

EnviroNews

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Summer 2009



Carbon Management Efforts

Environmental Tobacco Smoke:
A Public Health Menace



Safe Use of Plastic Food Packaging & Containers



Swine Flu



Mercury:
Occupational Exposure Risks



Heat Stress



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Saudi Aramco Receives NOC Environmental Stewardship Award



EPD manager, Mr. Hesham Musaid receiving the NOC Environmental Award from Mr. Wang Tianpu, President of Sinopec.

Saudi Aramco was awarded the National Oil Companies (NOC) Environmental Stewardship Award for its groundbreaking research on Electron Beam Flue Gas Treatment (EBFGT) technology. For the first time in the world, EBFGT has been successfully demonstrated on removing air pollutants from liquid fuel fired boiler flue gas. Environmental Protection Department (EPD) in collaboration with the King Abdulaziz City of Science and Technology (KACST) and the Institute of Nuclear Chemistry & Technology (INCT), Warsaw, Poland conducted the research utilizing the laboratory facility at INCT. The main objective of the study was to find an environmentally acceptable way to utilize high-sulfur containing, low-cost heavy fuel oil (HFO) in our operating facilities in lieu of the highly sought after sales gas. EBFGT is an emerging, state-of-the-art technology that utilizes high-energy electron beams to dissociate pollutant molecules and convert them to usable by-products. Although this technology has been applied to coal fired boiler flue gas on a limited scale, it has never been successfully tested on liquid fuel fired boilers. Conventional tech-

nologies such as alkaline flue gas desulfurization are complicated processes that generate a lot of liquid and solid wastes compared to EBFGT, which is simple and does not generate any waste products.

The results of the detailed investigation revealed that EBFGT is a technologically feasible and economically viable process. Laboratory tests conducted at the INCT consistently removed more than 90% of SO_x and more than 80% of NO_x, simultaneously, from flue gas generated by burning Saudi Aramco supplied crude oils (Arabian Heavy and Arabian Medium) and Heavy Fuel Oil. EBFGT is, currently, the only technology that can remove SO_x and NO_x simultaneously. Besides, it's a dry process and the resultant by-product is a saleable fertilizer component. Preliminary economic analysis indicates that EBFGT is competitive with conventional flue gas scrubbing for SO_x removal and highly competitive for simultaneous SO_x and NO_x removal. The study revealed that EBFGT has significant potential to be the main air pollution control technology at Saudi Aramco.

Carbon Management Efforts in Saudi Aramco

Dhiyab Al-Anazi, ECoD

Meeting energy demands while addressing potential climate change issues presents challenges and opportunities for the oil industry. Saudi Aramco has a history as a reliable supplier of energy. It continues to be a major provider of affordable oil for future generations.

Recently, the climate change issue has witnessed an unprecedented level of international attention. Saudi Aramco announced on many occasions that it shares the concerns of the international community on climate change. The Company acknowledges the need to play a leading role in addressing climate change issues. The following are the actions developed by the Company to address issues concerning global climate change:

Saudi Aramco Perspective on Climate Change

Saudi Aramco has developed a perspective on climate change. This perspective is designed to address climate change issues with respect to the associated carbon management activities in the company's operations. The growing need for additional, reliable and affordable energy supplies is among the most critical issues faced by any nation.

The perspective promotes the development and implementation of technological solutions to reduce Greenhouse Gas (GHG) emissions. This perspective would also support the continued delivery of reliable and affordable global energy supplies. In addition, the perspective called on Saudi Aramco organizations

to assist international efforts on reducing global carbon and other greenhouse gases. This reduction can be achieved through established international mechanisms such as the clean development mechanism (CDM). This mechanism provides an opportunity for industry to generate certified emission reduction (CER) credits and for industrialized countries that have reduction targets to use such credits for compliance.

Saudi Aramco Carbon Management R&D Efforts

A Carbon Management (CM) Roadmap has been developed as part of the perspective. Its purpose is to ensure that oil continues to maintain its position as a major contributor to the global energy market in a carbon constrained world. The roadmap is attaining this strategic objective through creating a forward-looking broad-based R&D program. This program would promote the development of economically sound carbon management technological solutions. These solutions would ensure that petroleum based applications will comply with future international regulations aimed at restricting CO₂ emissions. They would also maximize the value generated from the carbon cycle.

This roadmap focuses on the following areas from a petroleum perspective:

- Reducing CO₂ emissions from mobile sources
- Enhancing Oil Recovery using CO₂ injection
- Capturing CO₂ from fixed "stationary" sources



- Geological Sequestering of CO₂ in depleted oil reservoirs
- Promoting the development of CO₂ and carbon based industrial applications
- Building Industrial/research alliances.

Saudi Aramco is looking into ways to contribute to the Research and Development of carbon capture and storage technologies, and at the same time working through the proper channels to include CCS in project activities of the Clean Development Mechanism (CDM) of the Kyoto Protocol. This technology will be a major contribution to the international community's effort to achieve meaningful global greenhouse gas emissions reduction.

Saudi Aramco Intent on CDM

CDM is a viable international option that will enable industry to assist industrialized countries in their efforts to reduce emission while benefiting from CER credits. As a result, Saudi Aramco has initiated an in-

ternal evaluation of selected opportunities in its operation and capital program.

Cooperation to Implement Saudi Aramco Perspective on Climate Change

Beyond the company's perspective on climate change, Saudi Aramco is working to develop cleaner burning transportation fuels. This is being done in-house as well as in conjunction with other companies and institutions.

Parallel to the international regulatory path, and over the past decade, significant investments of resources and efforts have been made. The intention of these investments is to develop technological solutions that will mitigate man-made GHG emissions in general and CO₂ in particular. To further these efforts, Saudi Aramco is collaborating with several major oil companies, intergovernmental, R&D, and industrial consortia.

Heat Stress



Ahmed Al-Ghamdi, ECD

INTRODUCTION

Heat stress is the net heat load to which a worker may be exposed from the combined contributions of metabolic cost of work, environmental factors (i.e., air temperature, humidity, air movement and radiant heat exchange) and clothing requirements.

Heat stress is a function of the environmental conditions, and it also depends on the worker's physiological condition. Metabolic and work rate, as well as the amount of acclimatization (older people do not acclimatize as easily) also contribute to heat stress. These are affected by factors such as the individual's physical build, age, gender, obesity, and underlying medical conditions such as heart disease "stimulants (e.g., coffee, tea)" or the use of certain medications that inhibit sweating and the type of clothing worn.

Heat must be dissipated into the atmosphere and core body temperature maintained. If the environmental conditions in the workplace do not provide appropriate relief to the worker for this heat, a hazardous accumulation of heat will occur in the worker's body.

This may result in various disorders in the exposed worker such as, heat exhaustion, heat cramps, and heat stroke, and there are other problems as well.

HOW THE BODY HANDLES HEAT

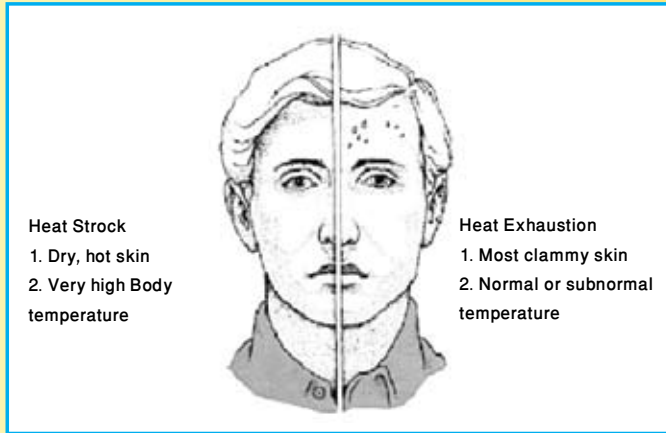
The human body is exposed to varying environmental temperatures and it has the ability to maintain a constant internal (core) temperature. To cool the body, the heart pumps more blood to external blood vessels which become vasodilated. This occurs near the skin surface, where excess heat is lost to the environment. Another physiological cooling mechanism is through the evaporation of sweat that cools the skin. The body usually responds when the internal or core temperature exceeds 37°C.

HEAT DISORDERS

Excessive exposure to elevated heat levels can bring about a variety of heat-induced disorders.

1. Heat Stroke

Heat stroke is the most serious health-related and life threatening medical emergency associated with working in hot environments. It occurs when the sweating mechanism fails and the body can no longer control its temperature. The victim's skin is hot and dry, and there may be mental confusion or loss of consciousness. The body temperature may exceed 41.1 °C.



Immediate first aid must be rendered. This includes moving the victim to a cool area, thoroughly soaking the clothing with water, and vigorously fanning the body to increase cooling. The cooling process should be continued in the hospital.

2. Heat Exhaustion

Heat exhaustion is less dangerous but more common than heat stroke. It occurs when the body loses large amounts of fluids by sweating. The signs of heat exhaustion include sweating, weakness or fatigue, giddiness, nausea or headache. The victim's temperature is normal and the skin is wet. In most cases, treatment involves having the victim rest in a cool place and drinking plenty of liquids if the patient is able to swallow.

3. Heat Cramps

Prolonged exposure to a hot environment causes profuse sweating with a net loss of the body's fluids and salts. When workers drink large quantities of water

but do not replace the salts adequately, this imbalance can lead to the onset of painful muscle spasms or heat cramps. To relieve this condition, workers should ingest electrolyte containing drinks.

