be imposed on oil and gas operators.

A similar theory, which some say is a backhand way to achieve strict liability in form but not in name, is the concept of 'nuisance per se'. Activities that are a nuisance per se have been deemed to be a nuisance regardless of where they are located, and the party liable regardless of care. In some states these are designated by statue. In Texas, and most other states, oil and gas operations do not constitute a nuisance per se. They might be a nuisance – but the tort will be required to be established by the plaintiff based on the facts of the situation.

Bottom line is that strict liability has little application in the oil field. Most disputes will be settled using tort law, and the required burden of proof must be met by the plaintiff.

McAlister v. Atlantic Richfield Co.
Statute of Limitations & Discovery Rule

When buying oil and gas prospects, or dealing with alleged environmental contamination, if the parties identify a legal or regulatory issue that is unresolved the claim may or may not be actionable based on a legal doctrine called the “statute of limitations”. Created by legislation in every state it provides that an impacted party has a limited amount of time to file a claim, or otherwise loses the right to pursue that claim in court.

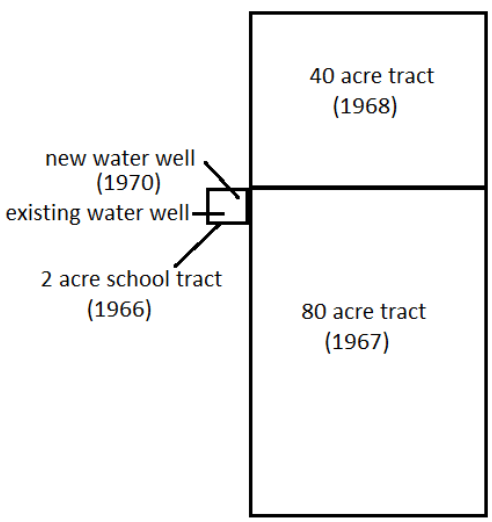
The reasoning behind the statute of limitations is that the courts did not want to be bothered with decade old disputes where the evidence and parties had disappeared – if you have a claim it needs to be promptly asserted so the evidence is fresh and the court can decide based on the facts. Usually a party has two or three years from when damage to real property becomes apparent to assert a claim.

For oil and gas operations, this means that damage that occurred in 1940, for example, might not be actionable today. The statute of limitations is subject to several exceptions and limitations however, and we will discuss these in the next two cases.

McAlister v. Atlantic Richfield Co.
Supreme Court of Kansas
233 Kan. 252; 662 P.2d 1203; 77 Oil & Gas Rep. 241
April 29, 1983, Opinion Filed

This is an action for damages caused by alleged violations of the Oil Well Pollution Act, K.S.A. 55-121. The issues of liability and damages were bifurcated and the matter proceeded on the issue of liability only. Summary judgments were entered for each defendant; from the trial court's ruling this appeal results.

This is an appeal from an order granting summary judgment in case No. 54,357, and a motion to dismiss in case No. 54,358. Both cases arise out of the same factual situation and were filed by plaintiff McAlister, against various oil companies who had conducted or were conducting oil operations on or near plaintiff's land.

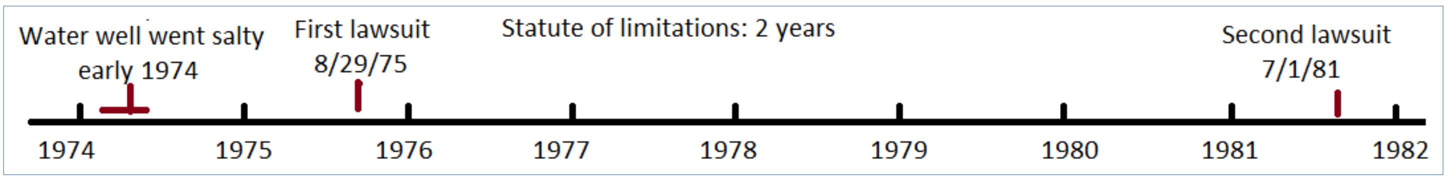


McAlister is the owner of three tracts of land in Harvey County, Kansas. Plaintiff purchased a two acre tract of land in 1966 where the old Willis School is located; in 1967 he purchased an additional 80-acre tract adjacent to the Willis School tract; and in 1968 an additional 40 acres adjacent to the Willis School tract was purchased by the plaintiff. McAlister purchased the land to form a new agriculture business and to conduct experiments, knowing the area was situated in an oil-producing area.

When the land was purchased there was an existing fresh water well on the Willis School tract that produced good water. McAlister determined that the existing well did not produce the volume of fresh water to supply his increasing needs. In February of 1970, McAlister had a new well drilled to the depth of 120 feet outside the schoolhouse. In the early part of 1974, McAlister noticed that the water in this well suddenly had developed an "extremely high chloride and salt content" which rendered the water unfit for any use. Plaintiff filed his first action in case No. 54,357.

During discovery, plaintiff determined that additional oil companies may have contributed to the pollution of his fresh water well; therefore, he filed the second action. At a hearing conducted by the district court, the judge sustained the defendants' motion for summary judgment in case No. 54,357 and motion to dismiss in case No. 54,358. Plaintiff has appealed both orders.

August 29, 1975, plaintiff filed his petition against five oil companies, Atlantic Richfield Company, successor to Sinclair Prairie Oil Company (Atlantic Richfield); Mobil Oil Corporation, successor to Magnolia Petroleum Corporation (Mobil); Aladdin Petroleum Corporation (Aladdin); Westrans Petroleum, Inc. (Westrans); J. S. Kantor d/b/a Kantor Oil Company (Kantor); and filed an amended petition on May 24, 1976, adding Southern States Oil Corporation (Southern). For some reason, plaintiff and his attorney had a parting of the way shortly after the petition was filed and plaintiff proceeded pro se. For the next several years, the parties conducted discovery. During 1981, each of the defendants filed motions for summary judgment which the trial court sustained.



When sustaining each defendant's motion for summary judgment, the trial court found (1) there was no genuine issue as to any material fact and the party was entitled to judgment as a matter of law (K.S.A. 60-256[c]); (2) plaintiff had not established a causal connection to any of the defendants and the claims were based on nothing more than speculation and conjecture; and (3) K.S.A. 55-140 was not appropriate or applicable to the case. Other findings were made by the court in each order of summary judgment but will not be stated in the opinion since they are not material to the finding.

Plaintiff listed witnesses who were local residents that would testify to various salt water or oil tank leaks, leadline leaks, well leaks, tank battery leaks, breaks, surface spills, and various disposal ponds now existing or which had existed in the past and were now covered over. None of the local witnesses could testify which defendant or if any defendants' acts caused pollution to the plaintiff's water well.

Depositions were taken from four expert witnesses listed by the plaintiff. (1) Ralph E. O'Connor, district geologist for the Kansas Department of Health and Environment: Mr. O'Connor had conducted extensive investigation of water wells within a several mile radius of plaintiff's Willis School well.

From the investigation, O'Connor concluded that the salt water pollution was a result of the plaintiff's drilling his water well too deep, thereby penetrating the salt laden waters present in the Permian zone underlying the equus beds. Other wells less than 120 feet in depth in the area produced fresh water. O'Connor also stated chemical analysis of the water from plaintiff's well indicated that the pollution of the well water was oil field derived.

(2) Dr. Ronald L. Wells, a consulting engineer and Director of General Laboratories in Hutchinson, and a graduate engineer from Colorado School of Mines, with training and past experience in

engineering, chemistry and physics, and having taken college courses in geology, historical geology, crystallography, and mineralogy, conducted two analyses of plaintiff's well water. Dr. Wells was of the opinion that the contamination of plaintiff's water well was salt water brine from oil field production.

Dr. Wells admitted he had no specific evidence of who contributed to the pollution of the plaintiff's water well. Dr. Wells was of the opinion that, if salt water brine was allowed to escape on the surface of sandy soil over the equus beds, it would percolate down into the equus bed. The escaping salt water brine would generally flow in one direction but also would fan out in several directions in the equus beds, contaminating the beds.

(3) John S. Fryberger, hydrogeologist and Vice President of Engineering Enterprises, Inc., and Richard Lewis, project hydrogeologist, filed a report. Based on tests of plaintiff's well water, they concluded that the salt water pollution in the water was from oil field production.

A field investigation encompassing an area of 25 square miles in the vicinity of the McAlister Willis School well determined the source of pollution of plaintiff's water well. The investigation, using Kansas Corporation Commission records and unpublished data, also involved interviewing local residents, measuring private wells, determining the configuration of the surface of the equus beds, and using aerial maps to determine the source of pollution of plaintiff's water well. The source of pollution was leachate from unlined ponds, seepage from improperly plugged wells, injection into shallow zones, poor maintenance of brine ponds, and leakage from leadlines and tanks conveying or holding brine water.

Based on the time of operation, size of ponds, and length of salt water pipelines, they concluded the percentage of damage contributed by each defendant. Some of the information contained in the report indicated the defendants' pollution, if any, could not yet affect plaintiff's water well due to the time necessary for the escaping pollutant to travel and affect plaintiff's well water.

(4) Robert Hecht-Nielsen: Hecht-Nielsen has a doctorate degree in mathematics and a bachelor of science degree from Arizona State University. Based on information supplied by the plaintiff, he prepared a report dated October 22, 1979. Using the information supplied, he devised a mathematical formula to determine the percentage of pollution contributed by each of the defendants. He admitted he was not prepared to prove the results of his determination.

Plaintiff brought the action for damages for the pollution of his fresh water well claiming defendants violated K.S.A. 55-121 and that there is evidence that the defendants allowed salt water brine to escape from their oil drilling operations.

Judgment was granted the defendants pursuant to K.S.A. 60-256(c), which provides in part:

> "The judgment sought shall be rendered forthwith if the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to a judgment as a matter of law." Emphasis supplied.

A motion for summary judgment may be granted only if the record before the court conclusively shows there remains no genuine issue of a material fact unresolved. Hanks v. Riffe Constr. Co., 232Kan. 800, 658 P.2d 1030 (1983); Motors Insurance Corporation v. Richardson, 220 Kan. 288, 552 P.2d 894 (1976); Brown v. Wichita State University, P.E.C., Inc., 217 Kan. 661, 538 P.2d 713 (1975);

Kern v. Miller, 216 Kan. 724, 533 P.2d 1244 (1975); State Bank of Burden v. Augusta State Bank, 207 Kan. 116, 483 P.2d 1068 (1971); Lawrence v. Deemy, 204 Kan. 299, 461 P.2d 770 (1969); Brick v. City of Wichita, 195 Kan. 206, 403 P.2d 964 (1965).

"A summary judgment proceeding is not a trial by affidavits, and the parties must always be afforded a trial when there is a good faith dispute over the facts. . . . "A mere surmise or belief, no matter how reasonably entertained, that a party cannot prevail upon a trial, will not justify refusing him his day in court." Brick v. City of Wichita, 195 Kan. at 211.

"Petitioner next complains that a question of material fact exists which precludes summary judgment. If a question of material fact remains, then to grant [*258] summary judgment is error." Hall v. Twin Caney Watershed Joint Dist. No. 34, 4 Kan. App. 2d 202, 204, 604 P.2d 63 (1979). Emphasis supplied.

The sole fact issue in this case is whether any or all of the defendants allowed salt water brine to seep from their oil field operations into plaintiff's water well. If there is a question remaining as to whether the seepage into the plaintiff's water well did occur as to a defendant, then, as to that defendant, summary judgment is in error. This action was initiated with plaintiff alleging that defendants violated K.S.A. 55-121.

K.S.A. 55-121, first enacted in 1921, provides in pertinent part:

> "It shall be unlawful for any person, having possession or control of any well drilled, or being drilled for oil or gas, either as contractor, owner, lessee, agent or manager, or in any other capacity, to permit salt water . . . from any such well, to escape by overflow, seepage or otherwise from the vicinity of such well, and it shall be the duty of any such person to keep such salt water . . . confined in tanks, pipe lines or ponds, so as to prevent the escape thereof."

The statute goes on to provide that such escape of salt water does not violate the statute if it is because of circumstances beyond the operator's control or could not have been reasonably anticipated or guarded against; but that issue has not been raised by the defendants, and none of them have presented any evidence by experts or otherwise as to that issue.

If any of the defendants violated K.S.A. 55-121 and caused plaintiff's pollution, they are civilly liable to plaintiff. In Rusch v. Phillips Petroleum Co., 163 Kan. 11, 180 P.2d 270 (1947), the plaintiff, a farmer, sued Phillips, Cities Service, Gulf, and Phil-Han, claiming pollution of his fresh water because of seepage from salt water disposal ponds. The court held, largely on the basis of chemical analysis showing that the salt water polluting plaintiff's water carried defendant's oil-bearing strata, that plaintiff's case should be submitted to the jury on circumstantial evidence. Further, the court held not only is the issue a jury question but that plaintiff need not disprove other oil operations did not cause his pollution.

"The pollution damages, if any, resulted from seepage from appellants' ponds into the substrata of the soil and through such strata into the springs and natural ponds located on appellee's land." 163 Kan. at 14.

The surface drainage in the Rusch case suggested that the water would drain toward plaintiff, but the subsurface contours were not known. There was another party who had not been sued but who had a disposal pond that very well could have caused the pollution complained of by the plaintiff; however, the court held that the case should be submitted to a jury, stating:

> "'It may also be noted that appellees were not obliged to exclude every other possible source of pollution after establishing facts from which it reasonably could be inferred that appellants had polluted the stream. The fact that appellants polluted the stream could, of course, be shown by circumstantial evidence. Such evidence in a civil case in order to be sufficient to sustain a verdict need not rise to that degree of certainty which will exclude every reasonable conclusion other than that reached by the jury. . . . [I]t was thereafter not a prerequisite to recovery that it be shown appellants were the sole cause of the pollution.'" 163 Kan. at 16."It is not imperative there should be proof of pollution by chemical analysis . . . ." 163 Kan.. 11, Syl. para. 2.
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> "G.S. 1935, 55-121, commonly referred to as the oil well pollution statute, does not prohibit merely the flow of salt water, oil or refuse from oil and gas wells over the surface and away from the immediate vicinity of such wells but, subject to the proviso therein contained, requires such substances to be safely confined, in the manner designated, to prevent their escape." 163 Kan. 11, Syl. para. 4.

The plaintiff in this case need not show negligence, nor need he pinpoint what a particular defendant did or did not do to cause his pollution; this is not an issue. All he need prove is a violation of K.S.A. 55-121. In Polzin v. National Cooperative Refinery Ass'n, 175 Kan. 531, 266 P.2d 293 (1954), a case involving pollution of fresh water caused by escape of salt water from a well in which salt water was forced, the court held that:

> "The evidence disclosed community of wrongdoing and concurrent negligence. In fact the burden did not rest on appellee to prove appellants' negligence. The statute makes it unlawful to permit saltwater, oil or refuse to escape. Appellants' only defense was to prove the escape thereof was beyond their control or that it could not have been reasonably anticipated and guarded against. (G.S. 1949, 55-121.)" 175 Kan. at 536. Emphasis supplied.

All of the summary judgments granted in this case reflect in the journal entry filed March 11, 1982, that they are based upon a finding that plaintiff could not pinpoint what each defendant did wrong. Such a finding is not a proper or material basis for summary judgment in this case. Such a finding and conclusion is immaterial where plaintiff has pled and offered substantive proof of a violation of K.S.A. 55-121 by each of the defendants.

In Reiserer v. Murfin, 183 Kan. 597, 331 P.2d 313 (1958), a case that involved an alleged pollution of plaintiff's fresh water well by salt water seeping through substrata, the court approved the ruling in Rusch v. Phillips Petroleum Co., 163 Kan. 11, holding that whether the defendant caused plaintiff's pollution is a jury question and affirming that negligence of defendant need not be proved.

"Defendant's obligation, or duty, is set out in the statutes above quoted [K.S.A. 55-118, -121] and in a damage action under these statutes negligence does not have to be alleged as an element of the petition. In Martin v. Shell Petroleum Corp., 133 Kan. 124, 299 Pac. 261, this court held that negligence did not have to be proved as an element in a damage action under 55-118. It would therefore be a useless thing to require plaintiff to plead something in his petition that he did not have to prove by his evidence." Reiserer v. Murfin, 183 Kan. at 600. Emphasis supplied.

The case was bifurcated and, therefore, issues as to damages have not and should not now be of concern in the appeal. The only issue is whether there is any controverted evidence as to the defendants' violation of K.S.A. 55-121 by allowing salt water brine to seep into the ground and escape their control and whether the escape of the brine caused plaintiff's pollution.

There is eyewitness and aerial photographic evidence that brine escaped the control of each defendant. There is also evidence that the salt water that escaped polluted plaintiff's well. Dr. Wells was firmly of the opinion that the salt water in plaintiff's well, in August, 1974, tested over 5,000 parts per million sodium chloride, was from the oil field production.

The witness O'Connor related that a sodium chloride ratio below six was indicative of oil field salt water and that plaintiff's water well tested 0.40, which was less than six. Dr. Wells was also of the opinion that all of the defendants caused plaintiff's pollution. Lewis and Fryberger concluded on the basis of field investigations, interviews with witnesses, and state documents and aerial photographs that each defendant had caused plaintiff's pollution. These facts and the locations of defendants' oil field operations relative to plaintiff's fresh water well require that the matter be submitted to a jury.

The trial court has weighed the testimony of the plaintiff's witnesses and determined their observations were of little value or were pure speculation and conjecture. In considering a motion for summary judgment, a trial court must give to a litigant against whom judgment is sought the benefit of all inferences that may be drawn from the admitted facts under consideration. Bowen v. Westerhaus, 224 Kan. 42, 578 P.2d 1102 (1978). The court erred in granting defendants' motions for summary judgment.

The judgment of the district court in case No. 54,357 is reversed and remanded for a trial of the issues.

During discovery plaintiff determined that two additional oil companies, Marathon Oil Company, Inc., successor to Ohio Oil Company, Inc. (Marathon), and Skelly Oil Company, Inc., now merged into Getty Oil Company (Getty), have contributed to the pollution of his fresh water well. Marathon and Skelly had conducted oil operations in the 1930's and 1940's near the present water well. On May 20, 1981, plaintiff filed a motion to amend his petition in McAlister v. Atlantic Richfield Co., by adding Marathon and Getty. The trial court ruled that the plaintiff could not amend because of the late date, but allowed the plaintiff to file a separate suit. On July 1, 1981, plaintiff filed his claim against Marathon and Getty, stating the same facts alleged in the original case. Getty filed an answer September 8, 1981, and a motion to dismiss on September 15, 1981. Marathon, prior to filing an answer, filed a motion to dismiss on September 8, 1981. Marathon and Getty each claimed that the statute of limitations, K.S.A. 60-515(a), barred plaintiff's action.

December 16, 1981, Marathon's and Getty's motions were heard by the court. The court ruled that more than two years after plaintiff was first damaged (1974), plaintiff filed his petition alleging that the damages were permanent in nature, and therefore plaintiff was barred by the two-year statute of limitations, K.S.A. 60-513(a); that Marathon's and Getty's last act that could have damaged plaintiff occurred more than ten years before plaintiff commenced this action; that assuming plaintiff's claims were true, his claims against Marathon and Getty are barred by the statute of limitations, K.S.A. 60-513(a) and (b).

Plaintiff, on January 8, 1982, filed a motion for a new trial. January 18, 1982, plaintiff filed a motion to amend his petition to claim the oil pollution damages were temporary in nature, therefore not barred by any statute of limitations.

March 11, 1982, the court heard motions in both cases filed by the plaintiff. At the hearing on the motions, all plaintiff's motions were overruled. April 7, 1982, plaintiff filed his notice of appeal [*262] of the overruling of his motions for a new trial, for leave to amend his petition, for consolidation, and the court's order dismissing plaintiff's petition. No discovery was conducted in this case. All parties to this action were familiar with discovery conducted in the companion case.

Plaintiff contends that his claim should not have been dismissed as barred by the statute of limitations where the action was filed for more than two years after plaintiff was first damaged but where plaintiff claimed temporary repeated damage to his business.

Temporary damages or continuing damages limit recovery for injury that is intermittent and occasional and the cause of the damages remediable, removable, or abatable. Damages are awarded on the theory that the cause of the injury may and will be terminated. Temporary damages are defined as damages to real estate which are recoverable from time to time as they occur from injury. 25 C.J.S., Damages @ 2, p. 626.

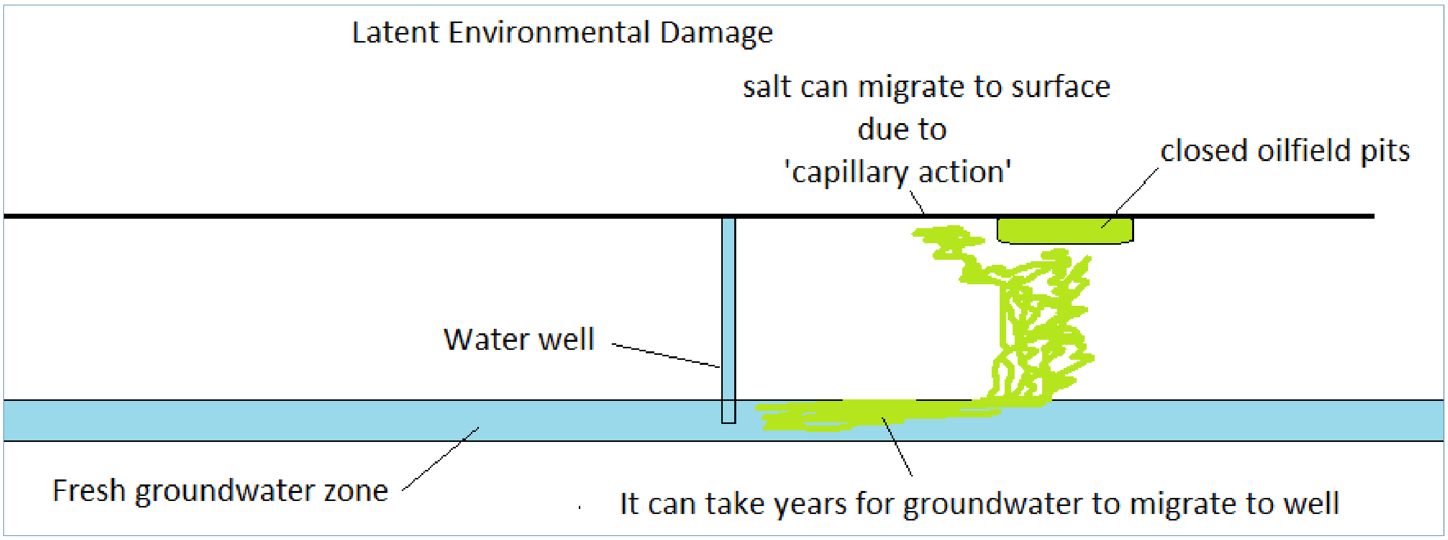
Permanent damages are given on the theory that the cause of injury is fixed and that the property will always remain subject to that injury. Permanent damages are damages for the entire injury done -- past, present and prospective -- and generally speaking those which are practically irremediable. 25 C.J.S., Damages @ 2, pp. 622-23. If an injury is permanent in character, all the damages caused thereby, whether past, present, or prospective, must be recovered in a single action.

Plaintiff claims a continuing wrong each time the salt water pollutants trespass onto his subsurface water. Marathon and Getty maintained oil operations that continue to allow salt brine into the equus beds, which brine continues to slowly move onto and under his land, injuring and reinjuring his land and personal business daily.

Plaintiff cites Peterson v. Texas Co., 163 Kan. 671, 186 P.2d 259 (1947), as authority. Peterson filed his first case against defendant in 1942, for damage to fresh water under plaintiff's land, damage to his basement and house foundation and his cattle, abandonment of his pasture, loss of chickens, and loss of egg production. Plaintiff was also compelled to hand carry water. Defendant operated an oil lease and allowed waste water to escape from a pond he maintained. The escaping waste water caused plaintiff's injuries. In 1943 the parties settled the case. Peterson brought a second action in 1945 against the same defendant. Peterson's second action was for damages incurred by defendant's operation of the oil lease which caused damage to the strata lying underneath his property. His well water became polluted causing him to rebuild it; he had to pump water out of his basement; additional damage was done to his farm animals; and additional loss of egg production occurred.

The court determined that each action was separate: (1) escaping surface pollution, and (2) pollution of the strata underneath Peterson's property. The second action was not barred by the statute of limitations or res judicata. In Gowing v. McCandless, 219 Kan. 140, 547 P.2d 338 (1976), an upper landowner brought an action for damages to crops caused by the defendant's obstruction of a watercourse. The obstruction caused occasional flooding of the plaintiff's land. Schroeder, J. (now Chief Justice) stated the Kansas law on temporary damages:

"When this case went to trial the plaintiffs were not seeking to recover permanent damages to their land occasioned by the obstructions placed in the watercourse on the defendants' land. The posture of the case here presented is one in which the plaintiffs seek to recover temporary damages arising from the maintenance of obstructions in the watercourse on the defendants' land (alleged in the petition to be a continuing nuisance), and limit the recovery they seek to damages to their crops, sustained within two years prior to the filing of their petition, and punitive damages.



"Where the injury or wrong is classified by the courts not as original or permanent, but as temporary, transient, recurring, continuing or consequential in nature, it has been held that the limitation period starts to run only when the plaintiffs' land or crops are actually harmed by overflow, and for purposes of the statute of limitations, each injury causes a new cause of action to accrue, at least until the injury becomes permanent. [Citations omitted.] This rule is especially applicable if the situation involves other elements of uncertainty, such as the possibility or likelihood of the alteration or abatement of the causative condition, or uncertainty in regard to the future use or improvement of the land, so as to prevent a reasonably accurate estimate of future damages. [Citation omitted.]

"A number of our cases have permitted relief for damages caused by overflowing waters if brought within two years of the overflowing. [Citations omitted.]

"In the instant case the evidence does not show the cause of the injury to be permanent. In many cases injuries have been classified as temporary or recurring in nature when caused by an abatable nuisance or condition, or by defects which can be repaired or remedied at reasonable expense.

Successive injuries of this nature have been held to give rise to separate and distinct causes of action. [Citation omitted.] "It has frequently been said the principle upon which one is charged as a continuing wrongdoer is that he has a legal right, and is under a legal duty, to terminate the cause of the injury. [Citations omitted.] "Under this rule the owner of land injured by overflows and poor drainage caused by an abatable condition or nuisance has the right to assume the condition or nuisance will be abated.

Here the appellees presented evidence that the obstructions were not 'permanent.' That is to say, the obstructions could be removed from the drainage ditch. In a legal sense these obstructions were not 'permanent' because they were not approved by the state." 219 Kan. at 144-45.

Plaintiff's well has been polluted and undrinkable since 1974. Plaintiff alleges in his amended petition, seeking damages for a temporary injury, that not less than 150 years nor more than 400 years will pass before the well water will be once again fit for drinking. For all practical purposes plaintiff's damage is permanent and capable of being determined.

Correctly determining that plaintiff's action was for permanent damages as alleged in the petition, the court concluded that such claim was barred by the statute of limitations. K.S.A. 60-513(a) states in part:

"(a) The following actions shall be brought within two (2) years:
. . . .
"(4) An action for injury to the rights of another, not arising on contract, and not herein enumerated."

Plaintiff's final contention is that the court erred when plaintiff was denied, by the court, leave to file an amended petition after defendants' motion to dismiss was sustained. Plaintiff filed his petition against Marathon and Getty July 1, 1981, claiming permanent damages. Getty filed its answer September 8, 1981, and a motion to dismiss on September 15, 1981. Marathon filed a motion to dismiss September 8, 1981, and never was required to file an answer because plaintiff's action was dismissed by the court December 16, 1981, his claim for permanent injury being barred by the two year statute of limitations. K.S.A. 60-513(a). January 18, 1982, plaintiff moved to amend his petition to claim temporary damages, which amendment the trial court denied.

[discussion of procedural rules and cases omitted] . . .

Allowing plaintiff to replead his claim against Marathon could not correct the defects in his claim.

The trial court did not abuse its discretion in refusing to allow plaintiff to amend his petition against Getty or Marathon.

The judgment is affirmed as to Marathon and Getty in case No. 54,358.

McAlester v. Atlantic Richfield Co.
Notes & Discussion

1. Did the landowner/plaintiff file his claim within the applicable statute of limitation in the first lawsuit? What about the second lawsuit? Note the ‘discovery rule’ – when did the landowner discover the salt pollution?

2. Did the court find that the damage was permanent or temporary in the instant case? Based on what evidence?

3. What impact on the statute of limitations did the distinction between permanent and temporary damages have in this case?

4. In the original petition, for what period of time can the plaintiff recover damages for?

5. What theories or strategies can a plaintiff use to attempt to avoid the statute of limitations in pollution suits?

6. In Fischer v. Atlantic Richfield Co., 774 F. Supp. 616; 116 Oil & Gas Rep. 616 (1989),the court noted that the defendant:

> . . . . also seeks summary judgment on the basis that plaintiffs' claims are barred by the 2 year statute of limitations in 12 O.S. 95(3). Summary judgment on this ground must be denied for several reasons. First, the statute of limitations does not bar an action for temporary pollution of groundwater. [cite] Second, to the extent that ARCO has made unfulfilled promises to plaintiffs to clean up the pollution, it is estopped to plead the statute of limitations as a defense. [cite] Third, the statute of limitations does not run against a public nuisance. 50 O.S. 7 (1981).
>
> Pollution of waters of the state constitutes a public nuisance under Oklahoma law. 82 O.S. 926.2 (1981). Therefore, to the extent that ARCO's activities have polluted state waters, ARCO may not plead the statute of limitations as a defense. Issues of fact are present as to whether ARCO has created a public nuisance.
>
> The parties are in agreement that if the injury to the land is temporary and abatable by clean-up operations, plaintiffs' damages are limited to those occurring within the two years preceding the commencement of this action, i.e., subsequent to October 6, 1985. [cite] In addition, however, plaintiffs are entitled to abatement of a continuing nuisance, regardless of whether the activity constituting the nuisance began within the 2-year statutory period. [cite] Either a mandatory injunction can issue, requiring the defendant to abate the nuisance, or plaintiff can be awarded the costs of abatement. . . .

Temporary v. Permanent Damage Issues

MILLER v. CUDAHY COMPANY, a Delaware Corporation, and General Host Corporation
UNITED STATES DISTRICT COURT FOR THE DISTRICT OF KANSAS
567 F. Supp. 892; 19 ERC (BNA) 1667
June 21, 1983

THEIS, Senior District Judge.
This saltwater pollution case, which has been bogged down in an extraordinarily contentious discovery phase for nearly six years, is currently before the Court on the plaintiffs' motion for review of an order filed in this case by United States Magistrate John B. Wooley, and on the defendants' motion for partial summary judgment. These two motions, fairly routine in other cases, have been pending for some time because of the avalanche of paperwork accompanying them.

The corpulent documents pertinent to these motions comprise nearly four hundred and fifty pages, and are accompanied by three unpaginated bound volumes of appendices numbering over one hundred.

Giving these documents, and the arguments made in them, the consideration to which they are due has been a time-consuming adventure for the Court, and has generated an Opinion substantially longer than the ideal. The task has nevertheless been completed, and, for the reasons that follow, the Court must deny both the plaintiffs' motion and the majority of the defendants' motion.

A. Brief Factual Background

The very numerous plaintiffs in the present lawsuit are owners and lessees of realty in Rice County, Kansas. To the northwest of this realty is the manufacturing plant of the American Salt Company [American Salt]. American Salt is a division of the defendant Cudahy Company [Cudahy], a Delaware corporation with its principal place of business in Arizona. Cudahy is, in turn, a wholly-owned subsidiary of the defendant General Host Corporation, a New York corporation with its principal place of business in Connecticut. For convenience, the defendants will hereafter be collectively referred to as American Salt. American Salt is engaged in the business of producing salt and salt products, and this business has been carried on continuously at American Salt's present location since 1908.

The natural salt formation exploited by American Salt lies approximately 725 feet below the ground surface in a stratum 280 feet thick. Two methods are used to bring this salt to the surface. The first method utilizes a shaft mine and involves physically removing solid salt to the surface. The second method utilizes a matrix of brine wells and involves dissolving the salt in injected high pressure water, retrieving the saturated liquid brine at the surface, and evaporating the brine to leave solid salt. This latter method is called solution mining and is the only one pertinent to the issues in this lawsuit.

The water required by the solution mining process is obtained by American Salt from a natural aquifer that underlies the area at a depth of thirty to sixty feet. The aquifer flows in a southeasterly direction, and consequently passes under the lands owned or leased by the plaintiffs after it has passed under the lands occupied by American Salt and its solution mining field. As the existence of this lawsuit suggests, the aquifer has become heavily polluted with salt and can be used neither for irrigation nor for domestic purposes over a large area southeast of American Salt's plant. Salt concentrations approaching 30,000 parts per million [p.p.m.] have been recorded in water drawn from this aquifer. The gravity of these concentrations can best be appreciated when it is realized that concentrations as low as 250 p.p.m. are sufficient to make water taste salty and to render it unfit for domestic use. Saturated brine, that is, water holding in solution the maximum amount of salt possible, has a salt concentration of approximately 165,000 p.p.m.

The contentions of the parties are outlined in the Pre-Trial Order, Dk. No. 309, which was filed on March 9, 1982 and supercedes the pleadings in the case pursuant to Rule 16 of the Federal Rules of Civil Procedure. The plaintiffs essentially lay the blame for the saltwater pollution of the aquifer on American Salt, allege "that the defendants' actions constitute a continuing nuisance, trespass, and damages," Pre Trial Order at 4, and demand a variety of relief, including per-acre damages, an injunction, and punitive damages. American Salt denies all liability in a complex and many-faceted argument that will be explicated shortly.

B. Motion To Review

On May 19, 1982 the plaintiffs moved to supplement their pleadings pursuant to Rule 15(d) of the Federal Rules of Civil Procedure. In connection with this motion, the plaintiffs designated a new expert witness, Curtis Miller. On June 1, 1982, American Salt moved to strike Miller and two other expert witnesses from the plaintiffs' designation of experts. Magistrate Wooley, in a seven-page opinion filed October 20, 1982, construed the plaintiffs' motion as a motion to amend pursuant to Rule 15(a) and, as such, overruled it. The Magistrate also granted American Salt's motion to strike expert Miller, but overruled its motion to strike the other two experts. The plaintiffs have appealed the Magistrate's order to this Court, the eighth time that such n appeal has been perfected during the discovery in this case.

The plaintiffs sought to supplement their pleadings pursuant to Rule 15(d) with allegations that the salt dissolved in the aquifer is rising to the surface by capillary action and threatening to turn the entire area into a desert devoid of all plant life. Magistrate Wooley concluded "that if such capillary action exists at all, it has been occurring for a long period of time prior to the filing of this motion," thus rendering Rule 15(d) inapplicable and transforming the motion into one for an amendment under Rule 15(a).

In determining whether justice required the amendment, Magistrate Wooley considered the feasibility of a separate suit on the capillary action theory, the motive of the plaintiffs in waiting until such a late date to assert the claim, and the glacial pace of the discovery completed up to that time.

The Magistrate concluded that a separate suit was feasible, that there was a "distinct probability of improper motives on the part of the plaintiffs," that additional delay of up to two years in the trial of this matter could result, and that allowing the amendment would grant an "undeserved tactical advantage to the plaintiffs" in regard to American Salt's motion for partial summary judgment that is dealt with in the next section of this Opinion. For these reasons, Magistrate Wooley overruled the motion. Finally, because the amendment was not permitted, American Salt's motion to strike expert Miller, whose testimony would have concerned only the capillary action theory, was granted.

It is well-established that the orders of a United States Magistrate must stand unless they are clearly erroneous or contrary to law, 28 U.S.C. @ 636(b)(1)(A); Devore & Sons, Inc. v. Aurora Pacific Cattle Co., 560 F. Supp. 236, 239 (D.Kan.1983). Although this Court would have approached these motions from a different conceptual basis had they been presented here in the first instance, the Court is unable to conclude that the result reached by the Magistrate is either clearly erroneous or contrary to law. The disputed order must, therefore, be sustained.

The short answer to the plaintiffs' motion to amend is that it is fatally defective [*896] in failing to allege any damage resulting from the capillary action. Had the salt actually arrived on the surface and killed the vegetation, a far different case would be presented -- and if the salt actually arrives on the surface at some future time, the Court has no doubt that a different case will be presented by the individuals damaged by such an arrival. At this point in time, however, justice simply does not require this Court to grant leave to the plaintiffs to amend their complaint in a way that alleges no damage and can lead to no recovery. When and if damage occurs, justice can be served by a separate lawsuit seeking recovery for that damage. Collateral estoppel and res judicata will not impede such a suit, as both Magistrate Wooley and this Court have concluded that the capillary action theory cannot be raised in this proceeding. The plaintiffs' motion to review the Magistrate's order is, therefore, overruled.

C. Motion for Partial Summary Judgment

1. American Salt's Argument

American Salt provides an analytical framework for its motion for partial summary judgment by dividing the plaintiffs into four distinct classes, as follows:

> (a) Plaintiffs who "have sued for damages to property where there is no evidence of any significant pollution to the groundwater and, in some cases, where the groundwater does not even exist in sufficient quantity to support irrigation."
>
> (b) Plaintiffs who "have sued for damages to property [that] admittedly lies outside the area of possible influence of the American Salt Company."
>
> (c) Plaintiffs who "have sued for damages to property [that] they purchased with the knowledge or on the assumption that the groundwater was already polluted with chlorides.
>
> (d) "All of those plaintiffs (or their predecessors in title) who do not fall into one or more of the three categories listed above knew or assumed or could have easily discovered that their groundwater was polluted with chlorides and believed that American Salt was responsible for such pollution more than two years before the date (May 31, 1977) this suit was filed."

Dk. No. 335, at 1. Because this analytical framework appears adequate to deal with the issues raised by American Salt's motion for partial summary judgment, it will generally be used as the organizational framework for this section of this Opinion as well.

2. Preliminary Geography

American Salt's manufacturing plant is located approximately one-half mile southeast of Lyons, Kansas and approximately four miles northwest of Saxman, Kansas. Two miles south of Lyons is Cow Creek, a minor tributary of the Arkansas River, which runs in a generally southeasterly direction. Cow Creek is located above the Cow Creek Valley Aquifer, which is the subject aquifer of this lawsuit and also runs in a southeasterly direction.

American Salt has provided the Court with two handsome multicolor maps, each approximately two by three feet in size and marked as exhibits A and 3, as well as numerous smaller geological maps incorporated into its so-called brief. Exhibit A shows the location of the lands owned or leased by each plaintiff, the boundaries of the Cow Creek Valley Aquifer, and the location of American Salt's properties, and is color coded to correspond to the four categories of plaintiffs established as American Salt's analytical framework. Exhibit 3 shows the extent, location, and severity of the salt pollution of the aquifer. The small illustration maps provide various other details. Reference to these maps has been extremely helpful to the Court, but, as might be expected, their impact is somewhat lessened when the information they contain is translated into words.

An examination of these documents shows that the area of the Cow Creek Valley Aquifer that could possibly be affected by American Salt's operations is somewhat limited. The geological makeup of the area apparently causes Cow Creek to operate as a southern boundary for the spread of groundwater contamination emanating from the location of American Salt's plant. Another natural boundary line exists between one and a half to three miles northeast of Cow Creek, running southeast and essentially paralleling Cow Creek. This northern boundary separates the Cow Creek Valley Aquifer, which contains a large quantity of groundwater, from the Upland Loess Area, which contains a much smaller quantity of groundwater. The area described by these two boundaries is a corridor between one and two miles wide in which most of the plaintiffs' property and most of the saltwater pollution can be found.

3. No Significant Pollution or Insufficient Groundwater

This category comprises ten groups of plaintiffs whose properties are situated either partially to the north of the north boundary of the Cow Creek Valley Aquifer or partially or wholly to the south of Cow Creek. Some parts of these properties therefore lie outside the aquifer and the area of salt pollution. American Salt claims that "it is unnecessary to cite any authority in support of the proposition that plaintiffs who have suffered no measurable harm to their groundwater cannot recover damages in this action," Dk. No. 337 at 150. Although the Court is inclined to agree concerning those properties completely outside the aquifer, the argument is specious as applied to those properties that overlie the aquifer even slightly. Any access to the aquifer would allow a well to be drilled, bringing the benefits of domestic and irrigation water to the whole tract, regardless of whether the entire tract overlies the aquifer.

Because American Salt has failed to carry its burden of proving beyond a reasonable doubt that it is entitled to summary judgment through a demonstration that no triable issue of material fact exists as to those properties partially overlying the aquifer, Cayce v. Carter Oil Co., 618 F.2d 669, 672 (10th Cir.1980); Madison v. Deseret Livestock Co., 574 F.2d 1027 (10th Cir.1978), its motion for partial summary judgment as to those tracts in category (a) and more precisely detailed on page 2 of Dk. No. 335 must be overruled except for the following tracts that are completely outside the boundaries of the aquifer:

Owner Tract

Wilmor H. Oden 400 acres in Sections 1 & 2, Township 21 South, Range 8 West of the 6th Principal Meridian.

Edris Edwards 160 acres in Section 26, Township 20 South, Range 8 West of the 6th Principal Meridian.

Joleen Ottlinger 80 acres in Section 31, Township 20 South, Range 7 West of the 6th Principal Meridian.

Because the property described above belonging to Joleen Ottlinger is the only property belonging to that person involved in this lawsuit, complete summary judgment against Joleen Ottlinger must be entered.

4. Outside the Influence of American Salt

This category comprises seven groups of plaintiffs whose properties are located southeast of Saxman, Kansas. The contentions of the parties show no parallelism with regard to these tracts.

American Salt appears to claim that an adjacent oil field "which has been in existence for many years and which would be a contributing (if not the original and exclusive) source of any chlorides found in the groundwater in the area" makes proof of causation impossible, Dk. No. 337 at 151.

The plaintiffs, on the other hand, appear to be arguing that the leading edge of the heavily polluted groundwater, which moves as the water in the aquifer flows southeasterly at the rate of approximately five feet per day, has not yet reached these properties but is certain to do so in the near future. The plaintiffs thus argue that these landowners "may reduce their future claims for permanent injury [*898] to a present claim for monetary damages," Dk. No. 351, Vol. 1, at 41.

Part of the difficulty with these properties is traceable to the unwillingness of the plaintiffs' expert witnesses to opine about the source of the salt pollution, if any, currently present in the aquifer in this locale. This unwillingness has resulted in a bizarre straight-line cut-off at the southeastern corner of Exhibit 3, which is the map showing the location and severity of the salt pollution of the aquifer. The Court is, therefore, left with no evidence tending even to suggest that pollution placed in the aquifer by American Salt has reached these properties.

The situation is the same as that discussed in section B of this Opinion concerning the capillary action theory: this land may be damaged in the future, but apparently is undamaged now. Because the plaintiffs have failed to present any evidence of presently existing injury, American Salt is entitled to summary judgment as a matter of law because no triable issue of material fact exists, Ando v. Great Western Sugar Co., 475 F.2d 531, 535 (10th Cir.1973); American Empire Ins. Co. v. Nugent, No. 77-1466 (10th Cir., unpub., Jan. 22, 1979), as to the following tracts:

Owner Tract

> Robert A. Johannsen Southeast Quarter of Section 29, Township 20 South, Range 7 West of the 6th Principal Meridian.
>
> Harry Zwick West Half of Section 33, Township 20 South, Range 7 West of the 6th Principal Meridian.
>
> Gary Zwick Southeast Quarter of Section 32, Township 20 South, Range 7 West of the 6th Principal Meridian.
>
> Harvey Willhaus 320 acres in Sections 4 & 5, Township 21 South, Range 7 West of the 6th Principal Meridian; 160 acres in the Northwest Quarter of Section 28, Township 20 South, Range 7 West of the 6th Principal Meridian.
>
> Lester Cole 180 acres in Section 4, Township 21 South, Range 7 West of the 6th Principal Meridian, and in Sections 33 & 34, Township 20 South, Range 7 West of the 6th Principal Meridian.
>
> Wilmor Oden Two lots in the Southeast Quarter of Section 2, Township 21 South, Range 7 West of the 6th Principal Meridian.
>
> Jay Brothers 10 acres in the Northwest Quarter of the Southwest Quarter of Section 29, Township 20 South, Range 7 West of the 6th Principal Meridian;
> Lots in Saxman, Kansas.

