

What caused the largest accidental oil spill in USA in the previous century? (Before 2010)

- This supertanker changed the traffic lane to avoid the ice area but accidentally running onto the rocks.
- Exxon Shipping Company failed to supervise the matter and provide a rested and sufficient crew for Exxon Valdez.
- The third mate failed to properly maneuver the vessel, possible due to fatigue or excessive workload.
- Exxon Shipping Company failed to properly maintain the RAYCAS radar

Describe how 2 of the following **4 oil-spill clean-up** procedures “should work”, and why there were “real-world” problems when attempting their use in the huge **Exxon Valdez spill**:

Barrier booms

- A barrier boom is a temporary floating barrier used to contain an oil spill, by concentrating oil in thicker surface layers.
- It is effective in calm waters, but as wave height increases oil or other contaminants can easily wash over the top of the boom rendering it useless.
- The approaching oil also needs to be decelerated to avoid drainage under the boom.

Beach cleaning

- Shoreline Flushing: This method uses hot water or by hands to remove or refloat stranded oil, which allows it to be more easily recovered as a slick on the water. One of the lessons learned from the 1989 Exxon Valdez oil spill was to be very careful about water pressure and temperature to avoid causing more harm (destroy the land and plant) to the shoreline. (Using water hose, rinse oil from shoreline into water)

There were several contributing factors, at least 8, that allowed the Macondo BP/Deepwater Horizon blowout and stupendous oil spill of 2010. List 3 of these, with a brief explanation.

- Shortcuts to save money/time by BP and Transocean
 - Many of the decisions that BP, Halliburton and Transocean made that increased the risk of blowout save the companies significant time and money.
 - Decisions include ignoring failed tests and not plugging the pipe with cement.
- Cement failure by Halliburton
 - Defective cement on the wall of the casing by constructor Halliburton
- Operator error by BP and Transocean
 - Managers misread pressure data and gave their approval to the replacement of drilling fluid with seawater, which was not heavy enough to prevent gas that had been leaking into the well, causing the explosion.

What happened in **Libya** that “broke the back of the major oil companies” in the **1960s**?

- In 1961, a huge oil field was discovered in the Sirte Basin.
- The Sarir field had approximately 12 billion barrels worth of oil, sulfur-free.
- Daily production saw roughly 300,000 barrels per day from Sarir field in 1968.
- Libya produced 30% of Europe oil.
- In 1969, a coup saw Muammar al-Qaddafi, a radical military officer into power.
- He desired oil revenues to become “leader of Arab world”, as a result, he shut down all US and British bases; closed all Catholic churches; etc.
- As the Suez Canal was still closed, he held all the power.

American Lifestyle and Peak Oil

USA Energy Policy - The goal of the “oil” portion of USA Energy policy is a continuous flow of low-cost oil. There are **four** main factors in the “petro-strategy” equation - items that, when taken together, dictate the future directions of US government involvement. List and explain 3 of these 4 general factors.

- Electricity approved 50 utility scale renewable energy proposals.
- Transportation, finalized national standard to double efficiency of light duty car and trucks, reducing oil consumptions and slashing greenhouse gas emissions
- Energy Efficiency, helped American commercial and industrial buildings become more energy efficient. Reduced carbon pollution through appliance efficiency standards.
- Oil and Natural gas, worked to reduce processing time for onshore drilling permits. Promoted environmentally responsible development of offshore resources.

usually only a single platform per field.

- SPAR
- floating on water, tethered (绑) to bottom of ocean.
- With this design, the drilling platform sits atop a giant, hollow cylindrical hull. The other end of the cylinder descends around 700 feet (213 meters) into the ocean depths. While the cylinder stops far above the ocean floor, its weight stabilizes the platform. A network of taut cables and lines trail out from the cylinder to secure it to the ocean floor in what is called a late catenary system. The drill string descends down through the length of the cylinder's interior and down to the ocean floor.