4. Fainting (heat syncope)

A physiological response to extreme heat is dilation of blood vessels. To decrease the core body temperature, the blood vessels in the skin and lower part of the body become enlarged. For workers who have to stand and may not be used to extreme heat, this may cause blood to pool and reducing the amount pumped to the brain resulting in fainting. The worker should recover after lying down. One way to prevent blood from pooling is to keep workers moving rather than standing still.

5. Heat Rash

In hot and humid environment, the evaporation of the skin is not efficient. As a result the sweat remains on the skin and sweat ducts become plugged which causes the appearance of skin rash. This condition can be prevented by removal from heat exposure. Bathing, drying the skin and resting in a cool place could also help.



PREVENTION OF HEAT EXPOSURE

Minimizing heat exposure in the workplace is one of the best ways to reduce heat stress in workers. Humans have the capability to adapt to heat stress. The acclimatization period usually takes about 5 to 7 days.

HEAT STRESS CONTROL

Several control measures can be taken to prevent heat exposure in the workplace. These measures include engineering controls, administrative control and protective clothing.

Engineering Control

- Reduce physical demands of work task through mechanical assistance.
- Control the heat at its source through the use of insulating and reflective barriers (e.g., insulate furnace walls).

- Exhaust hot air and steam produced by operations.
- Reduce the temperature and humidity through air cooling.
- Provide cool, shaded work areas.
- Provide air-conditioned rest areas.
- Increase air movement if temperature is less than 35°C (e.g., use of fans).

Administrative Control

This includes the followings:

1. Acclimatization: through graded program for 2 weeks for those who are away from work for more than one week. These workers should be acclimatized before resuming work.
2. Work scheduling: depending on the nature of the load, where rest intervals are recommended.
3. Surveillance program: screening heat exposed workers is vital before onset of acclimatization and this can be coordinated through a hospital.



Drinking Water

In the course of a day's work in the heat, a worker may produce as much as 2 to 3 gallons of sweat. It is essential that water intake during the workday be about equal to the amount of sweat produced. The worker should drink 5 to 7 ounces of fluids every 15 to 20 minutes to replenish the necessary fluids in the body. Salt tablets are not recommended.

Protective Clothing

Several types of personal protective equipment (PPE) are available to protect workers from heat exposure such as:

1. Circulating air system: it is based on circulating air effectively under the clothing which increases the amount of convective and evaporative cooling around the body.
2. Circulating water system: cool water is circulated through tubes and channels around the body.
3. Ice garments: the heat of the body is removed by conduction from the skin to the pockets of ice.
4. Reflective clothing: it is the best choice for protection against radiant heat sources so the amount of heat reaching the individual is reduced.

EVALUATION OF HEAT STRESS

One common method to evaluate heat stress in the work environment is to measure the temperature, velocity and humidity of the air and physical factors of the environment and then to assess their combined effects on the human body by using appropriate heat stress indices. There are many indices devised to evaluate heat stress. The index that is widely used is the wet bulb globe temperature (WBGT) index. WBGT index offers a useful indication of the environmental contribution to heat stress. It is influenced by air temperature, solar heat, air velocity and humidity.

Because WBGT is only an index, values are usually

adjusted for the contribution of actual exposure to heat stress and clothing, as well as for acclimatization. Tables that are used for such adjustments are available in reference materials, which are related to industrial hygiene and similar practices. It should be noted that full-heat acclimatization requires up to 3 weeks of continued physical activity under heat-stress conditions similar to those anticipated for the work.



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Mercury:

Occupational Exposure Risks



Hg

Francisco Estevez, ECD

What is Mercury?

Mercury (chemical symbol Hg) is a naturally occurring element found in the Earth's crust. Elemental mercury and several mercury compounds, each with different characteristics of solubility, volatility, toxicity and reactivity, are found naturally in geologic hydrocarbon including coal, natural gas, gas condensates and crude oil (Wilhem & Bloom, 2000). The origin of mercury in these formations is not clearly understood; however, at least two theories have been brought forth. One theory advocates its origin from atmospheric deposition over millennia (e.g., volcanic eruptions) while the other indicates that its presence is inherent to the geologic formation.



Compact fluorescent light bulb

At home mercury may be found in thermometers, fluorescent light bulbs, thermostats, appliances, dental fillings and pharmaceuticals. Even though it has many useful qualities, mercury is extremely toxic to our health and environment.



Elemental mercury
"sweating" out of steel

Contaminant of Oil and Gas

In oil and gas operations, elemental mercury is of special concern as it has the property to amalgamate and weaken metal components, particularly aluminum. Many reported cases all over the world (e.g., USA, Algiers, Australia, and Indonesia) describe huge

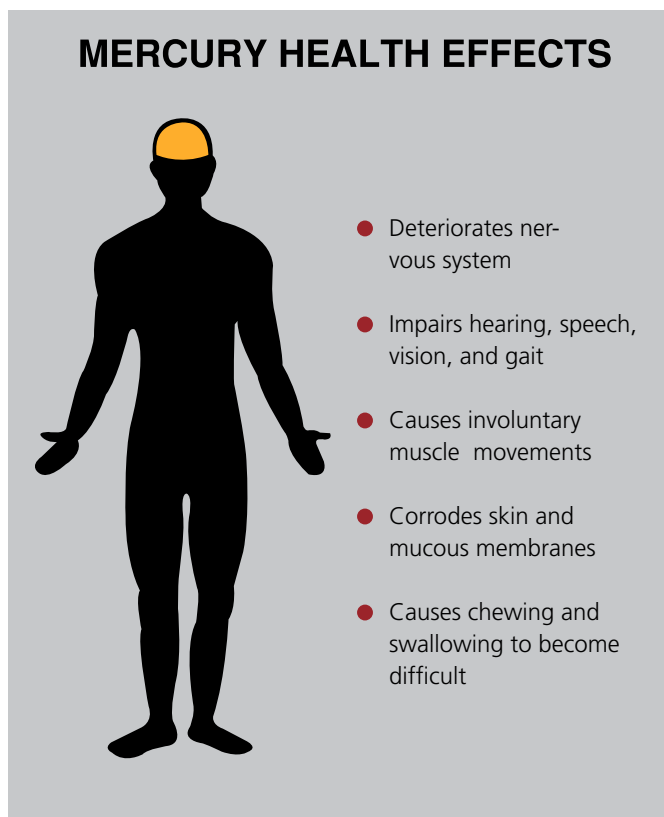
failures resulting in great damage and environmental catastrophes as a consequence of the uncontrolled presence of mercury in gas (Spiric, 2001). Volatilized mercury has also been responsible for damaging valuable refinery catalysts, and for contaminating both plant equipment and products (Bloom, 2000). For example, mercury is absorbed by steel and stainless steel surfaces. The degree of absorption is a function of both metallurgical and environmental conditions. The process of absorption is reversible so mercury absorbed by steel can re-evaporate into gas or re-dissolved into liquids that come in contact with contaminated surfaces.

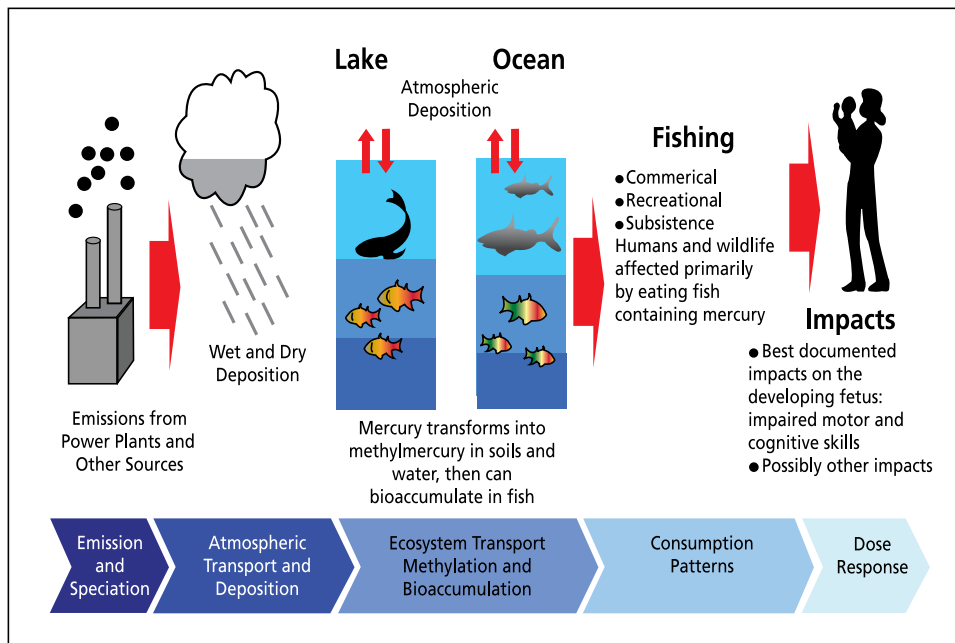
What are the potential health effects of exposure to mercury?