Because all of the property involved in this lawsuit belonging to Robert Johannsen, Gary Zwick, Harvey Willhaus, and Lester Colle is included in the preceding list, complete summary judgment against those individuals and in favor of American Salt must be entered. This entry of summary judgment is, of course, without prejudice to the right of these individuals to file new lawsuits unencumbered by the doctrines of res judicata and collateral estoppel when, if ever, the leading edge of the pollution in the aquifer crosses their property lines.

5. Property Purchased With Knowledge of Pollution

This category comprises six groups of plaintiffs whose properties are located deep within the area of the most severe salt pollution of the aquifer. American Salt relies on two parallel arguments to assert its entitlement to partial summary judgment. First, American Salt argues that these plaintiffs purchased their land with the knowledge that the groundwater was polluted, that the plaintiffs therefore paid a dry land price for the properties, and that the plaintiffs therefore have not been injured by the pollution.

Alternatively, American Salt cites the cases of Roberts v. Pacific Northern Railroad Co., 158 U.S. 1, 15 S. Ct. 756, 39 L. Ed. 873 (1895) and Taylor Investment Co. v. Kansas City Power & Light Co., 182 Kan. 511, 322 P.2d 817 (1958) for the proposition that these plaintiffs must suffer an adverse summary judgment because of their failure, at this stage in the litigation, to affirmatively prove that their grantors and predecessors in title specifically assigned a chose in action against American Salt for the aquifer pollution in the deeds to the properties. Neither of these arguments is persuasive.

As for the transactions allegedly completed at a dry land price, the plaintiffs correctly point out that the polluted condition of the aquifer is hardly the only possible reason for the transactions to be made at that price. For example, a dry land price may have been paid because the state of irrigation technology extant at the time of the transaction was simply inadequate to take advantage of any water under the property, whether polluted or not, or because the topography of the particular parcel rendered it unsuitable for extant irrigation techniques. If the state of irrigation technology has now improved to the point where the salt pollution is the only factor depressing the land values to dry land price, then these plaintiffs have suffered a compensable injury because of the pollution.

This area of contention is, furthermore, rife with material factual disputes, such as the prices actually paid for the land, the prevailing dry land price at the time of the transactions, the exploitability of the groundwater resources at various times, and the knowledge and assumptions of the grantors and grantees.

The alternative case law argument founders on legal grounds. Even ignoring the easy distinguishability of Roberts and Taylor, which both dealt with open, visible, and notorious surface infringements on the right to quiet possession, American Salt has failed to carry its burden of proof because of its erroneous conception of where that burden lies. Although American Salt's statement that the "plaintiffs have the burden of establishing their right to sue by virtue of assignments of choses of action in their deeds," Dk. No. 356 at 17, may be correct in the context of a trial, it is clearly erroneous in the context of a summary judgment motion.

The burden is on American Salt to prove every element of its entitlement to summary judgment beyond a reasonable doubt, and all inferences must be indulged in favor of the plaintiffs who oppose the motion, Madison, supra; Frey v. Frankel, 361 F.2d 437, 442 (10th Cir.1966). Because American Salt has failed to carry this burden, its motion for partial summary judgment as to those plaintiffs in category (c) and their properties, as more precisely detailed on page 5 of Dk. No. 335, must be overruled.

6. Plaintiffs Barred by the Two-Year Statute of Limitations

This catch-all category comprises twelve groups of plaintiffs whose properties, like those in the preceding subsection, lie within the zone of the most acutely polluted groundwater. American Salt advances a tripartite argument to support its motion for partial summary judgment against this final category of plaintiffs: (a) the damage to the aquifer wrought by the immense quantity of salt dissolved in it is permanent damage; (b) the plaintiffs in this category knew of the permanent damage more than two years before this suit was filed; and (c) the plaintiffs are therefore barred by the two-year statute of limitations found in K.S.A. @ 60-513. The Court has completed a very substantial amount of its own research on this subject to supplement the arguments and analysis provided by the parties, and believes that each part of this tripartite argument deserves individual discussion.

a. Salt Damage to the Aquifer as Permanent Damage

A foray into the Kansas case law to determine the significance and validity of this assertion has revealed a rather muddled state of affairs. The Kansas Supreme Court itself, in the case of McComb v. Stanolind Oil and Gas Co., 164 Kan. 1, 186 P.2d 574 (1947), has candidly admitted that "there seems to be some contrariety in the decisions" dealing with when a cause of action for damages to realty accrues, id. at 5. It appears to this Court that the contrariety is, in large part, due to the unprincipled and inconsistent use of the terms "temporary" and "permanent" in these cases.

As a preliminary matter, it should be noted that, when realty is damaged by pollution, the terms "temporary" and "permanent" can be applied to three quite distinct facets of the situation. First, the pollution itself, or the causal chemistry of the injury to the land, may be either temporary or [*900] permanent. Second, the damage or loss caused by the injury may be temporary or permanent. Last, the source or origin of the pollution, be it a sewage plant, an oil well, or a salt mine, may be temporary or permanent. The possibilities for inconsistencies are, of course, multiplied when different labels are applied to these facets, such as, for example, calling the source of the pollution a nuisance and then characterizing the nuisance as temporary or permanent.

Some of the Kansas cases focus on one of these facets, and some focus on another. In those cases where an explicit "temporary" or "permanent" distinction is drawn, it is determinative of when the cause of action accrued and, consequently, of when the cause of action became barred by the applicable statute of limitations. Because of the wide diversity displayed by these cases, a chronological survey of them is, unfortunately, a necessity, and so such a chronology follows.

1. Cases Prior to 1930

In the venerable case of Kansas Pacific Railway v. Mihlman, 17 Kan. 224 (1876), the Railroad trespassed on Mihlman's land and constructed a culvert and ditch, partially encroaching on Mihlman's land, that caused flood damage more than two years later. The Kansas Supreme Court concluded that the unlawful nature of the original trespass, actionable in itself, caused the statute of limitations to start running at the time of the trespass, and found Mihlman's suit barred. The Court, in an effort to highlight by contrast, went on to hold that where one creates a nuisance, and permits it to remain, so long as it remains it is treated as a continuing wrong, and giving rise, over and over again, to causes of action. But the principle upon which one is charged as a continuing wrongdoer is, that he has a legal right, and is under a legal duty, to terminate the cause of the injury. Id. at 231.

In McDaniel v. City of Cherryvale, 91 Kan. 40, 136 P. 899 (1913), the first explicit decision of a temporary/permanent question is found. The City of Cherryvale constructed a sewer system in 1905 that discharged into Drum Creek, a small stream that ran through McDaniel's property.

An oil refinery constructed in 1905 also discharged into the creek. Plentiful rains diluted the sewage and prevented McDaniel from noticing any problem. In 1909, a dry spell concentrated the sewage to such an extent that the water was rendered unfit for any purpose. The Kansas Supreme Court held that as the sewer system constructed by the city and the refinery constructed by the oil company were permanent in their nature and as the flow of the sewage and refuse from them was designed to continue indefinitely in the future a cause of action for permanent damages arose when the sewage and other impurities were first emptied into the stream. Id. at 43, 136 P. 899 (emphasis added). The Court refined its perception of the sewer system and refinery as "permanent in their nature" by holding that the sewer system and refinery are, in their nature, design, and use permanent structures, the operation of which will necessarily be injurious to plaintiff's land and must continue permanently to affect and depreciate the value of his land. Id. at 46, 136 P. 899 (emphasis added). Because the first dumping had occurred more than two years before McDaniel's suit was filed, he was barred.

2. 1930s Cases

Six cases of particular significance were decided in the 1930s, when the production of Kansas petroleum increased substantially. In Lackey v. Prairie Oil & Gas Co., 132 Kan. 754, 297 P. 679 (1931), the single oil well drilled by the defendant in 1925 had been joined by eleven to thirteen new ones whose combined output of waste and refuse injured Lackey's pasture. The Kansas Supreme Court noted that the oil wells were permanent structures, designed to continue indefinitely. The conditions under which they were operated were such that the injury was constant as well as progressive. Id. at 757, 297 P. 679 (emphasis added), and that in this instance the bringing in of the first oil well in 1925 caused injury to plaintiff's land, and the permanent nature of the injury was demonstrated more than two years before he sued for damages. Id. at 758, 297 P. 679 (emphasis added). Lackey's suit was, therefore, held to be barred.

In Berry v. Shell Petroleum Co., 140 Kan. 94, 33 P.2d 953 (1934), the question of whether salt pollution of underground water is temporary or permanent injury was argued to the Kansas Supreme Court. At trial, the plaintiff claimed and recovered permanent damages. The jury also expressly found that the groundwater, like the aquifer in this case, had a definite direction of flow. This finding was leapt on by the polluting oil company, which argued that the damage to the plaintiff's groundwater could only be temporary because the natural flow would eventually carry the pollutants away, and that the award of permanent damages should, therefore, be reversed. The Court held that this Court is not prepared to say that when the substrata has once become saturated with salt from an oil well the water moving through it will cleanse it so that the water in the well will become pure again.

The evidence on this point is too vague. We doubt if anyone knows. We think the instructions correctly state the law. Id. at 105, 33 P.2d 953. Despite the contentions of the parties and the obvious precedential weakness of this statement, American Salt has nevertheless cited it as binding authority for the proposition that salt pollution of an aquifer is a permanent injury, Dk. No. 337 at 155.

The next year, contrariety appeared in the case of Gardenhire v. Sinclair-Prairie Oil Co., 141 Kan. 865, 44 P.2d 280 (1935). The facts were somewhat similar to those in Lackey; 1926 oil wells that had previously caused some pollution were deepened in 1931 and thereafter caused substantially more pollution. Instead of focusing on the permanent nature of the oil wells themselves, however, the

Kansas Supreme Court appears to have focused on the nature of the injury caused by them: the defendants had no right to pollute a stream or natural watercourse by prescription.

Timber Creek and the ravine leading into it were natural watercourses. The pollution of the stream was wrongful and therefore no permanent right can be acquired. "The pollution of the stream being a wrongful act, no permanent right to continue it can be acquired; and, therefore, the damages to be awarded must be merely for the temporary injuries which have occurred to the time of trial or to the time of bringing the action, if, under the local practice, that is the time fixed for the computation of damages to be recovered in the action." Id. at 870, 44 P.2d 280 (citations omitted). The court went on to examine an instruction given by the trial court to the effect that any injury occurring more than two years prior to the filing of the suit and traceable to the pollution would cause the suit to be barred. The Court opined that "the given instruction was more favorable to the defendants than the law warrants," id. at 871, 44 P.2d 280.

The next year, in Fulmer v. Skelly Oil Co., 143 Kan. 55, 53 P.2d 825 (1936), the Kansas Supreme Court explicitly recognized that there is a confusion involved in the discussion of the law of the case as to the damages being permanent or temporary, and also as to the liability for damages for pollution being dated from the permanent structure of the plants, which by common knowledge may be positively expected to cause pollution and damage, or from the date of the first serious injury from pollution. Id. at 56, 53 P.2d 825.

The Court labeled the injury as permanent because the plaintiff had asked only for permanent damages, id. at 57, 53 P.2d 825, performed a survey of prior cases to determine when the permanent damage began, id. at 59-61, 53 P.2d 825, and held that the plaintiff's cause of action accrued when the stream was first polluted in 1917, and not when a drought caused the pollution to become so concentrated for the first time as to prevent the plaintiff's cattle from drinking it and thereby substantially injure the plaintiff.

An entirely new field of potential confusion was introduced by Jeakins v. City of ElDorado, 143 Kan. 206, 53 P.2d 798 (1936). As in McDaniel, supra, the plaintiffs in Jeakins were injured by the operation of a municipal sewer system. Two distinct claims were made: one for a decrease in the value of the plaintiffs' land and a second for psychological and health injuries to the plaintiffs.

The Court construed the first of these claims to be one for permanent damages, and the second to be one for temporary damages, id. at 210, 53 P.2d 798. McDaniel was then cited for the proposition that the sewer system, as a permanent structure whose "operation was necessarily a constant and continuous use," created a cause of action for permanent damages when the sewage was first placed in the stream, Jeakins, 143 Kan. at 210, 53 P.2d 798. Although this holding barred the claim for permanent damages, the Court nevertheless allowed the plaintiffs to proceed on their claim for temporary damages, apparently because the negligent operation of the sewer system by the city made that system a nuisance.

This new distinction was picked up by Seglem v. Skelly Oil Co., 145 Kan. 216, 65 P.2d 553 (1937), where the Kansas Supreme Court, in a holding very similar to that in Fulmer, took special care to point out "that this was an action for permanent damages to the farm, not for recurring damages, nor for the abatement of a recurring or continuing nuisance," Seglem, 145 Kan. at 221, 65 P.2d 553 (emphasis added). No attempt is made, however, to explain why the negligent operation of a sewer system leading to pollution creates a continuing nuisance, while the negligent operation of an oil field leading to pollution does not.

3. 1940s Cases

Four cases of significance to the present inquiry were handed down by the Kansas Supreme Court in the 1940s. The first, Donley v. Amerada Petroleum Corp., 152 Kan. 518, 106 P.2d 652 (1940), involved the now-familiar pollution of surface waters by an oil company. With nary a word written about the nature of the oil wells as permanent structures, the Court affirmed a judgment in favor of the plaintiffs, including both actual and punitive damages, based on a theory of temporary damage to a stock farm. The plaintiffs apparently made a simple election to sue for temporary instead of permanent damages, phrased their measure of recovery in the decreased rental value of the farm after the pollution, and sought that level of recovery for the two years preceding their filing of suit. The Court voiced no quarrel with this procedure.

The next year, in Eyman v. National Union Oil & Gas Co., 153 Kan. 45, 109 P.2d 477 (1941), the Kansas Supreme Court demonstrated an unwillingness to perform a Donley-type analysis when all of the items of claimed damage had occurred more than two years before suit had been brought. The petition alleged permanent damages to the premises, including the destruction of trees, but made clear that all of these damages were complete more than two years before. The plaintiff's argument that the oil wells constituted an abatable nuisance did not carry the day, but the Court simply ignored the nuisance component of the argument and focused on the permanent nature of the damage already done, Eyman, 153 Kan. at 47-48, 109 P.2d 477.

Peterson v. Texas Co., 163 Kan. 671, 186 P.2d 259 (1947), is yet another case of salt-water pollution from an oil field causing damage to an adjacent farming operation. Instead of the more usual surface pollution, however, this case dealt with salt pollution of the fresh-water strata beneath the plaintiff's farm. The plaintiff phrased his petition in terms of temporary damages, even though the temporary nature of the death of heifers, chickens, and large tracts of prairie grass is open to some dispute, and elected to sue to recover these temporary damages on a bi-annual basis. The reported case is, in fact, the second one brought by the plaintiff against the oil company. The court stated that there can be no doubt but that plaintiff did have knowledge as early as 1941 that oil-field refuse from defendant's wells was flowing onto his farm in substantial amount, id. at 677-78, 186 P.2d 259, but then went on to distinguish McDaniel, Lackey, Fulmer, and Eyman solely on the basis that those cases were for permanent damages. The judgment below in favor of the plaintiff was affirmed.

4. Cases After 1950

As previously mentioned, it was the 1947 McComb case that first took explicit notice of the contrariety in the Kansas cases. Cases after 1950 concerning the time of accrual of a cause of action and the temporary/permanent question take frequent notice of the conflict. See, e.g., Henderson v. Talbott, 175 Kan. 615, 266 P.2d 273 (1954) ("The question when a cause of action for damages because of overflow of land accrues is one beset with difficulties, on which the authorities are in great conflict and exhibit considerable confusion. This is true even in our own jurisdiction where it must be admitted there is some contrariety in our own decisions," id. at 620, 266 P.2d 273); Gowing v. McCandless, 219 Kan. 140, 547 P.2d 338 (1976) ("The [statute of limitations question] involved on this appeal is one normally encountered where damages occur when water overflows agricultural land.

On this general subject our decisions are conflicting," id. at 143-44, 547 P.2d 338); Dougan v. Rossville Drainage District, 2 Kan.App.2d 125, 575 P.2d 1316 (1978) ("The question of when a cause of action accrues as a result of a party causing another's land to be flooded has been extensively litigated in Kansas. Not all of the Kansas authority is in harmony," id. at 127, 575 P.2d 1316). As the quotations indicate, these cases deal with the flooding of one person's land because of another person's acts. The legal analysis as to the time of accrual of the cause of action, the significance of the temporary/permanent distinction, and the explication of nuisance doctrine performed by these recent cases, however, is fully applicable and very helpful to the present inquiry.

In Henderson, the defendant had constructed a dam on his property that backed up water on the plaintiff's property. The trial court ruled that the plaintiff could recover for all injuries accruing within two years of the filing of the suit, and the jury returned a verdict favorable to the plaintiff.

The Kansas Supreme Court quoted the following passage from 56 Am.Jur. Waters, @@ 45, 443 (now 78 Am.Jur.2d Waters, @@ 35, 39, 122, 123, 128, and 367): In actions by riparian owners for damages for interference with the flow of a stream, the scope of recovery is usually held to depend on whether the injury is permanent or continuing. The weight of authority is to the effect that whenever the structure or obstruction impeding the flow of water is of a permanent character, and its construction and continuance are necessarily an injury, the damage is considered original, to be recovered in one action, and not continuous in character, and the statute of limitations begins to run from the completion of the obstruction, or at least from the time of the first injury. But when the construction and continuance of the structure are not necessarily injurious, but may or may not be so, the injury to be compensated in a suit is only the damage which has happened; and there may be as many successive [*904] recoveries as there are successive injuries. In such cases the statute of limitations begins to run from the happening of the injury complained of.
. . .
The determination of the question whether the flooding of land gives rise to a single right or successive rights of action depends ordinarily upon whether the injury or the causative condition is permanent or temporary. The rule prevailing in most jurisdictions is that if the injury is permanent, or if the causative structure or condition is of such a character that injury will inevitably result and the amount of damage can be determined or estimated, a single action may and should be brought for the entire damages, both past and prospective. But if the overflow is merely temporary, occasional, or recurrent, causing no permanent injury to the land, or if the situation involves other elements of uncertainty, such as the possibility or likelihood of the alteration or abatement of the causative conditions, or uncertainty in regard to the future use or improvement of the land, so as to prevent a reasonably accurate estimate of future damages, it is generally held that each reptition (repetition) of the overflow gives rise to a new cause of action for which successive actions may be brought.

Henderson, 175 Kan. at 621, 266 P.2d 273. This language was then supplemented by the quotation from the Mihlman case concerning nuisance and previously set about above, supra slip op. p. 16, and a quotation from McDaniel indicating that the plaintiffs in that case "could have elected to have sued for temporary damages sustained within the statutory period preceding the bringing of the action," Henderson, 175 Kan. at 623, 266 P.2d 273 (quoting McDaniel, 91 Kan. at 43, 136 P. 899) (emphasis added). This authority was sufficient to cause the Court to affirm the plaintiff's judgment.

Of particular significance to the present inquiry is the following language, found at the end of the statute of limitations discussion:

In reaching the conclusion just announced we have not attempted to distinguish and are not disposed to labor the divers cases cited by appellant in support of his position. It suffices to say that some of them can be distinguished because the structure involved was located on the land of the person seeking to recover damages; some are distinguishable because the action was to recover for permanent injuries to the real estate in question; others are not comparable for the reason, that exactly contrary to the situation in the case at bar, the nuisance created by the structure in question was not abatable and the injuries resulting therefrom were continuous and permanent; and still others are not in point because of wholly dissimilar factual situations. And it should be added that if there is language in any of such decisions indicating views contrary to those herein expressed under prevailing conditions and circumstances it no longer entitled to weight and should be disregarded. Henderson, 175 Kan. at 624, 266 P.2d 273 (emphasis added). The notion that plaintiffs enjoy an election as to whether to pursue temporary or permanent damages was reinforced in the case of Augustine v. Hinnen, 201 Kan. 710, 443 P.2d 354 (1968).

The plaintiffs there sought actual and punitive damages for saltwater pollution of their fresh water wells by the defendant oil leasehold owners and operators. The pollution had begun nine years before the suit was filed at the earliest, and five years before at the latest. In its recital of the facts, the Kansas Supreme Court stated that "at the pretrial hearing plaintiffs elected to pursue their case on the theory of temporary damages for the two-year period beginning in the fall of 1962," id. at 711, 443 P.2d 354.

Although the opinion leaves something to be desired in terms of clarity, it appears that the jury found that the defendants had allowed the escape of deleterious substances within two years of the filing of the suit and that the jury awarded actual and punitive damages. The verdict for actual damages was affirmed.

In Gowing v. McCandless, 219 Kan. 140, 547 P.2d 338 (1976), upper landowners sought actual and punitive damages from a lower landowner whose obstruction of a watercourse seven years before suit was filed had caused damage to the plaintiffs' crops in later years by backing up water over the plaintiffs' fields. The Kansas Supreme Court noted that the plaintiffs had elected to seek temporary damages and then focused on the nature of the obstruction: In the instant case the evidence does not show the cause of the injury to be permanent. In many cases injuries have been classified as temporary or recurring in nature when caused by an abatable nuisance or condition, or by defects which can be repaired or remedied at reasonable expense. Successive injuries of this nature have been held to give rise to separate and distinct causes of action.Id. at 145, 547 P.2d 338. The judgment for the plaintiff was affirmed.

This general trend was followed in the recent case of Bowen v. City of Kansas City, 231 Kan. 450, 646 P.2d 484 (1982), where the plaintiffs sought to recover damages for flooding resulting from the defendant's creation and maintenance of a nuisance. The Kansas Supreme Court stated that Plaintiffs rely upon our decisions which state that where there is a nuisance which is a temporary condition that is abatable, a new cause of action arises each time damage occurs. This is undoubtedly the law insofar as a person who maintains an abatable nuisance is concerned. This court has considered numerous cases where periodic flooding resulted from the acts of another and we have held that the statute of limitations begins to run at the time each loss resulting from the maintenance of the nuisance occurs and not from the time the nuisance was first created. Gowing . . . . However, the rule of Gowing and its predecessors is predicated upon the defendant's ability and duty to abate the existing conditions which constitute the nuisance.Bowen, 231 Kan. at 454, 646 P.2d 484 (emphasis in original).

The final case to be considered in this section of this Opinion is McAlister v. Atlantic Richfield Co., 233 Kan. 252, 662 P.2d 1203 (1983), in which the plaintiff was seeking the recovery of damages caused by alleged violations of the Oil Well Pollution Act, K.S.A. @ 55-121. The plaintiff filed case

number 54,357 some seven years after his well water became undrinkable, naming as defendants two oil companies that had last conducted operations in the area in the 1930s and 1940s.
The plaintiff also alleged "that not less than 150 nor more than 400 years will pass before the well water will be once again fit for drinking," 662 P.2d at 1212. Justice Lockett held the claim to be barred by the two-year statute of limitations after making the following statements on the temporary/permanent question:

Temporary damages or continuing damages limit recovery for injury that is intermittent and occasional and the cause of the damages remediable, removable, or abatable. Damages are awarded on the theory that [the] cause of the injury may and will be terminated. Temporary damages are defined as damages to real estate which are recoverable from time to time as they occur from injury. 25 C.J.S. Damages, @23 , p. 626. Permanent damages are given on the theory that the cause of injury is fixed and that the property will always remain subject to that injury. Permanent damages are damages for the entire injury done -- past, present, and prospective -- and generally speaking those which are practically irremediable. 25 C.J.S. Damages, @ 2, pp. 622-23. If an injury is permanent in character, all the damages caused thereby, whether past, present, or prospective, must be recovered in a single action. 662 P.2d at 1211.

5. Proper Doctrinal Course For This Case

The proper approach to sorting out the preceding precedents and setting a course for this litigation to follow was suggested by the Kansas Supreme Court in Gowing. In a decision that has come to appear increasingly wise to this Court, that Court summarily decided that no attempt will be made in this opinion to venture into the thicket of Kansas cases beginning from statehood. Our recent cases establish a trend in the law which controls our decision herein. Gowing, 219 Kan. at 144, 547 P.2d 338.

The first principle that will be relied on, therefore, is that the recent trends in Kansas law should be given relatively greater regard than the trends expressed in the cases that are now between fifty and one hundred years old.

A second bit of guidance comes from the oft-repeated assertion of the Kansas courts that it is to be borne in mind that each [prior] decision has been rendered upon the particular facts of that case, and when that is borne in mind some of the difficulty disappears. McComb, 164 Kan. at 5-6, 186 P.2d 574. See also Dougan, 2 Kan.App.2d at 127, 575 P.2d 1316 ("Obviously, each case must be decided on its own facts, giving due regard to established law."). The second principle, therefore, is that those elements of this case that present a case of first impression in this jurisdiction and that serve to distinguish this case from the cases discussed above -- such as the pollution originating from a solution salt mining operation, the egregiousness of the pollution in this case, the large area and number of people affected, and the continuous nature of the enterprise (and perhaps the pollution itself) over such a protracted period -- are entitled to full weight and consideration.

The third principle is that the dynamic and evolving nature of tort law must be accorded its proper significance. In 1931, the Kansas Supreme Court, in the Lackey opinion, discounted a prior case with the statement that "the opinion was written nearly fifty years ago, and the writer of the opinion did not have the benefit of the searching analysis of tort liability which has been made in recent years," Lackey, 132 Kan. at 758, 297 P. 679. Of course, the same criticism can now be made of Lackey itself, which is presently fifty-two years of age.

A fourth principle can be derived from the indeterminate overruling of prior inconsistent cases accomplished in 1954 in the Henderson opinion. Although the scope of this overruling and the exact cases affected are uncertain to some degree, the existence of such language in the opinion is sufficient to case doubt on the validity of some of the harsher cases that preceded Henderson.

With these four principles firmly in mind, an examination of the cases surveyed in the preceding subsection of this Opinion convinces this Court that the Kansas Supreme Court, if presented with American Salt's statute of limitations argument, would find that argument unpersuasive.

The recent trend in the Kansas cases, traceable to Mihlman, Gardenhire, and Jeakins and most recently affirmed in Gowing and Bowen is to consider the damage resulting from an abatable nuisance that causes pollution to be temporary damage, giving rise over and over again to causes of action to recover for the injuries sustained in the statutory period immediately preceding the filing of the suit, at least so long as some acts of pollution continue. Several auxiliary points strongly support this conclusion.

First among these auxiliary points is the dispute between the plaintiffs and American Salt as to whether pollution is continuing. American Salt, as might be expected, asserts that its plant has caused no significant pollution since 1965, see, e.g., Dk. No. 356 at 73, No. 2. If one indulges the assumption that the salt now polluting the aquifer originally escaped from American Salt's control, and further indulges the assumption that American Salt's statement that no pollution is now occurring is true, then American Salt has, in essence, admitted to abating a polluting nuisance. Certainly American Salt would be hard-pressed to argue that its plant is a "permanent structure, the operation of which will necessarily be injurious to plaintiffs' land," McDaniel, 91 Kan. at 46, 136 P. 899, inasmuch as such an argument would be tantamount to an admission that the plant is still polluting, and uncontrollably so at that. The salt plant is not designed to pollute the aquifer, and should not do so in the absence of negligence. If the plant does pollute the aquifer, it does so because of "defects which may be repaired or remedied," Gowing, 219 Kan. at 145, 547 P.2d 338.

The polluting plant would, therefore, constitute an abatable nuisance that would support an endless series of separate and independent actions, at least until all pollution was halted and the nuisance thereby abated, id. Because the cause of the injury – the loss of salt into the aquifer -- is not fixed, an award of temporary damages "on the theory that [the] cause of the injury may and will be terminated," McAlister, 662 P.2d at 1211, is clearly appropriate.

The second auxiliary point is closely related to the first, and centers on an apparently admitted occurrence of aquifer pollution in 1979. The plaintiffs have alleged that one of the old brine wells was discovered to be communicating with both the aquifer and the high-pressure solution mining field in November of 1979, but that the shutdown of the solution mining field required to repair this defect was not undertaken until the losses of brine from the solution mining operation became so acute as to interfere with the desired production levels at the plant. See Dk. No. 351, Vol. 1 at 27-28; Vol. 2, App. 3 at 53-56. American Salt has cavalierly responded to this serious charge with the statement that the paragraph "is the only paragraph in the plaintiffs' entire summary which contains any evidence that one of the brine wells may have caused some pollution for a short period of time," Dk. No. 356 at 62 (emphasis in original).

The reason for such aloofness should be apparent. Were American Salt's statute of limitations argument accepted by this Court, American Salt would be absolutely immune from any damage claim by any of the present plaintiffs in perpetuity, even if those claims were based on recent or future wrongful acts of pollution that were part of a pattern of continuing or escalating pollution.

Accepting the statute of limitations argument would be the functional equivalent of granting American Salt a license to pollute as appears profitable or expedient to American Salt at any particular time, a result clearly in conflict with the previously quoted language from the Gardenhire case to the effect that "the pollution . . . being a wrongful act, no permanent right to continue it can be acquired," Gardenhire, 141 Kan. at 870, 44 P.2d 280. Of course, these anserous results of American Salt's argument are nowhere mentioned in its documents. This Court's conscience would be shocked by the insulation of a continuing wrongdoer from liability for his wrongful acts.

The third auxiliary point involves the rapid change in attitudes towards pollution of the natural environment witnessed in the last two decades. Justice Smith's observation that "the water supply of the people is of greater importance than the operation of a business at reduced cost," Berry, 140 Kan. at 102, 33 P.2d 953, has been vindicated by state statutes that prohibit the pollution of surface and subsurface waters by, among others, operators of salt water injection wells, K.S.A. @ 65-171d, and that expressly declare each day of polluting activity to be a separate offense, K.S.A. @ 65-171f. The Kansas Legislature has expressed a clear intention to heavily discourage the pollution of the state's water resources, and this Court is loath to thwart this goal with broad and ill-defined grants of immunity to continuing polluters for both past and future acts of pollution.

Last, it should not be forgotten what the plaintiffs have pleaded. Rather than claiming permanent damages for permanent injuries resulting from a permanent structure constituting a permanent nuisance, the [*908] plaintiffs have alleged "a continuing nuisance, trespass, and damages," Pre-Trial Order, Dk. No. 309, at 4. This Court can only construe such language as reflecting an election by the present plaintiffs to pursue the remedy of temporary damages.

The Court has, on its own initiative, done some cursory research on the question of how these temporary damages should be measured. Even a brief examination of the Kansas cases on this issue shows them to be suffering from the imprecise and unpredictable use of "temporary" and "permanent," see, e.g., Adams v. City of Arkansas City, 188 Kan. 391, 362 P.2d 829 (1961); Alexander v. City of Arkansas City, 193 Kan. 575, 396 P.2d 311 (1964). This already overburdened opinion cannot support an analysis of this question: the issue shall be saved for another day.

It may be remembered by the now-fatigued reader that this subsection deals with the first part of American Salt's tripartite argument in support of its statute of limitations argument, namely, whether salt pollution of the aquifer is permanent damage. See supra p. 14. The preceding discussion and analysis compels this Court to conclude that the plaintiffs' allegations are sufficient to categorize the American Salt operation as a continuing nuisance if it is responsible for the pollution now present in the aquifer; that the nuisance represented by the operation is abatable because the defects, if any, causing pollution may be repaired or remedied; and that the injury suffered by the plaintiffs because of American Salt's continuing pollution, if any, is temporary in nature. See generally City of Harrisonville v. Dickey Clay Mfg. Co., 289 U.S. 334, 340-41, 53 S. Ct. 602, 604-05, 77 L. Ed. 1208 (1933); Hilton v. Duke Power Co., 254 F.2d 118, 122 (4th Cir.1958); Conestee Mills v. City of Greenville, 160 S.C. 10, 158 S.E. 113 (1931).

b. Notice of Damage More Than Two Years Ago

Although the holding in the previous subsection tends to make American Salt's argument concerning notice irrelevant, the section of American Salt's brief devoted to this argument is so remarkable that it nevertheless deserves some comment. American Salt prefaces the argument with the statement that for the purposes of this Memorandum and the Motion [that] it supports, it is assumed that the American Salt Company caused the pollution [that] now exists in all the groundwater "downstream" from the plant -- the entire area [that] could have possibly been influenced by the activities of the company since its inception in approximately 1908. Thus, the issue of causation is not addressed herein.

Dk. No. 337, at 1-2. American Salt then follows this disclaimer with a detailed recital, comprising nearly one hundred and fifty pages, of the convincing evidence that American Salt's operations are directly responsible for the salt presently dissolved in the aquifer. This recital covers the entire period of the facility's existence and is exceptionally detailed for the period since 1933.

In order to support the argument that the present plaintiffs knew of the salt pollution damage to the aquifer more than two years before this suit was filed, American Salt was compelled to demonstrate both that the level of pollution was severe and that American Salt was discoverable as the cause of the pollution. The documentary and deposition evidence assembled by American Salt on these points is, to say the least, very persuasive, and should serve to save time at the trial of this matter.

Additionally, this Court notes that the impressive quantity of evidence dredged up by American Salt tends, by its very completeness, to remove this case from the class of cases that statutes of limitations were originally designed to control. The conceptual basis for statutes of limitations has often been explained. The United States Supreme Court has written that statutes of limitations are designed to promote justice by preventing surprises through the revival of [*909] claims that have been allowed to slumber until evidence has been lost, memories have faded, and witnesses have disappeared. Order of Railroad Telegraphers v. Railway Express Agency, Inc., 321 U.S. 342, 348-49, 64 S. Ct. 582, 586, 88 L. Ed. 788 (1944).

Likewise, the Rhode Island Supreme Court has written that statutes of limitations were intended to prevent the unexpected enforcement of stale claims concerning which persons have been thrown off their guard for want of seasonable prosecution . . . . They afford parties needed protection against the necessity of defending claims [that], because of their antiquity, would place the defendant at a grave disadvantage.

In such cases how resolutely unfair it would be to award one who has willfully or carelessly slept on his legal rights an opportunity to enforce an unfresh claim against a party who is left to shield himself from liability with nothing more than tattered or faded memories, misplaced or discarded records, and missing or deceased witnesses. Wilkinson v.Harrington, 104 R.I. 224, 243 A.2d 745 (1968).

Although this Court would never ignore a clear statute of limitations bar solely because the defendant appeared ready and able to defend himself, the existence of clear memories, cited records, and deposed witnesses is certainly a factor to weigh in the balance in a case such as this.

c. The Plaintiffs Are Barred by K.S.A. @ 60-513

K.S.A. @ 60-513 provides, in pertinent part, that

> (a) The following actions shall be brought within two years: . . .

(4) an action for injury to the rights of another, not arising on contract, and not herein enumerated.

(b) . . . the cause of action in this action [section] shall not be deemed to have accrued until the act giving rise to the cause of action first causes substantial injury . . . .

Because this Court has concluded that the plaintiffs' allegations in this case entitle them to attempt to show at trial that the American Salt facility constitutes an abatable nuisance causing temporary damages through salt pollution of the aquifer, the assertion that K.S.A. @ 60-513 bars the plaintiffs' claims in their entirety is without merit. This does not mean, however, that the section is irrelevant to this case. K.S.A. @ 60-513 does operate to preclude the plaintiffs from recovering for injuries sustained more than two years prior to May 31, 1977, the day this suit was filed. American Salt's motion for partial summary judgment must therefore be overruled in all particulars not expressly granted above, and the plaintiffs are entitled to attempt to prove and recover their damages that have accrued between May 31, 1975 and the date of judgment in this case.

IT IS THEREFORE ORDERED that the plaintiffs' motion for review of the Magistrate's order filed October 20, 1982 is overruled.

IT IS FURTHER ORDERED that the defendants' motion for partial summary judgment is sustained as to plaintiffs Joleen Ottlinger, Robert Johannsen, Gary Zwick, Harvey Willhaus, and Lester Colle.

IT IS FURTHER ORDERED that the defendants' motion for partial summary judgment is sustained as to the individual parcels of land listed below:

Owner Tract

Wilmor H. Oden 400 acres in Sections 1 & 2, Township 21 South, Range 8 West of the 6th Principal Meridian; 2 lots in the Southeast Quarter of Section 2, Township 21 South, Range 7 West of the 6th Principal Meridian.

Edris Edwards 160 acres in Section 26, Township 20 South, Range 8 West of the 6th Principal Meridian.

Harry Zwick West Half of Section 33, Township 20 South, Range 7 West of the 6th Principal Meridian.

Jay Brothers 10 acres in the Northwest Quarter of the Southwest Quarter of Section 29, Township 20 South, Range 7 West of the 6th Principal Meridian; Lots in Saxman, Kansas.

IT IS FURTHER ORDERED that the defendants' motion for partial summary judgment is denied in all respects not sustained above. IT IS FURTHER ORDERED that the Clerk of this Court notify the parties to this lawsuit that, as one of the Court's oldest cases, it will be set down on the trial docket at the earliest possible date after August 1, 1983 that the availability of courtroom facilities and the Court's commitments make feasible.

Miller v. Cudahy Co.
Notes and Discussion

1. The landowner makes four major arguments to avoid summary judgment on statute of limitations issues. What are they?

2. How has the analysis of the statute of limitations changed over the years according to the court?

3. What reasons does the court use to find that the damages are temporary?

4. What problems does the defendant have showing that the landowner knew or should have known that its land was being polluted?

5. In Chevron U.S.A. Inc. v. Superior Court, 31 Cal. App. 4th 1; 1994 Cal. App. LEXIS 1285; 36 Cal. Rptr. 2d 783 (1994) the court consider the statute of limitations in an action alleging diesel fuel pollution caused by defects in the installation of an underground storage tank:

> At an undetermined time between November 1967 and June 1970, Standard Oil Company of California, predecessor to Chevron U.S.A. Inc. (Chevron), sold to DiSalvo Trucking Co. (DiSalvo) and installed on DiSalvo's property underground fuel storage tanks. Nineteen or more years later, when the tanks were removed in 1989, DiSalvo discovered contamination of the soil.
>
> At the direction of Alameda County, implementing California's Underground Storage Tank Local Oversight Program, DiSalvo spent several hundred thousand dollars partially removing the contaminants. In 1993, DiSalvo sued Chevron for reimbursement of money already spent and to be spent to complete the cleanup. DiSalvo alleged causes of action for negligence, breach of contract, continuing nuisance, continuing trespass, and indemnity. . .
>
> . . . Case law provides, however, that an action alleging a continuing nuisance or trespass may be brought at any time before the nuisance or trespass has been discontinued or abated or within three years afterward. (See Wilshire Westwood Associates v. Atlantic Richfield Co. (1993) 20 Cal.App.4th 732, 744-745 [24 Cal.Rptr.2d 562] [hereafter Wilshire Westwood].) . . .

The court went on to discuss the relationship between a continuing nuisance or trespass, a public nuisance, and the statute of limitations:

> CONTINUING NUISANCE STATUTE OF LIMITATIONS
>
> Civil Code section 3490 provides: "No lapse of time can legalize a public nuisance, amounting to an actual obstruction of public right." This has been "construed to mean that the statute of limitations is no defense to an action brought by a public entity to abate a public nuisance. [Citations.]
>
> However, where private citizens have sued for damages for special injury based on public nuisance, our Supreme Court has characterized the nuisance as either 'continuing' or 'permanent' and has used the characterization to determine whether the suit is subject to the statute of limitations....
>
> [W]here a private citizen sues for damage from [**7] a permanent nuisance, the statute of limitations begins to run upon creation of the nuisance. Where a continuing nuisance is

> alleged, every continuation of the nuisance gives rise to a separate claim for damages caused by the nuisance." (Mangini v. Aerojet-General Corp. (1991) 230 Cal.App.3d 1125, 1142-1143 [281 Cal.Rptr. 827] [hereafter Mangini], original italics.)
>
> "[W]here the nuisance involves a use which may be discontinued at any time, it is characterized as a continuing nuisance, and persons harmed by it may bring successive actions for damages until the nuisance is abated. [Citation.] The crucial test of a continuing nuisance is whether the offensive condition can be discontinued or abated at any time. [Citations.] 'In case of doubt as to the permanency of the injury the plaintiff may elect whether to treat a particular nuisance as permanent or continuing.' [Citation.]" (Wilshire Westwood, supra, 20 Cal.App.4th at p. 744.). The same principles apply to continuing trespass. (Mangini, supra, 230 Cal.App.3d at p. 1148.)
>
> Recent decisions have confirmed an owner's right to sue over a nuisance on the owner's own land and a subsequent owner's right to sue a prior possessor of property for creating the continuing nuisance. (Wilshire Westwood, supra, 20 Cal.App.4th at pp. 745-746; Mangini, supra, 230 Cal.App.3d at pp. 1134-1137; accord KFC Western, Inc. v. Meghrig (1994) 23 Cal.App.4th 1167, 1178-1179 [28 Cal.Rptr.2d 676] [hereafter KFC]; Newhall Land & Farming Co. v. Superior Court (1993) 19 Cal.App.4th 334, 342-345 [23 Cal.Rptr.2d 377] [hereafter Newhall].) . . .

It is difficult without drilling test wells to determine if a UST is leaking. Is there an argument, based on this fact, that may toll the statute of limitations?

Also, the EPA has estimated that around 25% of underground storage tanks (UST's) exhibit some type of leak. In most cases it is not the UST itself that leaks, but the associated piping due to freezing and thawing or due to overfilling or spills. Based on this, can it be argued that it is common knowledge that many UST's leak therefore a landowner cannot claim to "discover" a pollution problem for statute of limitations purposes if the leak occurred a some point in the past?

6. The Resource Conservation and Recovery Act (RCRA) was amended in 1984 to address the problem of leaking UST's. Currently, UST's must meet certain construction standards and must be monitored for leaks after a designated phase in schedule. Leaks after these standards have been adopted are rare.

Duty to Warn of Environmental Dangers

AMERICAN CYANAMID COMPANY Appellant, v. M. G. SPARTO et al., Appellees
UNITED STATES COURT OF APPEALS FIFTH CIRCUIT
267 F.2d 425; 1959 U.S. App. LEXIS 3852
May 19, 1959

In 1935 the appellees, all members of the same family and all residents of Texas, purchased a 57-acre tract of land in the City of Fort Worth, Tarrant County, Texas. They have engaged in truck farming on 46.22 acres of this tract since 1936. The tract is bounded on the south and west by the Trinity River. The appellees, with the aid of three centrifugal pumps, have used the river's waters for irrigation whenever it was needed.

In 1942 the appellant's plant was erected as a part of the war effort for the purpose of producing a catalyst used by oil refineries in making high octane aviation gasoline. This plant is also located on the Trinity River, upstream from the appellees' farm. In its manufacturing process the appellant uses some 1,640,000 gallons of water daily. Approximately 90% of this water is emptied into the Trinity River. This process water contains several chemical compounds which are primarily [**2] ammonium sulphate and sodium sulphate.

In September, 1953, the appellees began noticing that the crops on their land, which had theretofore been normal and healthy, showed a slow growth and were 'stunted'. Despite the efforts of the appellees to improve the quality of the plants by fertilizing the land, the crops in 1954 and 1955 were also stunted and the yield per acre was substantially less than it had been before 1953.

In 1956 the appellees began using a new 'overhead' irrigation system, but the crops did not respond. By February, 1955, it was observed that the top of the soil was turning white and that it was, 'crusty and hard, just -- it is just growed together; it don't pulverize like it used to.' Soil tests made after the commencement of this litigation revealed that the appellees' land contained a high concentration of sodium sulphate as compared to other lands in the vicinity which had not been irrigated from the river.

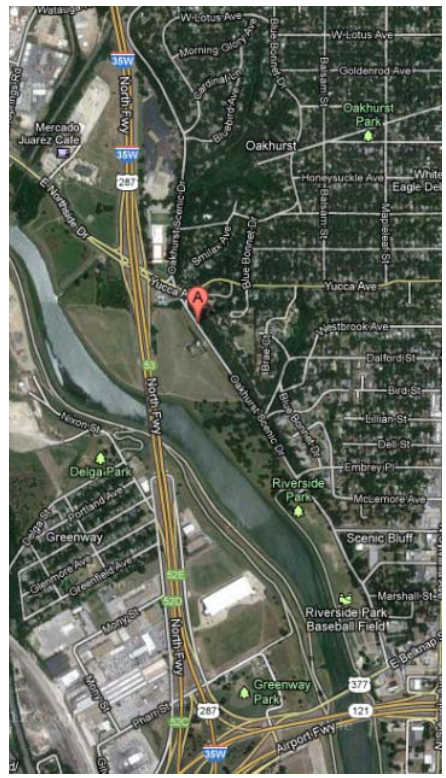
The appellees brought this suit in the state court to recover damages for injury to their land and crops resulting from the appellant's alleged wrongful pollution of the Trinity River. Their complaint sought to enjoin the appellant from emptying the contaminated water into the river. The case was removed to the United States District Court for the Northern District of Texas by reason of diversity of citizenship.