The **Soviet Union** was a superpower during the 1970s. Explain (1) how Oil played a critical role in maintaining its superpower role

- In the 1970s, 70% of the USSR's hard currency earnings were oil and gas.
- The Siberian Basin brought new oil wealth to the USSR
 - World's largest basin
 - Fields discovered in 1960s-1970s
 - Oil in the south; Gas in the North
 - Production surge in 1970 powered the USSR

(2) What oil-related events conspired to collapse and break-up the USSR during the 1980s.

- In 1979, the USSR planned the construction of "Urengoi 6", a pipeline that stretches 3600 miles from Northern Siberia Urengoi to Soviet-Czech border
- This brought the largest deal in USSR-West trade history
 - 25 years of gas at guaranteed price in return for funding and selling sophisticated equipment
- The CIA analyzed the situation and saw a potential energy-blackmail
- In 1981, Reagan announces embargo on all oil and gas equipment to USSR
 - GE gas turbine rotors for pipeline prohibited
- In 1982, France supplies some equipment instead
 - This resulted in a cost of roughly 1 billion dollars to the USSR in turbine problems.
- Japan, in turn, forced to cancel Sakhalin Island project, as they required American offshore drilling technology.
 - Put on hold for 25 years, and finally finished in 2007
- It ended up an environmental mess as nearly 3000 pipeline breaks and leaks per year.

Nigeria has the problem that much of its oil infrastructure undergoes violence, illegal oil-tapping or other hassles. What are petroleum companies doing differently to avoid such problems in **Angola**?

- In Nigeria, government does not share benefits accrued from oil industry equitably. Very little money flow back to the oil producing regions.
- Various rebel groups are fighting for control of the illegal oil industry.
- In Angola, very few people share benefits of country oil wealth.
- Contracts are negotiated between state owned oil company and multinationals. Introduced stringent anti corruption legislation and taking action publicly to combat corruption.

What is unique about **Mexico's largest field**?

- Mexico's largest field, Cantarell field (1976) was created when the Chicxulub meteor impacted the earth.
- The upper reservoir is a brecciated dolomite of Uppermost Cretaceous age.
- The breccia is from an underwater landslide when the meteor hit.
- The lowermost part of the field is a Lower Cretaceous dolomitic limestone.
- The field is made up of a number of sub-fields or fault blocks.

Heavy Oil - Does one currently extract it, and what are some problems in making this into an economic resource?

- Currently, heavy oil have been in countries like Venezuela, Iraq and Kuwait.
- Most notably, it has been extracted out of the Orinoco Belt where it filled sands of buried Miocene delta.
- One of the problems with heavy oil is that it doesn't flow easily at room temperature.

What is "tar sand"?

- Tar sand is heavy asphalt-like tar bitumen.
- It is approximately 10-12% tar in sand, with 2 tons of sands equating 1 barrel of oil.
- The Alberta province is the largest deposit for tar sands in the world.

Oil Shale - Where are the largest deposits in the world?

- Many of the largest deposits are in USA, with them making up 62% of the world's potentially recoverable.
- They're mainly in Colorado-Wyoming, with approximately 240 billion tons in quantity.
- They include Bridger Basin, Sand Wash Basins, Uinta Basin and Piceance Creek Basin.

How does Fracking work? And what are the advantages/disadvantages?

- Mixing sand with chemicals, pressuring, pump them into the well.
- Chemicals will break fracture the rock underneath and allow gas and oil to flow.
- **Advantages:** Possible to drill vertically and horizontally to get reserves that were previously inaccessible.
- **Disadvantage:** Causes small earthquakes. Methane leakage.
Flow-back water. Uses tremendous amount of water that contains chemicals and other environmentally damaging material.

What are two major crops used for Bio-Ethanol, and two major ones for Bio-diesel?

- Bio-Ethanol: Corn and Sugar (Cane/Sorghum)
- Bio-diesel: Soybeans and Canola

Hydrogen-fueled cars Pt. 50 - 60 % of the fuel cell cost.

critical Li Chile China argentine, bolivia

Hydrogen - How do we currently make large quantities of Hydrogen at low cost?

- Reforming natural gas
- Methane + 800C steam + Nickel catalyst -> Carbon Monoxide + 3 Hydrogen
- Carbon Monoxide + more Steam -> CO₂ + Hydrogen
- Reforming coal
- Coal + 900C steam + Nickel catalyst

Russia

Siberian Basin, currently the world's largest basin at 2.2 million km² played a role in keeping the USSR in power with oil fields discovered in 1960s-1970s. Oil was found in the South, gas was found in the North.