In addition to product and equipment contamination and damage, elemental mercury and several mercury compounds pose extreme risks on human health. Elemental mercury is rapidly absorbed by inhalation, moderately absorbed through the skin, and slowly

absorbed through the gastrointestinal tract (ACGIH, 2001). Symptoms associated with exposure to elemental mercury and mercury compounds include tremors, emotional instability and irritability, peripheral neuropathy, gingivitis, stomatitis, ocular and vision changes, hearing loss, and renal impairment (ACGIH, 2001). Inhalation of high mercury vapor concentrations for relatively brief periods of time can cause pneumonitis, bronchitis, chest pain, dyspnea, cough, stomatitis, gingivitis, salivation, and diarrhea. The central nervous system is the most sensitive target for elemental mercury vapor exposure. Similar effects are seen following all durations of exposure, but their severity increases as exposure duration and/or concentration increase. Prominent symptoms include tremors, emotional lability, insomnia, memory loss, neuromuscular changes, headaches, polyneuropathy, and performance deficits in tests of cognitive or motor function.

Even though other forms of mercury compounds, particularly inorganic mercury salts (e.g., HgCl_2) can also be found associated with produced hydrocarbons, they are not as prevalent as elemental mercury. Their effects on human health are also of importance and well documented throughout history. Divalent mercury (Hg^{II}) compounds are absorbed through the gastrointestinal tract and have also caused intoxications after dermal application. Their volatility is low, but they can be inhaled in toxicologically significant quantities from dusts. Monovalent mercury (Hg^I) compounds have very limited solubility and are less toxic than divalent forms. Deaths resulting from oral exposure to inorganic mercury have been attributed to renal failure, cardiovascular collapse, and severe gastrointestinal damage. Exposure to inorganic mercury may lead to nephrotic syndrome in humans (Risher, 2003).





At home: Mercury contamination results from exposure through the air, water, food, soil, or direct contact. Exposure to elemental mercury occurs when it is not stored in a closed container. Contamination may include the spilling of elemental mercury on clothes, furniture, carpet, floors, walls, the natural environment, and even the human body. Elemental mercury and its vapors are extremely difficult to remove from such items as clothes, furniture, carpet, floors, and walls.

In the environment, most of the mercury enters the atmosphere as elemental mercury (Hg^0), however, a significant amount also resides there as Hg^{II} in atmospheric water droplets. It is estimated that mercury vapor (Hg^0) has an atmospheric retention time of around one year. During that period it can travel a considerable distance, resulting in elevated mercury levels far from any mercury contamination source (Hutchison, 2003).

What can we do to prevent our exposure to mercury?



The vapors will also accumulate in walls and other structures in contaminated rooms. The contamination can remain for months or years, posing a risk to exposed individuals. The use of elemental mercury in a home or apartment not only poses a threat to persons currently residing in that structure, but also to those who subsequently occupy that dwelling and are unaware of the past mercury use. Avoid using elemental mercury. Appropriate substitutes are available for nearly all uses of elemental mercury. Therefore, be sure you need to use it. If substitutes are not available, make arrangements to safely dispose of whatever elemental mercury you might have. If you do need to use elemental mercury, make sure it is safely stored in a leak proof container. Keep it in a secure space (e.g., a locked closet) so that others cannot easily get it. Use of elemental mercury in a controlled environment helps to reduce the risk that contamination will occur.

At work: To minimize occupational exposures to mercury, appropriate procedures and controls should be implemented wherever mercury is used or suspected to be present. In occupational environments



such as laboratories and clinics, proper training in the safe handling of mercury-containing equipment is necessary, particularly during spill incidents that may release mercury to the work environment. Through the proper combination of engineering controls, rigorous work procedures, monitoring, medical surveillance, and the appropriate use of personal protective equipment, most occupational exposures to mercury can be prevented.

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A GUIDE TO PESTICIDE SAFETY

(Adapted from EPA and WHO)

Ziad Hawi, ECD

Purpose

The information included in this document is intended to raise awareness regarding the use of pesticides. In response to the unfortunate death of two children, poisoned by aluminum phosphide. This article highlights the potential hazards associated with the use of aluminum phosphide in particular, and pesticides in general.

Pesticides are poisons

BBC NEWS, Tuesday, 24 February 2009: "Two young Danish children have died in the Saudi Arabian city of Jeddah after inhaling poisonous pesticide fumes while they slept, local media say; the children aged six and 10, and their parents woke up complaining of stomach pains. An ambulance took them to hospital,

but the children did not survive. Their parents remain in intensive care. Investigators say the fumes came from a house that had been sprayed with a pesticide meant for agricultural use. Traces of the pesticide, aluminum phosphide, were found on dishes in the next door house in the al-Masarrah district, whose occupants had gone on holiday after having their house sprayed."

What is a pesticide?



1: Fumigation refers to the application in the vapor form.



The Environmental Protection Agency (US EPA) defines a pesticide as “any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest. Though often misunderstood to refer only to insecticides, the term pesticide also applies to herbicides, fungicides and various other substances used to control pests.” Among the different application methods, fumigants ¹ are of particular concern due to their acute toxicity by inhalation.

The following products are commonly used as household pesticides:

- Cockroach sprays and baits
- Ant powders.
- Insect repellents for personal use, such as citronella based products.
- Rat and other rodent poisons.

- Flea and tick sprays, powders, and pet collars.
- Kitchen, laundry, and bath disinfectants and sanitizers.
- Products that inhibit or control mold, mildew and fungi.
- Some lawn and garden products, such as weed killers.

Many pesticides are hazardous to humans, animals, or the environment because they are designed to kill or adversely impact growth, reproduction or other physiological function of living organisms. When used in the correct way, pesticides are a useful method of controlling potential organisms and pests which may pose a risk to public health, such as mosquitoes that vector the malaria disease.

What is a pest?

The EPA describes pests as “living organisms that occur where they are not wanted or that cause damage to crops or humans or other animals. Examples include: insects, mice and other animals, unwanted plants (weeds), fungi and microorganisms such as bacteria.”

What is aluminum phosphide?

Based on the EPA definition, aluminum phosphide is a restricted use pesticide, so may be purchased and used only by certified applicators. Due to its toxicity, its use and application is severely restricted by the Environmental Protection Agency to prevent incorrect use and application by members of the general public. Indeed, it can only be used by certified applicators because it is rated as a Class I toxic substance, the highest (most toxic) of four categories, for acute effects via the inhalation route. Products containing the substance must bear the signal word DANGER

Aluminum (and magnesium) phosphides react with moisture in the atmosphere. This reaction liberates **phosphine gas**, which acts as the pesticidal active ingredient.

Approved Uses

Aluminum phosphide is a fumigant approved to be used ONLY by certified/authorized individuals. It is used to control insects and rodents, primarily for indoor fumigation of raw agricultural commodities, animal feeds, processed food commodities, and non-food commodities in sealed containers or structures, and for outdoor fumigation of burrows to control rodents and other pests in non-domestic areas, non-cropland, and agricultural areas. It exists in the form of tablets, pellets, impregnated materials and dusts.

Toxicity symptoms

The active toxic substance is extremely irritating to the respiratory tract. Furthermore, poisoning due to ingestion carries a high mortality rate (50 to 90%). Cardiogenic shock is present in more severe cases. Pulmonary edema is a common cause of death. In other fatalities, ventricular arrhythmias, conduction disturbances, and asystole developed.

Poisoning symptoms are the same for adults and children. The latter, however, are more vulnerable because their internal organs are still developing and maturing and their enzymatic, metabolic, and immune systems may provide less natural protection than those of an adult.

Exposure to aluminum phosphide may also lead to the following symptoms:

- Burning of the skin and eyes.
- Headache, cough, tightness and pain in the chest, shortness of breath, dizziness, lethargy, and stupor.
- Fatigue, muscle pain, chills, tremors, incoordination, seizures, and coma may be seen.
- Nausea, vomiting, abdominal pain, and diarrhea.
- Renal (kidney) damage, hepatic (liver) damage, and jaundice may also occur.

First aid for various types of pesticide poisoning

When you suspect a pesticide poisoning case, the first thing to do is to determine the route of entry, for example whether the pesticide has been ingested, inhaled or whether it has entered through a wound or by skin contact. If the person is unconscious, having

BUT ALWAYS READ THE LABEL FIRST

General tips to protect children from pesticide poisoning

Children should not be exposed to pesticides. The following steps can help you protect your children from pesticides and their effects:



1. Always **store pesticides** and other household chemicals, **out of children's reach**, preferably in a locked cabinet.



2. **Read the Label FIRST!** Directions for use and the first aid measures are stated on the label.



3. Before applying pesticides or other household chemicals, remove children and their toys, as well as pets, from the area. **Keep children and pets away** until the pesticide has dried or as long as is recommended on the label.



4. If your use of a pesticide or other household chemical is interrupted (perhaps by a phone call), properly **reclose the container** and remove it from children's reach. Always use household products in child-resistant packaging.



5. **Never transfer pesticides to other containers** that children may associate with food or drink (like soda bottles), and never place rodent or insect baits where small children can get to them.



6. **When applying insect repellents** to children, read all directions first; do not apply over cuts, wounds, or irritated skin; do not apply to eyes, mouth, hands, or directly on the face; and use just enough to cover exposed skin or clothing, but do not use under clothing.



7. Wash children's hands, toys, and bottles often. Regularly clean floors, window sills, and other surfaces to reduce possible exposure to pesticide residues.

trouble breathing, or having convulsions, immediate and fast action is required. Give first aid immediately and call your local emergency service. If possible, have someone else call for emergency help while you give first aid. If the person is awake or conscious, not having trouble breathing, and not having convulsions, give him first aid as instructed on the label.