The case was tried to a jury and special issues were submitted. The jury found that the defendant was negligent in discharging the process water into the river and failing to warn the appellees, and that its negligence was a proximate cause of the injury to the appellees' land and crops; that the appellant had created a nuisance by discharging its process waters into the river, and that this also was a proximate cause of the appellees' injury; that the appellees were not contributorily negligent, that the injury to the appellees' land was temporary, and that the appellees should recover damages fixed at $ 34,431. The court overruled the appellant's motions for judgment notwithstanding the verdict and a new trial and entered judgment on the verdict. This appeal followed.

The appellant first specifies as error the court's overruling of its motions for directed verdict and for judgment notwithstanding the verdict based on the ground that the appellees' evidence failed to show that any land owned [**4] by the appellees, which was riparian in character, was injured by the effluent from the appellant's plant. The land of which the appellees asserted ownership and which is here involved is described in their complaint as 'the West 46.22 acres of land and being all of the land situated on the West side of the Oakhurst Scenic Drive in the City of Fort Worth, Tarrant County, Texas,' and described by metes and bounds.

There is an exception from the tract, also described by metes and bounds, of a 2.66-acre tract. The appellant asserts that the excepted tract was not located, hence it may have been a part of the cultivated land for which, the appellees [*428] not owning it, there could be no recovery. Plats of the land and adjacent properties, a photographic map, and abstracts of title, were introduced in evidence. M. G. Sparto was a witness and testified as to the location of the land owned and farmed by him and the other members of the Sparto family. Without objection he testified that the land was situated between the Trinity River on the west and Oakhurst Scenic Drive on the east. We think the location of the 46.22-acre tract was established and that no part of [**5] it was separated from the Trinity River by the 2.66-acre parcel.

The appellant points out that while the most of the land involved is in the W. H. Little Survey, through which the Trinity River runs, a portion is in the John Little Survey. This being so, it is said, the John Little Survey land is not riparian in character and no damages are recoverable with respect to it. Riparian rights do not extend beyond the original survey as granted by the Government, but it seems that only a lower riparian owner can complain of the diversion of water by an upper riparian owner to non-riparian land. The evidence is not clear as to whether the portion of the Sparto lands situate in the John Little Survey were included in the 46.22 acres, but if so, it constituted such a small portion of the whole that it should be ignored under the de minimis rule. The question was not raised in the trial court and will not be further considered here.



In 1952 the appellees granted to Tarrant County Water Control and Improvement District No. 1 an easement over 25.67 acres along the Trinity River 'For the purpose of constructing, reconstructing, widening, straightening, improving and perpecually [**6] maintaining a channel or channels, levee or levees, for flood control and flood prevention along the Trinity River. * * *' In the instrument granting the easement it was recited that it was 'understood that grantors expect to continue to use that portion of the property upon which an easement is herein granted after the construction of such channel or channels, levee or levees, for truck garden purposes, using water from the river for irrigation and expect to continue to use, own, hold and enjoy such premises for any and all other purposes desired by such grantors or their assigns so long as such use does not interfere with or decrease the rights of the grantee to its easement and rights herein granted.'

The appellant asserts that the extent of rights granted by this conveyance is tantamount to a grant of a fee title and therefore all land east of the easement was cut off from the river and ceased to be riparian land. Appellant further argues that the appellees have no cause of action for damages to non-riparian lands resulting from pollution of the river and therefore, since the amount of the damages was not limited to the easement lands, the verdict and judgment cannot [**7] stand. We cannot adopt the appellant's construction of the easement. The grant did not divest the appellees of the possession nor, except for the purposes specified, of the use of the land. The recitals in the instrument show an intention that the lands described should be used for truck farming under irrigation from the river. The granting of the easement was no such severance of the tract, subject to the easement as to deprive the rest of the area of its riparian character. 56 Am.Jur. 733, Waters § 280.

The appellant contended that substantially all of the water in the Trinity River as it flowed past the appellees' land originated in the discharge from the appellant's plant and was not riparian, and that there was not enough riparian water to permit the appellees to irrigate their lands. The appellant requested a series of special interrogatories to be submitted to the jury as to whether there was any riparian water in the stream opposite the Sparto lands. The court refused to make the submission and error is claimed. While the only waters of a flowing stream which are available for riparian uses are those of the ordinary flow and underflow, we think it would be incorrect to hold that the riparian nature of water in a flowing stream and the right of a riparian owner to use it may depend upon the source of the water. We are aware of no authority so holding. The trial court was correct in refusing to submit the requested questions to the jury.

The district court submitted to the jury a special issue in this form:

> 'Do you find from a preponderance of the evidence that defendant discharged soluble salts in its process water into the Trinity River and that defendant failed to warn plaintiffs that it was discharging the same into the Trinity River, and that such conduct was negligence, and that such negligence if any you have found, was a proximate cause of damage to plaintiffs' land involved in this suit.'

To this question the jury returned an affirmative answer. The submission of the issue is specified as an error. The appellant says that it had the right to discharge its process water, with its soluble salt content, into the Trinity River without being under a duty to warn the appellees that it was doing so.

The right of the appellant to make a reasonable use of the river for the disposal of its process water is not questioned. 56 Am.Jur. 808, Waters § 384. The right of the appellees to make a reasonable use of the waters of the stream for irrigating riparian lands must also be conceded. The right of each to make use of the water is qualified by the right of the other. This doctrine has been thus stated:

> 'As between individual riparian owners, it is an established principle that one may make no use of the stream that will result to the injury of the other, * * * This is but the application of the doctrine embodied in the ancient maxim, that one must enjoy his own rights so as not to injure those of another; or, as elsewhere well expressed 'the necessities of one man's business cannot be made the standard of another man's rights in that which belongs equally to both', which, of course, includes that in which both have an equal usufructuary interest, the extent of the right of riparian owners in the waters of a stream. It is but the rule of universal right and common justice, and stands in need of no sanction to give it authoritative force.' Ft. Worth Improvement Dist. v. City of Ft. Worth, 106 Tex. 148, 158 S.W. 164, 167, 48 L.R.A.,N.S., 994.

Since then, the appellant's right was not an unlimited one, it follows that if the exercising of that right created a risk of injury to the appellees which might have been averted by a warning, there was a duty to warn and the failure so to do would constitute actionable negligence. Missouri Iron & Metal Co. v. Cartwright, Tex.Civ.App., 207 S.W. 397; Buchanan v. Rose, 138 Tex. 390, 159 S.W.2d 109; San Antonio Hermann Sons Home Ass'n v. Harvey, Tex.Civ.App., 256 S.W.2d 906; Restatement, Torts, § 301, 65 C.J.S. Negligence § 89, p. 598. The special issue was proper and there was no error in submitting it. The affirmative response of the jury to the interrogatory established the negligence of the appellant and its liability to respond in damages.

In its charge to the jury the court defined 'nuisance' and no exception is taken to the accuracy or sufficiency of the definition. It submitted to the jury a special interrogatory based on nuisance in this form, 'Do you find from a preponderance of the evidence that the defendant created a nuisance, as that term has been defined herein, by discharging process water containing soluble salts into the Trinity River, and that such nuisance, if any you have found, was a proximate cause of damage to the plaintiffs' land?' The jury answered 'Yes.' To this question the appellant objected and the asking of it is assigned as error. The appellant in its requested charges, included interrogatories on nuisance which were the same in substance and not materially different in form from that which was propounded by the court. Having requested the submission of the issues the appellant cannot now put the court in error for having done so. Capital Traction Co. v. Brown, 1907, 29 App.D.C. 473, 12 L.R.A.,N.S., 831, 10 Ann.Cas. 813; 89 C.J.S. Trial § 572, p. 350. Cf. De Fonce Construction Co. v. City of Miami, 5 Cir., 1958, 256 F.2d 425, certiorari denied 358 U.S. 875, 79 S.Ct. 115, 3 L.Ed.2d 105.

In any event, we think the nuisance issue was properly submitted. Physical discomfort to the occupant of property is not, we think, an essential incidence of a nuisance as claimed by the appellant and as is stated in Boyd v. Schreiner, Tex.Civ.App., 116 S.W. 100. 5 Acts which damage property [**12] may also be a nuisance. City of River Oaks v. Moore, Tex.Civ.App., 272 S.W.2d 389; Continental Oil Co. v. Berry, Tex.Civ.App., 52 S.W.2d 953; King v. Columbian Carbon Co., 5 Cir., 1945, 152 F.2d 636. Cf. Burns v. Lamb, Tex.Civ.App., 312 S.W.2d 730. The finding of negligence is not inconsistent with a finding of nuisance. A nuisance may be caused by negligence and may exist irrespective of negligence. King v. Columbian Carbon Co., supra; Missouri-Kansas-Texas R. Co. v. Williams, Tex.Civ.App., 5 S.W.2d 575.

The appellant's liability for negligence and for maintenance of a nuisance have both been established. We find no error upon which to predicate a reversal of the district court's judgment.

Affirmed.

American Cyanamid v. Sparto
Notes and Discussion

1. In Texas, is there a general duty to warn third parties if one's activities create an environmental hazard? Note the Sparto court’s comments:

> Since then, the appellant's right was not an unlimited one, it follows that if the exercising of that right created a risk of injury to the appellees which might have been averted by a warning, there was a duty to warn and the failure so to do would constitute actionable negligence.

2. Did American Cyanamid have the right to discharge the salts into the river?

3. What significance is the fact that the court found that the lands were riparian in nature?

4. With regard to Texas law, the court in Ford Motor Co. v. Dallas Power & Light, 499 F.2d 400 (1974), stated:

> Texas law does recognize a duty to warn on the part of the person who creates a dangerous situation, although without negligence on his part. Buchanan v. Rose, 138 Tex. 390, 159 S.W.2d 109, 110 (1942). The Supreme Court in Buchanan stated:
>
> > We think it may also be said that if one by his own acts, although without negligence on his part, creates a dangerous situation * * * the one creating the same must give warning of the danger or be responsible for the consequences.

The Supreme Court did not find liability in Buchanan since the defendant had not created the dangerous situation but was merely aware of the danger and failed to warn.

Texas is among those jurisdictions which recognize a duty to warn only on the part of the person who has some operational responsibility for the existence of the situation having dangerous potentialities. Mere knowledge of a dangerous situation or helpless condition of another person only imposes a moral duty to warn or render aid but not a legal duty. Boyer v. Gulf, Colorado & Santa Fe Ry., 306 S.W.2d 215, 220 (Tex.Civ.App.1957, writ ref'd n.r.e.). This rule has been acknowledged in subsequent Texas cases. E.g., Henderson v. Willmon, 407 S.W.2d 24, 27 (Tex.Civ.App.1966, writ dism'd); Courville v. Home Transportation Co., 497 S.W.2d 788, 791 (Tex.Civ.App.1973); Page v. Scaramozi, 288 S.W.2d 909, 911 (Tex.Civ.App.1956, writ ref'd n.r.e.); City of Austin v. Schmedes, 270 S.W.2d 442, 446 (Tex.Civ.App.1954), aff'd in part, rev'd in part, 1955, 154 Tex. 416, 279 S.W.2d 326.

PART IV

THE OIL & GAS LEASE

The Oil & Gas Lease as Real Property

The law classifies property essentially one of two ways. Personal property is classified as that which is movable, and also includes claims and debt. Examples would be furniture, a pencil, stock certificates, bonds, or music. Crude oil that has been severed from the ground and is being stored in surface tanks is also considered personal property.

Real property is classified as real estate or things attached to real estate. Examples would be land, buildings, trees, well casing cemented into an oil well or water well.

It is important to distinguish between the two types of property for several reasons. First, contracts for personal property can be made orally in some situations. If the parties forget a term, even a fairly important term that may be considered 'material' in a real estate transaction, the court may insert or provide the omitted terms if the contract is for personal property.

Personal property. Personal property is subject to the provisions of the Uniform Commercial Code (UCC), a standard set of laws that apply to personal property that have been adopted by states nationwide. The goal of the UCC is to complete a transaction if the parties intended to complete a contract, even if quantities, pricing, or even party identities are not clearly agreed to.

Security interests for financing personal property, for example a bank that lends money using oil in storage as collateral, would file what is called a Uniform Commercial Code financial statement to protect their interest.

Real property. Contracts for real estate on the other hand are required to be in writing, and must contain all the material terms. Unlike personal property, the courts will not supply material terms to real property contracts if they have been omitted by the parties.

For real property a bank or financier seeking a security interest would file a mortgage in the land records of the county where the property was located.

Material terms & capacity. Material terms to an oil and gas lease or a mineral deed include the identification of the parties, a description of the lands being conveyed, for an oil and gas lease the term of such lease, and the document must have words of grant.

The parties to both a deed and oil and gas lease not only have to be identified but also must have capacity to execute the document. Minors, for instance, cannot sign a lease. They need a guardian or personal representative or parent to execute the document on their behalf.

Estates, property that was owned by someone who died, have their own execution requirements. Many times the executive or personal representative of the estate can sign such documents, and in such cases such execution sometimes needs to be approved by the court.

Corporations also are subject to state statutes which require corporate formalities to be used when executing documents dealing with real property.

Trusts also require signature, usually by the trustee. Issues often arise as to the trustee's powers, and many times the party examining title will need confirmation that a trustee can grant and oil and gas lease.

Voluntary Intoxication generally does not invalidate an oil and gas lease or deed, the grantor still has capacity. Involuntary intoxication does invalidate a real property document as the party is deemed to lack capacity.

In some states capacity is statutorily defined. In Oklahoma a statute does not allow 'imbeciles, idiots, or morons" to execute documents affecting real estate. They do not specifically define these terms.

A party must record the real estate document in the county where the land is located to put third parties on notice. If a lease, for example, is not recorded and a third party takes a second lease on the property without knowledge of the first the second lease could have priority of title if it is recorded.

Deed or lease interpretation. Because the lease is in writing it is subject to specific rules of interpretation if there is a dispute.

First the court will attempt to determine the intent of the parties at the time the documents were signed. If the documents are not ambiguous the court will employ the "four corner doctrine "and will not take any additional oral testimony as to the intent of the parties. The court will look between the ‘four corners’ of the document to determine the intent.

If the document is ambiguous the court can listen to oral testimony to determine what the parties intended. For this reason the addition of lengthy addendums or additional terms added to the oil and gas lease or deed are generally not encouraged.

If an oil and gas lease or deed has omitted a material term the courts will not supply that when real property is involved.

Last, the document is generally construed against the drafting party if any of the provisions are at issue.

Before Leasing: The Oil & Gas Title Opinion

The drilling of a well generally begins with a prospect developed by a geologist. In some cases the geologist will be employed by the exploration company, in some cases the geologist will be an independent working for himself, and in some cases the geologist will develop the prospect and sell it to the company in return for an interest in the development.

Once the geologist has a concept as to the prospect and development they will get the landmen involved. An 'in-house' landmen put together the prospect by hiring brokers to obtain leases, run title, and the brokers also negotiate 'farmouts', 'farmins', and 'area of mutual interests' or "AMI's" with other companies

To obtain the leases the identity of the severed mineral owners need to be determined. In some cases the title to the minerals are quite severed, which makes running title and determining ownership very difficult.

Field Landman. A field broker or field landman will be employed to go to the court house in the county where the land is located to check the title. All real estate transactions will be recorded in the county court house, which makes it inconvenient for many companies since many are located in rural areas far away from the home office.

The field landmen pull the 'books' at the courthouse from 'patent' (the grant of title from the United States or from the state) to present, 'running title'. Running title just refers to the determination of the chain of title and the transactions establishing ownership. A field landman generally receives between $150 and $450 per day plus mileage

If documents at the courthouse are ambiguous, or not available, the field landman can use the abstract company in each county to attempt to locate documents. Abstract companies charge by the hour to examine their documents, so are generally used after the free courthouse search has been completed

Chaining title and defects, 'drilling' title opinion. Once the field landman 'chains' title ownership together, in many cases the company will want a drilling title opinion to be prepared by an attorney. In some cases experienced field landmen can establish title and a company will temporarily skip the formal attorney prepared title opinion.

Before the leases are taken in many cases minor title defects will need to be cured to ensure title is held by the parties identified by the landman or attorney. In some cases the company will take the risk that title may fail due to an uncorrected defect and take a lease before curative is completed – this decision generally turns on the probability that title is good.

Lease form, term, royalty & bonus. Once title is established to the comfort of the company the field land man obtains leases. They generally will use a standard lease form, provided by an industry organization, company, and in some cases they mineral owners will have their own oil and gas lease.

Generally the major negotiating points are the bonus, the cash that is exchanged in return for signing the lease, paid on a per mineral acre basis. The term of the lease is also generally negotiated, standard leases generally have a 3 to 5 year primary term. Royalties may also be negotiated in some areas, with higher royalties receiving a lower bonus and vice versa.

The primary term of the lease is very important in that the company may have to obtain permits, and may be held up as it negotiates for a drilling rig and with partners and investors.

Designation of unit. Once the leases are taken in Texas a designation of unit will be identified by the operator and placed of record in the real estate records of the county. Leases in the unit will bear the proportionate risk of drilling the well. In other states an agency sets up the size of the drilling unit, and in those cases leases in the state designated spacing unit will share the risk of drilling. Texas is unique in that the lessee has the ability to designate the drilling unit shape and size, subject to Texas Railroad commission regulations.

Division order title opinion. If the well is completed as a producer a division order title opinion is prepared by an attorney. This document is different than the drilling title opinion in that it sets out in detail the exact proportionate share each party will receive from production. The drilling title opinion just sets out the proportionate share each lessee will pay in the drilling of the well, and ignores the royalty and overriding royalty interest owners who have an interest in production but pay no drilling costs

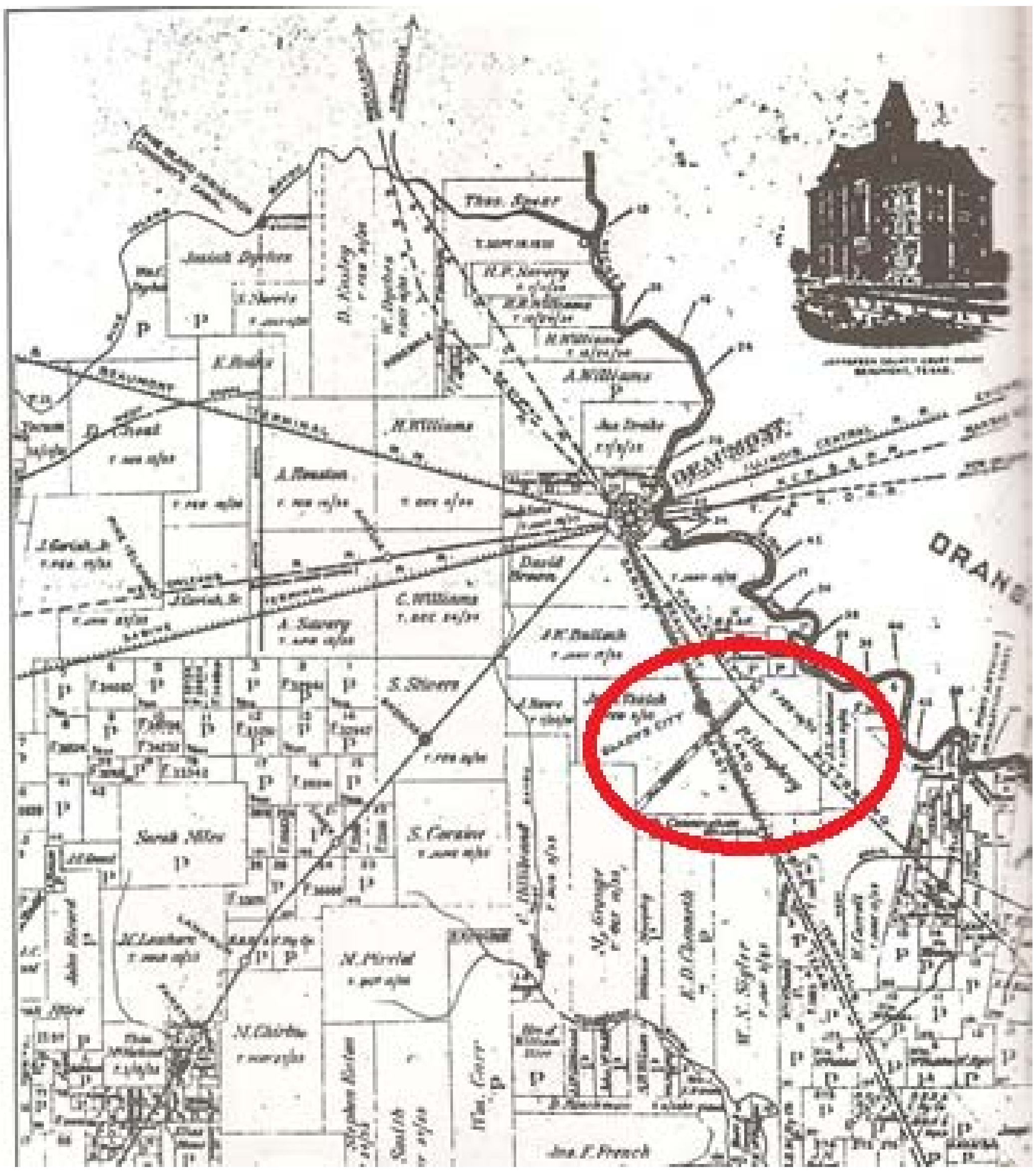
Before proceeds are distributed the company will cure any title defects. In Texas there are statutes in place requiring the distribution of funds within a given time period from first production. This is to avoid a company holding funds for an extended period and receiving interest to the detriment of the other owners. If the company cannot prepare the division order and cure title it by statute is required to pay interest on funds held for those parties

Title Failure: Implications for the Developer

What are the implications if a developing party obtains an oil and gas lease, in good faith drills a well that turns out to be prolific, then learns that the mineral owner did not have title and their lease is of no effect?

This scenario was argued after the drilling of the Spindletop well in South Texas in January of 1901 – and the litigation wound through the courts for over 90 years!

A map of the disputed mineral rights, under around one-third of the Spindletop acreage, prepared by surveyor Higgins in 1898 is set out below. The "Pelham Humphries' survey is circled in red, and the dispute arose if this party was one and the same as "William Humphries'.



The facts are relatively simple. When Texas was still part of Mexico Stephen Austin promoted colonization laws in attempt to attract early settlers to the region. A party could get a 'first class headright' consisting of 4,428 acres for ranching and another 177.1 acres for farming. The surface and minerals were both conveyed to the settler – keep in mind no-one had any idea that oil in prodigious quantities lay below these lands.

Colonist William Humphries, unable to read, applies for his headright. He is assigned headright number 118, the lands to be assigned after a survey is completed. Since Spanish was the language of record a petition is prepared in that language, but "Pelham Humphries' is the party recorded in the land record books in 1835.

The lands are located on the west bank of the Neches River, just a few miles south of present day Beaumont William, or Pelham, accepts the land by leaving his 'mark' on the title document. The land, in parts, is conveyed numerous times between 1835, eventually to be owned by W.P.H. McFaddin and several others.

McFaddin and friends lease to Anthony Lucas and Lucas Oil . On January 10th the well blows out, with volumes that will double Texas oil production in the near future.

For the next 90 years title attorneys and litigants argued whether "Pelham' Humphries was one and the same as 'William Humphries' – and the court found that they were one and the same person. Finding otherwise would have meant one of the most prolific wells ever drilled in Texas was drilled by a party that did not have the rights to explore and develop – and such a title failure would be measured in hundreds of millions of dollars.

Title Failure & Implications

What would happen if title failed in this case? What if a party drills a $9 million well into the Barnett Field, completes the well as a producer, then finds out they leased from the wrong party?

There are generally two rules regarding title failure. One is the 'good faith' rule. If a party made a good faith mistake and leased from a party without title they are allowed to recover the cost of the developmental activities – that is the cost of drilling and completion – then surrender the well and the revenue stream to the real owner.

The bad faith rule, where a well is drilled with actual knowledge that the title is defective, states that the developing party recovers nothing – they are out the cost of drilling and completion – and the real owner controls the well and revenue stream.

From a title attorney and landman's standpoint almost any problems these days arises due to a mistake – and with mineral title becoming more and more fragmented over time it is very easy to misconstrue a document and reach an incorrect conclusion as to who has title. The 'requirements' that title examiners include in their opinions help insure assumptions that are made are the correct ones – but even so running title is a challenging job in many areas.

Statute of Frauds, Real Estate Contracting, and Oil & Gas Leasing

When we are dealing with personal property an enforceable contract can be made either orally or in writing. In either case the terms must be definite, certain, and clear with regard to the material elements of the agreement.

Material terms to a contract include the identification of the parties, the consideration to be paid, the subject matter, and the performance expected. Generally the contract needs to be signed by the parties involved if it is put into written form.

Unlike contracts for personal property, real estate contracts are required to be put into writing. This requirement has a historical basis because of the value of the asset involved and the difficulty courts had addressing disputes as to the extent of land conveyed – or even if the parties had agreed to convey real property at all.

Courts in England found that there were often problems with an oral contract to convey land and disputes that revolved around oral testimony, also known as parole evidence. The oral agreement between the parties to convey land could be lacking with regard to specific terms, and those terms were difficult to infer from testimony.

Many real estate contracts today involve numerous clauses, and identification of the subject matter is not always easy (land descriptions are not always simple). It would be difficult to reach agreement on all the terms if done orally, and even more difficult to recall from memory.

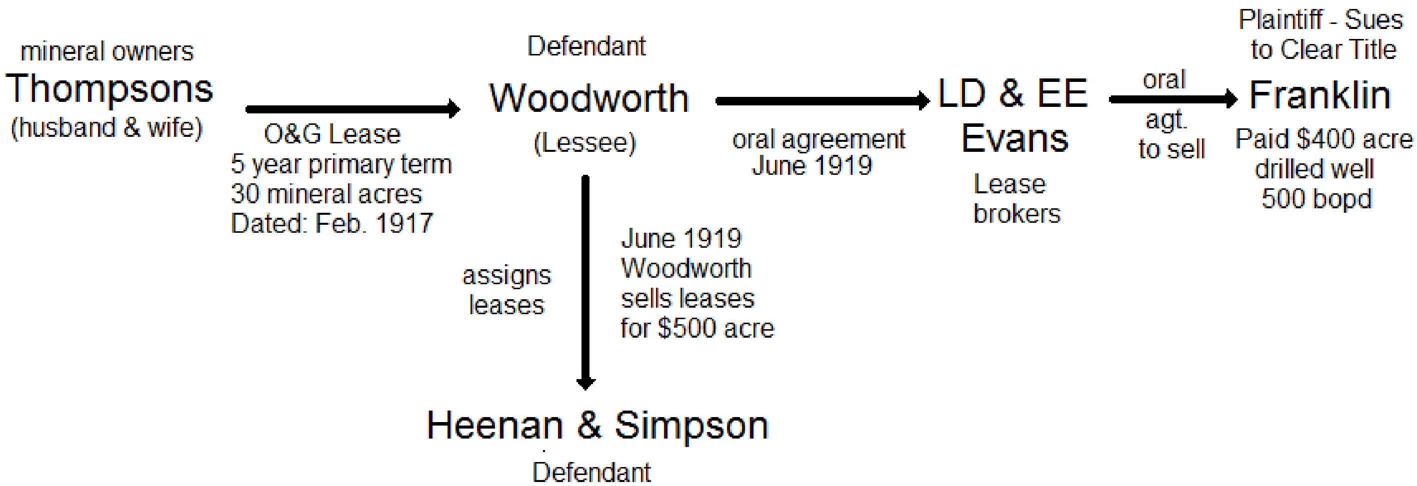
The requirement that real estate contracts be put in writing, with the writing containing all the material terms, is referred to as the "statute of frauds". When a writing is required the courts generally will not allow oral testimony to contradict the written agreement unless there was fraud or misrepresentation alleged in the transaction.

For statute of fraud purposes a mineral deed, oil and gas lease, oil and gas lease assignment, and a contract for the sales of leases or minerals have been deemed contracts for the sale of real property. Therefore all these agreements need to be in writing and contain all the material terms.

In many cases there will be form documents readily available for the parties to use in each of these transactions, ensuring all the material terms have been included in the document so that it meets the statute of fraud requirements.

They applicability of the statute of frauds to oil and gas leases, and agreements to assign or sell such leases, is illustrated in the following case.

<u>Woodworth v. Franklin</u>, 85 Okla. 27
Supreme Court of Oklahoma
September 20, 1921, Opinion Filed



NICHOLSON. J. This action was instituted in the district court of Carter County by the defendant in error, as plaintiff, against the plaintiffs in error, as defendants, seeking the specific performance of a contract of sale of two oil and gas mining leases covering certain lands in Carter county.

On June 7, 1919, the plaintiff. Franklin, filed in the trial court his petition herein, in which it is alleged that the defendant Woodworth was the legal and equitable owner and holder of two certain oil and gas leases covering 30 acres of land in Carter county, which leases had been executed to said Woodworth by L. H. Thompson and wife, one of said leases bearing date February 5, 1917, and the other bearing date February 13, 1917; that said Woodworth verbally designated L. D. Evans and E. E. Evans as his agents to sell said leases. It is further alleged that said Woodworth delivered said leases, together with the abstract of titles to said land, to his said agents with authority to sell said leases, and at the time of the delivery thereof said Woodworth executed and delivered to said agents a memorandum in writing(to which we will hereafter refer).

It is further alleged that said Woodworth verbally authorized his agents to go into possession of the land covered by said leases for exploration purposes and for other purposes conferred upon the lessee by said leases; that said agents, acting for and on behalf of said Woodworth, Bold said leases for the consideration of $ 12,000 to said plaintiff, Franklin; that after the purchase of said leases by him, he immediately went into possession of said lands for exploration purposes and began the erection of a derrick thereon, and began the actual drilling of a well.

It is further alleged that said Franklin tendered to the defendant Woodworth the purchase price of said leases, but that said Woodworth failed and refused to accept the same, and failed and refused to carry out the sale so made by his said agents, the reason therefor being that the said Woodworth was offered a larger sum of money by the defendant John Heenan, which larger offer was made after the sale by the said agents to said Franklin, and that the offer made by said Heenan to said Woodworth was with actual and constructive notice of the existence of the sale of said leases by said agents to said Franklin, and with actual notice that said Franklin was in possession of said oil and gas leases, and after he had entered possession of said land for the purposes stated in said leases. The plaintiff, in said petition, then offered to do equity, and tendered into court the consideration of $ 12,000.

It is further alleged that Woodworth executed an assignment of said leases to John Heenan, and thereafter John Heenan assigned an undivided one-half interest therein to one B. A. Simpson, and that Simpson assigned to Anderson & Simpson, a special partnership, all the interest he acquired by the assignment of Heenan to him, and that both B. A Simpson and Anderson & Simpson had both actual and constructive notice of the rights of said Franklin.

It is alleged that the plaintiff, Franklin, has the equitable title to said oil and gas leases, with all the rights and privileges conferred upon said Woodworth in said original leases, and is entitled to have said equitable title merged into a legal one; and he prayed for specific performance of his contract against the defendant Woodworth, and for judgment declaring Woodworth to hold the legal title in trust for him, and that the assignment from Woodworth to Heenan and from Heenan to Simpson, and from Simpson to Anderson & Simpson, be cancelled as clouds upon his right of exploration, and for such other and further relief to which he might be entitled, both legal and equitable.

The defendants John Heenan, B. A. Simpson, and C. L. Anderson filed a verified answer, in which they denied all the allegations in said petition contained, except such as were specifically, admitted, and specifically denied that the said E. E. Evans and L. D. Evans had any authority to make any contract for the sale of said leases, and further pleaded that on June 3, 1919, the defendant W. W. Woodworth, for a consideration of $ 15,000 cash, did sell, assign, and deliver to the defendant John Heenan said leases, and that said John Heenan did, on June 5, 1919, sell and assign an undivided one-half interest in and to said leases to said B. A. Simpson, and that B. A. Simpson assigned the same to said Anderson & Simpson;

that on the evening of June 3, 1919, the defendant John Heenan informed said plaintiff, Franklin, that he had purchased said leases, and on the 9th day of June, 1919, he served a written notice on said Franklin notifying him not to go upon said land or attempt to develop the same; that Franklin knew he never had any valid claim to said leases. any right to go upon said land, or any lawful contract; and that on the 3rd day of June, 1919, the defendant Woodworth notified Franklin that he had not authorized E. E. Evans or L. D. Evans to sell said leases to him, but that he had already sold the same to the defendant John Heenan, and thereafter, Franklin, without authority, right, or permission from anyone interested in either the land or the leases, forcibly and unlawfully went upon said property, and "jumped said leases," and is attempting to develop said property;

that said Franklin is a trespasser upon said premises, and with no greater rights or privileges than any naked trespasser would have upon said premises; that said plaintiff has no right to any improvements he should make upon said property, or to any oil he might produce or abstract from said property, but that the defendants are entitled to seven-eighths of all oil produced therefrom, and in the event plaintiff should produce and sell oil from said premises, said defendants are entitled to be paid for same at the highest market price paid for similar oil in that community, at any time before the trial of said cause; and further pleaded the statute of frauds in bar to plaintiff's suit, and prayed that the contract between said plaintiff and E. E. Evans be canceled and removed as a cloud upon the title;

that the plaintiff be adjudged to have taken possession in bad faith, and as a trespasser, and that all improvements placed upon said property by him be declared to be the property of the defendants, and for judgment for seven-eighths of all oil produced from said land, and in the event there was no oil produced, that they have judgment against said plaintiff for the sum of $ 100,000, damages, and for such other relief, both legal and equitable, to which they might he entitled . . .

The trial court found generally for the plaintiff, Franklin, and granted him the relief sought, and in discussing the facts we will resolve in favor of the plaintiff any conflict in the evidence, and will consider the evidence of the defendants only where there is no conflict.

It appears from the evidence in behalf of the plaintiff that E. E. Evans and L. D. Evans were partners and were lease brokers; that on the 2nd day of June, 1919, they met the defendant W. W. Woodworth about three and one-half miles west of Wilson, Oklahoma; that Woodworth told them there that he wanted to sell his land; that he started to give them a list thereof, and that E. E. Evans handed him a little plat book, and Woodworth marked the land out in it and told them to go ahead and sell it, and make some money out of it; that Woodworth described the 30 acres in controversy by marking it on the plat contained in the plat book, and stated that the lease would terminate in about two and one-half years; that he wanted $ 300 an acre, and signed the plat book "W3", which was his usual signature to instruments of this character.

Neither E. E. Evans nor L. D. Evans saw Woodworth again until about 10 or 11 o'clock on June 3, 1919, when E. E. Evans had met him on the streets of Wilson and told him of a trade he had up with one Roy Carmicheal the night before. E. E. Evans and Woodworth went up the street to where L. D. Evans was, and L. D. told Woodworth that he thought he could get $ 400 per acre for the leases. Woodworth replied that he would take $ 400 per acre if they could sell the leases for that amount that day, and at that time delivered the original leases and abstracts of title covering the land to L. D. Evans. E. E. and L. D. Evans went to Ardmore, and E. E. Evans called upon Franklin at his office in Ardmore, and submitted the matter of the sale of said leases to him, and the plaintiff agreed to purchase the same for the sum of $ 400 per acre . . .

This contract was executed between 3 and 4 o'clock on June 3, 1919, and the original leases and the abstracts were by E. E. Evans delivered to the plaintiff; the plaintiff prepared assignments of said leases and E. E. and L. D. Evans took said assignments to Wilson for the purpose of having the same executed by Woodworth. They did not find Woodworth at Wilson, but, learning that he had gone to Ardmore, they returned and found Woodworth in the Randol hotel; they told him that they had sold the leases, and he replied that he had sold them first; that he had sold the property for $ 500 an acre to the defendant John Heenan, and refused to execute the assignments to Franklin.

E. E. Evans asked Woodworth to go with him to Franklin to get the leases and abstracts, but Woodworth refused to do so. On the morning of June 4, about 9 o'clock, E. E. Evans went to Franklin and asked for the leases and abstracts, but Franklin refused to return them, stating that he was going to fight for the leases because he felt he was entitled to them; that he risked $ 12,000 against a dry hole. and that if the well had been dry he would feel himself bound on the contract. On cross-examination, the witness E. E. Evans was asked the following question: "Q. Mr. Franklin didn't pay you the $ 12,000?" To which he answered: "No, sir; I wasn't authorized to receive any $ 12,000." . . .

That on June 23rd, a well was spudded in on one of said leases, and was duly completed, and is producing about 500 barrels of oil per day; that Franklin had at the time of the trial expended the sum of $ 39,688.16 in developing said leases . . .

. . . We do not think the evidence shows that E. E. Evans and L. D. Evans were authorized to do more than procure a purchaser of the lease, we will assume for the purpose of this discussion that Woodworth authorized them as his agents to actually sell for him said leases, and proceeding under this assumption, will determine whether such authority was valid under the statute of frauds. Section 941, Rev. Laws, 1910, declares:

"The following contracts are invalid, unless the same, or some note or memorandum thereof, be in writing and subscribed by the party to be charged or by his agent" --and among the contracts designated by the fifth subdivision of said section are these:

"Fifth. An agreement for the leasing for a longer period than one year, or for the sale of real property, or of an interest therein; and such agreement, if made by an agent of the party sought to be charged, is invalid, unless the authority of the agent be in writing, subscribed by the party sought to be charged."

The two leases involved were executed and delivered to W. W. Woodworth by the owners of the land, one on the 5th and one on the 13th day of February, 1917, and by their terms the land described was granted, demised, leased, and let to him for the sole and only purpose of mining and operating for oil and gas and of laying pipe lines and of building tanks and structures thereon to produce, save, and take care of the products, and said leases contain the following stipulations which it is necessary to notice in view of the argument advanced:

"It is agreed that this lease shall remain in force for a term of five (5) years from this date, and as long thereafter as oil or gas, or either of them, is produced from said land by the lease. . . .

As the leases and assignments thereof were required to be in writing, an executory contract for the sale of said leases must also be in writing. Browne on The Statute of Frauds, sec. 230; Potter v. Arnold, 15 R.I. 350, 5 A. 379; 20 Cyc. 230. And as an executory contract for the sale of such leases, if made by Woodworth, would have been invalid if in parol, it is obvious that an agreement for the sale of said leases entered into by E. E. Evans and L. D. Evans as agents of Woodworth would be invalid under section 941, Rev. Laws 1910, unless their authority to make said agreement was in writing subscribed by Woodworth. 5 Am. Ruling Cas. 133, 4; Springer v. City Bank & Trust Co., 59 Colo. 376, 149 P. 253 Ann. Cas. 1917A, 520.

The only writing that it is claimed Woodworth executed consisted of a page in a plat book on which there appeared a four section plat upon which was marked a description of the land covered by the leases, and beneath this plat appears the following:

"No. Acres "Sec Twp. 4 S. Range 2 E. County
"Lease 2 1/2 years old.
"Present Owner W3.--30 acres
"P. O.

Is this page in the plat book, coupled with the delivery of the original leases and the abstracts covering the land to L. D. Evans, sufficient authority in writing to sell the leases? In Halsell et al. v. Renfrow et al., 14 Okla. 674, 78 P. 118 the Supreme Court of the territory says:

"An agreement for the sale of real property made by an agent is invalid, unless **[35]** the authority of the agent is in writing, subscribed by the party sought to be changed. Sec. 780, Wilson's Statutes 1903.

"It is a well-established proposition of general application that a complete contract binding under the statute of frauds may be gathered from letters, writings, and telegrams between the parties, relating to the subject-matter of the contract, and so connected with each other that they may be fairly said to constitute one paper relating to the contract.Beckwith v. Talbot, 95 U.S. 289, 24 L. Ed. 496; Ryan v. U. S., 136 U.S. 68, 34 L. Ed. 447, 10 S. Ct. 913; Bibb v. Allen, 149 U.S. 481, 37 L. Ed. 819, 13 S. Ct. 950. But the facts proven do not come within the rule. In order to be sufficient, the letters, telegrams, and writings relied upon must, by reference to each other, disclose every material part of a valid contract, and must be signed by the party sought to be charged. They must set out the parties, the subject-matter, the price, the description, terms and conditions, and leave nothing to rest in parol. Fox v. Easter, 10 Okla. 527, 62 P. 283; Gould v. Stormant, 51 Mich. 636; Eggleston v. Waggoner, 46 Mich. 610; Ferguson v. Blackwell, 8 Okla. 489, 58 P. 647.

"It is a general rule that parol evidence cannot be permitted to supply an omission of any essential element of the contract."

And in Baker v. Haswell & Taylor, 36 Okla. 429, 128 P. 1086, it was held:

"An agreement for the sale of lands is not valid within the statute of frauds, unless all the terms of the contract, including the consideration to be paid, are evidenced by writing."

The memorandum must contain the essential, terms of the contract expressed with such a degree of certainty that it may be understood without recourse to parol evidence to show the intention of the parties. Browne on The Statute of Frauds, sec. 371, and eases cited. InSeymour v. Oelrichs, 156 Cal. 782, 106 P. 88, 134 Am. St. Rep. 154. the Supreme Court of California said:

"A memorandum to satisfy the statute of frauds must contain the essential terms of a contract expressed with such a degree of certainty that it may be understood without recourse to parol evidence to show the intention of the parties."

And, again, in Craig et al. v. Zelian, 137 Cal. 105, 69 P. 853, the same court uses this language:

"The statute of frauds was originally enacted 'for the prevention of frauds and perjuries, and an agreement for the sale of the land is required to be in writing, in order that this purpose may be accomplished. The whole object of the statute would be frustrated if any substantive portion of the agreement could be established by parol evidence."

The Supreme Court of the United States, in Williams v. Morris, 95 U.S. 444, 24 L. Ed. 360, said:

"Unless the essential terms of the sale can be ascertained from the writing itself, or by reference in it to something else, the writing is not a compliance with the statute; and, if the agreement be thus defective, it cannot be supplied by parol proof, for that would at once introduce all the mischiefs which the statute was intended to prevent. 2 Kent. Com. (12th Ed.) 511; Norris v. Lain, 16 Johns. 151; Dung v. Parkins, 52 N.Y. 494; Baltzen v. Nicolay, 53 N.Y. 467; Wright v. Weeks. 25 N.Y. 153; Parkhurst v. Van Cortlandt, 1 Johns. Ch. 273; Parkhurst v. Van Cortlandt, 14 Johns. 15." . .

. . . We are convinced that the acts of Franklin in taking possession of the land under said leases after he knew that Woodworth denied the authority of Evans to sell the leases and had repudiated the contract entered into by Evans, and had sold and assigned the leases to Heenan, will avail him nothing, and will not take the contract out of the statute of frauds. . .

Having determined that the contract entered into between E. E. Evans and Franklin was invalid under the statute of frauds, because the authority of Evans was not in writing, and that E. E. Evans and L.

D. Evans were unauthorized to bind Woodworth by said contract, and that the acts of Franklin in taking possession of the property covered by said leases, under the facts disclosed, were insufficient to take the contract out of the statute of frauds. it becomes unnecessary to consider the third inquiry, supra, and the other objections urged to the validity of the contract.
The judgment of the trial court is reversed, and the cause remanded for further proceedings consistent with the views herein expressed. All the Justices concur.

<u>Woodworth v. Franklin Questions</u>

1. Does a contract for real property need to be in writing? A contract for personal property? Why the difference?

2. Is an oil and gas lease considered real property for statute of fraud purposes? An assignment of oil and gas lease? Mineral interests? A financial interest in a well (like a share of future royalties or a production payment)? An agreement to act as agent to sell real property?

3. What if the crude oil had already been produced, or severed, from the land and was being held in storage tanks. Is produced oil real property or personal property? See some of the earlier cases in the book on the nature of natural gas once it has been produced, and where it is being injected into storage reservoirs, if you have difficulty on this question.

4. Did Woodworth know about the Franklin offer to buy the leases when he agreed to sell those same leases to Heenan?

5. Did the plaintiff Franklin ever actually tender the $12,000 bonus to the defendant Woodworth or the alleged agents of the defendant (Evans)?