The Siberian Basin was formed with collisions of Siberian plate with Kazakhstan and Europe plates before around 350Ma. Triassic "failed" rifts also contributed to the formation. As this was in the Arctic region, sinking of uneven topography occurred. For its oil source, the Siberian Plate saw progressive flooding into semi-enclosed deep basin at as late as the Late Jurassic, roughly 100 Ma. This brought high-productivity as it consisted of a Low-oxygen bottom. Bazhenov beds also contributed to its oil source with their organic-rich and silica-rich shales at 20-50 m thick with an area of 1 million km². Siberian Oil Reservoirs were formed Early Cretaceous when the sea-level dropped. During this time, deltas advanced from highlands resulting in sand-clay fillings.

Siberian oil traps also had low arches, with seals formed from mainly late Cretaceous, ~80 Ma, shale.

Alaska

Paleo-geography conditions:

South of Brooks Range = "Exotic Terranes"

North of Brooks Range = North Slope

Motion of Pacific plate

Source and Reservoir and Seal sediments and setting:

North Slope: sediments come from North (Canada Arctic Islands)
early Cretaceous rifting and rotation; collision caused Brooks Range

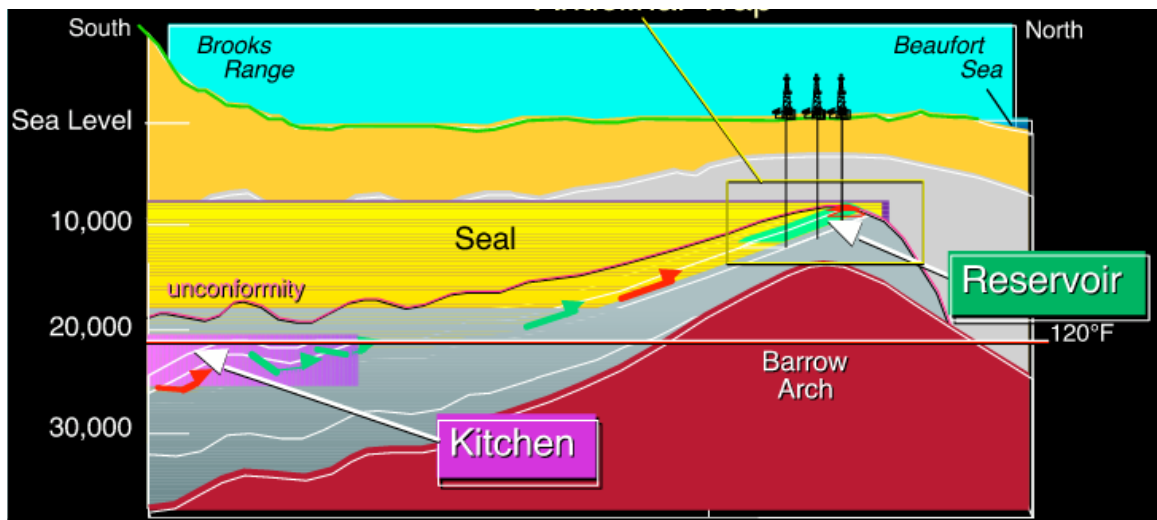
Triassic "Canada" Delta onto quiet shelf:

High sea level = marine shales = oil source (main)

low sea-level = sands oil reservoir (main one)

Burial (oil maturation) and wrapping (traps)

barrow arch = seaward edge of present coast



Cause of the Structure that caused the oil to “pool” as an economic deposit:
 1.5 million acre coastal plain = continuation of North Slope geology

Libya

Paleo-geography conditions:

Source and Reservoir and Seal sediments and setting:

Cause of the Structure that caused the oil to “pool” as an economic deposit:

Sands (~100 Ma) filling through between eroding granitic hills.

Sea-level rise (100 Ma) -> marine, organic rich shales

Source = Shale over thick porous sands.

Trap = Erosion surface