The appropriate first aid treatment depends on the kind of poisoning that has occurred. Follow these general guidelines:

- Inhaled poison. Carry the victim away from the area where pesticides were applied and call your local emergency service. Loosen the victim's tight clothing. If the victim's skin is blue or the victim has stopped breathing, give artificial respiration and call emergency. Evacuate the pesticide treated area.
- Swallowed poison. A conscious victim should drink a small amount of water to dilute the pesticide. Induce vomiting only if a physician advises you to do so.
- Poison on skin. Drench skin with water for at least 15 minutes. Remove contaminated clothing. Wash skin and hair thoroughly with soap and water. Later, discard contaminated clothing or thoroughly wash it separately from other laundry.
- Chemical burn on skin. Drench skin with water for at least 15 minutes. Remove contaminated clothing. Cover burned area immediately with loose, clean, soft cloth. Do not apply ointments, greases, powders, or other drugs. Later, discard contaminated clothing or thoroughly wash it separately from other laundry.
- Poison in eye. Hold eyelid open and wash eye quickly and gently with clean cool running water from the tap or a hose for 15 minutes or more. Use only water; do not use eye drops, chemicals, or drugs in the eye. Eye membranes absorb pesticides faster than any other external part of the body, and eye damage can occur in a few minutes with some types of pesticides.

Recommendations

To protect your family, always remember that pesticides are poisons. When seeking pest control services, Saudi Aramco camp residents must use the Saudi Aramco Pest Control function in their area. The hiring of outside pest control companies to conduct pest control work in company residential, office, or industrial areas is not allowed.

For outside residents, when you are seeking a pest control company, it is very important to choose a professional accredited and reputed applicator. Evaluating the competency of your agent can be done by discussing the following issues:

- Pests to be controlled.
- Active ingredient(s), formulation (baits, sprays, pellets, traps...) and application techniques of the pesticide chosen.
- Potential adverse health effects and typical symptoms of poisoning associated with the active ingredient.
- Alternative measures to discourage pests from entering your house (housekeeping, screening ports of entries such as drains and windows.)
- Safety precautions to reduce exposure to the pesticide (such as vacating the house, emptying the cupboards, and removing pets).
- You could also ask your neighbors and friends about the reputation of your agent.

References:

1. U. S. Environmental Protection Agency, www.epa.gov
2. World Health Organization, www.who.int



Environmental Tobacco Smoke: A Public Health Menace

Dale Jones, ECD

Almost all adults and children are regularly exposed to Environmental Tobacco Smoke (ETS). This includes secondhand or side stream smoke. Children are particularly susceptible to associated health effects of ETS. According to the World Health Organization's Eastern Mediterranean Region country profile, the reported smoking prevalence in Saudi Arabia is approximately 22% for males and 1% for females. Research has shown that approximately 15% of cigarette smoke is inhaled by the smoker. The remaining 85% lingers in the air for everyone else to breathe. Exposure to secondhand smoke is one of the leading preventable causes of disability and early death.

Comparison of the chemical composition of ETS and MS

ETS is composed of the smoke given off by the burning end of cigarette, pipe, cigar as well as smoke exhaled by the smoker. ETS contains over 4,000 chemicals, many of which are respiratory irritants, systemic toxins and contains at least 43 are known carcinogens. ETS is classified as a Group A carcinogen by major public health and environmental agencies. These agencies include the National Institute for Environmental Health Sciences (NIEHS), the International Agency for Research on Cancer (IARC), and the U.S. Environmental Protection Agency (EPA). This classification refers to chemicals or compounds that have been shown to cause cancer in humans, based on human population studies.

Secondhand Smoke

is toxic

**Cancer Causing
Chemicals**

Toxic Metals



Poison Gases



Secondhand smoke
It hurts you. It doesn't take much. It doesn't take long



Almost all adults and children are regularly exposed to Environmental Tobacco Smoke (ETS). This includes second-hand or side stream smoke. Children are particularly susceptible to associated health effects of ETS. According to the World Health Organization's Eastern Mediterranean Region country profile, the reported smoking prevalence

In “Current Intelligence Bulletin 54: Environmental Tobacco Smoke in the Workplace - Lung Cancer and Other Health Effects,” the National Institute for Occupational Safety and Health (NIOSH) shows a comparison of side-stream (SS) to mainstream (MS) smoke.

Table 1. The Toxic and carcinogenic components identified in Sidestream smoke (SS) and mainstream smoke (MS) are listed below:

Compound Vapor phase:	Type of toxicity	Amount in SS (1 cigarette)	Ratio of SS/MS
Carbon monoxide	T	26.8-61 mg	2.5-14.9
Carbonyl sulfide	T	2-3mg	0.03-0.13
Benzene	C	400-500µg	8-10
Formaldehyde	C	1,500µg	50
3-Vinylpyridine	SC	300-450µg	24-34
Hydrogen cyanide	T	14-110µg	0.06-0.4
Hydrazine	C	90ng	3
Nitrogen oxides	T	500-2,000µg	3.7-12.8
N-nitrosodimethylamine	C	200-1,040ng	20-130
N-nitrosopyrrolidine	C	30-390ng	6-120
Particulate phase:			
Tar	C	14-30mg	1.1-15.7
Nicotine	T	2.1-46mg	1.3-21
Phenol	TP	70-250µg	1.3-3.0
Catechol	CoC	58-290µg	0.67-12.8
o-Toluidine	C	3µg	18.7
2-Naphthylamine	C	70ng	39
4-Aminobiphenyl	C	140ng	31
Benz(a)anthracene	C	40-200ng	2-4
Benzo(a)pyrene	C	40-70ng	2.5-20
Quinoline	C	15-20µg	8-11
N'-nitrosonornicotine	C	0.15-1.7µg	0.5-5.0
NNK	C	0.2-1.4µg	1.0-22
N-nitrosodiethanolamine	C	43ng	1.2
Cadmium	C	0.72µg	7.2
Nickel	C	0.2-2.55µg	13-30
Polonium-210	C	0.5-1.6pCi	1.06-3.7

Abbreviations: C, carcinogenic; CoC, co-carcinogenic; MS, mainstream smoke; SC, suspected carcinogen; SS, side stream smoke; T, toxic; TP, tumor promoter; NNK, 4-(methyl-nitrosamino)-(3-pyridyl)- 1 -butanone. Source: NIOSH, U.S. Department of Health and Human Services [1989]; Hoffmann and Hecht [1989].

The IARC of the World Health Organization reviewed all significant published evidence related to ETS exposure and cancer. Their conclusion was that there is “clear scientific evidence of an increased risk of lung cancer in non-smokers exposed to ETS.” The findings further stated that the “increased risk is estimated at 20% in women and 30% in men who live with a smoker.” They also found that “non-smokers exposed to ETS in the workplace have a 16 to 19% increased risk of developing lung cancer.” The risk of developing lung cancer increases with the degree of exposure.

In June 2006, the U.S. Surgeon General, Richard Carmona issued a comprehensive scientific report, “The Health Consequences of Involuntary Exposure to Tobacco Smoke.” This report concluded that “there is no risk-free level of exposure to secondhand smoke.” Even brief exposure of nonsmokers to ETS affects health. It causes irritation of eyes, nose, throat, headache, and cough. Long term exposure to ETS has been shown to cause reduced lung function in otherwise healthy adults. Research has shown that passive ETS contributes to a number of diseases such as bronchitis, emphysema, heart disease, as well as cancers of the lungs, larynx, pharynx, esophagus, and bladder.



Health Effects on Children

Infants and young children whose parents smoke regularly in their presence are among the most seriously affected by ETS exposure. It has been shown to result

in decreased overall lung function in children. ETS also increases the risk for developing lower respiratory tract infections, such as bronchitis and pneumonia. ETS exposure plays a contributing role in the development of asthma in some children by increasing both the incidence and severity of asthma attacks. It also results in irritation and inflammation in children’s respiratory tracts. It can also lead to fluid buildup in the middle ears of children.

Women who smoke during pregnancy put their unborn fetuses at risk for serious adverse health effects, including premature birth and low birth weight. There is a higher incidence of learning disabilities for children of smokers. Studies have also shown a strong association between ETS exposure and increased risk of Sudden Infant Death Syndrome (SIDS). Smoking by women while they are pregnant as well as exposure of infants to ETS can cause SIDS as reported by the US Center for Disease Control (CDC).

Tobacco Control Measures

Worldwide, tobacco control measures have been shown to have a significant impact on tobacco consumption. Saudi Arabia bans the direct advertising of tobacco products. Dr. Suleiman Al-Sabi, secretary-general of the Charitable Society to Combat Smoking announced that an anti-smoking law has been drafted and is awaiting Cabinet approval. The proposed law will ban smoking in all public and workplaces in Saudi Arabia. Violators of this law will be fined SR200. Saudi Aramco has banned indoor smoking in all public buildings and worksites since 1994. They offer a Smoking Cessation Program through Preventive Medicine Services Division. Population-wide public policies that have been documented as cost-effective strategies include:

- Supporting a government ban on smoking in all public places, such as public buildings, restaurants, malls, etc. Proponents of the new Saudi law believe it will take effect in 2009.
- Restricting sales of tobacco products for children under the age of 18. Requiring proof of age ID.
- Requiring that merchants display cigarettes less prominently and keeping them out of reach.

- Providing school-based curriculum to address the health hazards associated with smoking. Many studies reveal that smokers usually begin the habit as adolescents, often due to the influence of friends. They become addicted to the product without fully realizing the health risks associated with the behavior.
- Providing government sponsored smoking cessation programs for those trying to quit.