6. Did fact that plaintiff Franklin drilled a well on the lease in controversy tilt the outcome in his favor? Why or why not? What if the well was a dry hole, would the plaintiff be liable to anyone if they did not have a good oil and gas lease or the right to drill?

7. What was the plaintiff Franklin asking for in the case, relief wise? (See the first paragraph of the opinion)

8. Note the plaintiff Franklin spent quite a bit of money developing the lease, and this resulted in a pretty good oil well for time it was drilled (a 500 barrel per day conventionally drilled well today would be considered outstanding)? Does Franklin get to keep any of the production? Can he get his drilling costs back?

Third Parties, Recording Statutes, and the Oil & Gas Lease

When parties complete a transaction involving real estate the agreement needs to be in a writing containing all the material terms to be effective between the parties. To be effective against third parties that are not parties to the agreement, and don't have notice of the transaction, a document of title or notice of the agreement needs to be "recorded" in the county where the land is located

Texas has 254 counties (see plat at right). When an oil and gas lease or mineral deed is granted it needs to be recorded in the county courthouse in the county where the land is located to be effective versus third parties.

When the document is delivered for recording the county clerk will assign the document a book and page number, and will "date stamp" and “time stamp” the document to certify exactly when it was received.

Oil and gas exploration companies wishing to explore on specific lands will therefore check the courthouse records to see who owns the minerals and if the minerals have been leased.

If a party is a good-faith purchaser for value, without notice of an unrecorded oil and gas lease, and obtains a new lease from the mineral owner and records the new lease in the country records, that new lease and third-party will have ‘priority’ in title. The new lease will give the purchaser good title even with the outstanding oil and gas lease that was taken prior in time.

This recording rule is meant to avoid parties from keeping a "pocket" deed or oil and gas lease, only to claim the interest after a well is drilled and productive. It also assures that the party checking the records in good faith can obtain clear title to the minerals, or obtain a lease which can support the capital expenditures needed for drilling.

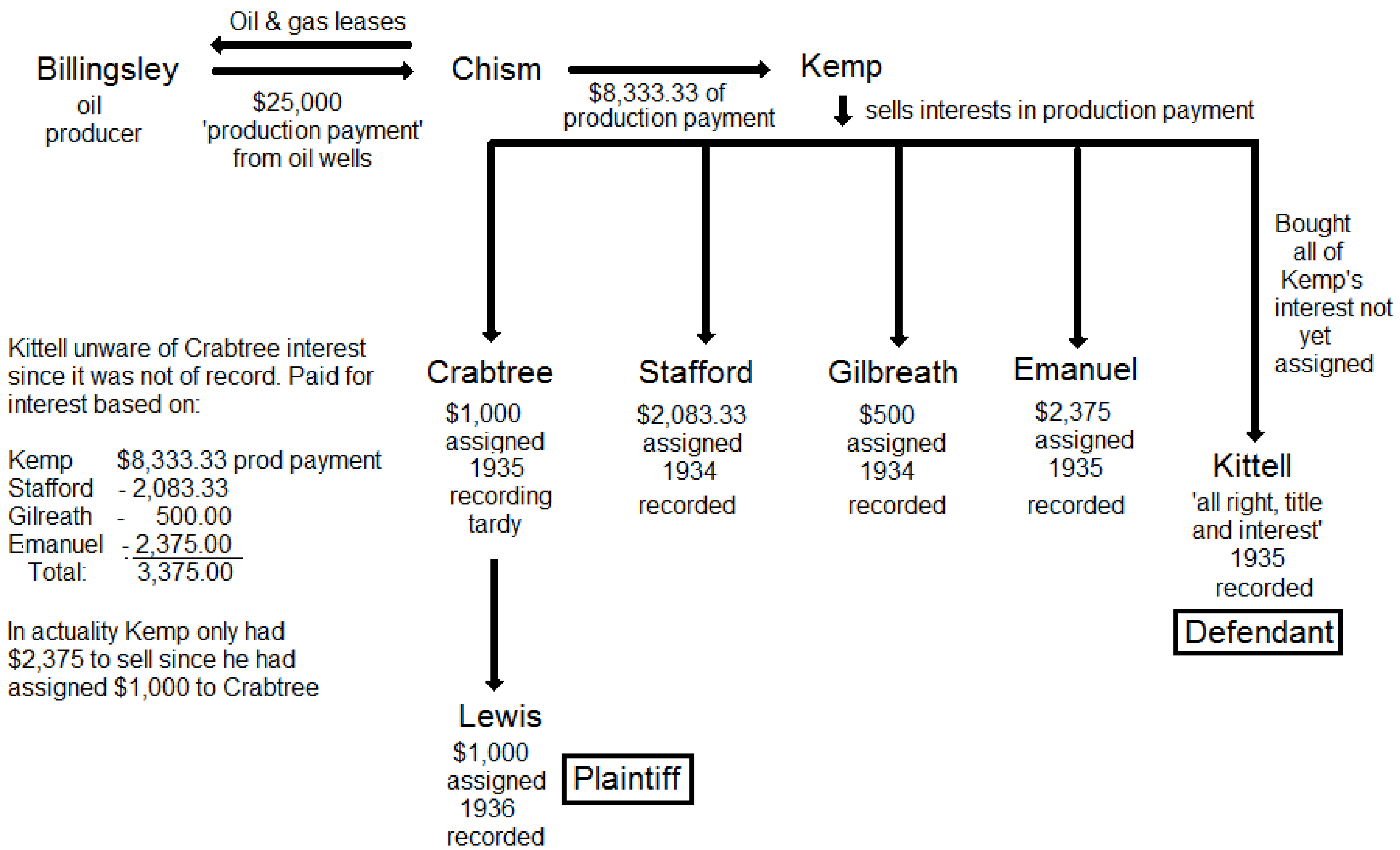
To be recorded the lease or deed needs to be ‘acknowledged’. The lease will contain form language at the end of the document, the ‘acknowledgement’, that certifies the parties signing the lease are who they say they are. A ‘notary’ will confirm the signatures.

The notary will certify that the identity of the party who signs is the party identified in the contract. The notary has a special stamp they will place on the document attesting to the certification, issued by the State of Texas.

The following case illustrates the impact of the recording statutes on third parties who are good faith purchasers for value without knowledge of a prior transaction.

Davis v. Lewis, 187 Okla. 91
Supreme Court of Oklahoma
March 5, 1940, Decided

[The facts are somewhat convoluted here, but this diagram might help clarify the situation]



C. J. Hazel Lewis filed an action in the district court of Pontotoc County against Stanolind Crude Oil Purchasing Company, a corporation, to enforce the payment to her of certain proceeds from the sale of oil and gas from a certain lease in that county. Muriel Kittell asked and was granted permission to intervene as a claimant of the fund sought by Lewis. Under the issues made by the pleadings, the company became a stakeholder, and the controversy is between Lewis and Kittell.

September 9, 1933, Chism acquired leases on certain land in Pontotoc County. November 20, 1933, Chism assigned said leases and all rights thereunder to Billingsley for a recited consideration of "one dollar (and the sum of $ 25,000 to be paid from an undivided one-eighth of the seven-eighths working interest of the oil and/or gas if, as and when the same is produced from the above-described land to be paid by the pipe line or purchaser taking said production)."

November 20, 1933, Chism assigned to E. W. Kemp $ 8,333.33 of said $ 25,000 consideration "to be paid to said E. W. Kemp from said production * * * and that said pipe line company or purchaser is hereby ordered and directed * * * to pay said sum to E. W. Kemp. * * *" All of the aforementioned instruments were acknowledged and recorded as instruments subject to record under our statutes.

August 25, 1934, Kemp assigned $ 2,083.33, of said $ 8,333.33 to Stafford, and on March 28, 1935, $ 500 of said $ 8,333.33 to Gilbreath. Each of these instruments was acknowledged and recorded. Kemp thus owned only $ 5,750.

April 9, 1935, Kemp assigned $ 1000 of said $ 8,333.33 to Crabtree by an instrument duly acknowledged, but Crabtree did not record this instrument until December 20, 1935. On January 31, 1936, Crabtree sold this $ 1,000 interest to Lewis and she recorded her assignment February 4, 1936.

In the meantime, on April 26, 1935, Kemp assigned $ 2,375 of said $ 8,333.33 to Emanuel, and this assignment was recorded April 26, 1935. When Emanuel examined the records in connection with his purchase, he decided that Kemp still owned $ 5,750, or $ 3,375 after Emanuel's purchase, and he recommended the purchase of that interest to Kittell, his sister-in-law.

April 26, 1935, Kemp executed an assignment to Kittell reciting the sale of "all the right, title and interest of the said E. W. Kemp in and to said $ 8,333.33," and this acknowledged instrument was recorded May 4, 1935.

A jury was empaneled, and after deliberation returned a verdict for Lewis; and Kittell, who is now Mrs. Davis, appealed.

We think the primary issue to be decided is well stated by Kittell as her proposition No. 1:

> "Plaintiff contends that the property claimed by plaintiff under and by virtue of the 'Assignment of Oil Payment' executed by D. C. Crabtree appearing at page 58 of case-made is personal property, and that the property claimed by defendant under and by virtue of "Assignment Oil Payment' executed by E. W. Kemp appearing at page 60 of case-made is personal property, and that the recording laws of the state of Oklahoma do not apply to either instrument. * * *
>
> "Defendant contends that said property and instrument are subject to the recording laws of the state of Oklahoma and that the defendant had a right to rely upon the records in the office of the county clerk of Pontotoc county, Okla., in determining what interest was owned by defendant's grantor, E. W. Kemp. * * *"

In other words, if the $ 25,000, and the various assigned fractions thereof, constituted personal property as differentiated from real property, then the statutes of Oklahoma providing for the recording of instruments relating to real estate had no application, and, under the issues and arguments made by the parties, Kittell was not justified in relying on the records alone.

Before proceeding further, we desire to observe that all of the instruments mentioned herein as assigning interests in the sum of $ 25,000 "to be paid from an undivided one-eighth of the seven-eighths working interest" were sufficiently comprehensive and explicit to constitute equitable liens. See Clark v. Armstrong & Murphy, 180 Okla. 514, 72 P.2d 362; Mullens v. Geo. C. Wright Lbr. Co., 182 Okla. 355, 77 P.2d 700; and other Oklahoma cases cited in Am. Dig. (West) Liens, Key No. 7; and Stone v. Wright, 75 F.2d 457. Since these liens arise by operation of law under the equity powers of our courts, they fall within the purview of section 10941, O. S. 1931, 42 Okla. St. Ann. § 6.

Section. 10943, O. S. 1931, [42 Okla. St. Ann. § 8], provides that "an agreement may be made to create a lien upon property not yet acquired * * * or not yet in existence. * * *"

We think this is sufficient to answer the argument made that whatever was conveyed by these assignments of money to be realized in the future was not a present interest or estate, but was an inchoate or future right, and therefore no purpose could be served by recording such instruments.

The character of the interest or estate created by instruments relating to oil and gas leases, etc., is well defined in Oklahoma. Cuff v. Koslosky, 165 Okla. 135, 25 P.2d 290, and other cases.

There seems to be a conflict in the decisions of the various courts with respect to the nature of the property assigned or conveyed by language such as is used in the instruments under consideration, or by substantially similar language. Dashko v. Friedman (Tex. Civ. App.) 59 S.W.2d 203; Conoco v. Union Oil Co. (Tex.) 83 F.2d 491, and McCrae v. Bradley Oil Co., 148 Kan. 911, 84 P.2d 866, all hold that agreements to assign or assignments of a fractional share of the oil and gas, or the value thereof, if, as and when produced, are sales of personal property, and are not sales of real estate.

The issues involved in those cases related to the enforceability of such contracts as affected by the statute of frauds and did not involve the issue we have before us arising under the recording laws. We are cited the case of Stone v. Wright, 75 F.2d 457, and Oklahoma case, and have found King v. Gants, 77 Okla. 105, 186 P. 960, which hold contrary to the Texas and Kansas cases cited. In Stone v. Wright, supra, the precise issue presented to us was involved, while in King v. Gant the language of the instrument was similar and was held to involve an interest in real estate and to be enforceable under the statute of frauds.

The general rule with respect to what instruments are entitled to record or must be recorded within the meaning of the law pertaining to recording acts is stated in 53 C. J. 609, § 9:

> "The provisions of the statutes which govern recording determine the questions as to what instruments are entitled to be recorded. An instrument which falls within a class which is authorized or required to be recorded by statute may be recorded. * * *"

Section 9672, O. S. 1931, 16 Okla. St. Ann. § 15, provides for the validity of instruments between the parties thereto, and as between the parties thereto and third persons with respect to whether they are or should be recorded; and that part respecting the parties thereto and third persons reads: ***"but no deed, mortgage, contract, bond, lease or other instrument relating to real estate * * * shall be valid as against third persons unless acknowledged and recorded as herein provided***."

The leases were required to be acknowledged and recorded. Tupeker v. Deaner, 46 Okla. 328, 148 P. 853. Likewise the assignment of the leases by Chism to Billingsley. Bentley v. Zelma Oil Co., 76 Okla. 116, 184 P. 131, and text in Summers Oil and Gas (vol. 3 Perm. Ed.) p. 284, § 551, note 69.

The various instruments under consideration relate to the consideration expressed in the assignment by Chism to Billingsley, and in our opinion are "instruments relating to real estate" within the meaning of our statute. It seems to us that these assignments of shares in the $ 25,000 relate to real estate and rights arising out of oil and gas leases, which are held to be interests in real estate, and are expressly mentioned in the statute.

In the Texas and Kansas cases mentioned earlier, there is no discussion of the recording statutes of those states, and it is entirely possible that there is such a difference between those and ours as to destroy any apparent conflict between those cases and our decision herein. As has been noticed, our recording statutes give a rather broad scope to the instruments comprehended therein by the use of rather general language as well as some precise "enumerations.

In Stone v. Wright, supra, the Circuit Court of Appeals, 10th Circuit, arrived at the same conclusion we have reached concerning an instrument containing substantially similar terms. In that opinion it is said:

> "The assignment to Western Paving Company was acknowledged and recorded as the statute requires and permits. It related to and affected real estate because the fund was to come from mineral extracted from the real estate, and it affected that real estate in many respects."

We hold, therefore, that the assignment to Crabtree, upon which Lewis bases her claim, was an "instrument relating to real estate" and was required to be acknowledged and recorded in order to be valid as to third persons under the law on the subject of recording.

Nonrecorded instruments are invalid as to subsequent purchasers in good faith, for value and without notice. No issue is made with respect to the good faith of Kittell or the value paid. The argument turns on the issue of notice. Her agent checked the records and, of course, did not see or learn of the Crab-tree assignment from the records, for it was unrecorded then. He testified that he relied altogether upon the records and based his calculation of the interest yet owned by Kemp after his (Emanuel's) purchase, by the records, and relied strictly on the records, and made no inquiry.

Kemp was a witness, and when Kittell's lawyer asked him whether he told Emanuel how much he had left, Lewis' lawyer objected on the ground his answer would not be the best evidence and "the records show what he owned."

This basis of this objection was Kittell's position exactly and was contrary to Lewis' contention and seems to us wholly inconsistent. The question was then withdrawn, and ***nothing appears in this record that could have constituted actual or constructive notice to Emanuel, as agent for Kittell, whereby she would have been put on notice to make other additional inquiry. Under this record she was a purchaser entitled to the full protection of our recording laws.*** Gungoll v. Elsberry, 177 Okla. 301, 58 P.2d 852, and other cases.

Kittell demurred to Lewis' evidence, and at the close of the case demurred and moved for a directed verdict. This was refused, and error was thereby committed. The jury should have been instructed to return a verdict for Kittell.

Our discussion obviates the necessity for determining other issues discussed, especially the one as to whether the case was one for a jury.

Stanolind, the stakeholder, has filed a motion to correct the money judgment rendered herein by striking therefrom any allowance of interest on the money which it has withheld pending the outcome of this litigation. In the briefs of both parties they have expressly waived any claim for interest on the money, and for this reason the motion of Stanolind is granted.

Judgment reversed and cause remanded for further proceedings not inconsistent with the views expressed herein.

[The court overturns a verdict for Lewis, and returns a verdict for Kittle (the good faith purchaser for value without notice of the unrecorded claim]

Davis v. Lewis Questions

1. What is a 'production payment'? Does the court treat it as real or personal property? Why does it matter?

2. What interest did Kittell think they were buying when they bought 'all right, title and interest' in the remaining portion of Kemp's production payment?

3. Would the case have turned out differently if Kittell knew of the Crabtree or Lewis interest, even if the Crabtree interest was not recorded?

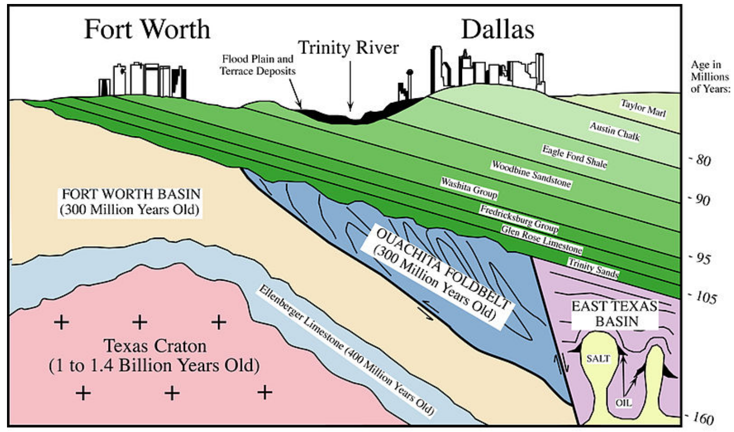
4. Could a production payment be a means of financing developmental activities for Billingsley or Chism? Keep in mind many banks at the time did not like to take oil and gas production as collateral due to the volatility of prices. Further, the 'capture' rule meant that the collateral might be 'stolen' by offsetting operators.

5. From this case, can you see how it might become very complicated when checking county courthouse records to determine exactly who owns what – even when the documents are recorded? Keep in mind many promoters did not use a lawyer to draft documents they recorded, which tends to increase the degree of ambiguity.

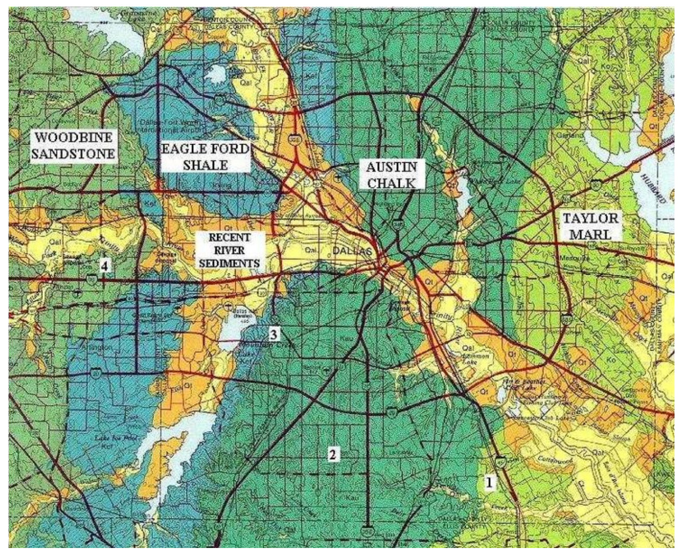
6. If a document is ambiguous, and you are checking title, what options do you have with regard to leasing those interests?

Back in Geologic Time: A Stratigraphic Trip to Fort Worth

Stratigraphy refers to geological and archaeological layers that make up an archaeological deposit. Archaeologists use stratigraphy to better understand the processes that created the site. A concept called the 'Law of Superposition' argues that because of natural depositional processes soils found deeply buried will have been laid down earlier—and thence be older—than the soils found on top of them.

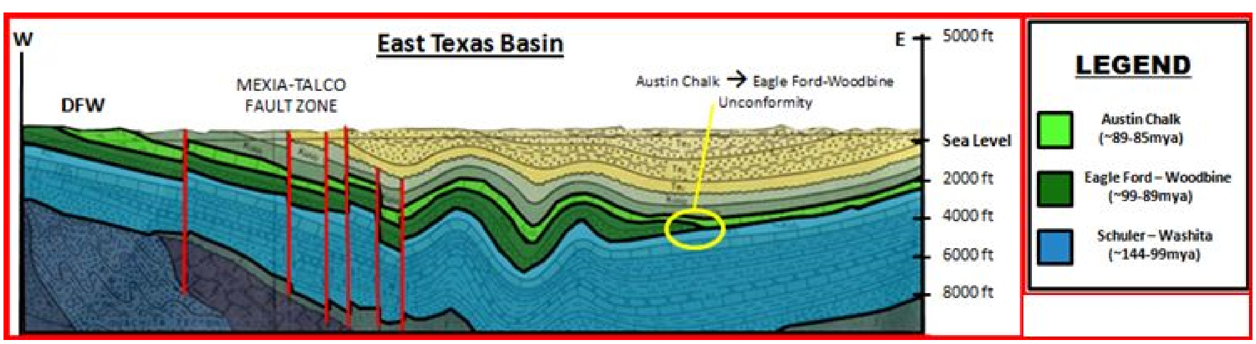


If we look at the stratigraphy of the area around the SMU campus we find that the 'Austin Chalk' outcrops in this area. It is whitish colored rock that flakes easily – and can be seen on the side of the Dallas Tollway as you drive north from the Mockingbird exit toward North Dallas. The rock is roughly 80 million years old – formed before the "crater of doom' and the extinction of the dinosaurs around 65 million years ago.



Just west of downtown Dallas we find the older 'Eagle Ford Shale' outcropping. This is the same formation that is being developed in south Texas where it is buried more than a mile underground and holds substantial amounts of crude oil and natural gas.

As we drive from Dallas to Fort Worth geological time is getting older – so that a trip between the two cities takes you back around 15 million years in the geologic time scale. That said both the rock in Dallas and Fort Worth is from the Cretaceous period – very young rock that is 'only' 75 to 100 million years old.



Source: maps from Wikipedia.com

Standard Form Oil & Gas Leases and Lease Provisions

A representative oil and gas lease from the American Association of Petroleum Landmen for Texas contains the following terms:

AAPL FORM 675
OIL AND GAS LEASE
TEXAS FORM-SHUT-IN CLAUSE, POOLING CLAUSE

THIS AGREEMENT made and entered into the __________ day of ______________, 20_____, by and between______________________________________, Lessor and ____________, Lessee. WITNESSETH:

1. Lessor, in consideration of the sum of ______________________ Dollars ($______), in hand paid, receipt of which is hereby acknowledged, and the royalties herein provided, does hereby grant, lease and let unto Lessee for the purpose of exploring, prospecting, drilling and mining for and producing oil and gas and all other hydrocarbons, laying pipe lines, building roads, tanks, power stations, telephone lines and other structures thereon to produce, save, take care of, treat, transport and own said products, and housing its employees, and without additional consideration, does hereby authorize Lessee to enter upon the land covered hereby to accomplish said purposes, the following described land in ___________ County, Texas, to-wit:

[LEGAL DESCRIPTION INSERTED HERE]

This Lease also covers and includes any and all lands owned or claimed by the Lessor adjacent or contiguous to the land described hereinabove, whether the same be in said survey or surveys or in adjacent surveys, although not included within the boundaries of the land described above. For the purpose of calculating rental payments hereinafter provided for the lands covered hereby are estimated to comprise ____________ acres, whether it actually comprises more or less.

2. Subject to the other provisions herein contained this Lease shall be for a term of _____________________ years from this date (called "primary term") and as long thereafter as oil and gas or other hydrocarbons are being produced from said land or land with which said land is pooled hereunder.

3. The royalties to be paid by Lessee are as follows: On oil, one-eighth of that produced and saved from said land, the same to be delivered at the wells or to the credit of Lessor into the pipe line to which the wells may be connected. Lessee shall have the option to purchase any royalty oil in its possession, paying the market price therefore prevailing for the field where produced on the date of purchase.

On gas, including casinghead gas, condensate or other gaseous substances, produced from said land and sold or used off the premises or for the extraction of gasoline or other products therefrom, the market value at the well of one-eighth of the gas so sold or used, provided that on gas sold at the wells the royalty shall be one-eighth of the amount realized from such sale.

While there is a gas well on this Lease, or on acreage pooled therewith, but gas is not being sold or used Lessee shall pay or tender annually at the end of each yearly period during which such gas is not sold or used, as royalty, an amount equal to the delay rental provided for in paragraph 5 hereof, and while said royalty is so paid or tendered this Lease shall be held as a producing Lease under paragraph 2 hereof. Lessee shall have free use of oil, gas and water from said land, except water from Lessor's wells, for all operations hereunder, and the royalty on oil and gas shall be computed after deducting any so used.

4. Lessee, at its option, is hereby given the right and power to voluntarily pool or combine the acreage covered by this Lease, or any portion thereof, as to the oil and gas, or either of them, with other land, lease or leases in the immediate vicinity thereof to the extent hereinafter stipulated when in Lessee's judgment it is necessary or advisable to do so in order to properly develop and operate said leased premises in compliance with the Spacing Rules of the Railroad Commission of Texas, or other lawful authorities, or when to do so would, in the judgment of Lessee, promote the conservation of oil and gas from said premises.

Units pooled for oil hereunder shall not substantially exceed 80 acres each in area, and units pooled for gas hereunder shall not substantially exceed 640 acres each in area plus a tolerance of ten per-cent thereof in the case of either an oil unit or a gas unit, provided that should governmental authority having jurisdiction prescribe or permit the creation of units larger than those specified, units thereafter created may conform substantially in size with those prescribed by governmental regulations.

Lessee under the provisions hereof may pool or combine acreage covered by this Lease, or any portion thereof as above provided for as to oil in any one or more strata and as to gas in any one or more strata. The units formed by pooling as to any stratum or strata need not conform in size or area with the unit or units into which the Lease is pooled or combined as to any other stratum or strata, and oil units need not conform as to area with gas units. The pooling in one or more instances shall not exhaust the rights of Lessee hereunder to pool this Lease, or portions thereof, into other units.

Lessee shall file for record in the county records of the county in which the lands are located an instrument identifying and describing the pooled acreage. Lessee may at its election exercise its pooling operation after commencing operations for, or completing an oil or gas well on the leased premises, and the pooled unit may include, but is not required to include, land or leases upon which a well capable of producing oil or gas in paying quantities has theretofore been completed, or upon which operations for drilling of a well for oil or gas have theretofore been commenced.

Operations for drilling on or production of oil or gas from any part of the pooled unit composed in whole or in part of the land covered by this Lease, regardless of whether such operations for drilling were commenced or such production was secured before or after the execution of this instrument or the instrument designating the pooled unit, shall be considered as operations for drilling on or production of oil or gas from the land covered by this Lease whether or not the well or wells are actually located on the premises covered by this Lease, and the entire acreage constituting such unit or units, as to oil and gas or either of them as herein provided, shall be treated for all purposes except the payment of royalties on production from the pooled unit as if the same were included in this Lease.

For the purpose of computing the royalties to which owners of royalties and payments out of production and each of them shall be entitled upon production of oil and gas, or either of them from the pooled unit, there shall be allocated to the land covered by this Lease and included in said unit a pro rata portion of the oil and gas, or either of them, produced from the pooled unit after deducting that used for operations on the pooled unit. Such allocation shall be on an acreage basis, that is to say, there shall be allocated to the acreage covered by this Lease and included in the pooled unit that pro rata portion of the oil and gas, or either of them, produced from the pooled unit which the number of surface acres covered by this Lease and included in the pooled unit bears to the total number of surface acres included in the pooled unit.

Royalties hereunder shall be computed on the portion of such production, whether it be oil or gas or either of them, so allocated to the land covered by this Lease and included in the unit just as though such production were from such land. The production from an oil well will be considered as production from the Lease or oil pooled unit from which it is producing and not as production from a gas pooled unit; and production from a gas well will be considered as production from the Lease or gas pooled unit from which it is producing and not from the oil pooled unit.

5. If operation for drilling are not commenced on said land, or on acreage pooled therewith as above provided for, on or before one year from the date hereof, the Lease shall terminate as to both parties, unless on or before such anniversary date Lessee shall pay or tender to Lessor, or to the credit of Lessor in the _____________, Bank at________________, Texas, (which Bank and its successors shall be Lessor's agent and shall continue as the depository for all rentals payable hereunder regardless of changes in ownership of said land or the rentals) the sum of ______________ Dollars ($_______________), herein called rentals, which shall cover the privilege of deferring commencement of drilling operations for a period of twelve (12) months. In like manner and upon like payment or tenders annually the commencement of drilling operations may be further deferred for successive periods of twelve (12) months each during the primary term hereof.

The payment or tender of rental under this paragraph and of royalty under on or before the date of payment. If such Bank, or any successor Bank, should fail, liquidate or be succeeded by another Bank, or for any reason fail or refuse to accept rental, Lessee shall not be held in default for failure to make such payment or tender of rental until thirty (30) days after Lessor shall deliver to Lessee a proper recordable instrument, naming another Bank as Agent to receive such payments or tenders. Cash payment for this Lease is consideration for this Lease according to its terms and shall not be allocated as a mere rental for a period.

Lessee may at any time or times execute and deliver to Lessor, or to the depository above named, or place of record a release covering any portion or portions of the above described premises and thereby surrender this Lease as to such portion or portions and be relieved of all obligations as to the acreage surrendered, and thereafter the rentals payable hereunder shall be reduced in the proportion that the acreage covered hereby is reduced by said release or releases.

6. If prior to discovery of oil, gas or other hydrocarbons on this land, or on acreage pooled therewith. Lessee should drill a dry hole or holes thereon, or if after the discovery of oil, gas or other hydrocarbons, the production thereof should cease from any cause, this Lease shall not terminate if Lessee commences additional drilling or re-working operations within sixty (60) days thereafter, or if it be within the primary term, commences or resumes the payment or tender of rentals or commences operations for drilling or re-working on or before the rental paying date next ensuing after the expiration of sixty (60) days from the date of completion of the dry hole, or cessation of production.

If at any time subsequent to sixty (60) days prior to the beginning of the last year of the primary term, and prior to the discovery of oil, gas or other hydrocarbons on said land, or on acreage pooled therewith, Lessee should drill a dry hole thereon, no rental payment or operations are necessary in order to keep the Lease in force during the remainder of the primary term.

If at the expiration of the primary term, oil, gas or other hydrocarbons are not being produced on said land, or on acreage pooled therewith, but Lessee is then engaged in drilling or re-working operations thereon, or shall have completed a dry hole thereon within sixty (60) days prior to the end of the primary term, the Lease shall remain in force so long as operations are prosecuted with no cessation of more than sixty (60) consecutive days, and if they result in the production of oil, gas or other hydrocarbons, so long thereafter as oil, gas or other hydrocarbons are produced from said land, or acreage pooled therewith.

In the event a well or wells producing oil or gas in paying quantities shall be brought in on adjacent land and draining the leased premises, or acreage pooled therewith, Lessee agrees to drill such offset wells as a reasonably prudent operator would drill under the same or similar circumstances.

7. Lessee shall have the right at any time during or after the expiration of this Lease to remove all property and fixtures placed on the premises by Lessee, including the right to draw and remove all casing. When required by the Lessor, Lessee shall bury all pipelines below ordinary plow depth, and no well shall be drilled within two hundred (200) feet of any residence or barn located on said land as of the date of this Lease without Lessor's consent.

8. The rights of each party hereunder may be assigned in whole or in part, and the provisions hereof shall extend to their heirs, successors and assigns, but no change or division in the ownership of the land, rentals or royalties, however accomplished, shall operate to enlarge the obligations, or diminish the rights of Lessee; and no change or division in such ownership shall be binding on Lessee until thirty (30) days after Lessee shall have been furnished with a certified copy of recorded instrument or instruments evidencing such change of ownership. In the event of assignment hereof in whole or in part, liability for breach of any obligation issued hereunder shall rest exclusively upon the owner of this Lease, or portion thereof, who commits such breach.

In the event of the death of any person entitled to rentals hereunder, Lessee may pay or tender such rentals to the credit of the deceased or the estate of the deceased, until such time as Lessee has been furnished with the proper evidence of the appointment and qualification of an executor or an administrator of the estate, or if there be none, then until Lessee is furnished satisfactory evidence as to the heirs or devisees of the deceased, and that all debts of the estate have been paid.

If at any time two or more persons become entitled to participate in the rental payable hereunder. Lessee may pay or tender such rental jointly to such persons, or to their joint credit in the depository named herein; or, at the Lessee's election, the portion or part of said rental to which each participant is entitled may be paid or tendered to him separately or to his separate credit in said depository; and payment or tender to any participant of his portion of the rentals hereunder shall maintain this Lease as to such participant.

In the event of an assignment of this Lease as to a segregated portion of said land, the rentals payable hereunder shall be apportioned as between the several leasehold owners ratably according to the surface area of each, and default in rental payment by one shall not affect the rights of other leasehold owners hereunder. If six or more parties become entitled to royalty payments hereunder, Lessee may withhold payment thereof unless and until furnished with a recordable instrument executed by all such parties designating an agent to receive payment for all.

9. The breach by Lessee of any obligations arising hereunder shall not work a forfeiture or termination of this Lease nor cause a termination or reversion of the estate created hereby nor be grounds for

cancellation hereof in whole or in part unless Lessor shall notify Lessee in writing of the facts relied upon in claiming a breach hereof, and Lessee, if in default shall have sixty (60) days after receipt of such notice in which to commence the compliance with the obligations imposed by virtue of this instrument, and if Lessee shall fail to do so then Lessor shall have grounds for action in a court of law or such remedy to which he may feel entitled.

After the discovery of oil, gas or other hydrocarbons in paying quantities on the lands covered by this Lease, or pooled therewith, Lessee shall reasonably develop the acreage retained hereunder, but in discharging this obligation Lessee shall not be required to drill more than one well per eighty (80) acres of area retained hereunder and capable of producing oil in paying quantities, and one well per six hundred forty (640) acres of the area retained hereunder and capable of producing gas or other hydrocarbons in paying quantities plus a tolerance of ten per-cent in the case of either an oil well or a gas well.

10. Lessor hereby warrants and agrees to defend the title to said lands and agrees also that Lessee at its option may discharge any tax, mortgage or other liens upon said land either in whole or in part, and in the event Lessee does so, it shall be subrogated to such lien with the right to enforce same and apply rentals and royalties accruing hereunder towards satisfying same.

Without impairment of Lessee's rights under the warranty in event of failure of title, it is agreed that if Lessor owns an interest in the oil, gas or other hydrocarbons in or under said land, less than the entire fee simple estate then the royalties and rentals to be paid Lessor shall be reduced proportionately. Failure of Lessee to reduce such rental paid hereunder or over-payment of such rental hereunder shall not impair the right of Lessee to reduce royalties payable hereunder.

11. Should Lessee be prevented from complying with any express or implied covenant of this Lease, from conducting drilling, or reworking operations thereon or from producing oil or gas or other hydrocarbons therefrom by reason of scarcity of, or inability to obtain or to use equipment or material, or by operation of force majeure, or because of any federal or state law or any order, rule or regulation of a governmental authority, then while so prevented, Lessee's obligations to comply with such covenant shall be suspended, and Lessee shall not be liable in damages for failure to comply therewith; and this Lease shall be extended while and so long as Lessee is prevented by any such cause from conducting drilling or reworking operations on, or from producing oil or gas or other hydrocarbons from the leased premises; and the time while Lessee is so prevented shall not be counted against the Lessee, anything in this Lease to the contrary notwithstanding.

IN WITNESS WHEREOF this instrument is executed on the date first above set out.

____

STATE OF Texas
COUNTY OF _________

Before me, the undersigned authority, on this day personally appeared ____known to me to be the identical person___ whose name___ are/is subscribed to the foregoing instrument, and acknowledged to me that __he __ executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office this the ________day of _______________ A. D., 20______.

____

Notary Public in and for ___________________________ County, Texas

<u>Oil & Gas Lease Questions</u>:

1. Why do we have a 'notary' at the end of the document?

2. Remember that the oil and gas lease is a contract. What is the result if a party fails to insert the legal description, or include all the parties, or what if the execution is 'defective'?

3. What provisions of the standard form oil and gas lease (above) might apply to the environmental issues encountered in exploration and development?

4. Why do you think it is common practice to use 'standard form' leases?

5. What if lease provisions allowed an operator to conduct their operations in an illegal manner – say allowed them to dump salt water into the Trinity River in violation of numerous federal and state statutes and regulations. Would the lease provisions be enforceable by the operator if they wanted to take such a foolhardy course of operation?

6. On assignment of the oil and gas lease, is the operator/lessee relieved of liability?

The Oil & Gas Lease as a Contract

The oil and gas lease is both a contract and conveyance. As such the law of contracts applies to the oil and gas lease document. A contract can be defined as (1) an agreement (2) for consideration (3) between competent parties to (4) do a legal act.

We begin our review of the oil and gas lease contract by examining the rules regarding the offer and acceptance, and how these fit into the making of an agreement between the parties. We will discuss the consideration and competent party requirements later in the text.

The Agreement: Rules of Offer & Acceptance

In the process of reaching an agreement to lease for oil or gas one party makes what attorneys refer to as an 'offer' to lease. In the oil and gas leasing context many times the lessee (company) offers to lease lands owned by a mineral owner (lessor).

The offer must contain the material terms of the proposed agreement, acceptance of which will create binding contract. If material terms are missing, as noted previously, in contracts involving real property (including oil and gas leases) no contract is formed. Since the oil and gas lease is considered real property the agreement needs to be in writing.

The material terms that should be included in an offer to lease generally include:

(1) the identity of the parties,
(2) a description of the property,
(3) the term of the lease,
(4) consideration, and
(5) the document needs to be signed by the party granting the lease.

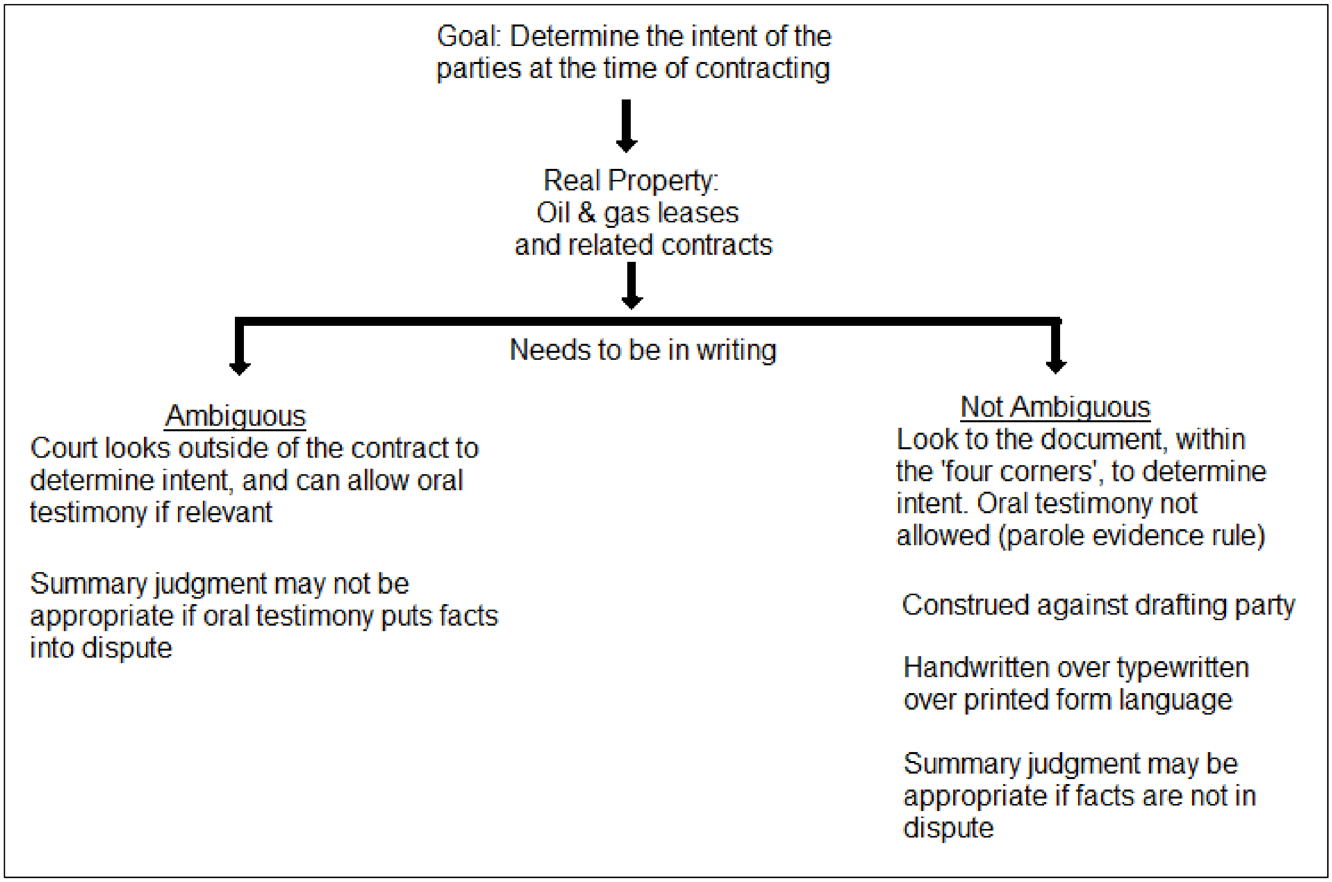
The general rule is that an offer lasts a 'reasonable' time, and generally can be revoked before it is accepted. What is a reasonable time depends on the facts of the situation. With regard to oil and gas leasing in some cases the party making the offer will include a deadline during which the offer must be accepted or the offer becomes void.

Once the offer is made the acceptance needs to be complete. In the context of a lessee making and offer to a mineral owner to lease, the mineral owner must agree to all of the terms of the offer. If the mineral owner changes any of the terms of the offer made by a lessee to lease the property, the change will be considered a 'counteroffer'. After a counteroffer the original offer would no longer stand, but the counteroffer stands in its place and can be rejected.

Due to the importance of contracting principles in oil and gas leasing many times oil and gas lease forms are used to ensure all the material terms are included. A form oil and gas lease also insures the document most likely will be considered unambiguous, with all the details put into the writing. Leasing protocols have been developed with regard to the offer and acceptance procedure to insure a contract is formed.

Oil & Gas Lease Interpretation

When involved in a contract interpretation dispute the basic goal of the court is to attempt to determine the intent of the parties at the time of contracting.



For conveyances of real property all of the material terms are required to be put in writing. As a result the court can review the writing in its entirety, and in theory reach the goal of determining the intent of the parties from the words and phrases that were used in drafting the document.

Contract is Not Ambiguous

When a contract is not ambiguous a rule of evidence applies that states that the court will look only within the "four corners" of the document to determine the parties intent. No oral testimony, otherwise known as ‘parole evidence’, to supplement or contradict the writing will be admitted.

When applicable any handwritten terms generally will be given more weight then typed terms, which in turn will be given more weight than printed form language in the document.

Another basic tenet of contract interpretation is that if there is a dispute the contract is generally interpreted against the drafting party. This is especially true when the drafting party has special expertise, which is generally the case where oil and gas companies draft oil and gas lease documents for relatively unsophisticated mineral owners to execute.

Contract is Ambiguous
When the contract is ambiguous, the court can allow parole or oral evidence to be taken if it is relevant. In this situation the court can look outside the contract to determine what the intent of the parties was at the time of agreement.

The court will make the determination whether a contract is ambiguous, which in turn will determine what evidence will be allowed and if oral testimony can be admitted.

Legal Implications
Especially important is the fact that for contracts that are not ambiguous a party can ask the court for summary judgment when the facts are not at issue. In most cases the facts will not be at issue, and the language of an oil and gas lease can be used without additional testimony allowing the court to make a decision.

Summary judgment reduces litigation costs, and speeds along dispute that otherwise might have to go to a lengthy discovery, trial, and appeal process.

When drafting a document relating to well gas transaction it is therefore imperative that the language is clear, so the court determines that the contract is not ambiguous should a dispute arise. This goal is somewhat muddled with the contrary goal of keeping the contract short, in which case language may be omitted or certain circumstances overlooked when trying to get a short contract prepared that both parties can timely agree on.

The chart above is a simple diagram of contract interpretation principles.

Oil & Gas Lease Forms
Because of the importance that a contract is unambiguous and that it contains all the material terms most oil and gas transactions involve the use of oil and gas form contracts. Most common are oil and gas leases and mineral deeds, as well as assignment of oil and gas lease forms.