Steps you can take to protect your family

- Do not smoke in your house or allow others to do so. Long after the cigarette is extinguished, smoke remains suspended in the air. As a result, people in the house are exposed to ETS even if they weren't present while you smoked. Smoking in another room, opening windows, and blowing smoke in another direction does NOT offer adequate protection.
- Home ventilation systems do not filter and circulate air well enough to eliminate second hand smoke.
- Never smoke in an automobile with the windows closed, especially if passengers are present. ETS exposure is significantly increased due to the high concentration of smoke in a relatively small enclosure.
- Ensure that others are not smoking around your children. Teach your children health risks associated with ETS as well as ways to avoid it.
- Avoid taking your family to public places where smoking is allowed. If there is no option, decrease their ETS exposure by keeping as much distance as possible from the smokers.
- If you smoke, QUIT! As public awareness of the hazards of ETS exposure grows, it will become more difficult to be a smoker. If you are not yet ready to quit, make sure to do what you can to protect your family.

Help stop smoking



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Cutting Edge Membrane Bioreactor (MBR) Technology - It's Here

Jim Evans, EED

In its ongoing role as steward of the environment, Saudi Aramco has recently been implementing the most advanced and effective technology available to treat and dispose of sanitary wastewater generated at Company facilities. This ensures that important Kingdom and Company standards for such practices are achieved. The Membrane Bioreactor (MBR) system, considered “cutting edge technology,” has now been installed and is operating at the Company’s East-West Pipelines Pump Station #3 and #6 industrial facilities. With this action, Saudi Aramco once again takes the lead in ensuring potentially adverse hazards to human health and the environment are managed in a way that minimizes both risks.

The MBR process will now be described in brief. Typically, sanitary wastewater at Saudi Aramco is treated at facilities known as “activated sludge” treatment plants. These plants utilize a population of living bacteria, (types of bacteria found in nature and even inside all of us), to remove the pollutants from sanitary wastewater or change them to a less polluting, and thus less harmful, form. These bacteria, in the presence of a copious supply of air to supply oxygen, consume the pollutants in wastewater in activated sludge bioreactor tanks, such as this one shown below.

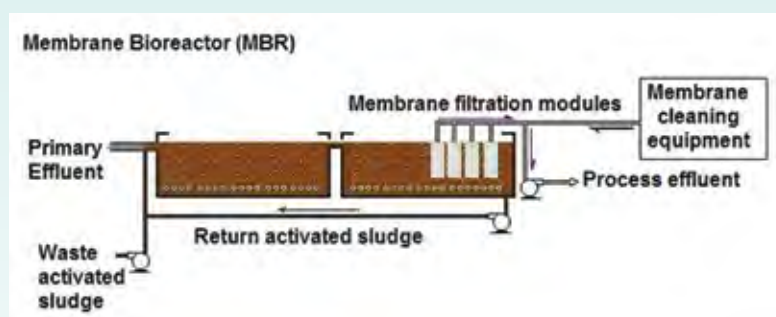
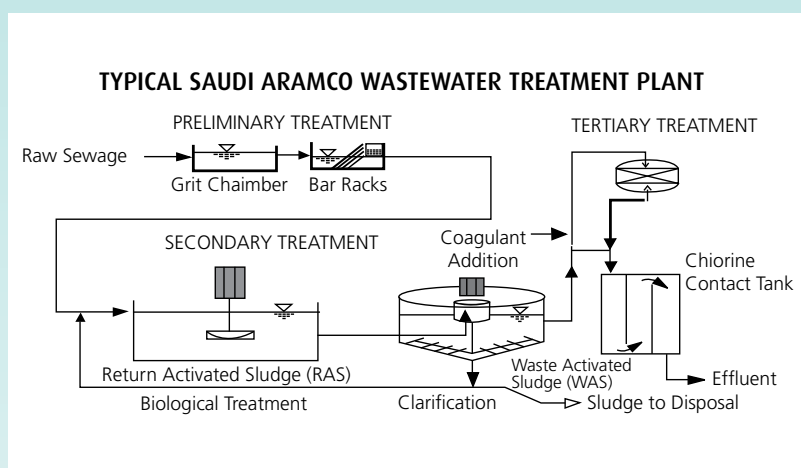


The bacteria are then allowed to settle out of the remaining wastewater to produce a clear liquid with most pollutants removed or substantially reduced.



The clear water produced at this point is typically disinfected by the addition of sodium hypochlorite. If reutilization of the wastewater is required, the water is further treated by filtration through sand filters and chemicals. Disinfection follows to fully ensure all material that could impose a health or environmental risk has been removed or reduced to an appropriate level. The actual sludge treatment process schematic used to render sanitary waste water effluent suitable as irrigation water is shown below.

In the new MBR technology, the clarification and sand filtration steps shown above are combined into one step which utilizes a tank in which very fine porous polyethylene membranes are immersed. These membranes typically come in either cylindrical "hollow fiber" form or modules in "flat sheet" form and possess pore openings as small as 4-5 microns. These are small enough to filter all suspended solid material and many pathogens typically found in sanitary wastewater. A schematic of the basic MBR process is shown below.



In most planned Company installations, the MBR system, is equipped with a small "anoxic" tank as the first step in the treatment process to aid in more complete nitrogen removal in all forms from the wastewater stream. This system modification ensures the system and the effluent produced will comply with new, more stringent, Ministry of Water and Electricity (MWE) requirements to which all wastewater treatment facilities in the Kingdom, public or private, are required to conform. A schematic of the MBR process with the anoxic treatment tank, with pictures of some of the immersed membranes, pipeworks, and bioprocess, are shown below.

The new MBR system provides many benefits over traditional activated sludge treatment systems such as:

- Reduced space required to construct a treatment facility
- Reduced time for systems resulting in less day to day maintenance and oversight
- Reduced capital costs of such a system that are typically less than those of comparable treatment trains methods

The systems are equipped with advanced monitoring sensors and equipment not found on most small activated sludge treatment systems. This allows for a more accurate degree of control by the facility operator. This ensures that they reliably produce an effluent that is suitable for reuse as irrigation water in Saudi Aramco communities and work locations.

Implementation of this technology is another example of how Saudi Aramco fosters and supports core Company values to protect human health, the environment and conservation of precious water resources. Again, Saudi Aramco demonstrates its ongoing commitment as a steward of the environment.



Safe Use of Plastic Food Packaging & Containers

Alaa Aljahdali, ECD

Introduction:

There are many types of plastic used in food packaging and storing. Some are more commonly used than others.

It is easy to identify the type of plastic used in a product by simply finding the plastic identification code, which is usually found on the bottom of a container. This uniform system of coding was introduced in 1988 by The Society of the Plastics Industry (SPI). Its main aim is to make it easier for plastics to be recycled. Another reason for having these codes imprinted on plastic containers is to provide consumers with a simple method for identifying the type of plastic resin used to make a particular product. The aim of this article is to provide readers with information that

should be considered when using plastic products, especially those that are used for food packaging and containers. Consumers should be aware of the following:

- Plastic Identification Codes
- Migration of Chemicals from Plastics
- Safe Use of Plastic Food Packaging & Containers

Plastic Identification Codes:

There are seven different groups of plastic polymers. Each group can be identified by its Plastic Identification Code (PIC) – Usually a number or letter abbreviation. For example, High-Density Polyethylene can be identified by the number «2» and/or the letters «HDPE»:

Plastic Identification Codes Table*

Plastic Identification Code	Type of plastic polymer	Properties	Common Packaging Applications
 PETE	Polyethylene Terephthalate(PET, PETE)	Clarity, strength, toughness, barrier to gas and moisture.	 <p>Soft drink, water and salad dressing bottles; peanut butter and jam jars</p>
 HDPE	High Density Polyethylene (HDPE)	Stiffness, strength, toughness, resistance to moisture, permeability to gas.	 <p>Milk, juice and water bottles; yogurt and margarine tubs; trash and retail bags.</p>
 V	Polyvinyl Chloride (V)	Versatility, clarity, ease of blending, strength, toughness.	 <p>Juice bottles; cling films</p>
 LDPE	Low Density Polyethylene (LDPE)	Ease of processing, strength, toughness, flexibility, ease of sealing, barrier to moisture.	 <p>Frozen food bags; squeezable bottles, e.g. honey, mustard; cling films; flexible container lids</p>
 PP	Polypropylene (PP)	Strength, toughness, resistance to heat, chemicals, grease and oil, versatile, barrier to moisture.	 <p>Reusable microwaveable ware; kitchenware; yogurt containers; margarine tubs; microwaveable disposable take-away containers; disposable cups and plates.</p>
 PS	Polystyrene (PS)	Versatility, clarity, easily formed	 <p>Egg cartons; disposable cups, plates, trays and cutlery; disposable take-away containers; yoghurt and margarine containers</p>
 OTHER	Other	Dependent on polymers or combination of polymers.	 <p>Beverage bottles; baby milk bottles</p>

* Agri-Food & Veterinary Authority of Singapore

<http://www.ava.gov.sg/FoodSector/FoodSafetyEducation/Food+Facts/SafeUsePlasticContainers/index.htm>

Migration of Chemicals from Plastics

Proper usage of plastic food packaging and containers will greatly minimize the potential migration of chemicals into food. The quantities of migrating chemicals will depend on several factors including the nature of food, the contact time and contact temperature.

One of the most common concerns among consumers is the use of Bisphenol A (BPA) in polycarbonate plastics. BPA has been extensively studied by the U.S. Food and Drug Administration (FDA) and other international food safety authorities and results tests have revealed that human health risk is almost non-existent at the levels at which these chemicals might migrate from the plastic packaging and containers. Therefore, the FDA has permitted the use of BPA in polycarbonate packaging for all types of food. In addition, chemicals (including monomers that are used to manufacture plastics) must comply with strict international standards and regulations before being approved for use.

Safe Use of Plastic Food Packaging & Containers

The potential for migration of chemicals depends on several factors such as the nature of food, the contact time and the contact temperature. Therefore, it is vital that consumers pay attention when using plastic food packaging and containers. For example, use the right plastic container for the right type of food, follow proper storage conditions, etc. The following are some tips for safer use of plastic food packaging and containers.



Plastics in the oven

- Pre-cooked food can be reheated in conventional ovens only if the food packaging material is designed for oven use. Always follow the manufacturer's instructions.

Plastics in the microwave



- Use containers that are suitable for microwave use (Refer to Plastic Identification Codes Table)

Plastic cling films

- Always follow the manufacturer's instructions on the appropriate handling of cling films. Cling films are not intended for use in conventional ovens or with pots and pans on burners. Improper use may result in cling films being melted into the food which will increase the potential for chemical migration.
- If cling films are to be used in a microwave, then only those suitable for microwave use should be utilized. Ensure that they do not touch the food to minimize the risk of melting into the food.



Freezing, Defrosting and Cooking

- Freezing meat and other fresh products directly in their original commercial plastic bags is a safe practice. If the storage is going to be for an extended period, it is recommended to double the wrapping with moisture proof freezer bags to preserve the quality and texture of the product.



- Unless the plastic packaging is microwave-safe, avoid defrosting or cooking the food or other fresh products in their original commercial packaging in a microwave.



Reusing plastic packaging and containers

- Avoid using takeaway plastic food containers for repeated storage of food. In general, these containers are disposable items that are designed for single use. For repeated storage of food, use reusable plastic food containers that are sturdy and can withstand high temperatures. Even reusable plastic food containers can become worn after a period of use. Therefore, replace as necessary.



References

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- Food Standards Agency, <http://www.food.gov.uk/>
- U. S. Food and Drug Administration (FDA), <http://www.fda.gov/>
- Agri-Food & Veterinary Authority of Singapore <http://www.ava.gov.sg/>

Soil and Groundwater Cleanup Using Phytoremediation Technology



Mansor Kashir, EED

Introduction

This article describes the restoration efforts of the Guadalupe site in California using phytoremediation techniques to cleanup impacted soils and groundwater. This project was a contribution of Unocal Corporation to the Petroleum Environmental Research Forum (PERF) Biosharing Project, conducted by a number of companies including Saudi Aramco. The produced petroleum at this site was too viscous for efficient recovery, so its mobility was increased by pumping in and circulating a solvent referred to as "diluent" which mixed with the crude oil and was recovered again with it. The composition of the diluent was similar to that of a mixture of kerosene and diesel oil and was derived from the distillation of crude oil. Over the years, diluent was inadvertently released from pipelines and storage tanks and is now present in soils and groundwater at the site.

Site Remediation Plan

A number of activities were conducted to clean up the site; including the excavation of highly contaminated

soils at the site and piling them on top of High-Density Polyethylene (HDPE) liner. The leachate seeping out of these piles is monitored and collected using perforated pipes impinged at various elevations at the pile (Figure 1). These pipes are extended to the outside corners of the soil piles and the generated leachate is collected, tested and disposed of on regular bases.



Figure 1: Excavated Contaminated Soils Piled at the Site and Leachate Sampling and Collection System is Installed.

Pilot Scale Phytoremediation Test

Basically this test involved the use of plants to increase the amount of oxygen in the groundwater, which in turn increases the biodegradation activities of hydrocarbons. Two small areas underlain by diluent-impacted groundwater within the Guadalupe dunes were selected for phytoremediation experiments, SITE 1 and SITE 2. Both sites are located within interdune areas where the water table is sufficiently shallow that plant roots are expected to reach the capillary fringe within a few months and have a measurable effect on both soil and groundwater contamination. Diluent is a Light Non-Aqueous Phase Liquids (LNAPL) and the dissolved phase tends to concentrate in the uppermost portion of the water table and thus is potentially amenable to phytoremediation. At both experimental sites, the source of diluent remains deeper beneath high dunes and includes some free products. Excavation to remove all free products would be expensive and disruptive to the dune ecosystem. These experiments ultimately hope to address whether phytoremediation and natural attenuation combined serve as a permanent low maintenance "pump and treat" system which will continue to operate until the diluent plume is consumed.

The phytoremediation study at SITE 1 consists of native willow plants and poplars densely planted above a diluent plume in an interdunal area. The intent was to maximize the rate of photosynthesis and rhizosphere development by planting these trees as cuttings and container stocks, deep and close together to begin having a measurable effect on soils and the diluent plume as soon as possible. At SITE 2, (Fig-

ure 2) the aim was to recreate a natural landscape, planted to a diversity of native species in their appropriate microhabitats. These are located above a pair of diluent plumes at a shallow depth, so this experiment addresses questions regarding both landscape reclamation and phytoremediation.

The results of the chemical analyses of the average groundwater samples collected from 27 wells located at the study site showed that an increase in oxygen content can be greatly related to the increase in plant cover (Figure 3). This in turn increases the number



Figure 2 SITE 2 - Native Willow Plants Used in the Phytoremediation Experimental Study.

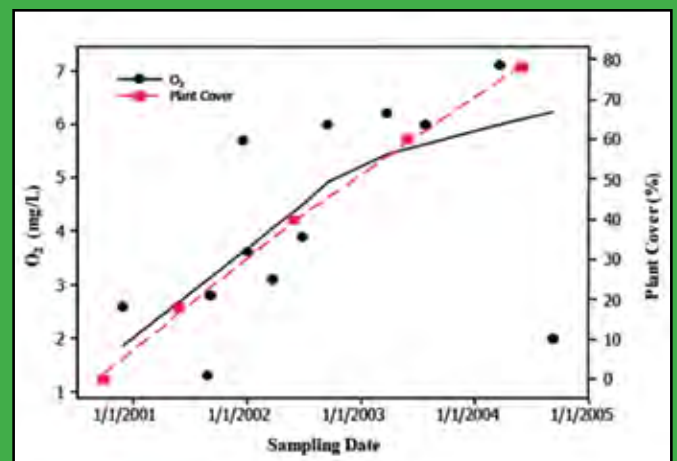


Figure 3 Plant Cover and Dissolved Oxygen Concentration Over Time Averaged for the 27 Groundwater Wells.

The groundwater analyses showed that, both Total Petroleum Hydrocarbons (TPH) and dissolved carbon dioxide concentrations dropped continuously as plants grew (Figure 4). In particular, the average TPH concentration across all 27 wells in the planted areas decreased most rapidly, as plant growth became significant.

The site was kept closed for public access and biological and wild life habitats are well protected (Figure 5). The project site is going to be continuously monitored until groundwater is remediated. It is expected that

this will take a substantial amount of time, however, it is the most preferred method due to its simplicity and cost effectiveness.

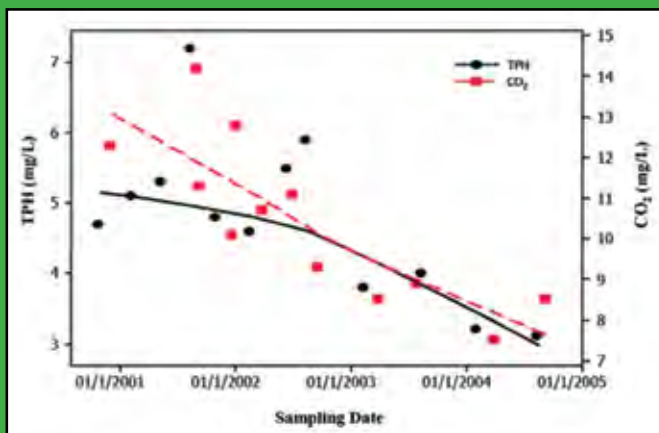


Figure 4 TPH and Dissolved Carbon Dioxide Concentration Over Time Averaged for the 27 Wells.



Figure 5 Wild Life Habitats at Unocal Site at Guadalupe, California are Well Protected.

Conclusion

From the results obtained and shown above, it can be concluded that this method can be very effective in remediating hydrocarbon contaminated sites, especially when contaminated soils and groundwater are located at shallow depths. Plantations increase oxygen content in groundwater and soils, which in turn increases the number of bacteria that acts to degrade hydrocarbon contamination. It is one of the most preferred methods due to its simplicity and cost effectiveness.



New Red Fox Sewage Treatment Units

Matt MacDonald, MEPU

The Marine Department is a vital part of Saudi Aramco's Industrial Services Organization. The department has a reliable fleet of vessels to provide an assortment of Marine Services. These services include supporting the exploration, production and transportation of oil, in and around Saudi Aramco's offshore concession areas.

Operating parameters for these vessels include environmental compliance in regard to sewage wastes generated onboard. Current regulations are established by the International Maritime Organization/ MARPOL and are enforced by the flag states that the vessels operate in.

Annex IV of MARPOL

Annex IV contains a set of regulations regarding the sewage discharge into the sea. These regulations also address the ships equipment and systems for the control of sewage discharge, the provision of facilities at ports and terminals for the reception of sewage, and requirements for survey and certification. The Annex IV also includes a model International Sewage Pollution Prevention Certificate. This certificate is to be issued by national shipping administrations to ships under their jurisdiction.