The forms are generally drafted by experts and are updated to reflect the latest legal or technological developments in the industry. For example, many modern oil and gas lease forms have updated ‘pooling’ clauses added to reflect the popularity of horizontal drilling – a drilling method that was used infrequently a decade or more ago but now is common practice. The royalty clauses have also been updated to clarify the ability of the lessee to deduct (or not deduct) transportation and marketing fees involved in lease production.

The Fort Worth based American Association of Petroleum Landmen (AAPL) offers a number of commonly used forms, all of which have been developed by the expertise of their members and the legal community.

Capacity to Contract - Intoxication

Suppose you are a landman and obtained a mineral deed or lease from a mineral owner that is "not of overstrong intelligence to start with", who "simply staged a two- or three-year chronic drunk of surprising intensity and constancy, with the result that his mind progressively deteriorated". During a period when the mineral owner was sober they executed a deed to your oil company client. Does the mineral owner have capacity to convey? Keep in mind this case deals with chronic alcohol use, the concepts could apply to chronic drug use also (prescription or otherwise).

The Tindel case addresses some of the capacity issues when dealing with intoxicated parties, addiction, undue influence, and adequacy of consideration:

^^

Tindel v. Williams, 187 Okla. 482

Supreme Court of Oklahoma

May 14, 1940, Decided

No. 29272.

DANNER, J. In October, November, and December of 1935, the plaintiff, George K. Williams, executed to the defendant, Fred R. Tindel, two mineral deeds and a quitclaim deed, conveying all of his 11/45ths interest in 140 acres of valuable oil land.

This action to vacate said conveyances is prosecuted by his sister, who was appointed guardian in April of 1938, upon his being declared incompetent. The trial court canceled the deeds, on the grounds of fraud, incompetency, and lack of consideration, and the defendant appeals. The contention is that the judgment is against the weight of the evidence.

The plaintiff, a mixed-blood Chickasaw Indian, lived at Ardmore, Okla. In 1932 and 1933, when he was approximately 27 years of age, he came into $ 37,000 in cash, in addition to his interest in the oil producing royalty mentioned above.

He began drinking heavily. He was not at that time acquainted with defendant, but in the latter part of 1932 he met defendant's half sister and began living with her, later marrying her in 1933. After the marriage he met the defendant, who for a livelihood was selling whisky in a small home in Ponca City.

Plaintiff began patronizing defendant's business, and said business almost immediately prospered greatly. It was not long until the defendant purchased an elaborate night club east of Ponca City, including facilities for dining, dancing, and gambling, and a bar at which whisky, champagne, and mixed drinks were served. The establishment also contained separate living quarters for the family, wherein plaintiff and sometimes his wife took up their abode for periods of varying duration, although during the ensuing two years plaintiff frequently visited and remained for a while in Ardmore, Oklahoma City, and other places.

The defendant's place of business and living quarters seem, however, to have attracted the chief interest of plaintiff. As time went on, his prodigalities and drinking increased and his fortune diminished, so that by the summer of 1935 his $ 37,000 cash was gone, and by October of 1935 he had conveyed his mineral interests to defendant.

In 1936 he was arrested for robbery with firearms and was convicted and sent to the penitentiary at McAlester. Conversely, the defendant in the meantime gradually prospered, from a very modest bootlegging business, in the beginning, to ownership and management of a remunerative night club, and from that into the oil business.

While the plaintiff by no means spent all of his money and time at defendant's establishment, the evidence was sufficient to warrant belief that a substantial part of it was, and that defendant and the nature of his business contributed largely to plaintiff's delinquency. According to the testimony of several witnesses, plaintiff was very drunk and gambling at defendant's place at all times observed by them, and lost much money in that manner.

No record exists as to the actual amount which plaintiff drew out of the bank by check while he was in Ponca City, but the following amounts were shown to have been telegraphed him from Ardmore at his request: On August 25, 1934, $ 500; September 15, 1934, $ 300; December 17, 1934, $ 1,000; December 18, 1934, $ 1,000; December 24, 1934, $ 1,000; January 19, 1935, $ 1,000. Also, on August 25, 1934, the date shown above on which $ 500 was wired him from Ardmore, plaintiff gave defendant a check for $ 750, which was cashed, making the traceable amount on that particular date $ 1,250. The thousand dollars per day, noticeable on December 17th and 18th, followed by another thousand in six days, and another thousand shortly afterward, is significant. On several, if not all, of the above telegraphic money orders, the defendant identified plaintiff in order to enable him to receive the money.

Without detailed narration of the testimony of the various witnesses, it is sufficient to say that the plaintiff, apparently not of overstrong intelligence to start with, simply staged a two- or three-year chronic drunk of surprising intensity and constancy, with the result that his mind progressively deteriorated. That is the ultimate fact of legal importance, and though perhaps some of the events and episodes transpiring during that period would make interesting reading, their recitation is unnecessary.

In addition to the lay witnesses, from Ardmore, Ponca City, and other places, one medical expert (who did not know plaintiff and had not examined him, however) testified, in answer to a hypothetical question, that under the circumstances delineated therein the plaintiff would not have been competent "to transact business during that time," meaning a period of time including the dates of the conveyances.

The case is not so simple, however, from a legal viewpoint, as the foregoing may seem to indicate. The defendant produced five disinterested witnesses who testified that they observed and talked with plaintiff on the dates and at the places of execution of the conveyances in October, November, and December, 1935; that he was sober and apparently normal and capable of understanding; that he did not even appear nervous or jittery.

Said witnesses were the notaries public and others in the abstract offices where the instruments were executed, and in the office of the county clerk where the deeds were recorded. One of said notaries had also met and conversed with plaintiff on the street shortly prior to execution of one of the instruments. . . .

A deed, executed by a person unable to know the nature or circumstances of his act, though his incompetency be produced by intoxication, is voidable, and said deed may be canceled by himself, although the intoxication was voluntary and not produced by the circumvention of the other party. Coody v. Coody, 39 Okla. 719, 136 P. 754, L. R. A. 1915E, 465. It is not, of course, the mere fact of being drunk which avoids the deed. It is the incompetency itself, as that phrase is defined by the law, which is the determining feature. It is the state and condition of the mind that the law regards and not the causes that produced it.

If from any cause his reason has been dethroned, his disability to contract is complete. So, as stated, the mere fact that one is drunk when he enters into a contract is no ground for setting it aside, unless the drunkenness deprives the party of his reasoning and of an agreeing mind, or unless the drunkenness was brought about by the opposite party, who took advantage of it. . . .

A habitual drunkard is not incompetent as a matter of law. As a general rule, a deed made by him during a sober interval is binding, but where his mind has become so impaired by habitual intoxication that he cannot act with "agreeing mind," it is voidable, and although he made the deed in a sober interval, it is invalid where there is a showing that he was overreached. 6 A. L. R. 337, 314. Harlow v. Kingston, 169 Wis. 521, 173 N.W. 308, 6 A. L. R. 327, in which the deed in question was canceled by the court, had two of the elements of the present case, but not the third, in that the drunkenness was not induced or encouraged by the grantee. Quoting:

> "Plaintiff had been on a prolonged spree and had been grossly intoxicated, although at the time of the making of the deed he was sober; that he had been out of money for several days and had exhausted his credit. * * * That while the plaintiff was not appreciably under the influence of liquor at the time of the sale, nevertheless, by reason of his debauch, he had such a consuming thirst for liquor and his mind was so dominated thereby that it did not act normally and he did not appreciate what he was doing. * * * That the price paid was grossly inadequate and the transaction unconscionable."

The following excerpt from the opinion is framed in language probably too broad, but it illustrates the tendency of the courts in such cases:

> "When an unconscionable bargain has resulted from conditions due to intoxication and debauchery, equity considers the transaction an imposition on the incompetent party and awards relief."

We have not found any Oklahoma decisions squarely in point with the instant case on the fact situation. In the Coody Case, supra, the deed was canceled because of actual intoxication coincident with its execution. In Parker v. Parker, 75 Okla. 234, 182 P. 697, 11 A. L. R. 720, the deed was canceled because of habitual intoxication resulting in weak-mindedness, there being no evidence of intoxication at all when the deed was executed, the court holding that by reason of the existence of a confidential relation between the grantor and grantee the burden was upon the grantee to show that the transaction was fairly conducted, which burden the grantee, through the failure to produce evidence, had not met.

Byrd v. McKoy, 183 Okla. 209, 81 P.2d 315, involved a habitual drunkard, and it was held that the judgment of the trial court refusing to cancel the deed was not clearly against the weight of the evidence, but in that case it was shown by affirmative evidence that the grantor was in fact sober and thoroughly understood what he was doing and desired to complete the transaction. Furthermore, there was no overreaching, no plying with liquor, no inadequacy of consideration. See, also, the following: Miller v. Kimmel, 76 Okla. 233, 184 P. 762; Miller v. Howard, 76 Okla. 237, 184 P. 773.

In the latter case the deed was held valid because the evidence indicated that the grantor was not intoxicated when the deed was executed. But the court said:

"The most serious question in the case is whether by the long use of intoxicating liquors the wind of the plaintiff * * * had become so diseased and weakened that he did not understand the nature of the transaction, and did not know what he was doing, and although the plaintiff's evidence shows that Miller's mind had become slightly impaired by the excessive use of intoxicating liquors, there is abundant evidence in the record showing, as found by the trial court, that his mind had not become so impaired that he did not fully realize what he was doing and the consequences of his acts." . . .

Kendall, Adm'r of Estate of Redeagle, v. Ewert, 259 U.S. 139, 66 L. Ed. 862, 42 S. Ct. 444, originated in the District Court of the United States for the Eastern District of Oklahoma. There were present the elements of habitual drunkenness and "overreaching," both in the matter of consideration and in the means employed to obtain execution of the instrument, which was a dismissal of action affecting title to realty. The Supreme Court of the United States reversed a decree of the Circuit Court of Appeals which had dismissed the action to vacate the instrument, and held that said instrument should be canceled. We quote the 4th syllabus and a portion of the opinion:

"Evidence of competency, entirely clear, should be required to sustain a transaction in which a common habitual drunkard has been overreached by a competent and aggressive person. * * *

"Without further discussion of the evidence, it is sufficient to say that, while the witnesses differ as to whether Redeagle had deteriorated to the point of being incompetent to do business when temporarily sober, they all agree, and the district judge agrees with them, that, long before the stipulation for dismissal was signed, he had come to be generally regarded as a common, an habitual, drunkard, and we think the circuit court of appeals failed to give the weight to this fact which it deserves. That habitual drunkards are not competent to properly transact business is so widely recognized in the law that in many states statutes provide for placing them under a guardian or committee, with authority to put restraint upon them and to preserve their property, not less for themselves than for those dependent upon them. * * *

"The extent to which one must have fallen below the standard of ordinary business capacity before he will be generally recognized in a community as a common drunkard is so notorious that we do not hesitate to say that evidence of competency entirely clear should be required to sustain a transaction in which such a person has plainly, as in this case, been overreached by a person dealing with him who is competent and aggressive. Men so reduced will sacrifice their property, as they have sacrificed themselves, to the craving for strong drink; and Ewert's letters show that he knew perfectly well that the Indian with whom he was dealing had reached that unfortunate stage of decay."

The court then pointed out that the difference between the consideration and the actual value of the property involved, was "most persuasive evidence of the condition of incapacity of Redeagle at the time the stipulation was obtained from him, even though he may have been temporarily sober when he signed the paper."

In Miller v. Sterringer, 66 W. Va. 169, 66 S.E. 228, 25 L.R.A. (N. S.) 596, the grantor was to a certain extent an imbecile from constant use of intoxicants and was but slightly intoxicated when the deed was made. The grantee was a saloon keeper with knowledge of the grantor's weakness, at whose place the grantor had been in the habit of purchasing most of his liquor. The property deeded to the grantee for $ 500, on time and without interest, had been purchased by grantor, only two months before, for $ 700. It was held that the deed was invalid, and that under the circumstances it was not necessary that the grantor be totally incapacitated by liquor in order to set aside the deed.

The court cited many authorities in support of the principle that equity will relieve one from a contract made by him in drunkenness, though his reason may not have been wholly overthrown, where fraudulent advantage has been taken, or where the drunkenness has been brought about by the other party, quoting particularly the case of Calloway v. Witherspoon, 40 N.C. 128, basing the doctrine not on the ground of drunkenness but of fraud. . . .

In Clarkson v. Kitson, 4 Grant Ch. (U.C.) 244, the grantor, a habitual drunkard, conveyed property for an inadequate consideration to the keeper of a tavern in which grantor was living. The grantee had supplied him with liquor at different times, and though there was no proof that the grantee had induced him to become intoxicated at the time the deed was executed, the deed was set aside by the grantor's heirs.

In Jones v. McGruder, 87 Va. 360, 12 S.E. 792, a habitual drunkard's deed to a grantee who had previously led him into intoxication, but not on that occasion, was set aside.
Judicial notice appears to have been resorted to, in the following language from Menkins v. Lightner, 18 Ill. 282, involving habitual drunkenness and an inadequate consideration, although it was shown that the grantor supposedly was "sober" when the deed was executed:

> "After the defendant had established so long a continuous career of drunkenness, and craziness from it, as has been proven here, it is not enough or satisfactory to show a mere sober interval of a few hours, or even a few days. I am not prepared to believe that the mind can so resume a healthy vigor after so much and so long derangement from such besotted habits. * * * When the mind is thus broken down by a long course of dissipation, the feverish moments of a half sober or even sober interval cannot be called * * * a lucid interval, for the purpose of establishing the acts of the party. To lay down such a rule would be to invite the covetous and the crafty to seize the victim in an interval of his greatest physical agony and prostration as the one in which the mind alone is clear, free and judicious. All observation contradicts the inference of so instantaneous a mental recovery."

The foregoing is remindful of plaintiff's testimony in the present case, wherein, after describing instances where he would imagine he saw horses or elephants standing in the road ahead of the automobile driven by him, causing him to stop the car, he stated that such phenomena occurred every time he tried to sober up.

Adams v. Ryerson, 6 K.J. Eq. 328, involved a situation where the grantor, a habitual drunkard, gave a deed to the grantee, a liquor seller from whom he was accustomed to buy liquor, for little or no consideration. The deed was cancelled by the court. See, also, the following: Guidici v. Guidici, 2 Cal. 2d 497, 41 P.2d 932; More v. More, 136 Cal. 489, 65 P. 1044, 66 P. 76;Lavette v. Sage, 29 Conn. 577; Cruise v. Christopher, 5 Dana (Ky.) 181; Rutherford v. Ruff, 4 S.C. Eq. 350, 4 Desaus. 350. The following language from Hume v. Cook, 16 Grant Ch. (U.C.) 84, has frequently been quoted in the decisions of the various courts:

> "The case is very strong against such a transaction where the grantee is a tavern keeper who was dealing with a drinking lodger. I understand the rule of equity to be that a conveyance by an intemperate man of all his property, to the tavern keeper with whom he lives and at whose house he had been supplied with the drink which he prefers to all earthly objects of desire and to all hope

of future happiness, is subject to the same rules as a conveyance to a person occupying toward the grantor a relation of confidence or influence. The danger, in consequence of which those rules have been laid down, exists in a much larger degree in the former case than in the latter, and needs to be guarded against with greater caution."

The fraud which was found by the trial court to have been perpetrated consisted of the taking of the deeds by the grantee, under the circumstances herein delineated, for no consideration or a grossly inadequate consideration. ***In other words, that contributing toward the production of incompetency in another, and, with knowledge of such incompetency, accepting a deed for an inadequate consideration, is sufficient to constitute fraud. Such is the generally accepted rule.***

The test of affirmance or reversal in an action of this kind is not whether the judgment is against the "clear weight" of the evidence, as that expression is sometimes inadvertently used, but whether same is *clearly against the weight* of the evidence. In the light of the foregoing authorities, with which we agree in the main, we are of the opinion that the judgment is not clearly against the weight of the evidence.

The judgment is affirmed, and the motion of plaintiff for judgment on the supersedeas bond, covering that portion of the judgment for the amount of oil and gas royalties received by defendant from the time of his assumption of possession of the land until the filing of suit, is sustained.
^^

Tindel v. Williams Questions

1. What is the rule dealing with capacity when a party is intoxicated?

2. What if a party is a habitual drunkard, but is sober when they sign a deed? Are there still capacity issues?

3. Does the court generally look to the adequacy of consideration in a contract? What about a situation like this case where the defendant allegedly contributed to the plaintiff’s drinking problem?

4. What advice would you have to landman attempting to obtain a least from a party with a drinking or drug problem?

5. In Coody v. Coody, 136 P. 754 (Okla 1913) the court noted:

    > Without passing upon the sufficiency of the petition as to the other grounds upon which relief was sought, we think the court erred in sustaining the defendants' demurrers, for if, at the time the deed of August 31, 1909, was executed, plaintiff was so under the influence of intoxicants as to be wholly unable to transact business and to understand the nature of the deed which he signed, he may plead his disability from such drunkenness in an action to cancel the deed. HN2 Intoxication which is absolute and complete, so that the party is for the time entirely deprived of the use of his reason and is wholly unable to comprehend the nature of the transaction and of his own acts, is a sufficient ground for setting aside or granting other appropriate affirmative relief against conveyance or contract made while in that condition, even in the absence of fraud, procurement, or undue advantage by the other party. . .

Oil & Gas Leasing & Transactions: Ignorance of Value

The nature of oil and gas leasing and developmental activities creates a situation where the value of mineral rights and oil and gas leasing rights can change very quickly – and violently – both positively and negatively. A good exploration well will boost values and can create a boom in leasing activity, which a dry hole can 'condemn' a geological prospect.

Because of the volatility, and the specific geological features of any one field, it is very difficult at any one time to tell what a 'fair' value is for a lease or a sale of mineral rights. Keep in mind a buyer, if they are a sophisticated oil company, probably has spent thousands of dollars on geophysical and geological data and analysis, and most likely has a better idea than the mineral owner what potential an area may have for production. The oil and gas company has no duty to disclose the data they may have obtained, or their interpretation of the data, to the mineral owner.

Regardless of how attractive a prospect appears to be to the geologist, until it is drilled and production commenced it is very difficult to determine 'fair' or 'market' valuations. Even with a well completed for production competent parties may dispute the value of the resource.

Legal Implications

As a general rule when a contract exists between competent parties the courts will not review the amount of consideration to determine if it is 'fair' or even 'reasonable' amount, absent fraud or misrepresentation. The concept is that the court will not salvage a party from a 'bad deal' they agreed to, and will not become involved to re-write the contract to protect them.

When a lessee/landman is involved in leasing or related transactions, absent fraud or misrepresentation, if they convince a mineral owner to lease to them for what later appears to be a very undervalued sum the court will generally not invalidate the contract. Of course, the mineral owner/lessor needs to have the capacity to lease.

While the general rule is that the courts will not re-write a contract to correct a 'bad deal' the mineral owner must have capacity to contract - and while it is rarely seen the following court ruled that the mineral owner was so ignorant of mineral values, and uneducated in the ways of business, that they were incompetent to lease (hence a guardian was appointed to act on their behalf).

^^

Shelby v. Farve, 126 P. 764
Supreme Court of Oklahoma
September, 1912, Decided ; June 25, 1912, Opinion Filed

DUNN, J. This case presents error from the district court of Marshall county. On May 29, 1909, the plaintiffs in error filed a petition in the county court of the said county asking for the appointment of a guardian or guardians of Marcelene Farve and Stella Farve, defendants in error, on the ground that they were mentally incompetent to manage their property. There- after, and on June 15, 1909, the said county court, on a hearing, found:

"The said Marcelene Farve and Stella Farve are both adult fullblood Mississippi Choctaw Indians, that each of them is ignorant, uneducated, and mentally incompetent to transact her business and to manage her property, and the court further finds that the said Marcelene Farve and Stella Farve own by inheritance from their mother Melvina Jackson an allotment of the tribal lands situated in Carter county, Okla., on which are valuable asphalt deposits, and that, by reason of said asphalt deposits, said allotment of land is of the value of $ 40,000 or more.

The court further finds that there is now a mineral lease on said lands and revenues arising therefrom in the way of royalties amounting to from $ 900 to $ 1,200 a year. The court also finds that the said Marcelene Farve and Stella Farve have attempted to sell said lands for a grossly inadequate consideration, and that, unless a guardian of their estate is appointed, they are liable to sell their interests in said estate for a grossly inadequate consideration, and that it is proper and necessary that a guardian be appointed to take care of and protect their said property."

From this order the defendants appealed to the district court on questions of law and fact.

[For statutory reasons the district court ruled that the defendants should prevail, and no guardian was required to be appointed to protect the interests of the Farves}

. . . "The phrase 'incompetent,' 'mentally incompetent,' and 'incapable,' as used in this chapter, shall be construed to mean any person who, though not insane, is, by reason of old age, disease, weakness of mind, or for any other cause, unable, unassisted, to properly manage and take care of himself or his property, and by reason thereof would be likely to be deceived or imposed upon by artful or designing persons."

This definition in our judgment fairly expresses the meaning intended by our Legislature when these provisions were passed. Our own statute (section 5033, Comp. Laws 1909) defines persons of unsound mind as being "idiots, lunatics and imbeciles." It is clear that these parties do not come within any of those definitions, but it seems to us that the finding of the court that they were so ignorant in so far as the value of their property was concerned that it was probable they would make an improvident disposition thereof is the situation contemplated by the statutes under which this proceeding was brought, and that it is amply supported by the evidence. . .

Upon examination, Stella Farve, called on behalf of petitioners, testified in reference to her land:

"Q. Can you read? A. No, sir.
Q. Can you write? A. No, sir.
Q. Did you ever go to school? A. No, sir.
Q. Do you know how to figure? A. No, sir.
Q. What was your mother's name? A. Melvina Jackson.
Q. And she died sometime in March last year? A. I can't tell you exactly how long it has been.
Q. Do you know when she died? A. Yes.
Q. Where did she die? A. Died on Hickory, about ten miles from Ardmore.
Q. Did she have an allotment when she died? A. Yes.
Q. Do you know where it is? A. Close to Ardmore, about six miles.
Q. What direction; do you know what direction it is from Ardmore? A. No.
Q. Have you ever seen it? A. No.
Q. Have you ever been on it? A. No.
Q. Do you know what kind of land it is? A. No, sir.
Q. Do you know what's on it? A. No, sir.
Q. Do you know what it is worth? A. No; I don't know what it is worth.
Q. Your mother had only two children--you and your sister? A. Yes, sir.

Q. You and your sister claim that land now? A. Yes, sir.
Q. Why haven't you ever been on the land and investigated to see what it was worth? A. We couldn't live on the land because it don't have any house on it.
Q. You have an allotment of your own, haven't you? A. No; I haven't got any. I am not on the roll.
Q. Why, didn't you come here in time? A. Yes; I come here in time, but I was mixed breed.
Q. Is your sister, Marcelene, enrolled? A. Yes; she's on the roll. She's a full-blood.
Q. You are only half-sisters then? A. Yes, sir.
Q. Have you ever tried to sell that land that your mother used to own, to anybody? A. Yes; I did.
Q. To whom? A. Walter Colbert.
Q. How much was he to give you for it? A. I don't know.
Q. Did you ever try to sell it to anybody else, or did anybody else ever try to buy it from you? A. No.
Q. Didn't Mr. Criner try to buy it? A. Yes; he's the one that tried to buy it first.
Q. Did you ever sign a deed? A. Yes; and he give it to us back.
Q. How much was he to give you for it? A. I don't know. He promised me first--said he would give me $ 300.
Q. Were you willing to take that for it? A. Yes, sir; I was.
Q. Did you sign a deed to him for it? A. Yes.
Q. Do you know how much Walter Colbert agreed to give you for it? A. No.
Q. You don't know how much. Did you sign any papers for Walter Colbert? Did you ever sign any papers or make your mark to any papers for Walter Colbert? A. No; not yet.
Q. Have you got any agreement with him about signing any papers for him? A. Yes; I will sign them if they will let me sign them. It got all tangled up.
Q. How much was he to give you for it? A. About a thousand dollars I reckon.
Q. Were you willing to take that for it? A. Yes; I was.
Q. Did Mr. Criner tell you that $ 300 he was going 'to give you was all the land was worth? A. Yes.
Q. Did you believe that? A. I didn't exactly believe it. I didn't have nothing, didn't have no money. That's the reason I took it.
Q. You thought it was worth more than that? A. Yes.
Q. Did he say it was worth that much? A. Yes.
Q. Did he say that was all it was worth? A. Yes.
Q. Do you believe that's all it is worth? A. I guess better take a thousand dollars; not get nothing now. * * *
Q. You say your husband is dead? A. Yes.
Q. With whom do you live now? A. With my sister.
Q. Did you ever have any money in the bank? A. No.
Q. Did you ever own any land? A. No, sir.
Q. Have you ever owned any property of any kind yourself? A. No, sir. Q. Do you know what asphalt is? A. No, sir.
Q. Did you ever see any? A. No.
Q. Do you know what asphalt is worth? A. No.
Q. Do you know what land is worth that's got asphalt on it? A. No.
Q. Do you remember when your mother filed on this land at the land office? A. No, sir.
Q. You didn't go with her? A. No, sir.
Q. Were you living here then? A. Yes, I was.
Q. Can you figure? A. No, sir.

Q. Do you know how many five dollar bills it takes to make a hundred? A. Yes.
Q. How many? A. I ain't going to tell you, though.
Q. Tell the court, You aren't telling me. The court: Answer the question. A. I ain't going tell.

The court: Well, you must answer. Tell him how many. A. Don't believe I could tell you.

Q. Who brought you down here today? A. Myself.
Q. Did you pay your expenses? A. Yes, sir.
Q. How many deeds you say you signed to your mother's land? A. Signed for George Criner, that's all.
Q. Did you sign one to W. B. Frame? A. I don't know.
Q. Did you ever have any deal with him about the land? A. Don't know.
Q. Did he ever pay you any money in connection with the land? A. No; George Criner did, but not him.
Q. You never had any money in the bank? A. No, sir.
Q. Do you know what a check is? A. Yes, sir.
Q. Can you write one? A. How can I write one when I said I don't know how to write?
Q. Can you read? A. No.
Q. Did you ever go to school? A. No, sir."

David Shelby, who testified that he held the position under the United States government of district agent, testified that the land contained asphalt, and in his judgment was worth $ 40,000, and that he had refused to recommend a deed for $ 10,000 for Marcelene's share.

From the foregoing and other testimony contained in the record we are convinced that these parties were mentally incompetent and incapable of protecting themselves in their estate, and that, by reason thereof, they are not only likely, but absolutely certain, to be deceived and imposed upon by artful and designing persons, and the jurisdiction and authority is vested in the county court to appoint a guardian or guardians to protect them. Accordingly, the judgment of the district court is reversed, and the cause remanded, with instructions to proceed in accordance with this opinion.

<u>Shelby v. Farve Questions</u>

1. If a court won't review an agreement to lease absent fraud or misrepresentation, what can a landman do to reduce the risk that those factors might be asserted by the mineral owner who has made a 'bad deal' in a leasing transaction?

2. Keep in mind while the amount of consideration will not be reviewed, the lessee must give some consideration to the mineral owner. Generally the promise of future royalties will suffice to satisfy the consideration requirement.

3. While the court will not review the amount of consideration, where it is grossly disproportionate to the value conveyed the court may look very closely to insure fraud or misrepresentations have not been made by the lessee/landman.

4. Many leases and other documents will not recite the exact value of consideration received, at least with regard to the 'bonus' paid for executing the lease. Why would a lessee/landman not want to put the value paid for the lease in that document?

Consideration & the Oil & Gas Lease

"Consideration" is one of the requirements necessary to create a contract. Consideration is the value a lessee gives up in order to obtain the oil and gas lease.

Texas courts, as well as the majority of others in the country, follow the rule that they will not inquire into the adequacy of consideration absence fraud or misrepresentation. The policy behind this rule is that the courts don't want to become involved in renegotiating or rewriting deals that have already been agreed to by the parties.

In many cases, in the consideration clause in the oil and gas lease, the lessee will insert consideration of "one dollar and OVC" in the form language (one dollar and other valuable consideration).

Why would a lessee not want to put in the actual value of bonus paid? The answer lies in the fact that the oil and gas lease will be placed in the public real estate records, and by putting in the actual payment made competitors can determine how much the company is paying for leases per acre. And the competitors can offer slightly more which will undercut the lessee's acquisition program. Mineral owners also would have access to the data, which might spark a push by these parties to obtain a better bonus amount then their neighbor.

There are at least three or more forms of consideration in and oil and gas lease:

1. A "bonus" is a payment to the mineral owner lessor at the time the lease is executed. It is normally paid on a per mineral acre basis. Bonuses can vary widely with in a field, depending on the geological interpretation and sophistication of the parties.

In the Barnett shale field north of Fort Worth a decade ago oil and gas leases saw bonuses being paid of around $200 per acre. After hydraulic fracturing and horizontal drilling were perfected those lease bonuses went above $20,000 per acre.

2. Royalties are a share of production, if any, from any wells drilled on the property. Historically the royalty has been one eighth of any oil or natural gas produced, but modern leases provide for 3/16 to 1/5 royalties or more, depending on the area.

In some cases the mineral owner may opt for a higher bonus and lower royalty, or a lower bonus and a higher royalty, shifting the risks in accord with their financial needs

3. Delay rentals are included in some leases that require yearly payments to maintain the least during the primary term. These payments are consideration in lieu of drilling activity, and in some cases have been eliminated from the lease. Where no delay rentals are present the lease is called a "paid up" lease. Regardless of whether a delay rental clause is present, consideration is still adequate because of the bonus and promise of future royalties.

4. Most leases also provide for shut in royalties. These are royalties in lieu of production if for some reason the well is not producing for a given period of time. Shut in payments are very important in some states such as Texas, since missing a payment means that the lease is not "producing" and may expire by its own terms – even if a well has been drilled on the leasehold premises.

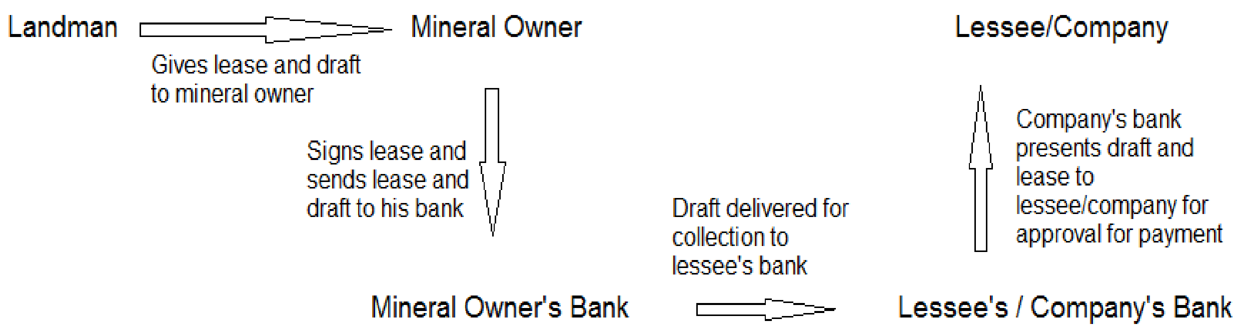
Drafts & the Oil & Gas Leasing Transaction

"Draft" - "Collection" item versus "Cash" item like a check

Drawer gives a written order to the Drawee directing payment to a Payee
(landman) (lessee) (mineral owner/lessor)

In a typical oil and gas leasing situation the landman will meet with the mineral owner and propose paying the mineral owner a 'bonus' to entice them to sign the oil and gas lease. In most types of transactions that the mineral owner is familiar with they either pay or are paid by a 'check'. A check under uniform state law is considered a "cash item" by the bank – that is for legal purposes the check is identical to cash, and the funds are immediately credited or debited to an owner's account when the check is presented to the bank.

With regard to oil and gas leasing activity the mineral owner is paid with a "draft". A draft is considered a "collection item" under the law by the bank. When the mineral owner takes the draft to his bank money is not immediately credited to their account even though the draft looks very similar to a check.



After the mineral owner deposits the draft with their bank the mineral owner's bank sends the draft to the company/lessee's bank. The mineral owner's bank has submitted the draft for 'collection' in the legal parlance.

The company/lessee's bank contacts the company/lessee and asks whether they will approve payment of the draft. Only when the company approves payment of the draft is cash actually transferred into the mineral owners account.

Why use a draft in a leasing situation? One reason a draft is used is that it allows a landman to close a transaction quickly while allowing them a short time to check title to ensure the mineral owner has clear title to lease.

The instances when a company can decline to pay a draft are limited. A draft might be refused if there are title issues or defects, or if a draft is "stale" - that is it has been held for too long before being submitted to the company's bank requesting payment.
In some cases the draft will contain specific language providing that there is no liability on non-payment of the draft. The courts generally will enforce the language of such drafts, however have

found that until payment is made no contract has been formed – so the mineral may be able to lease on better terms to another party.

Historically, in speculative areas, leases were occasionally taken with drafts the landman might not intend to pay unless a well was completed as a producer. Non-payment on a dry hole always created legal questions, and the practice was referred to as 'cold drafting".

A sample form draft courtesy Terry Cross of McClure & Cross, is set out below. Many will have numbers at the top and company identification, making the documents look much more like a check.

On approval of lease or mineral deed described hereon, and on approval of title to same by drawee not later than ____________ days after arrival of this draft at collecting bank.

______________________________ 19____

PAY TO THE
ORDER OF ______________________________

______________________________ $ __________

______________________________ DOLLARS

This draft is drawn to pay for Oil and Gas Lease, Mineral Deed dated ______________________________ and covering

____

The drawer, payee and endorsers hereof, and the grantors of the lease or mineral deed described hereon, do hereby constitute and appoint the collecting bank escrow agent to hold this draft for the time above specified subject alone to acceptance of payment hereof by the drawee, within said time, and without any right of the drawer, payee or endorsers hereof, or said grantors, to recall or demand return of this draft prior to the expiration of the above specified time, and there shall be no liability whatsoever on the collecting bank for refusal to return the same prior to such expiration.

In the event this draft is not paid within said time, the collecting bank shall return the same to forwarding bank and no liability for payment or otherwise shall be attached to any of the parties hereto.

TO ______________________________ DRAWEE

AT: ______________________________

____
Collecting Bank

____
Drawer

Form No. 525 Pound Printing & Stationery Co.,
2325 Fannin Street • Houston, Texas 77002 (713) 659-3159

Standard Form

Standard Form Oil & Gas Lease Release

Due to the way the term clause is constructed in an oil and gas lease note that it is difficult to know if a lease has been extended into the secondary term. As such title examiners will require a release of lease in many cases, to insure that older leases have not been extended by production or included in a unit that has production or a shut in well. A representative oil and gas lease release form from the American Association of Petroleum Landmen for Texas contains the following terms:

AAPL FORM 687 TEXAS
RELEASE OF OIL AND GAS LEASE

STATE OF TEXAS
COUNTY OF ______________

KNOWN ALL MEN BY THESE PRESENTS, that the undersigned does hereby relinquish, surrender, and forever quitclaim to the hereinafter named Lessors, their heirs, successors and Assigns, as their interest may appear, any and all right, title and interest whatsoever presently owned by the undersigned in and to the land described herein below by virtue of the following described Oil and Gas Lease, to-wit:

[describe lease and recording data]

Insofar as said Oil and Gas Lease covers the following described land:

[describe legal description of lands released]

IN WITNESS WHEREOF, this instrument is executed on this ___________________ day of ___________________, 20__________.

______________________________   ______________________________

[have notarized so the document can be recorded]

PART V

RISK MANAGEMENT & CAPTIAL ALLOCATION

The Role of the Joint Stock Company in Business Development

Raising capital has always proved problematic for the entrepreneur with a legitimate business idea. Historically there were limits as to the amount that could be raised by one individual, how the terms were structured, and in the early to mid-1800s debtor prisons were common in the United States, Britain, and in Europe for those who could not repay investors or creditors.

Entrepreneurs such as Charles Goodyear, early developer of rubber products, were imprisoned numerous times for debts he could not repay. Even at his death it took years of court proceedings and accounting to pay off existing creditors (the successful Goodyear Tire & Rubber Corporation apparently used his name, but that joint stock corporation otherwise was not associated with Mr. Goodyear who had died decades before incorporation).

The concept of bankruptcy and bankruptcy law was one that had not been adopted in many countries until the 1900's. Even with bankruptcy provisions what debts, and how they were restructured, left many entrepreneurs saddled with obligations for ventures that proved less than successful.

One of the most important business structures ever invented by Western governments was the limited liability joint stock corporation. As business enterprises grew larger during the 1800s they also needed more capital, and they needed long-term continuity of ownership that other forms of business organizations proved less capable of providing. Railroads, mines, canals and roads were large scale, highly capital intensive ventures that were difficult to organize under existing business structures.

Many cultures and governments that did not adopt the joint stock corporation as a form of business entity fell behind in economic development and growth. Asia and the Middle East, for example, were two areas that were slow to adopt this new type of legal entity.

As the US and Europe industrialized the capital raised under the limited liability joint stock corporation structure gave these firms and these countries an advantage. Shareholders, as partial owners of the enterprises, in some cases became quite wealthy if the venture was an economic success.

Today equities issued by joint stock corporations are a major source of wealth in the US and globally. Studies have indicated that in the US the top 10% of households by wealth own 80% percent of the value represented by outstanding public shares.

Early forms of business organization

The sole proprietorship that was common in the 1800s had severe drawbacks for use in developing any type of business that required economies of scale. The ability of an individual to raise capital was limited. The life of the venture depended on the owner, and with an average lifespan of 45 years this proved problematic. It was difficult to achieve any scale of enterprise without the help of the government, which generally required special contacts or privilege to obtain.

The business partnership was an alternative structure to the sole proprietorship. The partnership was easy to form. Each partner could act for the partnership. A contract made by any partner was binding on all, and each partner was liable for all partnership debts. These attributes could also be a drawback if the partners did not coordinate activities closely or had different strategic goals. As enterprise size increased, control, coordination, liability, and direction became an issue.

One of the problems with the business partnership was that if one partner died or terminated the relationship the whole partnership terminated. An accounting would be required for partnership assets so they could be allocated to all of the partners at termination, with valuation based on book value. A further limitation was that a partner could not sell or transfer their interest without the approval of other partners.

Problems with the partnership included individual liability of the partners, the lack of enterprise continuity, the lack of centralized decision-making, the fact that any partner could act for the partnership enterprise, and the need for numerous partners in an enterprise if it needed to raise significant levels of capital. Dissolution on the death of a partner also crated disputes as to valuations, and interrupted to availability of capital for use on corporate projects.

<u>Case study: Isaac Merritt Singer - Singer Sewing Machine Company</u>

The following discussion is from an article entitled "Locking in Capital: What Corporate Law Achieved for Business Organizers in the Nineteenth Century" by Margaret M. Blair, UCLA Law Review, December, 2003 (*51 UCLA L. Rev. 387):*

> . . . [T]he story of the rise of the Singer Sewing Machine Company provides an example in which the corporate form was used - not to raise financial capital, nor to achieve the benefits of limited liability - but to lock in existing capital, to provide a mechanism for settling any subsequent disputes among the leading participants in the firm, and ultimately to support the development of a massive marketing organization. The I. M. Singer & Company began in 1851, when Isaac Merritt Singer got his first patent on a machine that would make a continuous series of stitches.
>
> Singer was not an engineer or mechanic by training - indeed, he had spent most of his early adulthood attempting to be an actor. But while he never achieved much success as an actor, during one spell of unemployment, in 1839, he had taken a job as a laborer in Chicago, apparently working on construction of the Lockport and Illinois Canal. In that capacity, he invented and patented a machine for drilling rock. While he continued for many years to attempt to make a living as an actor, his knack for mechanical invention proved more remunerative, and in 1844 he began working on a machine to carve wooden type for printers. For the next six years, Singer formed brief partnerships with a few investors, and borrowed money wherever he could to work on his type-carving machine (which he had completed and patented by 1849) and to attempt to sell it.
>
> Despite his efforts, there seemed to be little interest in Singer's type-carving machine. So Singer, encouraged by his partners at the time, Orson Phelps, who owned a machine shop in Boston where Singer was working on his design, and George Zeiber, who was providing financing for the type-carving effort, shifted his attention to the idea of developing a sewing machine. In 1845, Elias Howe had invented a machine that would sew stitches, but it was clumsy and difficult to use for a number of reasons. By 1850, a number of other inventors had also developed crude sewing machines, but all were clumsy and none worked particularly well. Phelps showed Singer one of the early machines and urged him to attempt to improve upon it. Singer immediately envisioned a machine in which a straight needle carrying one thread moved up and down, and a shuttle working below the needle would move a second thread back and forth. Zeiber put up additional financial capital, and by late 1850, Singer had a working model, the basic design of which would eventually

become the basis for all modern sewing machines. The partnership agreement among the three men called for the resulting patent to be the "equal property of the three partners." . .

In 1851, Singer again took on another partner, this time one who was his equal in shrewdness, and who could stand up to his bullying behavior. Edward Clark was a lawyer, and was granted a one-third share in the business in exchange for supplying legal services, especially in the ongoing patent battles. Clark pushed through Singer's patent application, and once granted, arranged for the rights to the patent to be divided equally between himself and Singer. Clark and Singer then bought out Zeiber's interest in the firm for $ 6000. Clark and Singer became the only partners in I. M. Singer & Company.

During the next ten years, the market for sewing machines grew, slowly at first. Building a market for sewing machines was difficult because the machines represented a very substantial investment relative to typical levels of household wealth and income. Moreover the product was at first seen as something that had no purpose other than to save time for women, women were viewed as unlikely to be able to operate such a mechanical device, and in any case, "respectable" women would probably not choose to use a complex mechanical device. Moreover, the legal feuding among holders of various sewing machine patents became increasingly intense, costing I. M. Singer & Company most of their profits, and virtually all of Clark's time and energies during the years from 1851 to 1856.

In the fall of that year, the three leading manufacturers, together with Elias Howe, who among them held dozens of patents on sewing machines and their various improvements - including all of the most important patents - agreed to form the first "patent pool." The parties contributed all of their relevant patents to a single pool, and agreed that, for a fee of $ 15 per sewing machine sold, they could all use each others' patents. Part of this fee was set aside for fighting future patent infringement battles against any other manufacturers who might attempt to use the devices covered by patents in the pool, and the rest would be divided among the three manufacturing firms in the pool. n246 An additional fee of $ 5 per machine was to go to Howe, who held that key early patent and had won a series of court battles defending his claim.

With the patent wars settled, I. M. Singer & Company manufactured and sold 2564 machines in 1856, and by 1860, production and sales reached 13,000 machines. Singer and Clark were rapidly becoming wealthy, and though still organized as a conventional partnership, were beginning to build a substantial manufacturing, distribution, and sales organization. They had established sales offices in many major U.S. cities, as well as in Paris, Glasgow, and Rio de Janeiro, and were even thinking about establishing manufacturing operations overseas. Singer and Clark, though they didn't particularly like or trust each other, had managed to establish a reasonably successful working relationship.

Meanwhile, however, Singer was thoroughly enjoying his new wealth, and was living an unusually flamboyant life. In 1860, a series of incidents brought public attention to the fact that Singer had domestic relationships with, and numerous children by, four different women, only one of whom he was legally married to. To escape the wrath of the woman with whom he had been living the longest and the most openly, who called herself Mrs. Isaac Singer, and with whom he had fathered eight children, Singer fled to England. There he promptly became involved with a fifth woman, whom he eventually did marry once his divorce from his first wife was finalized.

Apart from the unseemliness and notoriety of this lifestyle (which might have had a negative impact on the ability of the firm to market Singer machines to "respectable" households) why did this matter to Clark? The problem, Clark could easily foresee, was that if the firm were still organized as a partnership at the point at which Singer died, the valuable business that the two of them had built over the previous years would be destroyed in the legal battles over claims to Singer's estate.n252 Singer's heirs, however many of them there might be, would all have some legal claim to some share of the business, and it would probably require years of court battles to establish who was to get what. Clark feared that without liquidating much of the firm, he would not be able to come up with enough cash to prevent catastrophe by buying out Singer's share from the heirs. Clark realized that the solution to this problem was to incorporate the business and to ease Singer out of active management. By the 1860s, the corporate form was becoming much more widely used by manufacturing firms, so Clark would understand that once incorporated, the business assets would no longer be the joint property of Clark and Singer, but would belong to the corporation.