"The discharge of sewage into the sea will be prohibited, except when the ship has in operation an

approved sewage treatment plant or is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land; or is discharging sewage which is not comminuted or disinfected at a distance of more than 12 nautical miles from the nearest land."

In addition, the Arabian Gulf has been designated as a Special Area under MARPOL. This designation took effect August 1, 2008.

Red Fox Unit Highlights

To comply with these regulations, Saudi Aramco Marine Engineers researched the commercial market. The intent of the Engineers was to select a unit that would best suit the needs for the company vessels. This unit would also have to be in compliance with all environmental regulations.

After a careful technical evaluation, the Marine Engineers' recommended the purchase of the Red Fox "Fox Pac" marine sewage treatment plants. These units are certified for discharge in all areas under the MARPOL Annex IV convention. The basic process of the unit is outlined as follows.

How it works:

Aeration: The influent enters the unit through the inlet connection and into the aeration chamber. Inside the aeration chamber, the raw sewage is mixed with the fluid that contains a large concentration of very active aerobic bacteria. This bacteria begins to consume the organic waste material in the sewage. Air is provided into the mixture through the air diffusers which encourage the aerobic bacteria function.

Clarification & Filtration: The mixture flows from the aeration chamber into the clarification and filtration chamber. As the mixture flows pass the filtration media in this chamber, organic waste that was not completely processed gets trapped in the filter media. The aerobic bacteria can then consume these particles trapped in the media completing the process.

Disinfection: The mixture flows from the clarification and filtration chamber through external piping into a separate, chlorine-contact-chamber tank. This tank allows the mixture to be sanitized and disinfected with the introduction of a chlorine mixture. This fluid is retained in this chamber until all of the bacteria have been killed off. The treated effluent is then safely discharged overboard.

One of the most important features of the Red Fox units is its simplicity of design. There are no internal moving parts, no programmable controllers, macerator pumps, or control valves, which are standard on most of the competitor models. This will result in a huge advantage for our vessel operators. It will also minimize any downtime for repairs due to component failure. In addition, the Red Fox units are constructed of either Fiberglass Reinforced Plastic or internally-coated Heavy-gauge steel. Either of these construction materials can supply excellent anti-corrosion advantages.

These systems are currently being installed to replace older, outdated units. In addition, we are also installing the Saudi Ministry approved comminuted and disinfected type units. These units are also approved under the convention.

redFox Fox-Pac (MSD)
Marine Vessels & Offshore Platforms
USCG/IMO Certified Type II MSD



The Fox-Pac is designed primarily for marine vessels and fixed platforms that have limited space and weight capacity for a sewage process system.

The Fox-Pac is smaller and less costly than our standard marine units. In order to produce this scaled down version, retention time was reduced and the gravity separation process was combined with a high-rate biological aerobic filtration process with two treatment tanks.

redFox Model Offshore Platforms	Persons Black Water	Persons Black & Gray Water
RF-50-FP	3	2
RF-200-FP	10	5
RF-350-FP	18	10
RF-500-FP	25	14
RF-750-FP	38	21
RF-1000-FP	50	28
RF-1500-FP	75	42
RF-2000-FP	100	57
RF-2500-FP	125	70

Fox-Pac Benefits:

- Crew Sizes from 1 To 125
- 50 to 2,500 GPD
- USCG and IMO approved MSD Type II
- Low maintenance
- Low power/utility consumption
- Can be retrofitted into an existing holding tank
- Self-sustaining in fresh or saltwater
- No costly chemicals involved
- No internal moving parts
- Standard configurations or custom designed to meet space limitations



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Red Fox FP 500 Installed on Aramco Tug Tanajib

EnviroNews

Environmental Articles



Environmental Challenges: Manifa Causeway and KAUST Projects

The ultimate goal during executing mega projects in the marine environment is to balance between necessary development, environmental protection and sustainable resource conservation. In Saudi Aramco, this goal is achieved by implementing a number of functional strategies such as early involvement by Environmental Protection Department (EPD) marine scientists in project conceptual development to prevent or minimize potential impacts to the marine en-

vironment. The Company professionals oversee the design and implementation of Environmental Impact Assessments (EIA), including incorporation of recommended mitigation measures. The implementation of Environmental Monitoring Programs, during and after the construction of the project, is now a prime requirement for large projects such as the Manifa Causeway and King Abdullah University of Science and Technology (KAUST) Campus.



Manifa Causeway:

To develop a mega project in a coastal and ecologically sensitive area is very challenging; in Manifa that challenge was even greater due to the importance of the Manifa nearshore and offshore as major shrimp fishery grounds. EPD marine scientists worked with the Manifa project team at the conceptual stage of

the project and successfully avoided potential significant impact of the proposed drilling island Causeway to the marine environment by introducing a number of large openings onto the Causeway design to allow for a better water circulation and movement of marine life in and out of Manifa-Tanajib bay; and altering the selected route of the causeway and location of the drilling islands to avoid coral reefs and dense seagrass meadows. During project development, a comprehensive Environmental Impact Assessment (EIA) was conducted; it recommended a number of mitigation measures to minimize the impact of construction, dredging and landfilling. An Environmental Monitoring Program (EMP) was executed with the start-up of the project to oversee the implementation of the mitigation measures and to monitor the impact of ongoing construction. The EMP will continue during the project and will carry on for three more years after the project completion.

KAUST Campus

During the project development phases of the KAUST, Saudi Aramco provided environmental consulting and scientific support to ensure the design and construction of an “Environmentally Responsible Campus.” EPD marine scientists played a critical role in influencing master plan development with a view of assuring the conservation of sensitive marine habitats in their natural state, and promoting the highest level of environmental stewardship by shifting the location of the campus from the sea toward the land to conserve sensitive marine habitats. Significant unplanned cost-savings have accrued from the adoption of an environmentally responsive Master Plan. Furthermore, In-house marine science expertise was harnessed to provide advocacy and guidance for a marine science research program already underway at KAUST.





Management of Naturally Occurring Radioactive Material (NORM) Guidelines for the Oil & Gas Industry

A significant achievement with strategic and far reaching global impact highlights Saudi Aramco contributions towards the Gas and Oil Industry. EPD chaired the Task Force responsible for developing and publishing the new International Association of Oil & Gas Producers (OGP) NORM guidelines. A key objective of the Saudi Aramco NORM management strategy is sharing best practice, and it is through

this objective that EPD provided the impetus, expertise and knowledge for OGP's latest publication. The guideline document acts as a road map and establishes uniform approaches for NORM management that makes the implementation of tasks easy to manage. The guidelines are flexible and accommodate regulatory variations under which individual companies may be required to operate. The publication acts as a single point of reference, is user-friendly, and utilizes flowcharts to guide the user through different NORM management strategies, activities and processes.



Partnership with Local Municipalities

During 2008, EPD partnered with Dammam Municipality to raise the level of Environmental Health knowledge and experience of municipality health inspectors. A total of 100 food hygiene inspectors and specialists from local Municipality offices in the Eastern Province were sponsored to complete a series of internationally recognized food safety training modules with the goal of enhancing their knowledge of inspection procedures to maintain a higher overall level of sanitation of food retailers and vendors. In

addition, local government inspectors and specialists were introduced to Saudi Aramco auditing procedures and advised on the most effective methods of implementing and monitoring Hazard Analysis Critical Control Points (HACCP) as a food safety quality assurance program in food manufacturing.

New Oil Recovery Barges

Mohammed Al-Shehri, Marine Dept.

The Marine Department has recently acquired three multipurpose oil recovery barges. This reaffirms the Marine Department's commitment to help protect the marine environment.

The barge designs are based on the Marine Department's requirements. The designs also comply with those stipulated by the International Maritime standards. In addition, the basic hull design allows for a choice of oil recovery system options and enables the crafts to be used in other support roles. The design encompasses a marine grade aluminium hull with LOA of 10m and beam of 3.5m. This permits a generous deck work space as well as an internal recovered-oil-storage capacity of 10 cubic meters.

The oil recovery barges are fitted with the Lamor Bow Collector system. This feeds recovered slick oil directly into the oil recovery tank. The Bow Collector system advances through a slick at up to 4 knots. This allows a greater area to be swept thus providing a higher oil encounter rate than traditional skimming systems. The system is easily deployed, from the bow of the boat. It will be able to skim oil within minutes of arriving at a spill site. This modular system is neatly stored on deck and can be deployed by one person. Oil recovery mode can be initiated within a matter of minutes.

These barges will substantially strengthen Saudi Aramco's oil spill response capabilities.



Haradh Gas Plant 2008 Environmental Awareness Campaign

Under the theme of “Toward a Better Environment for Future Generations,” Haradh Gas Plant department conducted a two-day environmental awareness campaign and exhibit in the period from October 13-14, 2008, in conjunction with the Arabic environment day. The event was inaugurated by SAGO Executive Director Mr. Saad Turaiki and Haradh Gas Plant manager Mr. Fahad Al-Salhi.

Seven Saudi Aramco departments have participated in the event, namely: Environmental Protection Department, SA/CR Community Services Department, South Ghawar Producing Department, 'Uthmaniyah Gas Plant Department, Sea Water Injection Department, Hawiyah Gas Plant Department and Southern

Area Production Engineering Department. Additionally, three (3) vendors contributed in the campaign; namely: Saudi Rubber Products Co, Al-Kalthumi Environmental Works and Arabian Environmental Science Ltd Co (ARENSCO).