Equity shares would be issued to Clark and Singer, each of which would provide a pro rata claim on any distributions from the business. But any such distribution would be at the discretion of a board of directors of the company, and could not be compelled by either former partner, nor by the executor of the estate, nor would it likely be compelled by any court of law handling the proceedings. Heirs could be given equity shares in the business out of Singer's estate without disturbing or breaking up the assets and governance structure of the business.

By this time, the company had no need to raise additional capital, as it was generating cash faster than it could reinvest it. Nor were there any particular concerns about limiting the liability of shareholders: The firm had little or no debt (except perhaps small amounts of trade credit from materials suppliers), and class action lawsuits for fingers injured by sewing machine thread guides and presser feet had not yet been invented. The only function that incorporation served was to ensure that the substantial organizational capital that had been accumulated by the firm could not be torn apart, nor could its reputation be easily destroyed, as a result of the messy personal affairs of one of the partners.

According to Singer's biographer, it took three more years for Clark to get Singer to agree to incorporation of the business, but in August of 1863, I. M. Singer & Company was dissolved, and the business was reorganized as the Singer Manufacturing Company.n255 The firm by then had twenty-two patents and capital assets of $ 550,000. Within four years after incorporation, it had established manufacturing and sales operations overseas, becoming the first American firm to produce and market extensively in Europe.

According to Chandler, Singer was also the first manufacturing company to establish a sales force of its own salaried employees, rather than relying on sales agents. The Singer organization that developed in the 1860s and 1870s included retail branch offices in virtually every community in the United States of at least 5000 in population (as well as in many communities in Europe and South America). Each branch office included, at a minimum, a general salesman, an instructor (often a female employee hired to teach other women how to use the machines), a mechanic (to assure customers that machines could be promptly repaired if they broke down), and a bookkeeper. . . .

The agreement they ultimately reached was that Singer and Clark would each take 40 percent of the shares of the new company in exchange for their interests in the partnership, with the rest to be subscribed to by four senior officers of the firm (who were each required to buy 175 shares at $ 200 per share), and twelve other employees of the company who were offered the opportunity to buy shares. A young manager, Mr. Inslee Hopper, was [*448] named president.n261 The initial board of trustees would include Singer, Clark, Hopper, George Ross McKenzie (a trusted agent of the firm for a number of years), William Proctor, and Alexander Sterling.

While Singer retired from active involvement in the company after that, Clark did not, becoming president after Singer died in 1875. Chandler gives Clark and McKenzie credit for building an integrated organizational structure that became a model for many other large manufacturing and distribution companies in the late nineteenth and early twentieth centuries. . . . [end of case]

Limited Liability Joint Stock Corporation

In the early 1800s limited liability joint stock corporations needed legislative approval to be formed, and usually consisted of monopolies formed to serve the public purpose such as those building canals or roads. By the 1830s some states adopted general incorporation statutes, and by the mid-1850's quite a few states recognized the corporate form of organization.

The corporation was deemed to be a separate and distinct entity from its individual owners. The corporate enterprise could have unlimited duration. Shareholders would have limited liability but no managerial authority. Shares could be sold in small quantities to any number of investors, and when one shareholder died unlike partnerships the corporation endured.

Shares in the corporation could be traded 'making a market' if demand existed. Unlike a partnership shares were valued at market value, not book value. Shares might be locked in due to limited liquidity, which is a problem with closely held corporations even today.

Under early corporate law provisions the corporation could make a 'capital call' on shareholders. Early mining firms used this for mine extensions or new shafts or to purchase new equipment. There was no limit on the extent of call or use, profitability was not required. Some speculators used capital calls to pay dividends, which generally increased share prices. Management could even operate a non-profitable enterprise using the capital call monies to operate.

Samuel Clements noted that Nevada's Comstock lode mining stocks many times were not profitable from an operations standpoint, but after capital calls became very attractive in appearance to eastern investors due to their dividend payout.

A party who did not make the company's capital call might forfeit the stock and ownership rights. Management could use a capital call in an attempt to increase ownership interest if they knew certain shareholders had liquidity issues.

Due to share volatility and periodic panics, recessions, and depressions, stocks were generally considered to be a highly speculative investment. Only over the last 50 years have stocks been considered a reasonable asset class for individuals to invest in.

Studies: Risk, Fear, Evaluation & Learned Behavior

As we noted in our introductory comments to this course, a basic understanding of the basic legal and regulatory framework surrounding the energy sector is essential to make informed decisions with regard to the allocation of capital for mineral development. In addition to this knowledge of the regulatory structure, we are fortunate that over the last few years a number of studies have been conducted addressing the decision making process involved in capital allocation or investment.

We reviewed some of these studies relating to the role of emotions, and the impact of skill and luck, in the decision making process. Some of the studies focused on the investor decision making process, and some of the studies dealt with general behavioral and decision making tendencies. After reviewing the studies the following is our summary of the major research findings and how they impact the decision making process:

- **Risk, Fear & Courage** - Due to the 'hardwiring' of the human brain, a result of evolution, we place a great deal of value in avoiding danger and loss, reducing risk and fear, and averting harm.[22] Financial losses are processed in the same area of the brain that responds to mortal danger, therefor risk makes many individuals and investors uncomfortable.[23] Many decision makers consciously or unconsciously seek to avoid risks, or attempt to substantially reduce exposure to risk.

  When making decisions scientists find that in day to day activities most individuals rely on a fast, intuitive, and emotional based decision making process. This thought process exposes them to the risk-adverse hardwired biases. But the studies tend to find an odd fact – successful investors generally have bold personalities and have generally made bold decisions to assume selective risks that most individuals would have avoided.

  Timid individuals are generally more likely to consider themselves unlucky according to the surveys. Hence the studies conclude that to obtain any type of substantial gain on an investment or wealth, risks must be incurred – at the very least an individual will need to put capital, time, or effort at risk.

- **Decision Making** - The risk adverse nature of the brain's hardwiring creates common errors in the investment decision making process. One reason investors avoid risk is that losses are very painful - three times as painful as gains are pleasurable according to behavioral scientists.[24] As a result many investors will subconsciously focus on reducing the risk of loss versus maximizing expected returns. Over time their risk adverse investments decisions tend to substantially underperform the markets or their benchmark.

  Further, studies indicate that due to the risk adverse predisposition of most individuals many investors will hesitate to sell an investment at a loss due to the psychological pain. Studies of investor behavior in actual brokerage records indicate investors are much more likely to sell appreciated stocks than stocks that have lost value – a behavioral means to avoid the pain of

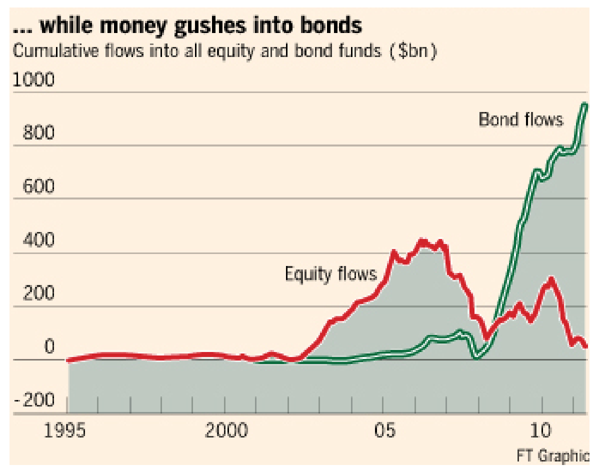
[22] Kahneman, Thinking, Fast and Slow (2012) discusses the common methods most individuals use to process information.
[23] Zweig, Your Money & Your Brain (2007) is a good overview of recent studies dealing with the biology associated with investment decision making and the implications for investors.
[24] DiSalva, What Makes Your Brain Happy and Why You Should Do The Opposite (2012)

loss.[25] Likewise business decision makers commonly avoid the ‘sunk cost’ concept and ‘throw good money after bad’ when an investment concept turns sour.

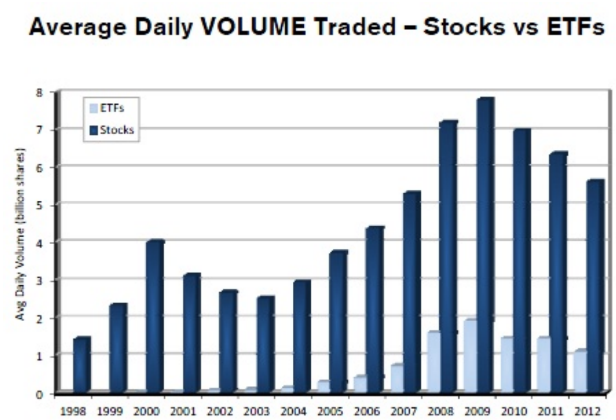
Studies also indicate that for most of the population there is an inverse relationship between taking financial risks and measures of analytical intelligence such as a SAT or IQ scores.[26] This fact would predict that professionals (doctors, lawyers, accountants, and engineers) may be especially predisposed to risk avoidance.

- **<u>Learned Behavior From Investment Gains or Losses</u>** - While losses are painful, studies have also indicated that immediate or unexpected investment gains are very powerful behavioral events due to brain chemistry and the reward process – and they can be addictive, like nicotine. “The neural activity of someone whose investments are making money is indistinguishable from that of someone who was high on cocaine for morphine” according to a recent study.[27]

This can severely distort the decision making process. These immediate gains tend to produce a ‘day trader’ or ‘gambler’ type mentality, which ultimately is not ideal for building wealth since few short term traders or gamblers make substantial returns over the longer term. Excess investment optimism and expectation of immediate investment gain favor decisions based on emotions, with little detailed analysis, situations where the risks incurred are not commensurate with the potential reward.



Unexpected or immediate investment gains cause the brain to released dopamine according to scientists, a substance that produces a natural high or state of general euphoria.[28] While the pain associated with losses is a powerful tool to ‘teach’ the brain to avoid similar investment mistakes in the future, the euphoria from the dopamine released when investment gains are realized is likewise a powerful tool which teaches the brain to accept risk and to repeat the decisions that created the gain.



The dopamine-induced general euphoria arising from investment gains can be used to explain the technology bubble, the real estate bubble, and the statistical fact that stocks that have increased in price over the last year are much more likely to continue to increase in price over the next twelve months compared to the market (a trait referred to as ‘relative strength’, ‘persistence’, or ‘momentum’).

[25] Zweig, <u>Your Money & Your Brain</u>

[26] Thomas J. Stanley, <u>The Millionaire Mind</u>, Andrews McMell Publishing (2000) is a good overview of the behavioral attributes of financially successful individuals.

[27] Zweig, <u>Your Money & Your Brain</u>

[28] Kuhar, <u>The Addicted Brain: Why We Abuse Drugs, Alcohol, and Nicotine</u> (2012) discusses the impact of dopamine on behavior.

The fact that the relative strength characteristic is seen in historical data across markets and across time periods adds weight to the premise this is a biologically-based behavioral response.

The intense pain associated with investment losses can explain why investors have fled the stock market into the ‘safe’ bond market since 2008 (money flow chart courtesy Financial Times). It can also explain the decline of trading volume at retail brokerages, and the meager equity mutual fund inflows (volume chart courtesy Josh Brown).

Generally, when an asset class falls out of favor due to a severe correction, it tends to stay out of favor for some time as investors seek to avoid a re-occurrence of a painful loss.[29] This finding was confirmed by a survey of 1,000 U.S. households last year in which Prudential Financial found that 44% of those surveyed said they would ‘never’ invest in the stock market - ever.

- **Data Evaluation** – Successful investors tend to make decisions only after conducting extensive due diligence, weighing the risks and rewards associated with various opportunities, according to the studies.[30] One example is investor Charles Munger, who notes that one must look at dozens of opportunities in detail before finding one where the risk is commensurate with the reward.[31] But in an age of databases and worldwide connectivity no-one can know all the facts needed to make a decision – and the future cannot be predicted.

  The human brain has evolved in a manner where it has not been programmed to deal with all the data it currently receives. Studies have shown that when an individual is given too much data the decision making process becomes very difficult. An example is a batter deciding in a fraction of a second whether to swing at a pitch in a baseball game – it is difficult to determine the type of pitch, where it will go, if it will be a strike, and if you can hit it based on the data input to the brain from the visual cues. A party can overanalyze a complex situation - and end up 'frozen' - unable to make a decision or perform (picture a batter taking a third strike).

  Where an individual is subject to data overload, a common occurrence when dealing with investments, after conducting a basic analysis of the risks and reward studies indicate the individual is best to go with their experience (gained from 'defined practice') and their emotions (educated 'hunches') in making the decision. This means an individual will by necessity rely on past experience - and this takes time to develop.

  A number of the studies and books note that experienced decision makers, when faced with difficult and complex decisions, form 'hunches' as to whether an investment will work or not. They may not be able to verbalize why they like (or dislike) the opportunity. Lucky people, and good investors, tend to conduct substantial due diligence - but in the end also rely on their 'gut instinct' developed from past experience.

- **Risk Management** - A study of wealthy households in *The Millionaire Mind*[32] discussed the findings of the role of risk and decision making for these successful individuals. While they in

[29] Coxe, The New Reality of Wall Street (2004)
[30] Lehrer, How We Decide (2010) discusses how the brain processes information and makes decisions.
[31] Lowe, Damn Right (2000) is a good overview of strategies used by Charles Munger and Warren Buffett to generate excess returns
[32] Thomas J. Stanley, The Millionaire Mind

general had a fear of risk, the study found ‘a clear and significant correlation between willingness to take financial risk and net worth’.

The risks assumed by these wealthy individuals were not wild gambles. The authors found that successful investors and business owners understood the relationship between risk and return. They conducted due diligence and tend to invest in those areas where risks are minimized and returns are substantial. In addition, the wealthy households ‘do many things to increase the odds of winning’.[33]

Wealthy households have addressed the hardwired behavioral tendency to avoid risk and have modified this tendency by engaging in strategies to reduce the fear of loss. Although the studies and advice vary, a number of common strategies are suggested for investors wishing to reduce risks while maintaining the opportunity for gains:

Invest in a profitable business niche – One of Warren Buffett’s main investment maxims is to invest in a ‘good investment boat’ – that is one with good margins and growth potential.[34] Good management will not be able to counter a stagnant, low growth, low margin, highly competitive business in a way that substantially increases the value of the enterprise. A good business niche, and healthy growth and margins, are very important. Ideally the business should be scalable, that is can be grown without substantial capital infusions.

Utilize the ‘Kelly Formula’ – The Kelly Formula is a methodology to maximize investment gains by only investing when the probabilities are heavily weighted in your favor.[35] Avoiding fast, emotional-based decisions, successful investors take the time to analyze the odds and probabilities – to the extent they can be ascertained.[36] Once a good business niche has been identified, and the Kelly Formula is used to identify investment opportunities, the most successful investors tend to concentrate their bets to maximize expected returns.

When problems arise cut your losses - The strategy of selling quickly when problems arise assists in preserving capital. Selling quickly when the investment premise changes, or unforeseen business difficulties arise, is a difficult decision to make because of the fear of investment loss, regret, and the recognition that one has mis-analyzed the opportunity.[37] Good investors expect small losses as part of the investment business and accept the risks. Large gains should over time exceed the small losses.

- **The Role of Luck** – In *The Millionaire Mind* the researchers found that most millionaires surveyed did not attribute their success to luck – but surprisingly four of ten of the very wealthy millionaire households said luck was important or very important to the degree of their success. Their definition of luck was not taking a blind gamble, but a bet that the probabilities would reward them for the risks they incurred. Successful and lucky individuals are very good at examining situations and determining the odds of success given the potential risks and rewards.

[33] Stanley, Ibid.; See also Gunther, The Zurich Axioms (2005), discusses twelve strategies used by successful investors to manage investment risk
[34] Cunningham, The Essays of Warren Buffett: Lessons for Corporate America, Second Edition (2008)
[35] Poundstone, Fortune's Formula: The Untold Story of the Scientific Betting System That Beat the Casinos and Wall Street (2006)
[36] Rosenthal, Struck By Lightning: The Curious World of Probabilities (2006)
[37] Gunther, The Zurich Axioms (2005)

There are numerous books and studies published on the topic of luck and on the question of why some individuals or investors seem to be lucky and others are not. The findings tend to be diverse, and are difficult to summarize. Many draw the conclusion that behavioral attributes can increase the probability that one becomes 'lucky'.

Some of the major themes we found from studies on the topic of luck include the following:[38]

Recognize opportunity - Bits of potential luck drift past most individuals constantly, but only the observant and bold take advantage of them. In *The Millionaire Mind* the researchers note their studies show wealthy households could see an investment opportunity that others ignored or otherwise did not recognize. One author stated it as follows: "Lucky people create, notice, and act upon chance opportunities where others do not."

Take reasonable risks – "Successful people, by being open to opportunity and exposing themselves to chance, take new directions that prove more fruitful than anyone could have predicted" according to one author of a book on luck.[39] Lucky people are bold, not rash, when exploiting opportunities provided the probabilities are in their favor.[40]

Persistence & positive attitude – Lucky individuals tend to work hard at developing their skills and are persistent in the face of failure. Bad luck is treated as a learning experience. Mistakes are analyzed in detail then discarded, and where appropriate new strategies are adopted. Many individuals who are lucky have a belief that they are subject to good fortune, which helps them persist during difficult times.

Hunches and experience – Numerous decision making experiences allow individuals to compile a set of subconscious facts and decision making rules which can be used to evaluate an investment or business idea. The lucky also work at developing their skills, some of which are very intricate but overlooked and difficult to explain to the unskilled (try explaining or teaching a new driver how to use a manual transmission).

Utilize contacts – Many lucky individuals have developed many professional and personal contacts. These contacts have created opportunities – many times unexpectedly. The lucky are curious and observant and engage those around them. These contacts also have skill sets that the lucky tend to utilize.

[38] See: Smith, Luck: What it Means and Why it Matters (2012); Gunther, The Luck Factor: Why Some People are Luckier Than Others (1977); Fitzgerald, Lucky You (2004); Myers, How to Make Luck (1999); Wiseman, The Luck Factor (2003).
[39] Smith, Luck: What it Means and Why it Matters
[40] In Damn Right, Charles Munger's biography, he claims a handful of bold decisions made when the odds were in their favor explains much of the excess returns he and Warren Buffett generated over the last five decades.

Studies: Decision Making Talent – Innate or Developed?

Why are Charlie Munger and Warren Buffett such gifted investors? Or Phil Mickelson such a talented golfer? Or some energy managers so effective in making difficult decisions involving highly complex exploration and development issues?

The energy sector is a fascinating case study of decision making. Managers are constantly evaluating new technology, field data from exploration activities and drilling, production data, product prices and markets. One of the main questions that is presented is when do you have enough data to make a reasonable decision? Additional data can always be obtained, usually at additional cost (shooting seismic, for instance).

Delays in decision making might lower the risks but might also mean lower returns (rule of capture, cost of leases and drilling increases as it becomes clear from new data the extent of the recoverable reserves, etc.). Regulatory and legal decisions on the need and timing of permits, and potential liabilities, are part of the decision making mix.

Over the last thirty years numerous academic studies have been conducted to identify the behavioral and physical attributes of highly skilled individuals. Researchers looked for traits, habits or characteristics that explained their outstanding talents.

We are, of course, most interested in what factors create a good energy sector manager or a gifted investor like Buffett or Munger. While the findings varied slightly, overall they reached similar conclusions on what was required to develop a unique expertise and world class skill set.

One of the consistent findings of the studies was that over the last century we have seen a rapidly rising standard as to what compromises expert performance regardless of the field of expertise. This trend is attributed to better learning and training methods, better nutrition, more accumulated knowledge, access to computers and databases, and the globalization of world markets.[41] The fact that the cost of communication and data is approaching zero with internet connectivity also plays a role.

Expert Performance. The studies found that experts in general did not exhibit any special skill or ability outside of the domain of their expertise, even if the activity was similar in nature. While third parties may consider experts more intelligent due to their skills, the studies indicate that generally this is not the case.

Surprisingly, even among athletes, changes in the brain and decision making from training were most profound in explaining outstanding performance. In the decision making process experts can recall and extract more information after a brief exposure to the facts, and the decision is generally faster and less deliberate than when made by lessor skilled individuals. The familiarity with the facts also reduces the cognitive demands, allowing the expert to focus on the most important data.[42]

Time to Develop Skills. Most world class performers, and investors for that matter, store vast amounts of task specific knowledge acquired during the learning process. They process this

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[41] Geoffrey Colvin, *Talent is Overrated: What Really Separates World Class Performers from Everyone Else* (2010) is an excellent overview of recent studies on this topic

[42] David Shenk, *The Genius in all of Us: Why Everything you've Been Told About Genetics, Talent, and IQ is Wrong* (2010) is another excellent overview of recent studies on this topic

knowledge much quicker than non-experts, and quickly ascertain patterns of information helpful to enhancing their performance.

The majority of outstanding performers require at least 10 years to develop their skill. In some cases, such as for scientists, investors, and writers, the research indicated the period needed was generally closer to two decades.[43]

Attributes Deemed Unimportant. When searching for attributes correlated with outstanding performance the studies also were able to identify attributes that had little relationship with performance. Many of the studies indicate the following attributes had little statistical significance in predicting exceptional performance:

- Genetic pre-disposition, or natural ability, is generally not a prerequisite for expert performance
- Where familiar environments require the analysis of substantial amounts of data intelligence or IQ levels made little difference in predicting performance
- Inherent memory skills had little correlation with success, although many experts developed specialized abilities with practice to remember domain-specific information that enhanced their performance
- The connection between general intelligence and outstanding performance in specific areas is weak – however in general higher IQ individuals tend to be more successful overall, especially when dealing with unfamiliar tasks

Attributes Deemed Significant: Defined Practice. The studies indicate that for most cognitive and motor skills – whether the activity involved sports, chess, music, investments, business management or other domains – 'defined practice' was the trait most highly correlated with outstanding performance.

Deliberate or defined practice is defined as an activity which was repeated numerous times, usually individually without coworkers or teammates, with feedback, that was mentally challenging, that normally is not enjoyable due to the time, focus, and effort required. The impact of defined practice was cumulative, so it is difficult to become an outstanding performer if the skill is not developed starting early in life.

A case study is Warren Buffett. He developed his investment expertise early working for his stockbroker father, buying his first stock when he was eleven.[44] He had several newspaper routes growing up and other small business ventures he invested and he had a burning desire to generate income and build wealth.

Working for his father Buffett attempted to develop investment expertise as a 'chartist' or technical analyst but found that he could not generate consistent returns. He also attempted to time the market, again with limited success.[45] Only after graduate school (and classes from Ben Graham at

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[43] In *Talent is Overrated* they note it took Warren Buffett 20 years to develop his expertise in investments, starting at a young age when he worked for his stockbroker father.

[44] *Talent is Overrated*, pp 34-35. Buffett's first stock was Cities Service, an energy company headquartered in Oklahoma.

[45] John Maynard Keynes was also a market timer initially, then changed his investment style to a value-based methodology which was much more successful (see May, 2012 LSGI Advisors Report, page 12).

Columbia) did he discover an investment methodology that was effective – long term value based investing, focusing on undervalued microcap firms that were mispriced by the market. Before he began delivering world-class investment performance it took Buffett two decades of extremely hard work and trial and error experience to develop his unique investment skillset.

Attributes Improved. The performance studies found that defined practice results in a marked improvement of the following attributes:

1. An individual perceives more from the data they observe
2. They remember more from the data they review
3. They need less data to draw a conclusion (due to experience)
4. They observe data that most others ignore
5. They look further ahead in devising a strategy to deal with the inputs, and
6. They have a sense of intuition as to what strategies might prove most effective. [46]

Multiplier Effect. Defined practice also tends to create what researchers called the "multiplier effect". They found a small advantage in one area of expertise could spark a series of events that produces much larger advantages. The skillset is multiplied, and the individual develops a strong intrinsic motivation to improve, practice, and learn.

For example Buffett had a small advantage working for his stockbroker father learning about investments – but that was multiplied when he decided to enhance his skillset by working on Wall Street and studying investments at Columbia under Professor Graham.

Summary. According to the studies outstanding skillsets do not originate from superior general abilities; it comes from specific skills that have been developed in a particular way over a long period of time.

While few will endure the amount of defined practice needed to develop world class abilities, an individual who understands how expertise is developed can significantly improve their own abilities.

[46] Anders Ericsson, T*he Road To Excellence: The Acquisition of Expert Performance in the Arts and Sciences, Sports, and Games The Road to Excellence*, (1996); *The Cambridge Handbook of Expertise and Expert Performance* (2006)

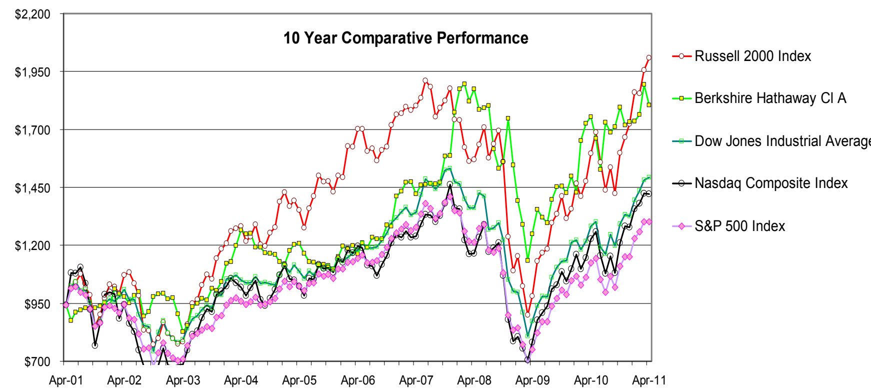
Has Warren Buffett Lost His Midas Touch?

Presented to the Michigan Tech Applied Portfolio Management Program
Houghton, Michigan - April 8, 2011

Warren Buffett is widely regarded as one of the most successful investors in the world. He ranks as one of the world's wealthiest people and is commonly referred to as the "Oracle" or the "Sage" of Omaha or as the "Legendary Investor" or "The Master" due to his investment expertise.

Noted for his adherence to a 'value' based investing philosophy he started managing money in the late 1950's, eventually acquiring control of Berkshire Hathaway (BRKA). He now serves as the Chairman and CEO of Berkshire and is the primary shareholder. Some consider him the best stock investor ever – and thousands attend his annual shareholder meeting to listen to his investment commentary.

Underperforming the Russell 2000. Many of Mr. Buffett's early investors became quite wealthy as the company's stock grossly outperformed the market indexes – but over the last ten years the excess returns on Berkshire Hathaway stock have been much more modest. In fact, *over the last ten years Berkshire Hathaway stock has underperformed the Russell 2000 small cap index*!



In theory an investor in an exchange traded fund which tracked the Russell 2000 index would have had better returns than an investor in Berkshire stock! While he still outperformed the Dow Jones and Nasdaq and S&P 500 indexes the outperformance by Mr. Buffett's investment vehicle was much smaller than it has been historically.

As one young fan exclaimed to a player involved in the Chicago Black Sox baseball scandal almost a century ago: 'Say it ain't so Joe'.

Has the Babe Ruth of investing struck out? The relative underperformance of Mr. Buffett's Berkshire Hathaway share price over the last decade – not a short time frame – raises the academic question: Has Warren Buffett lost his Midas touch? To answer that question we have to examine what he has done to generate excess returns historically – and his strategy for success.

Wealthy Educators: Ms. Anderson & The Othmers. In September, 2007, the George School, a preparatory school in Bucks County, Pennsylvania, received a $128 million donation from Barbara Anderson, an alumna of the high school. The administrators of the private, 500-student institution set on a leafy 240-acre campus were stunned.

Ms. Anderson, who now lives in Fresno, California, is a retired kindergarten teacher. Her parents were well educated but not considered wealthy. At 75, and diagnosed with Alzheimer's, she wanted to make the gift to the school for the fine education she received and the work ethic the school encouraged.

Separately, living quiet, unpretentious lives Dr. and Ms. Othmer – he was a professor of chemical engineering at Polytechnic University in Brooklyn and she was a former grade school teacher - died in the late 1990's. They had no children. When the Othmers died, friends were shocked to learn that their estate was worth close to $800 million – to say nothing of colleagues at Polytechnic University when they learned of their $175 million gift to the institution.

What is the connection between the Othmers and Ms. Anderson? How did these teachers acquire so much wealth?

In Ms. Anderson's case, her father happened to be a finance professor at Columbia University. He became well known in academic circles for the textbook he co-authored with another professor entitled "Security Analysis". His name was David L. Dodd. The co-author was a professor named Benjamin Graham. The textbook sales generated a good profit, but did not make either wealthy.

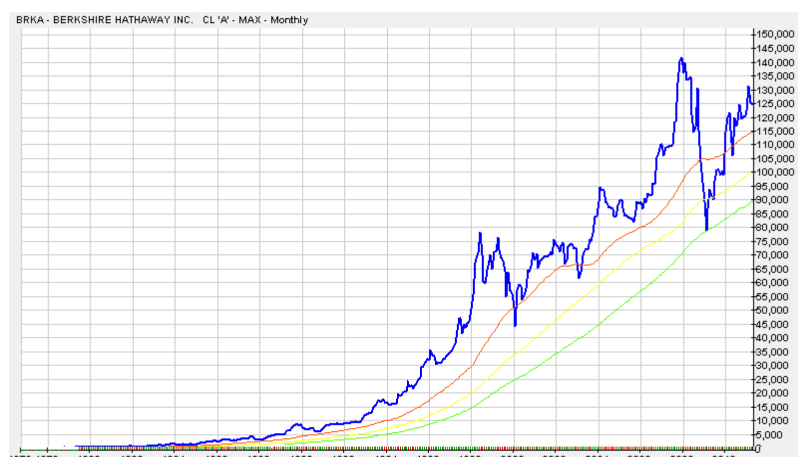
A prospective student who had been rejected from Harvard's MBA program supposedly wrote to Dr. Dodd in 1950: "I thought you were dead, but now that I know that you're alive, I'd like to come study with you." That student was admitted to Columbia, eventually graduating.

Dodd invested for himself and his daughter in a private investment partnership managed by his young student. The student was Warren Buffett. The investors were eventually given the option of liquidating their investment when the partnership dissolved – or taking Berkshire Hathaway shares priced in the open market under $50 per share. Dodd elected to take the shares.

The Othmers, like many long term investors, invested their money into small, well managed, undervalued companies. Like the Dodds, the Othmers had an additional benefit: in the early 1960's they each invested $25,000 in a private investment partnership run by Warren Buffett.

The Othmers received thousands of shares of Berkshire Hathaway at $46 a share when Mr. Buffet dissolved his partnership. Today those shares trade around $125,000 a share. Mrs. Othmer's shares were worth $578 million on her death; her husband's, sold on his death when the price was lower, were worth $210 million.

A graphical representation of the Othmer's investment in Mr. Buffett's Berkshire Hathaway is set out in the chart at right.



Common thread. The common thread for both the Othmers and Dodds was Warren Buffett - arguably one of the best investors of all time. Mr. Buffett managed a private investment partnership from 1957 until roughly 1969. When he shut down the partnerships investors could either 'cash out' or roll over their investment into Berkshire Hathaway. Over a 13 year period Buffett outperformed the market by an average 21.8% before his costs, fees, and expenses. Those who cashed out did very well. Those that rolled their investment over into Berkshire Hathaway stock did incredibly well. [47]

Buffett's Rules for Investment Success

A summary of the investment strategies utilized by Warren Buffett were published by a law professor at Cardozo University. Entitled "The Essays of Warren Buffett: Lessons for Corporate America" it is a compilation of Buffett's annual reports and other communications. Some of Buffett's investment strategies are as follows:

1. **Buy a Good "Business Boat"** - Buffett points out the importance of choosing a company situated in a growing and profitable industry. He identifies his largest investment mistake - buying the small company his firm was named after (Berkshire Hathaway) - not because the company was flawed, but because the industry it was in (textiles) was so unattractive. The company was cheap by most valuation metrics, but there was a good reason.

The textile industry provided very meager returns for Berkshire. No matter how well managed the company was it would always have subnormal returns. The textile industry was a commodity business, competitors had facilities located overseas that were low cost producers, and substantial excess capacity existed worldwide. Buffett notes "a good managerial record (measured by economic returns) is far more a function of what business boat you get into than it is of how effectively you row . . . Should you find yourself in a chronically leaking boat, energy devoted to changing vessels is likely to be more productive than energy devoted to patching leaks."

2. **Compound Returns by Deferring Taxes** - One reason that investors in Berkshire stock did so well was that their investment was compounded and their capital gains taxes were never realized. "Tax-paying investors will realize a far, far greater sum from a single investment that compounds internally at a given rate than from a succession of investments compounding at the same rate. But I suspect many Berkshire shareholders figured that out long ago" according to Buffett.

3. **Concentration of Investments** - Professor Cunningham notes that "contrary to modern finance theory, Buffett's investment knitting does not prescribe diversification. It may even call for concentration . . . a strategy of financial and mental concentration may reduce risk by raising both the intensity of an investor's thinking about a business and the comfort level he must have with its fundamental characteristics before buying it." Other articles have noted the tendency of Buffett to concentrate his investments, and claim that this is part of his success. If nothing else, concentration allows an investor to follow a company much more closely – which allows them to better judge when a stock is undervalued.

4. **Good Business Judgment, Mis-valuation, & Small Companies** - Buffett subscribes to the theory that the market is not always efficient, and that at certain times companies will be grossly undervalued or overvalued. The market allows an astute investor to buy positions in companies well below intrinsic values. In the long term, such value will be recognized.

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[47] Buffett started his first private investment partnership in 1957. He convinced a number of Omaha individuals to invest $25,000 each. Buffett put in $100 of his own money, appointed himself general partner and began to purchase small undervalued stocks. His goal was to beat the Dow Jones Industrial Average by an average of 10% a year. When he dissolved the partnership in 1969 Buffett's investments had ballooned at a compound rate of 30.4% annually, compared to just 8.6% annually for the Dow. The return on Buffett's initial $100 investment would certainly be described as "incredible". Mr. Buffett is currently Chief Executive Officer of Berkshire Hathaway (NYSE symbol: BRKA).

"An investor will succeed by coupling good business judgment with an ability to insulate his thoughts and behavior from the super-contagious emotions that swirl about the marketplace . . . The speed at which a business's success is recognized is not that important as long as the company's intrinsic value is increasing at a satisfactory rate - in fact, delayed recognition can be an advantage: It may give us the chance to buy more of a good thing at a bargain price."

Few people realize that during the period Buffett managed his partnership he focused on small, illiquid, microcap firms. Such companies were more likely to be mis-valued, and more likely to contribute to the growth of shareholder value.

5. **Small Asset Base** - Due to the size of the funds Berkshire now manages Buffett recognizes that the return he will obtain from his investments will be lower than when he was managing much smaller sums. Using analogies to the growth of bacteria, he notes that growth from a small base can continue at a much faster pace for much longer than from a large base. The larger sums now being managed limit the size of companies Berkshire can invest in - using a concentrated investment approach meaningful investments cannot be made in small and micro-cap companies.

Munger's Rules for Investment Success

Charles Munger, Vice-Chair of Berkshire Hathaway and long time Buffett partner in the investment world, is also an incredibly talented investor. An attorney by trade Munger began investing in real estate then founded a small investment partnership, Wheeler, Munger & Company. Mr. Munger actively managed this investment partnership from 1962 to 1975, then played a key role in building Berkshire Hathaway, and provided a significant influence on Buffett's investment theory and strategy. Over a 14 year period Munger outperformed the market by 17.9% per year before his costs, fees, and expenses.

Janet Lowe, author of a book on him entitled "Damn Right!", sets out several themes explain Munger's incredible success generating excess returns and accumulating wealth:

1. **Live Below Your Means** - Munger notes that it is very important to consistently underspend your income, especially when starting a career, investing the excess funds wisely. The most difficult part of building wealth is "accumulating the first $100,000 from a standing start, with no seed money" according to Munger. Making the first million is the next big hurdle.

2. **Understand Your Risk Tolerance** - Every investor has to know the level of risk that they can comfortably assume. Since losses are inevitable - and the book discusses numerous mistakes made by both Munger and Buffett - an investor must adopt a strategy that fits their risk profile. Since recent behavioral finance studies indicate that losses are three times as painful as gains for most investors, many investors may want to adopt a relatively conservative strategy.

3. **Research Opportunities** - Investors must be able to process a massive amount of information effectively, and must learn to evaluate the risks and rewards of potential investments. Business magazines are a great resource for evaluating trends, and Munger notes that "I don't think you can get to be a really good investor . . . without doing a massive amount of reading."

4. **Invest for the Long Term in Small Companies** - Volatility has not been a major concern of Munger, provided the long term odds of success are in his favor. In fact, volatility can allow an investor to accumulate positions in a viable enterprise at prices below intrinsic value. He tended to focus on very small companies that were not well known or followed by Wall Street and tended to be illiquid. A long term focus is essential when ignoring the volatility of markets and individual stocks, and can provide impressive gains that tend to compound over time.

Both Munger and Buffett ignore beta - the measure professional investors use to gage volatility and hence "risk" - preferring to focus instead on the risk/reward relationship of the business over the longer term. "Volatility over time will take care of itself" according to Munger, provided favorable odds exist that the business will grow.

5. **Mutual Funds Are No Substitute** - Americans are oversold on the benefit they receive from money managers, especially mutual fund managers, and "that bothers Munger enormously." Transaction costs, taxes, and fees can significantly reduce total returns. Munger advocates buying index funds, or alternatively buying high quality stocks that are not overvalued and holding for the long term.

6. **Patience, Coupled With Decisive Action** - Excellent investment opportunities are not common. Investors should continually search and evaluate opportunities. Utmost patience is required, until one is found that has extremely favorable odds of success. Munger was an expert at applying the Kelley formula to investment decisions. "People underrate the importance of a few simple big ideas" according to Munger. Extreme decisiveness, once the commitment is made, dramatically improves financial results over a lifetime.

7. **Tax Planning** - Taxes and tax planning play a major role in wealth accumulation. As a lawyer drawing an income Munger was subject to relatively high income tax rates, significantly above what he paid on capital gains, which reduces the ability to build wealth. The recognition of any capital gains on investments many times can be delayed or offset by investment losses, allowing the investment to compound at an accelerated rate.

8. **Love the Process** - Because investors must initially be willing to live below their means, have the skills to conduct a massive amount of due diligence, exhibit patience, read voraciously, manage risk effectively, and make decisive actions when the odds are in their favor, an investor must love the evaluation and investment process since it is not without a massive amount of work.

9. **Pay a Reasonable Price** - While value is important, investors should buy good businesses that are in sectors that exhibit favorable business characteristics. Management can only do so much with a company in a declining industry. Good businesses will grow in value over time.

10. **Choose Good Partners** - Every investor relies on the advice of others in making investment decisions - whether those are investment advisors, brokers, newsletters, or business partners. Munger was fortunate to have selected some of the best partners available to assist in evaluating investment issues. Successful investors will have top quality investment partners.

Common Investment Strategies of Two 'Super-Investors'

Several common themes emerge when examining the strategies of Mr. Munger and Mr. Buffett. Common elements of their strategies to generate excess returns include the fact that they both:

(1) focused on very small publicly traded companies,
(2) ran concentrated portfolios,
(3) looked for companies with niche markets,
(4) focused on the longer term,
(5) were not afraid to buy illiquid stocks,
(6) bought firms with growth potential,
(7) looked for the ability to generate attractive margins,
(8) bought their positions at reasonable valuations,
(9) managed a limited amount of assets (so they could take advantage of the small company sector),
(10) tolerated above-average portfolio volatility,
(11) bought firms that they felt they understood,
(12) purchased only after conducting extensive due diligence,
(13) were not concerned at a lack of Wall Street coverage or interest.

General Lessons for Investors

When we examine Mr. Buffett's and Munger's historical performance and strategies several lessons are apparent:

- An investment manager that can outperform the market has an incredible impact on total long term returns
- Strategies that have a high probability of outperforming the market are extremely valuable to investors with a long term time horizon
- Time is one of an investor's most valuable assets
- Even small differences in annual returns can have enormous longer term impact on total returns due to compounding [48]
- You don't have to be a Harvard MBA to be a successful money manager

Investment Success Alters Buffett's Investment Strategy

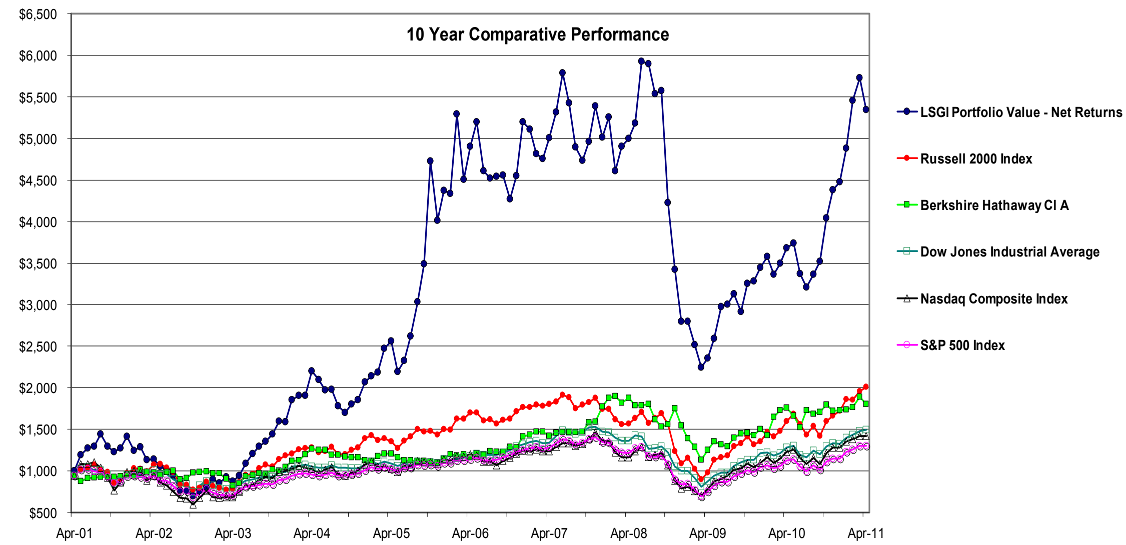
The fact that Berkshire stock has underperformed historical growth rates and the Russell 2000 index should come as no surprise. In fact Mr. Buffett has warned repeatedly that the performance of Berkshire stock will never approach what it was two decades ago.

He notes that due to the size of his company he can no longer target the small, illiquid, volatile, undervalued, un-noticed firms with solid margins and a good market niche that would have a significant impact on overall company performance. These small companies were a major factor

[48] Had Mr. & Mrs. Othmer invested in the S&P 500 index instead of with Mr. Buffett they would have an account worth roughly $2.7 million (a return of around 11.8% a year) – very impressive. But not anywhere near the almost $800 million obtained with Mr. Buffett (annual returns of around 24.1%)

contributing to Berkshire's growth. Investment success forced Mr. Buffett to alter his investment strategy – with predicable results.

Numerous academic studies indicate that the factors of success listed above, utilized by both Buffett and Munger, have historically generated excess returns for investors. While Berkshire Hathaway and Mr. Buffett's portfolio are much too large for them to continue to use these time-proven tools of success we don't have that problem. In fact, for a number of reasons, we think this is one of the best times ever for individual investors with sound investment strategies and a passion for research.



The amount of financial data available on demand for investors has never been greater – and if the Buffett/Munger time proven strategies enumerated above are successfully implemented the returns can be impressive – well above the major market averages. But the strategy and implementation must be well thought out and executed.

Investment implications. Like the early prospectors in Michigan's Copper Country who found great challenges and difficulties, and in some cases great wealth[49], the small company sector is rich with opportunities for those who dare to prospect therein. Small companies are, in every sense of the word, the investor's Mother Lode. Market inefficiencies are the tools with which to mine.

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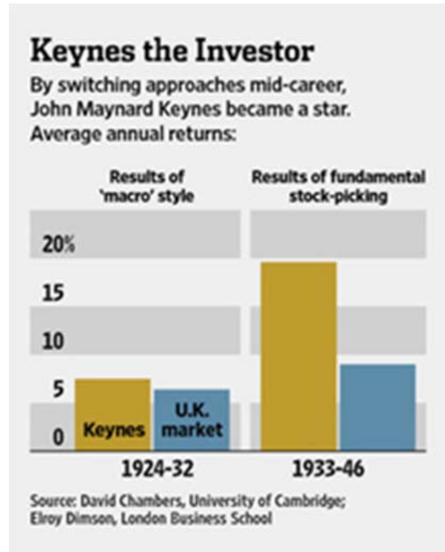
49 Shareholders in successful mining ventures in the Keweenaw Peninsula could do quite well. Henry Hobart, school teacher at Clifton (a ghost town located near Eagle River), wrote on February 3, 1864 that: "Many have made a fortune by investing their money in stock. This is an easy way but it also an easy way to lose a fortune. But it is said that a man must run some risk if he wishes to make anything." Hobart references the wealth created by investing in mining stocks numerous times in his diary – and indicates that he purchased shares in the North Cliff mine during this time period. See: Hobart, "Copper Country Journal, The Dairy of a Schoolmaster, 1863-1864" (republished 1991).

John Maynard Keynes: 'Stellar' Investment Manager

John Maynard Keynes is known as an economist, but he also was one of the first active portfolio managers – and his returns were stunning for his time. He managed part of the endowment of King's College in Cambridge. Over Keynes twenty-two year investment career (1924-1946) his Chest Fund accounts returned 15.21% compared to the U.K. market's return of 8.08% - an annual outperformance of 7.13%. Over time this excess return generated incredible gains for his investors compared to the indexes.



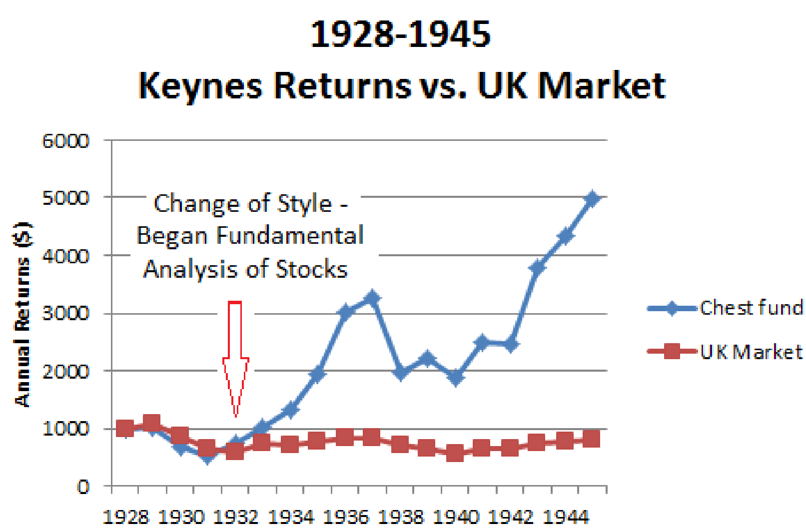
To determine the strategy Keynes utilized to generate these excess returns David Chambers, a professor at Cambridge Business School, and Elroy Dimson, a professor at the London Business School, examined more than two decades of trading data.

The professors found that Keynes actually utilized two market strategies over his investment career. In the first eight years he tried to time the market to generate excess returns. In the second period he actively selected individual stocks he found attractive.

In the first period he barely beat the market – but in the second period he substantially outperformed the major stock indexes over an extended time period. (Chart courtesy Wall Street Journal)

The study concluded Keynes excess returns in the second (later) period were a result of the following strategies – many which were later adopted by super-investors Warren Buffett and Charlie Munger:

1. Keynes ran a highly concentrated portfolio. During certain periods he would concentrate 50% or more of his portfolio in his favorite five holdings.



2. Keynes focused on small companies that were relatively illiquid and ignored by investors

3. Keynes invested in firms that were undervalued and mispriced by the market

4. Keynes invested for the longer-term, holding many of those companies for five years or more during which time investors discovered the underlying value of the enterprise

5. Keynes only invested in sectors that he deemed attractive, and avoided those he did not

6. Keynes was not bound by the concept that he had to diversify his portfolio to limit risk. He only invested in companies and sectors where he felt the risk/reward relationship was tilted heavily in his favor.

7. Keynes was not afraid to invest in an asset class that was not highly favored by knowledgeable investors of his time

The coefficient of determination ('r squared') between Keynes' Chest Fund and the UK market was essentially zero – meaning that the movements in the UK market did not statistically explain the movements of the Chest Fund (a fact that supports Keynes active management style and stock picking ability – the excess returns were due to his skill and not market trends).

Note that the Chest Fund was 2.4 times as volatile as the UK market over the 1928-45 time frame. If volatility is a measure of risk as some academics argue, Chest Fund investors were rewarded for those higher risks by the excess returns they earned. While Keynes excess returns were substantial, they fall short of the excess returns generated a few decades later by Warren Buffett and Charlie Munger.

What is striking about the study is that both Munger and Buffett adopted many of the strategies used by Keynes – investing in a concentrated portfolio of undervalued small companies and holding for long term appreciation. Like Keynes, Buffett and Munger only invested in sectors they found attractive and did not diversify to limit risk. All three mangers generated substantial excess returns over time.

Lessons From Legendary Investors

It has been said that Shelby Davis was one of the best investors the public has never heard of—unlike the well known Warren Buffett and Charlie Munger of Berkshire Hathaway fame.

Davis grew an investment of $50,000 in 1947 to roughly $900 million on his death in 1994. Like Buffett he favored stocks in the insurance industry. Davis had little money management experience before starting his portfolio and active management activities (actually, stocks were considered a very risky asset class in the 1940's, not suitable for most individuals or institutions).

A book on his life and investment philosophy entitled "The Davis Dynasty" was published a few years ago. Davis acknowledged he was lucky to start his investment activity when the market was at the start of a long bull run, making it easier to perform well.

Investment Strategy. Like Buffett and Munger, Davis focused on very small companies due to the mis-valuations and inefficiencies present in that sector of the market. He also concentrated his portfolio on a very small subset of firms he considered excellent businesses (around 30 companies). For the most part these firms had little analyst or institutional coverage. Davis was one of the few that followed many of the companies in his portfolio.

Not a trader, Davis held the stocks for the longer term and benefited as the firms grew in size and profitability. He also invested in a sector he knew well (the insurance sector) - a sector that generally was not in favor. He conducted extensive due diligence on the firms he bought, and was also very thrifty keeping his investment related expenses at a minimum. Davis also lived well below his means and was know for his frugal nature. These strategies also served Warren Buffett and Charlie Munger well.

Volatility & Investment Returns. An interesting fact about the Davis portfolio is that in the bear market of 1973 to 1975 his $50 million portfolio shrunk to $20 million—a loss of roughly 60%. But after 1975 the $20 million in his portfolio grew very quickly—the stocks of small firms performed very well coming out of the economic decline, as has generally been the case historically. Stock prices of larger firms recovered after 1975, but not to the extent of the small, illiquid firms.

Davis bought very aggressively as firms became grossly undervalued in 1975 and the economy began to recover from the steep recession. He noted that "a down market lets you buy more share in great companies at favorable prices. If you know what you're doing you'll make most of your money from these periods. You just won't realize it until much later." Over the next 19 years the $20 million portfolio grew to $900 million.

Charles Munger, Co-Chairman of Berkshire Hathaway, also was running an actively managed portfolio in the 1973-1975 time frame. In a book on his investing activities entitled "Damn Right" it indicated he also ran a concentrated portfolio of small, illiquid firms, investing for the longer term in companies not covered by analysts or followed by institutions.

Like Davis, Munger's portfolio was down in the 1973-75 recession—by roughly 60% from the portfolio highs seen in 1972. Like the Davis portfolio the Munger portfolio recovered after the recession quite well as the small company, inefficient and illiquid sector of the market, outperformed as the economy began to grow – and his portfolio gained 73% in 1975.

By the time of the 1973-75 recession Buffett had liquidated his investment partnership. His investors had the option of rolling their money into the stock of Berkshire Hathaway—but even the stock of Berkshire Hathaway fell by 50% during the downturn (keep in mind the company was a microcap at the time).

Lessons of the 1973-1974 Recession. Note several things about the Davis, Buffett, and Munger's experience during the 1973-1975 downturn. First, no matter how good the business prospects of companies in the portfolios, or the quality of management at Berkshire Hathaway, stock prices were depressed with the general market. Like the recent bear market, statistically all the portfolios and stock prices of public companies correlated closely with the general market trend—which was down.

All of their portfolios (or in Buffett's case the stock price of Berkshire Hathaway) were very volatile. All focused on investing in small companies that were illiquid but growing. All the managers ran a concentrated portfolio, with a few stocks they knew well (Buffett of course by this time concentrated all the assets into one company, Berkshire Hathaway, which could buy assets or stocks of other firms).

The portfolios, and Berkshire stock price, declined in value by a substantial amount in the 1973-75 bear market—over 50%, correlating closely with the market. These great stock pickers and portfolio managers and their investors did not avoid the massive bear market. As the economy recovered after 1975 the performance of all the managers was very good—a reflection of their focus on firms in the inefficient small and micro-cap sector of the market.

Economic data indicates the current recession is as severe, if not more so, than the 1973-75 period. Alan Greenspan in recent comments has noted in many respects the current economic downturn is worse than the Great Depression. In our opinion the micro-cap sector is as ignored today as it was back in 1973, and the inefficiencies are just as large.

While the losses have been significant in this downturn, in our opinion opportunities exist for investors that are as attractive as those in 1975. If history repeats small firms, like the ones that Davis, Munger and Buffett focused on, should substantially outperform as the economy begins to recover.

The tools available to find small, attractive firms, are much more powerful than those available to Davis, Munger and Buffett. Buffett and Davis spent hours searching for attractive companies in the S&P stock guides. The factors they found attractive—growth, valuation, size, market niche—can be screened for using computers and electronic databases today.

The pool of small public companies available to invest in is also much larger today than thirty-five years ago, and SEC reporting requirements are in many ways more rigorous resulting in more information available on which to base investment decisions.

Looking Forward. Many investors have not been pleased with the recent performance of their portfolios or the market in general. But if an investor employs the same strategies that served Mr. Davis, Buffett, and Munger so well they may perform nicely going forward, even though the current economy and market conditions may not be as attractive as in previous periods.

Even during the sharp 1973-1975 recession all of these successful investors: (1) focused on very small companies, (2) ran concentrated portfolios, (3) looked for companies with niche markets, (4) focused on the longer term, (5) were not afraid to buy illiquid stocks, (6) looked for firms with growth potential and (7) the ability to generate attractive margins, (8) bought at reasonable valuations, (9) managed a limited amount of assets so they could take advantage of the small company niche, (10) tolerated above-average portfolio volatility, and (11) bought firms that they understood (12) only after conducting extensive due diligence.

Each of these investors outperformed the major market indexes over time.

Fortune’s Formula: A Mathematical System for Maximizing Returns

What does capital allocation and maximizing bandwidth in the transmission of data over phone lines have in common? Uncertainty.

In 1956 a researcher named J. L. Kelly published a paper while working at Bell Labs. The paper sought to solve issues associated with noise over phone lines and maximize bandwidth. Noise was random and unpredictable. Problems associated with data transmission are very similar to issues a gambler or trader faces in determining the optimal amount of money to trade at any given time. The formula Kelly published dealing with data transmission has been adopted in the financial sector, allowing traders to allocate capital to obtain maximum capital appreciation.

With the power of advanced computers mathematicians over the last several decades have enhanced this formula with models attempting to accurately predict the outcome of games of chance. Using these models some of these experts, like MIT Professor Dr. Edward Thorpe, have proven that an individual can increase their chances of success in blackjack and other games of chance.

Elements of a Successful Investment System

According to Dr. Thorpe and other like-minded researchers, an individual should not bet in a game of chance or invest in the market unless they have a statistical advantage. One of the most challenging issues for Dr. Thorpe was finding situations where the individual has an edge. Thorpe noted that many sectors of the stock market are inefficient, and for this reason individuals are more likely to find an edge in the equity markets than in gambling venues.

When an investor finds a situation where they have a statistical edge they should place ‘proportional bets’ based on their analysis of the applicable risks and rewards. When a large positive outcome has a high probability of occurring, the investor should bet (invest) heavily. When the odds are not as heavily tilted in an investors favor they should scale back the size of the bet.

If an individual does not have an advantage or edge in the market they should not invest according to Thorpe. Instead they should place their money in a passive exchange traded fund that tracks the major market indexes, or keep their assets in cash.

Statistics indicate that most professional money managers of public mutual funds underperform the major market averages since their ‘edge’ does not compensate for the cost of their active management activities according to Thorpe. In many cases investors would obtain better returns with index funds.

The "Kelly Formula" and Charles Munger

Using this proportional betting system, sometimes referred to as the ‘Kelly Formula’, academics have shown that an investor should experience exponential portfolio growth, well in excess of the market averages. The downside is the portfolio volatility created by a system utilizing the Kelly Formula will be above average in most cases, in some cases well above average. Keep in mind that the Formula will result in non-linear returns over time, that is the returns should have an exponential type growth curve (see chart of Munger’s Berkshire Hathaway stock price over several decades).

Some well known investment managers have developed similar approaches with regard to investment systems without the mathematical undertone. Charles Munger, Warren Buffett's partner, attributes the most important factor in their joint investment success was the patience to wait for a good investment idea, then to bet heavily on that idea when the odds were stacked in their favor.

The amount of time required to conduct the due diligence to evaluate the hundreds of investment opportunities, and the expected odds of success, is something most investors don't appreciate. Munger and Buffett both found the process of due diligence stimulating. When they found attractive situations where the odds were in their favor they 'bet heavily' according to Mr. Munger.

Volatility

Financial columnist Mark Sellers had an excellent column in the Financial Times discussing the Kelly formula, returns, volatility, and risk:

> ''People say they want to make a lot of money in the stock market but, because of human psychology, very few can handle the volatility that comes with this pursuit. The pain of losing $1, even temporarily, is much greater than the pleasure of making $1.
>
> The book Fortunes Formula details the origins of a formula developed by Bell Labs mathematician John Kelly. His formula allows a gambler to determine the optimal bet size if the gambler can estimate the odds of winning the bet and the pay-off for winning compared with the penalty for losing. The formula can also be modified so that it applies to multiple simultaneous bets – in other words, a stock portfolio.
>
> By studying the Kelly formula, as I have, it becomes apparent that in order to get optimal portfolio returns, an investor has to be willing to endure a lot of volatility. That is because the Kelly formula will have you making large, concentrated bets when you find favorable risk/reward opportunities. And concentration brings volatility.
>
> This is unacceptable to most people because they irrationally equate short-term volatility with risk. So rather than achieving optimal portfolio returns coupled with high volatility, people would rather achieve sub-optimal portfolio returns coupled with low volatility. And that's why few funds stand out from the crowd; they're giving their customers what they want.''

Developing the Investor's 'Edge'

In a recent article in *Kiplinger's Personal Finance* author James Glassman identified one niche where an investor might develop an edge:

Kiplinger's Personal Finance — Your Guide to Making Money Work

<u>So Small - So Profitable</u>
by James K. Glassman

> A quarter-century ago, a young University of Chicago economist named Rolf Banz made a surprising discovery: the smaller a stock's market value, the more profitable the investment.
>
> This is how it works. If you divide the stock universe into ten slices--deciles--by company size, they line up perfectly. The stocks in the first decile (that is, the ones with the largest stock-market valuations) have the lowest average returns.
>
> The ones in the second decile have the second-lowest returns and so on, down to the tenth decile, ***home of the smallest stocks and the highest returns.***
>
> <u>Double the return</u>
>
> ***The figures are eye-popping***. Ibbotson Associates found that between 1926 and 2004, the average return (price increases plus dividends) for the first decile was 11%; for the fifth decile, 15%; and for the tenth, 22%. In other words, ***in a typical year, the smallest stocks return about twice as much as the largest***. . . .
>
> In What Works on Wall Street, author James O'Shaughnessy tested the results of different investing strategies between 1951 and 2003. ***He found that the smallest of the micro caps--those with capitalizations less than $25 million--returned an annualized 28%.***
>
> Slightly larger stocks, with caps between $25 million and $100 million, returned 16%. Meanwhile, the S&P 500 returned only 12%. . . . (emphasis supplied)

In theory, this small company niche could give an investor an ‘edge’ - and allow them to use the Kelly Formula to outperform the market, making proportional bets on highly probable events that have an attractive risk/reward relationships.

In fact both Mr. Munger and Buffett exploited this small company niche early in their investment management career. Many of the firms they included in their portfolios would be classified as microcap stocks. The excess returns that they generated for investors in their portfolios reflect the success of their methodology and the successful application of the Kelly Formula and the related statistical theory.

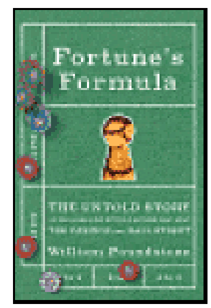
Fortune's Formula:
<u>The Untold Story of the Scientific Betting System That Beat Casinos and Wall Street</u>

A book on the Kelly Formula and its application to gaming and investment decision making has been published recently by William Poundstone. Entitled ‘Fortune’s Formula’ it is an interesting and entertaining read.

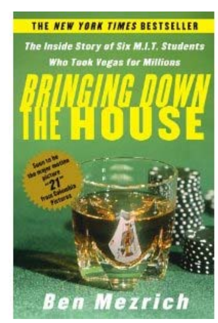
The book chronicles Dr. Thorpe's study of blackjack, roulette, and ultimately the stock market, and his transformation from a mathematics professor into a hedge fund manager. It also provides colorful insight on how the use of information in the gaming and gambling industries has evolved over the decades.

Thorpe's strategy worked in theory as well as practice. His fund outperformed the S&P 500 index by an average of 6.3% per year over a 19 year period and had very consistent positive returns, much like Warren Buffett's early partnerships.

A second book that discusses the application of the Kelly formula is "Bringing Down the House: The Inside Story of Six MIT Students Who Took Vegas for Millions." This book focuses on gambling and risk, but is an entertaining and probably embellished account of the use of the Kelly formula concept to generate gambling returns.



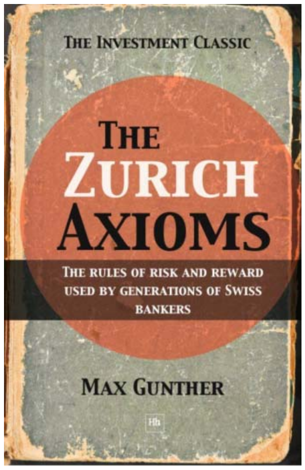
Fortune's Formula: The Untold Story of the Scientific Betting System That Beat Casinos and Wall Street
by William Poundstone
400 pages, Hill and Wang, September 14, 2005
List: $27.00; $17.82 at Amazon.com



Bringing Down the House:
The Inside Story of Six MIT Students Who Took Vegas for Millions
Ben Mezrich
257 pages, San Val (September 2003)
List: $9.00

The Zürich Axioms: A Study of Risk

Max Gunther's *The Zurich Axioms* (Harriman House Publishing 2005) addresses risk management strategies that can be used in the investment decision making process. The risk management strategies can also be used when making career or business decisions.



Gunther notes many individuals seek to avoid all risks in investments and in life's daily activities. But to obtain any type of substantial gain in life, wealth, or personal stature Gunther claims risks must be taken – at the least an individual will need to put capital, time, or effort at risk in an undertaking.

The book sets out a formula, or philosophy, consisting of twelve risk-related elements that should be considered when making important decisions. These twelve elements are labeled the 'Zürich Axioms'.

The goal of the Axioms is to maximize personal wealth, return on investment, and personal satisfaction. Most people don't obtain wealth from low-risk savings strategies. Those individuals who are financially successful have generated their wealth through investment in real estate, stocks, or some other type of enterprise where risk played a major element in the investment decision making process.

The following is a list, and brief discussion, of the Axioms:

Axiom number one: In order to obtain a respectable return, or to maximize one's well-being or career ambitions, an individual must assume a certain level of risk.

> Risk makes many individuals uncomfortable. Many seek to avoid all risk. But successful investors always play for meaningful stakes, assume risks, and resist the allure of diversification.
>
> Diversification has three major flaws: (1) diversification is contrary to the notion one should always play for meaningful stakes, (2) by diversifying a situation is created which gains and losses are likely to cancel each other out, and (3) by diversifying too many investments are involved to closely track, therefore it is difficult to assess the risks and rewards of each.
>
> In summary the first axiom says to put your money at risk. Don't be afraid of getting hurt, especially if you are younger and have time to recover from cyclical downturns. The degree of risk embraced should not be hair-raising. On the other hand the risk incurred must reflect a meaningful investment

Axiom number two: Always take your profit too soon.

> The successful investor recognizes their gains early rather than waiting too long to sell. Markets are cyclical whether dealing in real estate, gold, grains, or stocks, and gains can quickly reverse. An investor should sell and recognize a profit when the investment reaches the expected goal.

The issue of when to sell to recognize a gain is a very difficult one even for expert investors. An investor should set a goal for returns at the start of the venture. When that return is realized in investor should sell. In rare instances the situation may change. Facts may indicate that further upside is possible, in that case an investor may want to re-examine and only sell a portion of the investment.

<u>Axiom number three</u>: When problems arise sell quickly.

This strategy will assist an investor in preserving capital. Selling quickly when difficulties arise is difficult to implement because of the fear of regret, investment loss, and the admission that one has mis-analyzed the opportunity. Good investors expect accept small losses as part of the investment business. Large gains should over time exceed the small losses that are recognized.

<u>Axiom number four</u>: Human behavior, and market behavior, cannot be predicted. Distrust anyone who claims to know the future.

An investor should not build an investment program based on expert forecasts. Disregard those prognostications. Nobody knows what the future holds, therefore it cannot be predicted. Make your own decisions based on the applicable facts.

<u>Axiom number five</u>: Chaos cannot be made orderly by the use of formulas

Because history rarely predicts the future, historical data and trends should be considered suspect when analyzing risk. Complex mathematical formulas of financial behavior have failed numerous times even for very sophisticated investors. An investor should not try to see order where order and predictability does not exist. The focus should be finding a promising investment where the odds are tilted heavily in the investors favor.

<u>Axiom number six</u>: Preserve your mobility and investment options.

An investor should not maintain their investment position due to loyalty to a company or individual. Losses should be cut short regardless. If a better investment comes along an investor should sell and move on. Once losses begin they tend to continue, therefore investor should recognize losses quickly and reinvest the proceeds.

<u>Axiom number seven</u>: Hunches can be trusted if they can be explained.

It is a mistake to ignore hunches altogether, however it is also a mistake to trust them indiscriminately. Through intuition and life experiences people compile a set of subconscious facts and information which may lead them to an investment idea. Trust a hunch only if you can logically explain it

<u>Axiom number eight</u>: Religion, superstition, and astrology have no role in investing.

Relying on religion, superstition, or the occult to provide wise investment decisions, especially with regard to risk management, is not a wise strategy.

Axiom number nine: Beware of excess optimism

You should never make an investment because you are merely optimistic about the future. Investors should be confident with regard to their judgment, and the facts on which their analysis is based.

Axiom number ten: Disregard the majority opinion, it's probably wrong

Many times a majority of investors will draw the wrong conclusion. It is very difficult to take a minority viewpoint with regard to a potential investment in the face of consensus. An investment thesis supported by facts and reasoning is preferable blindly investing with the majority.

Axiom number eleven: If it doesn't pay off the first time forget it

If an investor makes a bad decision they should cut their losses quickly and move on. Very rarely is it a wise decision to revisit the idea at a future date. The investor should never try to save a bad investment by averaging down as a stock price declines.

Axiom number twelve: Don't become entrenched to an inflexible long-range investment plan.

Business and economic conditions change constantly. A party should have the flexibility to sell or to add to a position and should not be locked into an inflexible position. Invest money in ventures that are attractive as they present themselves, and sell or withdraw money from investments as hazards present themselves or investment goals are realized.

Bottom line, the Zurich Axioms set out well reasoned rules with regard to decision making and risk management:

1. Run a concentrated portfolio
2. Keep the odds are in your favor
3. Cut your losses short
4. Let winners run, but sell when they reach fair market value
5. Do your own analysis
6. Beware of excess optimism or pessimism and of expert options
7. Remain flexible and adapt to the investment environment

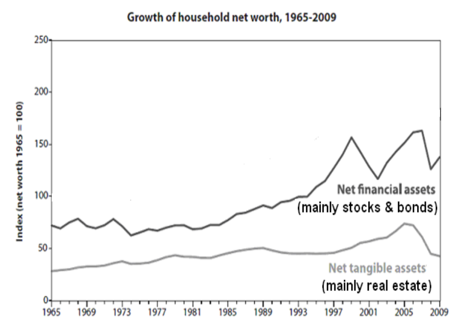
Overall a well written and insightful book n managing risk in the decision making process.

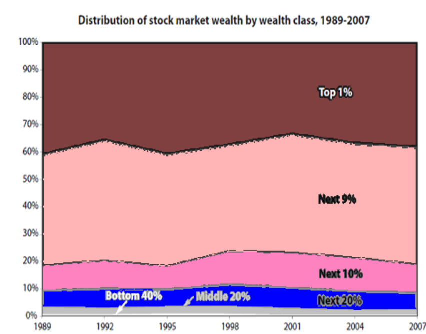
America's Wealth: Economic Trends Benefit Shareholders

The Economic Policy Institute published a study in the spring of 2011 on the effect of the financial crisis on the net worth and wealth of U.S. households. The report concludes that the stock market "by and large is of little of no direct financial importance to the majority of U.S. households."

The study concludes that the stagnant real estate market is severely impacting non-wealthy households. The major asset of most non-wealthy households is residential real estate. Those in the top 10% of households by wealth are doing extremely well comparatively due to their high stock ownership levels and the above average performance of the market. The report contained some interesting findings, including:

- In 2009, approximately one in four U.S. households had zero or negative net worth, up from 18.6% in 2007. For black households the figure was about 40%.





- The median net worth of black households was $2,200 in 2009, the lowest ever recorded. The median among white households was $97,900.
- Roughly 37% of U.S. households have a net worth of less than $12,000
- Even at the 2007 economic peak, half of all U.S. households owned no stocks at all—either directly or indirectly through mutual or retirement funds.
- The wealthiest 1% of U.S. households had net worth that was 225 times greater than the median or typical household's net worth in 2009. This is the highest ratio on record.
- House prices fell 32% from 2006 through the first quarter of 2009. Prices have since rebounded slightly, but 22.5% of households with mortgages have zero or negative equity.
- Because of the housing bust, home equity as a percent of home value fell from 59.5% in the first quarter of 2006 to 36.2% in the fourth quarter of 2009. For the first time on record, the percent of home value that homeowners own outright dropped below 50%—*meaning that banks now own more of the nation's housing stock than people do.*
- The wealthiest 5% of U.S. households own 79.2% of common stocks excluding pensions, and roughly 69.2% of common stocks if you include pensions.
- The top 1% of U.S. households measured by wealth have an average net worth of $13,976,000. The top 5% of U.S. households measured by wealth have an average net worth of $2,734,000
- In 2007 the wealthiest 1% of U.S households owned $4.2 million in stock

With (1) high unemployment, (2) stagnant housing prices, (3) rising energy and (4) food costs, (5) record numbers of long term unemployed, (6) record food stamp issuance, (7) record numbers of homeowners 'underwater' on their mortgages, it will be difficult for the Fed to tighten monetary conditions.

"*The Success Equation*" - The Role of Skill & Luck in Investment Decisions

The U.K. Guardian in January of 2013 reported that a cat won their year-long stock selection contest against investment professionals and students. While the professionals used their decades of investment knowledge and traditional stock-picking methods, the cat selected stocks by throwing his favorite toy mouse on a grid of numbers allocated to different companies.

The stock selection contest illustrates the fact that many activities generate outcomes that are a function of both skill and luck. When analyzing specific results in business, sports, and investing it is often difficult to distinguish what share of the outcome was attributable to skill, and what share of the outcome was attributable to luck.

Skill v luck. Addressing the skill versus luck topic, Michael Mauboussin, the Chief Investment Strategist at Legg Mason Capital Management , recently published a book entitled "*The Success Equation*" (Harvard Business Review Press (2012)). The book examines the various studies on the topic and the implications for investors. His goal was to analyze the interaction between skill and luck and to provide a guide to allow investors to make better decisions.

Focusing on business, sports, and investing, Mauboussin claims that if an activity involves a relatively large portion of luck then short term results will be inconsistent:

> "How well you do in the short run doesn't tell you much about your skill because you can do everything right and still fail or you can do everything wrong and succeed. For activities near the luck side of the continuum a good process is the surest path to success in the long run."

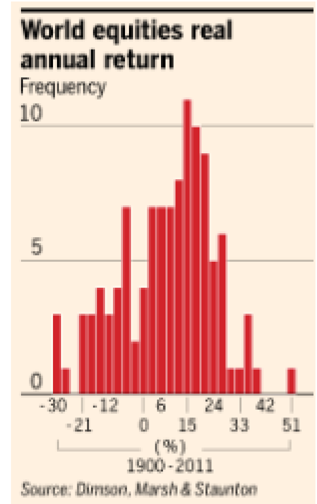
Based on his analysis of historical data he created a skill/risk continuum:

Skill driven outcomes. The outcome of a tennis match, Mauboussin claims, is likely to be decided based on skill due to the number of times the players execute their shots. Tennis players hit hundreds of shots during a match. The player with the more skill generally will prevail since the 'sample size' – the number of times a player gets to exhibit their skills – is relatively high. Statistically this makes it more likely that the result will favor the one with the better skill set, and increases the odds of the more skilled player winning.

Football teams on the other hand only run a few dozen plays during a game. Scoring is controlled by a half-dozen or fewer skilled players, adding more luck to the mix. The 'sample size' is much smaller, therefore it is more likely the more skilled team will lose compared to tennis or chess. Ice hockey players with exceptional skills are on the ice maybe one-third of the game, which leads to outcomes driven by higher degrees of luck than skill according to the studies. Statistical data supports these observations.

Luck driven outcomes. In some activities skill takes a back seat to luck. For example when choosing lottery numbers, playing slot machines, or spinning the roulette wheel luck plays a larger role in the outcome. When luck is involved "it is hard to fail on purpose."

In a recently published a note entitled "Investing Forecasts Omit Key Factor – Luck" Financial Times editor James Mackintosh discusses the large role luck plays in stock selection and market forecasting. He notes one-year stock market returns are difficult to forecast because they are a function of luck, driven by chance over such a short period of time:



> Over such a short [one-year] period, chance dominates, as the extreme variations of returns suggest. Only just over two-thirds of the time was the one-year real return on world shares between minus 12 and plus 23 per cent in the past 112 years (see chart). Statistically, investors should have little confidence in any base for one-year forecasts.

Investing is also an activity that is highly subject to luck according to Mauboussin – at least in the short term. Longer term the investment process, philosophy, and strategy utilized by the manager will determine if excess returns are being added by the manager's skillset:

> Because investing involves so much luck in the short term it would stand to reason that short term success or failure is not a reliable test of skill. But all of us effortlessly find causes for the affects we see and making money appears to be clear evidence that the investment manager knew what he was doing investing is a field where this fallacy is very costly...
>
> Investing is a highly competitive activity which means that randomness plays a large role in determining results. While there is evidence of skill, only a small percentage of investors are skillful and an assessment of their short term results will not reveal their ability....

An investment process and strategy that creates a situation where the odds favor excess returns will, over time, allow investors such as legendary fund manager Bill Miller to outperform the S&P 500 index fifteen years in a row. Mauboussin notes Miller will have periods of underperformance during times of bad luck. While short term results may be impacted by adverse luck, skill can be statistically verified with positive longer term investment results.

In situations where luck plays a relatively large role in the outcome (like investing), Mauboussin claims the decision making process becomes more important than the short term result:

> In other words in a pursuit such as blackjack where luck is very important, you have to adopt a process that you can trust and not worry so much about the outcome of each hand or even each session of play. Your only chance of winning is to adhere to the rules that you know work....

Which led Fortune magazine to summarize the findings of Mauboussin's studies as follows:

> The best investors (and gamblers) focus on good process as much or more than on the good outcome

Reversion to the mean. "Any time luck contributes to outcomes", such as with investing, "you will have reversion to the mean" according to Maubossin. If the results of an activity are solely attributable to skill he notes the statistics should not show mean reversion.

Testing the thesis that investment returns are driven by luck in the short term he looked at the returns of U.S. mutual funds. Market data indicates the correlation between excess returns in a three year period and the next is negative, at least when examining the 1,500 mutual funds in Maubossin's database. He claims this indicates a high degree of luck is involved.

Looking back at the portfolios of some of the great investors like Charles Munger, Edward Thorpe, and even the stock of Berkshire Hathaway back in the 1970's (when the company was a microcap), the performance tended to revert to the mean after a period of underperformance.

Improving skill and luck. Maubossin also discussed improving the decision making process to enhance both skill and luck. He claims accurate feedback is essential no matter where one is positioned on the luck/skill continuum, but the individual needs to be aware if the feedback is primarily a function of luck or skill.

Improving a person's skill or luck means constantly looking for ways to change behavior for the better – "either because what you're doing is wrong, or because there's a slightly better way of doing it. This is true whether you are a basketball player shooting free throws, a doctor performing surgery, and executive making acquisitions, or an investor buying stocks."

Skill can be improved by a process known as deliberate practice. This involves hours of concentrated and dedicated repetition to improve the specific skill. Skill shines through only if there are a sufficient number of repeated outcomes from the activity to weed out bad luck.

For investors, due to the degree of luck involved, the focus should be on improving the investment decision making process and strategy according to Maubossin – essentially the investor refines the investment process to 'make their own luck.'

Studying some of the great investors – Warren Buffett, Charlie Munger, John Maynard Keynes, Edward Thorpe – it appears that all refined the investment process to maximize their returns over time. All of these investors ultimately used some form of the 'Kelly formula', a strategy where an investor who finds a situation where they have an edge places 'proportional bets' based on their analysis of the applicable risks and rewards.

The Kelly formula provides that when a large positive outcome has a high probability of occurring the investor bets (invests) heavily. When the odds are not as heavily tilted in the investor's favor the individual should scale back the size of the investment or not invest at all.

One of the downsides of using the Kelly formula is that it will generate a higher degree of volatility than normal since the investments will tend to be concentrated on those situations there are favorable risk/reward opportunities. Concentration tends to generate portfolio volatility.

While the market has evolved since the days of Keynes, Buffett, Munger and Thorpe, Mauboussin claims that historical market data indicates a focus on improving the investment process in an analogous manner will generate similar long term excess returns in today's markets.

Studies: The Role of Liquidity on Portfolio Returns

Academics have spent decades studying historical market data in a quest to uncover inefficiencies that can be exploited by portfolio managers. If market inefficiencies are discovered the excess returns that might be generated, compounded over time, could be substantial.

Market Inefficiencies - In a recent study of market data Yale University Finance Professor Roger Ibbotson and colleagues noted that inefficiencies have provided managers with three strategies which can be used to generate excess returns. [50] The three strategies, all statistically validated, are as follows:

1. Investing in small and micro capitalization stocks. Small companies are 'known in the long-run to outperform large-cap counterparts' according to Ibbotson. Managers seeking excess returns 'can favor small cap stocks.' [51]

2. Investing in value stocks, those selling at a discount to market valuations. Value stocks tend 'to outperform growth'. Managers seeking excess returns can focus on a value-based investing strategy using this market inefficiency.[52]

3. Investing in stocks that have outperformed the market. These outperforming stocks tend to continue to outperform the market in the future. A manager can therefore use momentum, or relative strength, related strategies in seeking excess returns.[53]

In the study of historical market data Ibbotson examined the three strategies noted above and a fourth factor – liquidity – to determine if liquidity had any impact on portfolio returns.

Liquidity Studies – Liquidity refers to the ease with which an investment (stock, bond, or mutual fund) can be converted into cash without a significant decrease in its price or value. In Ibbotson's study they measured liquidity by the number of a company's shares traded in the last year divided by the number of outstanding shares.

In one study Ibbotson, along with analysts from Morningstar Investment Management, examined actively managed mutual fund performance from February 1995 to December 2009. Using Morningstar data they built a model based on the average liquidity of stocks held in each mutual fund portfolio.

What the researchers found was that regardless of style (value versus growth, small cap versus large cap) "***on average mutual funds that held less liquid stocks significantly outperformed mutual funds that held more liquid stocks***."

Using Morningstar's fund classification, the study found that the largest difference in returns between liquid and illiquid stocks was seen in Morningstar's 'small cap' classification. The less liquid portfolios generated an excess return of 7.1% per year. The study concluded that liquidity – or lack thereof – can be used by active mutual fund managers to generate excess returns (also known as 'alpha').

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[50] 'Liquidity as an Investment Style', Roger Ibbotson, Zhiwu Chen, and Wendy Hu (April 21, 2011)
[51] 'The Relationship Between Return and Market Value of Common Stocks', Rolf Banz (1981)
[52] 'Size and Book-to-market Factor in Earnings and Returns', Eugene Fama and Kenneth French (1995)
[53] 'Returns to buying winners and selling losers: implications for stock market efficiency', Narasimhan Jegadeesh and Sherdan Titman (1993)

In more recent research Ibbotson examined the returns of 3,500 publicly traded U.S. stocks from 1972 to 2009, ranking the stocks by their relative liquidity. He then examined the effect of liquidity on (1) small and microcap portfolios, (2) value stocks, and (3) stocks that have performed well and have high relative strength or momentum.

Ibbotson's research portfolios were rebalanced yearly as stocks became more or less liquid or otherwise moved between size, value, or momentum quadrants. The results of the study*:*

> *Liquidity, or lack thereof, was generally much more effective at predicting returns than the size of the companies in the portfolio, the extent the portfolio could be classified as value or growth, or the extent the stocks in the portfolio displayed elevated momentum.*

The chart below, from the findings, illustrates the point:[54]

Portfolio Classification (1972 - 2010 period)	Low Liquidity Portfolio Average Annual Return	High Liquidity Portfolio Average Annual Return	Illiquidity Excess Returns
Value	20.8%	12.5%	8.3%
Growth	11.9%	3.9%	8.0%
High Momentum	17.4%	11.0%	6.4%
Low Momentum	14.3%	5.6%	8.7%

<u>Microcap Portfolios</u> – Ibbotson found the largest excess returns were generated from illiquid micro-cap stock portfolios. The study notes this asset class attracts very little interest from institutional investors and the shares tend to trade relatively infrequently, therefore the stocks tend to be mis-priced.

The table below illustrates Ibbotson's conclusion that "the liquidity effect is the strongest among micro-cap stocks." These small companies generated a remarkable 18.2% compounded annual return over four decades – and outperformed the more liquid micro-cap stocks by 12.0% per year.[55]

Portfolio Classification (1972 - 2010 period)	Low Liquidity Portfolio Average Annual Return	High Liquidity Portfolio Average Annual Return	Illiquidity Excess Returns
Micro-Cap	18.2%	6.2%	12.0%
Mid-Cap	15.2%	9.6%	5.6%
Large-Cap	12.5%	9.9%	2.6%

<u>Reasons Illiquid Stocks Outperform</u> – Ibbotson and his colleagues set out two reasons to explain why illiquid stocks outperform the market:

- Most investors prize liquidity – they want the ability to sell or buy an investment at any time without moving the price up or down. For that reason illiquid stocks sell at a discount. Those investors willing to buy illiquid stocks have to be compensated for the fact they are acquiring an asset that is not as attractive in the eyes of most investors. The discounted price allows the purchaser, over time, to reap excess returns.

- As demand increases for a stock due to positive corporate developments liquidity (the trading volume) also tends to increase. This increased demand pushes the price of a stock upward,

[54] 'Liquidity as an Investment Style', Roger Ibbotson, Zhiwu Chen, and Wendy Hu (April 21, 2011)
[55] Id.

generating excess returns. The impact of increasing demand is most pronounced in the small and micro cap stock sectors.

Ibbotson concludes that liquidity can be used as a separate and independent factor in the search for stocks that can generate excess returns.

Analyst Coverage & Liquidity – Richard Bernstein of New York-based Bernstein Capital Management examined the relationship between liquidity, analyst coverage, and stock returns in the mid-1990s when he was chief investment strategist for Merrill Lynch & Co.

Bernstein found that for publicly traded firms that received no or scant analyst coverage the lack of readily available information resulted in their stocks being less liquid. The return from these neglected stocks was very robust and mimicked the returns of private equity.

In another recent study researchers examined if the market visibility of public firms had an impact on their valuation. They found the smaller, less visible firms that increased market visibility through investor relation activities increased liquidity and in turn investor returns.[56] Increased analyst coverage had the same effect. The excess returns were most pronounced for those firms will little or no analyst coverage.

A separate study of 'neglected' stocks with no analyst coverage conducted several years earlier found a statistically significant increase in returns once a company obtained an analyst following.[57] The study also found that liquidity increases with increasing analyst coverage.

Venture Capital Type Returns & Liquidity – Another study by a finance professor at the University of Chicago's Booth School of Business [58] examined whether illiquid venture capital investments "behave the same way as publicly-traded securities" and, if so, which kind of securities they most closely resemble.

Compiling data from the 16,613 financing rounds of 7,765 private companies over a thirteen year period, the study found the smallest and most thinly traded Nasdaq stocks have similar volatilities and delivered similar excess returns as venture capital investments. They concluded that illiquid "thinly-traded Nasdaq small stock portfolios are natural candidates for a performance attribution of venture capital investments."

Conclusion - Illiquidity-driven excess returns were consistently generated across styles and strategies according to recent academic studies. Illiquid large cap stocks returned more than liquid large cap stocks. Likewise illiquid growth portfolios returned more than liquid growth portfolios, and illiquid high momentum stocks returned more than liquid high momentum stocks. The value and low momentum styles findings were also similar.

Ibbotson and the related studies conclude that liquidity can play a major role in generating excess returns.

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[56] 'Analyst Interest, Market Visibility, and Stock Returns', Michael Juncg, Franco Wong, Frank Zhang (2012); see also: 'Stock liquidity and investment opportunities: evidence from index additions', Joahn Becker-Blease, Donna Paul (2006)

[57] 'The first analyst coverage of neglected stocks', Cem Demiroglu, Michael Ryngaert (2010)

[58] 'The Risk and Return of Venture Capital', John Cochrane (2004).

Return Persistence & Future Stock Performance: Are Momentum Strategies Effective?

Return persistence – the tendency for stocks to trend in the same direction – has been the topic of a number of academic studies. Many academics, and a number of portfolio managers, adhere to the theory that the market is reasonably efficient. As such, historical stock prices should reflect the sum of public knowledge and should have little predictive value of future stock price movements.

Many value managers adhere to this theory. The fact that some studies show that stocks tend to trend on one direction is therefore puzzling to these researchers.

The latest comprehensive study of this issue by Elroy Dimson, Paul Marsh and Mike Staunton of the London Business School examined 108 years of market data. They looked at markets in 16 different countries to determine if a stock's historical return has any predictive basis when looking at future stock returns.

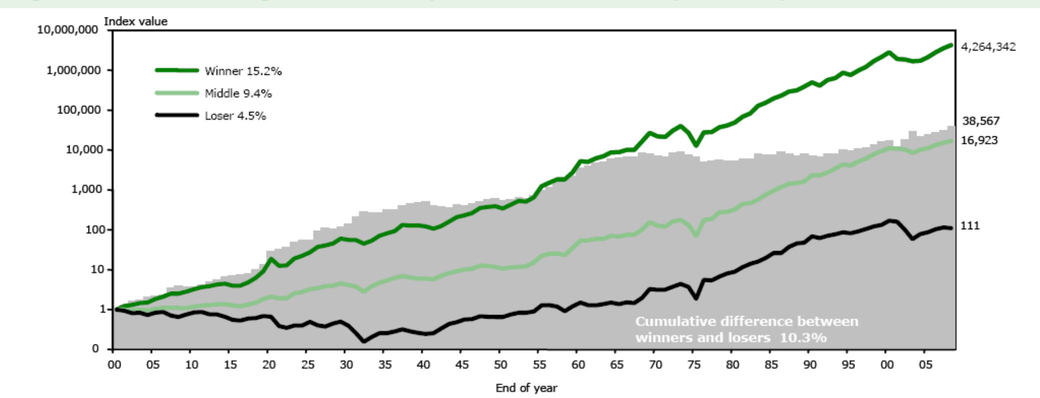
Return Persistence. The study found extensive evidence that was statistically significant, across time periods and markets, that returns are persistent – that is a stock that has performed extremely well in the last year has an increased probability of performing well in the future. Conversely, stocks that have performed poorly have an increased probability of underperforming the market going forward.

Strategies which utilized this persistence, called 'momentum' investing or 'relative strength' or 'trend following' by some, generated excess returns that were striking. Over 108 years, taking the largest stocks, those that performed in the top 20% in the previous year, outperformed those in the bottom 20% by 10.3% *per year* in the U.K. markets. Over time such incremental returns compound – delivering substantial excess returns for long term investors.

Over shorter periods the excess returns of momentum investing remained significant. Over the 1956 to 2007 period the top 20% outperformed the lowest performing 20% by 10.8% per year. The impact of this strategy was present not only in the U.K. markets but every market they studied, including U.S. markets.

Small Cap Sector. Significantly, at least from our standpoint, is that the excess returns attributed to persistence was larger for small cap stocks than large cap stocks. While the best performing U.K. portfolios weighted by company size had an annual return of 18.3% for the 1956-2007 period, using an equally weighted portfolio in which smaller companies had the same impact as larger ones resulted in an annual returns of 25.6% - generating much higher excess returns.

Figure 9: Annual value-weighted momentum portfolio returns for the Top 100 UK equities 1900-2007



This chart shows value-weighted returns for winner and loser portfolios among the Top 100 equities, defined with breakpoints at the 20th and 80th percentiles. The shaded area is the cumulative difference between winners and losers, and measures the value of a long-short WML portfolio. The momentum process followed here is a 12/1/1 strategy. Source: ABN AMRO/LBS Global Investment Returns Yearbook 2008, chart 26

The average market return during these periods was 13.5%. The inefficiencies of the smaller cap sector apparently compounds the momentum effect.

It is also significant that when they studied the best performing 10% of the portfolio in the prior year versus the lowest 10%, the momentum effect was also greater then using the 20% cutoff. The better the previous year performance, the more likely the significant out-performance would continue.

While most active managers do not expressly focus on this issue they either adopt a momentum based strategy or reject the premise by default. Pure value based managers reject the momentum effect, while hedge funds using pure technical analysis buying purely on price action clearly adopt the theory.

The authors conclude that practices like letting winners run and cutting losers short implicitly incorporate a momentum bias in the management style – and the performance of these managers should benefit from such a strategy. The performance improvement should be significant. This is especially true of small cap portfolios according to the data.

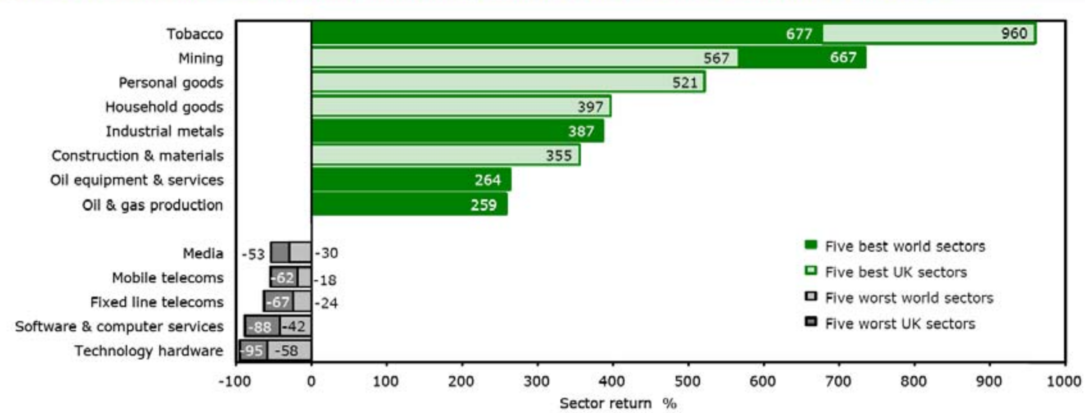
In the 1956 to 2007 period the non-market related difference in return, referred to as 'alpha', was roughly 11 percent per year – an incredibly high value considering the fact that many active managers have difficulty generating positive alpha.

<u>Best Performing Sectors.</u> Another interesting output of the study was the finding that since 2000 certain sectors have performed incredibly well in the global markets.

On a global basis most of these sectors are in the commodity sectors – mining, metals, and energy, as well as the tobacco sector.

One of the authors of the study noted that finding an attractive sector is especially important for an investor, and he claims this explains why some investors like Warren Buffett have done so well. A well performing sector, with a strategy to buy well performing stocks, historically has generated substantial excess returns.

Figure 3: Returns on best and worst performing sectors from mid-March 2000 until end-2007



Source: ABN AMRO/LBS Global Investment Returns Yearbook 2008, Chart 5 and Nomura/FTSE International All-World Review

The researchers conclude: "The momentum effect, both in the UK and globally, has been pervasive and persistent. Though costly to implement on a standalone basis, all investors need to be acutely aware of momentum. Even if they do not set out to exploit it, momentum is likely to be an important determinant of their investment performance."

A Statistical Analysis of Returns from Notable Active Portfolio Managers

Can Excess Returns Be Generated by Active Managers in Contemporary Markets?

Prepared by Hunter Research, Inc. *January 29, 2013*
Dr. Dean Johnson, Principal

Carroll Consulting
P. Patrick Carroll, Principal

Scope

Hunter Research, Inc. has been engaged to review the first 13 years of performance data generated by the investment partnerships or portfolios managed by Warren Buffett, Charles Munger, Walther Schloss, and John Maynard Keynes (the "Active Manager Study Group"). We quantified the extent to which each of these outstanding active portfolio managers generated excess returns for their investors.

We also were engaged to examine the first 13 years of performance data from the LSGI Technology Venture Fund LP, managed by Joseph Dancy (the Dancy LSGI Fund), to determine if it has generated excess returns for investors. Lastly, we compare all managers' excess returns, discuss the market environment over each 13 year period, and identify common management strategies that might explain performance.

LSGI Technology Venture Fund LP managed by Joseph Dancy (the Dancy LSGI Fund) has existed for 13 years. A meaningful comparison can be made of the Dancy LSGI Fund over these years with the first 13 years of performance of some iconic investment funds.

Executive Summary: Findings

After conducting a statistical analysis on the first 13 years of the partnership and portfolio returns of the Active Manager Study Group and the Dancy LSGI Fund, we found the following:

- The Active Manager Study Group and the Dancy LSGI Fund both generated substantial excess returns for their investors over and above what would have been expected from their levels of market risk.

- Warren Buffett and the Buffett Partnerships generated the largest excess returns over their first 13 years with an average annual excess return of 22.51%. The excess returns were statistically significant.

- The Dancy LSGI Fund generated the second largest average annual excess returns over its first 13 years of 18.63%. The excess returns were statistically significant.

- All results from our analysis were statistically significant except for Keynes' results. Keynes invested in European markets, not American markets. The Standard & Poors 500 benchmark used in our regressions is a U.S. benchmark and may not proxy the European markets during the time period in which Keynes was investing. However, we chose to compare his performance (and all other investors) to the S&P 500 in an attempt to make consistent comparisons.

- The level of the excess returns generated by the Dancy LSGI Fund compare favorably with returns of the some of the great investors of the 20th century: Warren Buffett, Charlie Munger, Walter Schloss, and John Maynard Keynes.

Discussion
Each manager's portfolio was subject to substantially different market and economic conditions as much as a century apart. The manager's absolute returns are not necessarily a true indication of the manager's skill due to these varying conditions.

Per industry standards, the investment returns for each manager should be adjusted for the risks incurred and for the performance of the underlying equities market.
The S&P 500 Index was employed as a proxy for the market. It is the most commonly utilized benchmark to evaluate active portfolio managers.

Each of the managers examined were 'active' portfolio managers. Active managers rely on analytical research, forecasts, personal judgment, and experience to make investment decisions. Active managers attempt to generate excess investment returns (referred to as 'alpha') over and above the fair market return.

Alternatively, passive managers attempt to track market performance, or 'index,' their portfolio. Passive managers do not expect to generate excess returns for their investors.

While active management has historically been the most common management style, the investment requirements of pension funds, endowments, and institutional investors coupled with new investment products that track market indices have led many investors to passively index their portfolios. Passive investors attempt to minimize trading costs in order to track the underlying asset class.

Many individuals are now choosing passively managed funds because most active investors do not consistently beat their benchmark and, on average, return less than their benchmark.

So, what are the results for the portfolios of the Active Manager Study Group and the Dancy LSGI Fund? Below is a brief description of the background, philosophy, and performance of each member of the Active Manager Study Group and the Dancy LSGI Fund.

Active Manager Study Group: Warren Buffett - The Buffett Partnerships[59]
Warren Buffett is perhaps the best recognized equity investor in the world. He is a major shareholder and CEO of Berkshire Hathaway (symbol: BRKA), a multinational conglomerate. Berkshire is an insurance company that evolved into an investment company owning positions in many different industries.

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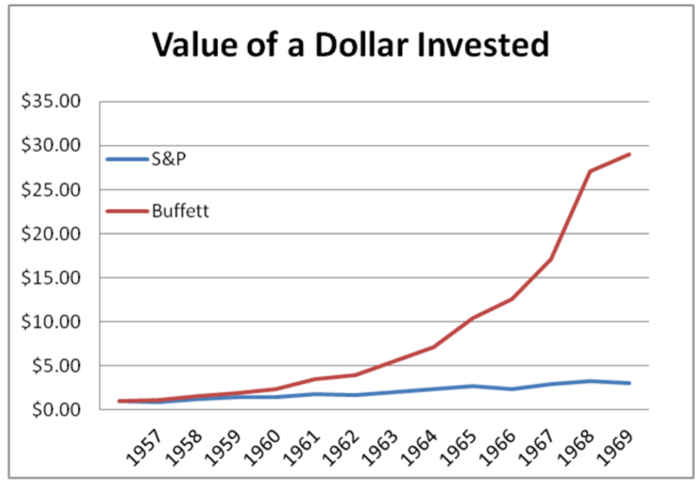
[59] Kilpatrick, Andrew. Of Permanent Value: The Story of Warren Buffett: McGraw-Hill, 2001.
Lowenstein, Roger. Buffett: The Making of an American Capitalist: Broadway, 1995.
Hagstrom, Robert. The Warren Buffett Portfolio: Mastering the Power of the Focus Investment Strategy: John Wiley & Sons, Inc: 1999.
Hagstrom, Robert. The Warren Buffett Way: John Wiley & Sons, Inc: 2005.
Schroeder, Alice. Warren Buffett and the Business of Life: Random House Inc: 2008.
Vick, Timothy. How to Pick Stocks Like Warren Buffett: Profiting from the Bargain Hunting Strategies of the World's Greatest Value Investor: McGraw-Hill: 2001.

According to *Forbes*,[60] Buffett has a net worth of $46 billion (as of September, 2012). He pledges to leave 99% of his wealth to charity. He is currently fighting prostate cancer and other health issues.

Figure 1: Value of $1 (Buffett and S&P 500)



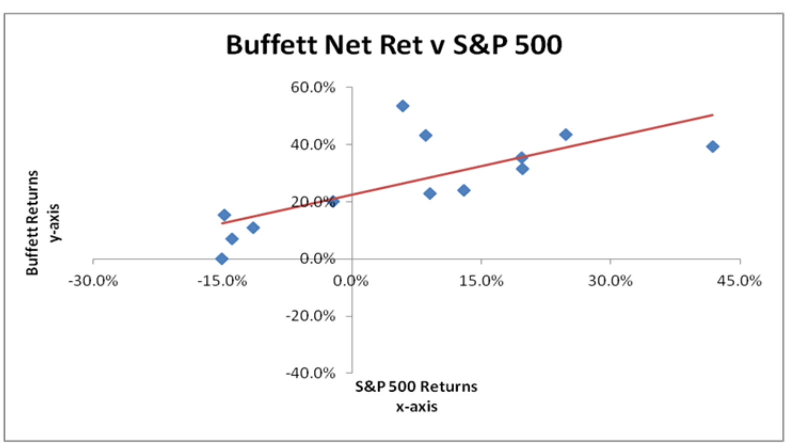
Buffett was born in 1930 in Omaha, Nebraska. He moved as a child with the Buffett family to Washington, D.C. when his father, Howard Buffett, was elected as a U.S. Representative.

As a child, Buffett showed interest in investments and business. He went door-to-door selling gum and Coca-Cola at a significant premium to the purchase price, and delivered newspapers, writing off his bike and watch as business tax deductions. He also spent time in the customer lounge of a regional brokerage observing investment strategies and methodology. As a young teen, he purchased pinball machines and placed them in area barber shops.

Buffett attended the Wharton Business School at the University of Pennsylvania for two years and then transferred to the University of Nebraska-Lincoln to finish his degree in business administration. After obtaining his undergraduate degree, Buffett applied to Harvard's business school, but his application was rejected. He went on to study at Columbia Business School under professors Benjamin Graham and David Dodd. Dr. Graham was an economist who developed the concept of value investing, making a distinction between investing and speculation. Buffett graduated from Columbia with a Master of Science in Economics.

Buffett went to work for Dr. Graham as a security analyst in 1954. Buffett developed an investment strategy similar to Graham's which used financial metrics to identify companies whose intrinsic values are underpriced by the stock market.

Figure 2: Buffett Regression



Buffett believed that Graham's method of using quantitative screening criteria to identify attractive companies was too strict and did not take into account important qualitative data that could cause some stocks to substantially increase in value. However, Buffett still utilized Graham's value-based philosophy for the foundation of the strategy in his own partnerships.

In 1957, Graham retired. Buffett began investing as a major partner in several economically distressed businesses. He

[60] http://www.forbes.com/profile/warren-buffett/

found it difficult to actively restructure small firms with issues like layoffs, acrimony, cost restructuring, and adverse impact on small towns.

Because of Buffett's aversion to taking an active role in management, he learned to delegate authority to his management team, and still today considers it very important to be comfortable with management's skills. He continues to be active in business.

Buffett's Market Conditions

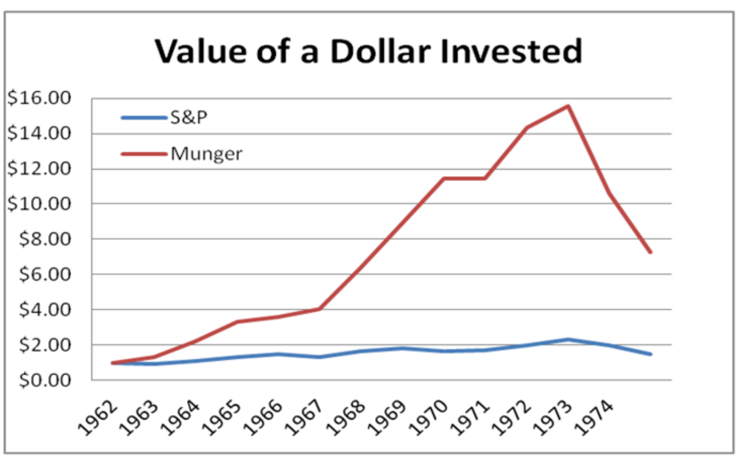
During the first 13 years of Buffett's partnership, the market experienced the second strongest results for any manager evaluated. As seen in Figure 1, one dollar invested in the S&P 500 grew to $3.04. The S&P 500 return was positive during 8 of the 13 years – or 61.5% of the time. The S&P 500 increased by double digits in 7 of the 8 years.

In the 5 years of the Buffett Partnership where the S&P 500 decreased in value, it declined in value by double digits in only 2 of those years. The era in which Buffett first operated, the 1950s and 1960s, was a growth era. This era was favorable for the growth of small businesses like the companies in which Buffett invested. Buffett, like the others in the Active Management Group, operated before Regulation Fair Disclosure, which could have provided our Active Manager Study Group an advantage compared to today's investors.

Active Manager Study Group: Charles Munger - Wheeler, Munger Partnership[61]

Mr. Munger is Vice-Chair of Berkshire Hathaway and a long time Buffett partner in the investment world. Munger, like Buffett, was born in Omaha, Nebraska, but a few years earlier, in 1924.[62] Munger studied mathematics at the University of Michigan. After college, he joined the U.S. Army Corps as a meteorologist. Charles then attended Harvard Law School and graduated in 1948 with a Jurist Doctor *magna cum laude*.

Figure 3: Value of $1 (Munger and S&P 500)



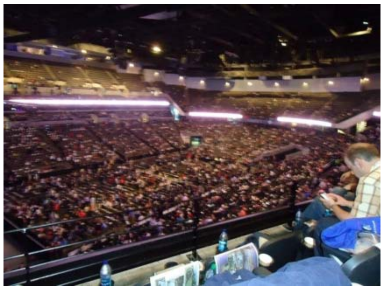
Munger became a real estate attorney at Munger, Tolles & Olson LLP, but later stopped practicing law to focus on investment management. He invested in real estate development. He was a founding partner of the investment firm Wheeler, Munger, & Company with a seat on the Pacific Coast Stock Exchange.

The firm performed quite well until severe losses in 1973 and 1974 caused the company to close in 1975. Munger then became Chairman of Wesco Financial Corporation, investing in and owning disparate businesses. Wesco is now a wholly owned subsidiary of Berkshire Hathaway.

Munger is also a value investor. He believes a concentrated portfolio, holding a small number of stocks he knows well, generates the greatest returns.

[61] Lowe, Janet. Damn Right: Behind the Scenes with Berkshire Hathaway Billionaire Charlie Munger: John Wiley & Sons Inc: 2000.

[62] Pictures of Munger and Buffett were taken at the 2011 Berkshire Hathaway annual shareholder meeting in Omaha by students in the Michigan Tech Applied Portfolio Management Program.

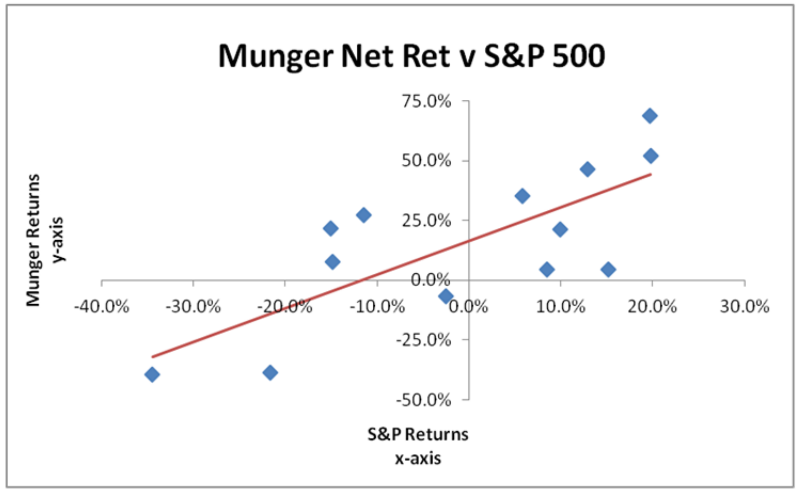


Mr. Munger expects capitalist markets to swing in value and believes in staying the course with valued investments. Munger believes Wall Street exacerbates market swings because of a short-sighted, competitive culture chasing financial performance. He believes markets must be regulated, or people will drive the markets to extremes.

Munger's Market Conditions

During the first 13 years of operations the S&P 500 index was positive in 8 years – or roughly 61.5% of the time. The S&P 500 increased by double digits in 5 of these years. In the 5 years of the partnership where the S&P 500 decreased in value, it declined in value by double digits in 4 of those years. Over the first decade, Mr. Munger was well on his way to matching Mr. Buffett's first decade performance. While Mr. Buffett enjoyed the good fortune of avoiding a major bear market, Mr. Munger was not so lucky. As seen in Figure 3, the bear market of 1973-1974 dealt Mr. Munger's portfolio a serious blow.

Figure 4: Munger Regression

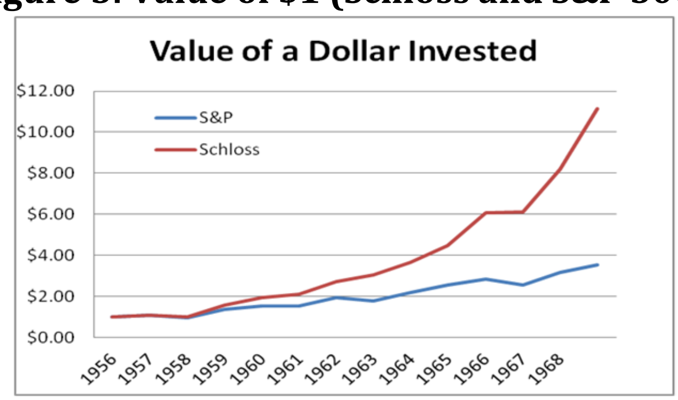


Active Manager Study Group: Walter Schloss – Schloss Partnership [63]

Walter Schloss was a value investor whose investment strategy was molded by courses he took from Benjamin Graham. Buffett highlighted Schloss and his investment methodology in Buffett's famous essay, "The Super Investors of Graham and Doddsville."

Schloss' forte was identifying securities that were deeply discounted in the market compared to the underlying value of the enterprise. Schloss looked for companies that had little or no debt and were selling cheaply enough to provide a 'margin of safety' should the business sour. Schloss created a partnership similar to Buffett's that operated from 1955 until 2000. Schloss and his son, Edwin, ran the fund very frugally, with no secretary, clerk, or bookkeeper.

Figure 5: Value of $1 (Schloss and S&P 500)



Buffett noted that Schloss "has no connections or access to useful information. Practically no one in Wall Street knows him and he is not fed any ideas. He looks up the numbers in the manuals and sends for the annual reports, and that's about it . . . He knows

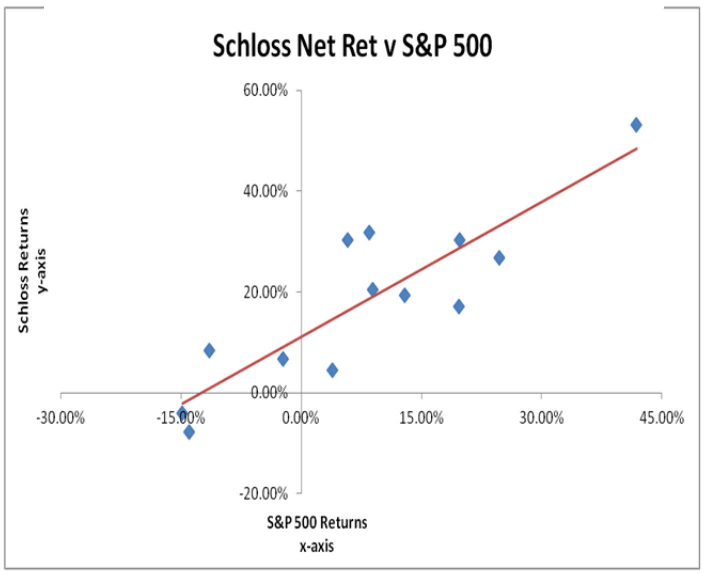
[63] Buffett, Warren. The Superinvestors of Graham-and-Doddsville. Columbia Business School Magazine: 1984.

how to identify securities that sell at considerably less than their value to a private owner. And that's all he does. He doesn't worry about whether it's January, he doesn't worry about whether it's Monday, he doesn't worry about whether it's an election year. He simply says, 'If a business is worth a dollar and I can buy it for 40 cents, something good may happen to me.' And he does it over and over and over again."

In a tribute to Schloss, *The Economist* published an article entitled, "Death of a Non-Salesmen."[64] They noted that, although he was a very good investor, he was not widely known by the public, "nor was he known for marketing his skills to investors (he was indifferent to collecting clients and only 92 managed to sign on)." By maintaining a manageable asset size, Schloss averaged a 15.3% compound return over the course of five decades.

Mr. Schloss did not feel he was good at evaluating management. He was more comfortable analyzing financial numbers and annual reports than meeting individuals in management. He liked management that owned a lot of stock in the company and firms with a low price-to-book ratio. The Schloss portfolio used simple statistical measures to find "cheap" stocks and diversified the portfolio, often holding well over 100 stocks.

Figure 6: Schloss Regression



Schloss' Market Conditions
During the first 13 years of operations, the S&P 500 index was positive 9 out of 13 years – or roughly 69% of the time. The S&P 500 increased by double digits in 8 of these years!

In the 4 years of the time where the S&P 500 decreased in value, it declined in value by double digits in 3 of those years. Overall, the S&P 500 grew $1 into $3.53 over the first 13 years of Mr. Schloss' tenure.

Active Manager Study Group: John Maynard Keynes – Chest Fund[65]

John Maynard Keynes is regarded as the founder of a major school of macroeconomic thought. He was also one of the first active equity portfolio managers, and his returns were enviable, making him one of the first wealthy money managers.

Mr. Keynes managed part of the endowment of King's College in Cambridge, and over 22 years (1924-1946) his Chest Fund accounts returned 15.21%, compared to the U.K. market's return of 8.08%. His investors received substantial gains over and above the market index.

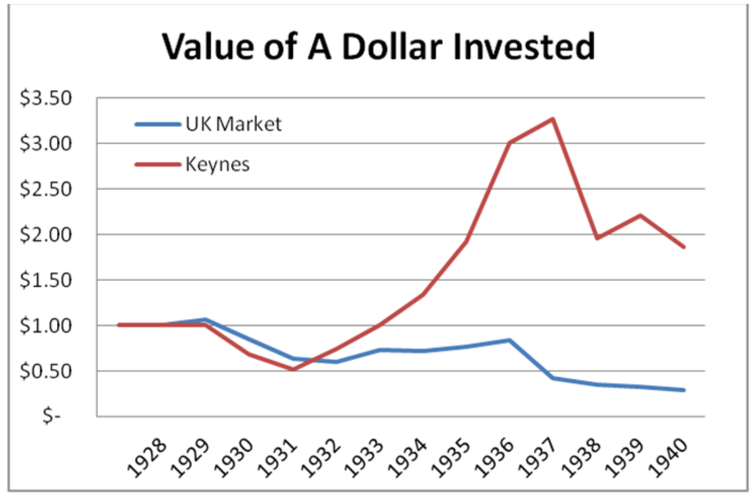
Keynesian economics holds that the private economic sector is inefficient and volatile, so governments should assist in leveling business cycles by adopting interactive monetary and fiscal policy. He suggested monetary policy can influence prices and unemployment through central banks

[64] Walter Schloss: The passing of a truly contrarian investor. The Economist. New York: May 17, 2012.

altering money supply and interest rates. Keynes advocated that fiscal policy can affect the economy by adjustments in taxation and government spending levels.

Keynes' investment career was split into two periods. At the start of his career, perhaps largely influenced by his development of the field of macroeconomics, Keynes believed he could effectively time the market to generate excess returns.

Figure 7: Value of $1 (Keynes and S&P 500)



During Keynes' market timing philosophy, he was not able to significantly beat the market.

After several years of average returns, Keynes changed his philosophy to a value investment approach fundamentally similar to the approach Buffett and Munger adopted years later. Keynes' second philosophy focused on running a highly concentrated, small, relatively illiquid portfolio of undervalued companies.

David Chambers, a professor at Cambridge Business School, and Elroy Dimson, a professor at the London Business School, recently examined more than two decades of Keynes' trading data to help determine Keynes' strategy and philosophy.[66]

Keynes invested for the longer-term, holding many of the companies in his portfolio for five years or more. While the market may fail to recognize a stock's true value for an extended period, he expected investors, at some time point, to discover the underlying value of the enterprise. He only invested in sectors that he deemed attractive and avoided those he did not.

Keynes' Market Conditions

Keynes had the unfortunate luck of managing a portfolio during the most challenging period of the last century – The Great Depression and its aftermath. While Keynes' excess returns were substantial, they fall short of the excess returns generated a few decades later by Warren Buffett and Charlie Munger.

What is striking about Keynes is that decades later both Munger and Buffett adopted many of the strategies used by Keynes: investing in a concentrated portfolio of undervalued, small companies and holding for long term appreciation.

Given the regression results for Keynes were not statistically significant, we will not draw conclusions or display the analysis.

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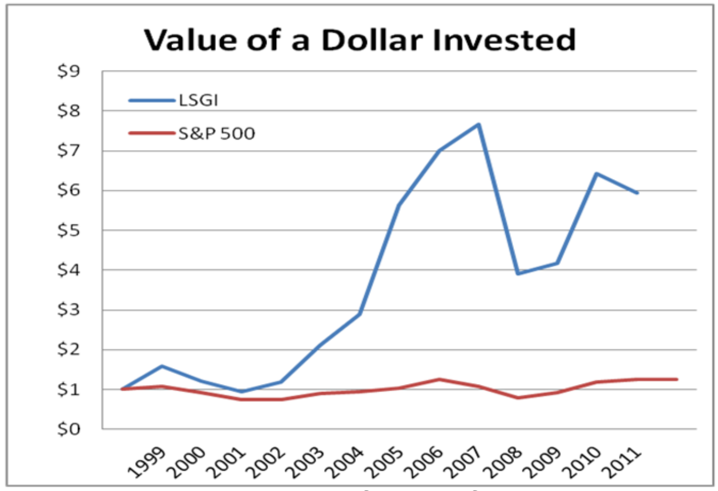
[66] Keynes the Stock Market Investor. David Chambers University of Cambridge - Judge Business School, Department of Finance & Accounting. Elroy Dimson, London Business School; University of Cambridge - Judge Business School. September 6, 2012 Available at http://ssrn.com/abstract=2023011

The Dancy LSGI Fund – LSGI Partnership

Educated and trained as an engineer in the extractive minerals and mining industry, Joseph Dancy worked at domestic facilities mining or processing iron ore, native copper ore, copper sulfide ore, coal, and uranium.

Figure 8: Value of $1 (LSGI and S&P 500)



Later trained as an attorney with an MBA, he has advised companies owning or operating oil and gas pipelines, crude oil and gas wells, onshore and offshore drilling rigs, electrical cogeneration plants, and salt water disposal wells.

Understanding the difficulty most active asset managers have in generating excess returns for their investors, Mr. Dancy realized that with the onset of the computer age and online databases, small investors should be able to use financial data to develop an investment strategy that has a relatively high probability of outperforming the major market indices. Mr. Dancy's special knowledge and background in energy law gives him an advantage over many other investors.

Using studies of historical strategies that outperformed the market[67], Dancy utilized a value-based investment strategy looking for small growth companies. He 'screened' online databases for attractive companies on which due diligence was conducted.[68] His investment thesis relies on the ability to find a unique quantitative niche to create higher probability of generating excess returns.

He prefers to invest in companies and sectors with which he is familiar, including energy, basic materials, agriculture, or technology related companies. Like Buffett and Munger, Mr. Dancy runs a relatively concentrated portfolio of companies in sectors he understands and management with which he feels comfortable.

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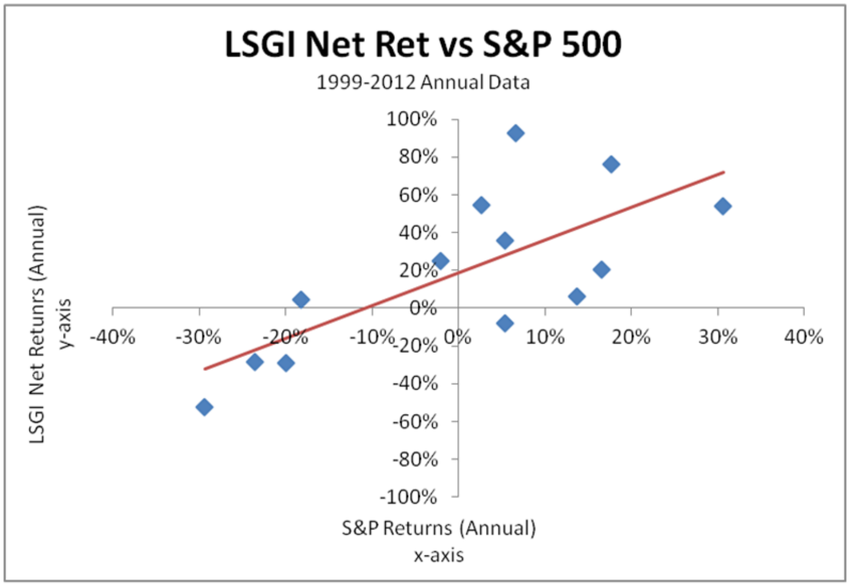
[67] Several of the more influential studies that Mr. Dancy found useful in developing or confirming his investment strategy were Al Frank's "Prudent Speculator" (1989), James O'Shaughnessy's "What Works on Wall Street" (1997), Norman G. Fosback's "Stock Market Logic" (1993), and a paper by Federal Reserve researcher Dr. J. Benson Durham entitled, "The Extreme Bounds of the Cross-Section of Expected Stock Returns" (2002).

[68] Warren Buffett likewise screened for companies, but used hardcopy Standard & Poor's stock market guides to find attractive investment candidates versus an electronic database.

LSGI's Market Conditions

During the first 13 years of LSGI operations, the S&P 500 index was positive 9 out of 13 years – roughly 69.2% of the time. The S&P 500 increased by double digits in 4 of these years. The S&P 500 decreased 4 out of the first 13 years, and, of those 4 years, 3 of them were double digit decreases. Due to the small size of the companies in Mr. Dancy's portfolio, this market activity had an adverse effect on the returns the portfolio was capable of generating. Mr. Dancy did not anticipate that the LSGI Fund would face several of the most daunting markets in the last century during the first 13 year period of operations. His investment thesis and management ability have been challenged by (1) the Technology Bubble of 2000 and its aftermath, (2) the Great Recession of 2008, and (3) the ongoing financial difficulties of major countries and regions.

Figure 9: LSGI Regression



Market Comparison

Below is a table comparing the markets in which the Active Manager Study Group and LSGI operated. The chart shows the percent of time the market was positive, the percent of time the market increased by double digit percentages, the percent of time the market decreased by double digit percentages, and the value of $1 invested in the S&P 500 over the manager's first 13 years of operation.

13 Year Period	S&P 500 Performance			
Market Comparison	% of years with annual increase	% of years with double digit increase	% of years with double digit decrease	Value of $1 Invested in the S&P 500 over Manager's first 13 years
LSGI	69.20%	30.80%	30.80%	1.26
Buffett	69.20%	61.50%	15.40%	3.04
Munger	61.50%	53.80%	23.10%	1.48
Schloss	76.90%	61.50%	15.40%	3.53
Keynes	N/A	N/A	N/A	N/A

Based on the chart, markets are ranked from most favorable to least favorable as follows:

1. Schloss
2. Buffett
3. Munger
4. LSGI

Investment management is full of managers who get lucky over a short period of time. Much like in sports when an underdog miraculously beats a goliath-like opponent, lucky managers will beat skilled ones on occasion. Further, a bear market can prove challenging for even the most skilled manager (i.e., Munger during the 1973-1974 market.)

However, regardless of how lucky you are, luck will always be beaten by skill in the long run. When looking to invest money, the fundamental question is, “Is this manager skilled enough to consistently beat the market and other active investors?”

CAPM Results
Although each manager was subject to different market and economic conditions, it is possible to compare the performance and effectiveness of each manager. One of the models used by institutional investors to determine if a portfolio manager is generating excess returns over and above what is expected from the market is the Capital Asset Pricing Model (CAPM).

The CAPM expresses a mathematical regression between a portfolio’s returns and the market’s returns. The end result of the CAPM analysis is a straight line that best fits the data points. It is commonly used to assess a portfolio’s risk adjusted returns. This line of best fit can be used to determine how well—or poorly—the portfolio performed compared to the market benchmark. The regression results reveal if the portfolio returns were due to fluctuations in the market or were generated by the decisions of the portfolio manager.

The regression model calculates three main statistical indicators to describe portfolio performance:

First is beta. Beta determines the level of market risk built into a portfolio (i.e., how sensitive the portfolio returns are to changes in the market). A beta above 1.0 indicates that a portfolio took more risk than the market. Betas above 1.0 mean the portfolio returns amplify changes in the market, both positive and negative. A beta below 1.0 indicates that a portfolio took less risk than the market, thus the portfolio returns dampen changes in the market.

Second is alpha, which indicates excess portfolio returns. Alpha determines how well the returns generated from an active strategy compare to the benchmark index (passive strategy) after accounting for the amount of market risk (beta) in the active portfolio.
Alpha is the most important statistical indicator when evaluating performance. Because alpha controls for the amount of market risk (beta), investment managers with different levels of beta can still be directly compared based on their alpha values. That is, alpha is an apples-to-apples measure of excess performance, regardless of the beta (amount of market risk) of the portfolio.

A perfectly passive investment strategy with no fees would produce an alpha equal to zero. The goal of an active manager is to produce a positive alpha, net of fees.

The third statistical indicator is R-squared. R-squared documents the percentage of the portfolio’s return that can be credited to the market’s return. R-squared values range from 0.00-1.00.

A perfectly passive market index fund has an R-squared of 1.00, which indicates 100% of the portfolio’s returns are completely explained by movements in the market’s return. However, the perfectly passive market index fund will not produce a positive alpha (a positive excess return).

R-squared for actively managed funds will be less than 1.00. Active portfolio managers will deviate from the market portfolio. As such, the market portfolio will not explain 100% of the active portfolio's return. Naturally, the objective in deviating from the market portfolio is to generate a positive alpha.

As described above, the regression yields a line of best fit through data plotted on a graph (x-axis being returns on the market, y-axis returns on the portfolio). Reviewing the earlier sections of this report, the regression lines for each individual investment manager can be seen in Figure 2, Figure 4, Figure 6, and Figure 9.

The slope of the regression line is beta. When the market portfolio (horizontal axis) increases by 1%, the slope of the line reveals if the portfolio was magnified (beta greater than one) or dampened (beta less than one).

The y-intercept of this line is alpha. This intercept says that if the market portfolio had returned 0% over the year, the portfolio would have returned alpha over the year. As such, alpha documents the extra return the portfolio earned above the market portfolio return.
Finally, R-squared is implied by the differences between the regression line and the actual data points.

In the next section, the results from the CAPM regression are summarized for each fund manager.

Results of Regression Analysis
Alpha and beta are estimated by statistical regression. Without delving deeper into statistics, we will simply note that the estimates for alpha and beta found in bold in the table below are statistically significant at the 5% level. R-squared's accuracy is not measured by statistical significance. Therefore, bolding is not necessary.

Indicator	LSGI	Buffett	Munger	Keynes	Schloss
Alpha	**18.63%**	**22.51%**	**16.54%**	6.26%	**11.03%**
Beta	**1.74**	**0.66**	**1.41**	0.42	**0.89**
R-squared	0.539	0.538	0.574	0.188	0.763

What does it all mean?

Looking at alpha, all of these investors achieved returns in excess of those predicted by the market and the level of market risk taken. LSGI's alpha of 18.63% was second only to Buffett's. It should be recognized that these are the alphas of some of the best portfolio managers of all time.

LSGI and Munger took more market risk (higher beta) than the other managers. However, it is important to remember that alpha controls for market risk, in that alpha provides an apples-to-apples comparison for any level of market risk.

For the three investors with the highest excess returns (LSGI, Buffett, and Munger), a little more than half of the portfolios returns were explained by the market (R-squared values ranging from 0.538 - 0.574.). This means that the portfolio managers were adding value with their stock selection and management decisions. As expected, Schloss has a higher R-squared value due to his holding a larger number of assets in his portfolio. Keynes' European portfolio produced a low R-squared, due to the use of the U.S.-based S&P 500 index as a proxy for the market portfolio.

CAPM Conclusions

- Excess returns can be generated today at levels commensurate with excess returns generated by some great value investors of the past.

Generating Excess Returns

Several common themes emerge when examining the investment strategies of the managers who generated excess returns in this study. Common elements of their strategies include:

1. They looked for companies with niche markets.
2. They were not afraid to buy illiquid stocks.
3. They bought firms with growth potential.
4. They bought their positions at reasonable valuations and a margin of safety.
5. They managed a limited amount of assets.
6. They tolerated above-average portfolio volatility.
7. They bought firms that they felt they understood.
8. They purchased only after conducting extensive due diligence.

In terms of alpha generation, Buffett, LSGI, and Munger are clearly the top three performers. Was there a different strategy they used which helped generate returns above the other investors? Three main differences were identified in the strategy they used:

1. They focused on very small publicly traded companies.
2. They wanted to be comfortable and confident in management's abilities.
3. They ran a concentrated portfolio.

Ability of Managers Analyzed

While the market is populated with a large number of investors, it is sparsely populated with investors that are skilled in finding undervalued assets. Judging by the thirteen years of data analyzed for each investor in our study, it is highly probable that they are very skilled investors, and very unlikely that they are just lucky. We believe that placing funds with any one of these investors will consistently offer returns above the market and most other investors.

PART VI

BIOFUELS, ALTERNATIVE FULES & AIR QUAILITY ISSUES

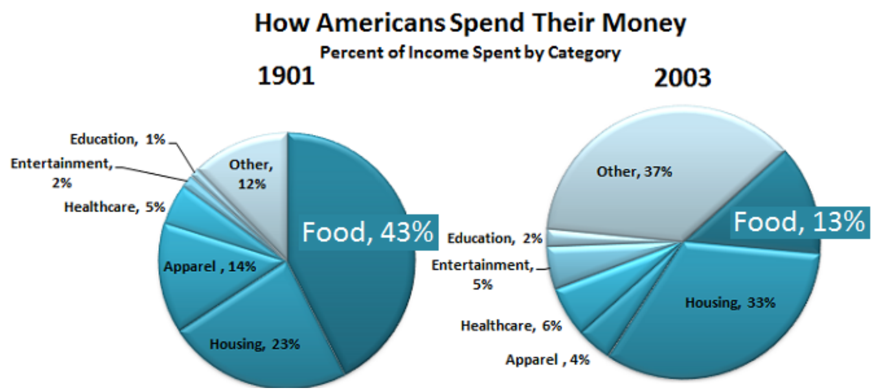
The Crude Oil - FAO Food Price Index Price Correlation

Last year (2012) Atlantic writer Derek Thompson shared some interesting data on how much the American economy has prospered over the last century. Using Census Bureau data, Thompson showed how the percentage of income an average American household spends on various goods.

What struck us as especially interesting was the fact that in 1901 roughly 43% of the household budget was for food. By 2003 that had shrunk to only 13%. During that same period the yield on an acre of corn went from roughly 25 bushels per acre to 150 bushels per acre thanks to mechanization, cheap and plentiful fertilizers, herbicides, and seed genetics.

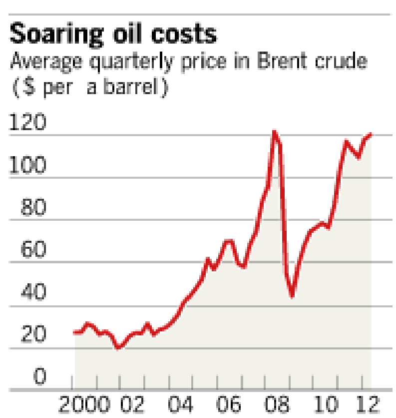
By coincidence the 'Age of Oil' was essentially launched in 1901 with the discovery of the prolific Spindletop well drilled in South Texas. The energy provided by natural gas and crude oil have had an incredible impact on the productivity of the agricultural sector – with some expert studies indicating Western agricultural practices utilize 10 calories of petroleum energy to produce one calorie of food (other global agricultural regions are not so energy intense).

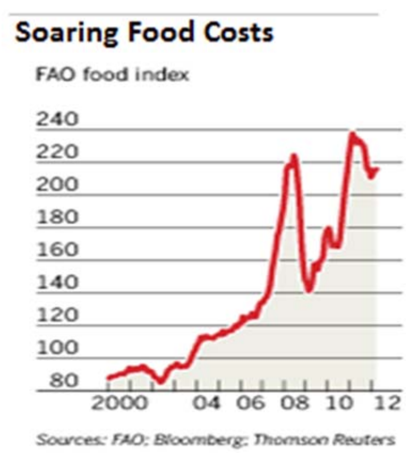
Prior to the Age of Oil the energy input was much closer to the energy output of the food produced. Experts claim that without hydrocarbons the agricultural sector could only feed 3 billion people – less than one-half the current global population of 7 billion.



Knowing the historical relationship between energy and agriculture products, and the relentless year after year growth in global demand for both crude oil and grains, it did not surprise us to find the extremely high correlation between crude oil prices and the FAO global food index since 2000 (charts below courtesy the Financial Times).

The coefficient of determination ('r squared') between the price of Brent crude and the FOA food index for the last twelve years is 0.932 - meaning that 93.2% of the change in the price of food as measured by the FAO food index is statistically 'explained' by the change in the price of oil during this period. This is an extremely high level of statistical correlation over a statistically significant time frame.





We expect crude oil and food prices to remain highly correlated – and up-trending – over the next several years. If our forecast is correct it should be a very positive environment for companies in both sectors.