The exhibition had a total of 19 booths with valuable and diversified environmental topics. The number of visitors was around 700 from various Saudi Aramco organizations, contractors and students from Haradh public schools. The second day of the campaign was dedicated for the local Haradh community. Thousands of environmental posters, brochures and booklets were distributed during the event.



National Safety Council (NSC) Awards for Yanbu Refinery

In March 2009, Yanbu Refinery received the National Safety Council Occupational Excellence Achievement award as well as NCS's Perfect Record award for 2007. The Occupational Excellence Achievement Award recognizes organizations that have reported injuries and illnesses that involved days away from work up to a certain level, but had zero fatalities during the calendar year. The Perfect Record Award recognizes organizations that completed a minimum of 12 consecutive months without any such injuries or fatalities.



Saudi Aramco Perspective On Climate Change – Information And Dialogue

EPD organized a two-hour information and dialogue session on Saudi Aramco perspective on climate change for members of Executive Management, General Management and Department Heads. The objective of the session was to share with members of management the approved Management Committee approach on addressing climate change debate and carbon management activities. The session highlighted company stands on the different international debate points, Saudi Aramco intent on Kyoto Protocol's Clean Development Mechanism (CDM), and R&D Efforts on Carbon Management technologies. In addition, the session included a discussion panel to answer any question or concerns the members of management have on the subject. The discussion panel included experts from the four organizations that developed the perspective: Corporate Planning, EXPEC ARCH, R&DC and EPD.



2009 World Environment Day - Mall Of Dhahran

In celebration of the World Environment Day 2009, Environmental Protection Department in partnership with Public Relations Department, organized a three-day (June 3-5) environmental awareness campaign and exhibit. The event, with the theme of "Your Planet Needs You: Help Protect Your Environment," aimed to raise the environmental awareness and encourage environmentally friendly attitudes amongst the exhibit visitors to ultimately create an environmentally responsible culture. Participating organizations were SAMSO, Utilities, Central Community Services, Power Distribution, and Marine departments as well as

the Municipality of Eastern Province, EP Directorate of Education, an energy conservation public company, and Friends of Environment group. The event included children's videos, awareness literature, and presentations that signified different aspects of environmental protection and environmental health including demonstrations on food safety, oral hygiene, smoking cessation program, household chemicals, tips on recycling, energy and water conservation, and water treatment. The exhibit also highlighted a number of environmental technologies deployed by the Company. The event was well received by the public and around 10,000 people have visited the exhibit with encouraging feedback.



Saudi Aramco Environmental Education Initiative

As a concluding stage for the Environmental Education Initiative pilot phase, Saudi Aramco in cooperation with the Eastern Province Directorate of Education organized a recognition Ceremony in SCITECH on June 15, 2009. Four schools and teachers, and twenty students were recognized and presented with trophies and prizes. The recognized schools and students were selected based on their environmental initiatives and activities contributing significantly

towards realizing the objectives of the Environmental Education Initiative. The main objective of the Initiative is to develop a citizenry that is aware of the environment, and concerned about its protection. Through the initiative, young elementary school students are given the know-how and the tools to encourage environmentally friendly attitudes and commitments.

The event was opened by the Vice President of Saudi Aramco Engineering Services, who briefed the audience about the importance of the Environmental Education Initiative and thanked the EP Directorate of Education for their excellent support and cooperation. Mr Mahmoud Al-Deeri, the Director of Educational Affairs General Administration, represented the EP Directorate of Education.



Environmental Stewardship Workshop

The Environmental Protection Department held a two-day Environmental Stewardship Workshop on June 16-17, 2009, at the R&D Technical Exchange Center in Dhahran as part of its continuing effort to expand the awareness of Saudi Aramco's workforce on environmental issues facing the Company and to motivate the workshop participants to further enhance the environmental performance of their own organization. In attendance were 23 division heads from a wide range of Company departments. The workshop covered 11 main environmental topics: 1) Facility Environmental Performance Index, 2) Envi-

ronmental Impact Assessments, 3) The Environmental Performance Assessment Program, 4) Wastewater Management, 5) Marine Protection, 6) Industrial Hygiene & Environmental Health Management, 7) Air Quality, 8) Solid & Hazardous Waste Management, 9) Radiation Protection, 10) Groundwater Protection, and 11) Climate Change and Carbon Management. To date, over 172 mid-level supervisory personnel have successfully participated in these Environmental Stewardship workshops.



Saudi Aramco Efforts in Protecting and Restoring Mangroves



Introduction:

Mangroves are salt tolerant species of woody plants that grow in the intertidal, sheltered zone of tropical and some subtropical coastal areas including the Kingdom's coasts. They grow on the interface between land and the sea, in estuaries and sometimes on the upper edges of coral reefs area. Two common species of mangrove are found along the Red Sea coast, the red mangrove *Rhizophora mangle* and the black mangrove *Avicenna marina*. Along the coast of the Arabian Gulf, only the black mangrove *Avicenna marina* is found.

Mangrove habitats have important ecological functions as well as economic uses. These habitats are among the most productive ecosystem in the marine environment. For example, in Malaysia, a 15 year old stand of one species of mangrove (*Rhizophora* sp.) produces 23.3 tones/ha/year of biomass. Primary productivity has a direct relation to fish and fisheries

production. In addition to this productivity, the following are some of the functions and uses of mangrove trees and habitats:

- Protection of shoreline, seagrass beds, and coral reefs
- Nursery for fish, shrimp, and mud-crabs
- Food and sanctuary for other marine life
- Potential ecotourism sites
- Protection of reclaimed land

Saudi Aramco Efforts

The following are examples of Saudi Aramco's initiatives to protect and restore the fragile mangrove habitats in the Arabian Gulf and the Red Sea areas:

1. Mangrove Investigation (1984): In conjunction with King Fahd University of Petroleum & Minerals, Saudi Aramco developed a program to study mangrove distribution, growth rate and pro-

ductivity in and around Tarut Bay. The aim of this program was to determine mangrove coverage in the Tarut Bay area.

2. First Mangrove Transplantation Effort (1991): This was a continuation of the 1984 study that was initiated to transplant mangrove in different coastal locations. Among the sites used for this program, Abu Ali Bay site was the only successful transplantation site. From 100 seedlings of mangrove transplanted in this area, thousands of trees were observed at the site 10 years later.
3. Tarut Bay - Ras Tanura (RT) Mangrove Transplantation campaigns (1996, 1999, & 2003-2008): The main objective of these campaigns has been to help in restoring lost mangrove habitats in Tarut Bay due to intensive coastal development, and to educate future generations on the importance of these habitats. The first campaign held as part of these efforts was in 1996 in cooperation with NCWCD (National Commission for Wildlife Conservation and Development), where more than 2000 seedlings were transplanted in the area.
4. Contribution to the National Mangrove Committee (2003): Saudi Aramco became an active member of the National Mangrove Committee that was formed upon a request from HRH Prince Sultan Bin AbdulAziz. The Company donated 1,000,000 SR toward the protection of the Kingdom's mangrove habitats.
5. 2004 Mangrove Surveys: Saudi Aramco Environmental Protection Department participated in the mangrove surveys along the Red Sea Coastal areas with a focus on the entire coast of Jizan. This survey was conducted to document the distribution of mangrove habitats along the coast, and to highlight impacted areas as well as identifying possible impact sources.
6. Designation of a Mangrove Conservation Area

(2005): The Company, in line with its environmental protection policy, has designated the northern part of Tarut Bay (between Rahima and Safwa) as a mangrove conservation area; no environmentally damaging activities are to take place within this conservation area.

7. In April 2009, more than 500 volunteers lead by the company's CEO participated in the transplantation of 10,000 mangrove seedlings in Tarut Bay, under the theme "Save the Mangrove." This transplanting effort was carried out by Public Relation Department, Environment Protection Department, Northern Area Community Services, Industrial Security, Transportation Department, SAMSO and Saudi Aramco Affairs, in coordination with the Ministry of Agriculture. To date, and as a result of these initiatives, Saudi Aramco participated in the transplantation of more than 60,000 mangrove seedlings.



Food Safety In The Summer

Summer is a time when food poisoning occurs most often, particularly when high risk foods, such as meat, poultry, eggs, dairy products, seafood and cooked rice are left unrefrigerated, allowing food poisoning bacteria to multiply. These bacteria are undetectable by sight, smell or taste. Children, elderly, and pregnant women are among high risk groups, who are **PARTICULARLY SUSCEPTIBLE TO FOOD POISONING!** The Environmental Protection Department offers the following food safety tips during the summer:

- **BUY** from reputable suppliers, where food is stored at proper temperatures.
- **CHECK** expiration dates; do not buy food that you can't consume within the use-by date on the label.
- **TRANSPORT** chilled, frozen or hot foods straight home in insulated containers.

- **SEPARATE** raw foods and ready-to-eat foods in your refrigerator in order to avoid cross contamination. (Fresh, ready to eat foods top shelves, raw foods on bottom shelves). Never store raw meats or poultry above ready to eat foods.
- **PREVENT** bacterial growth by keeping high-risk foods, such as meat, poultry, fish and dairy products below 5 °C or above 60 °C.
- **THAW** food in the refrigerator, not at room temperature even if it takes longer. Where applicable, follow the manufacturer's guidelines to ensure that your product has been thawed correctly.
- **WASH** your hands before preparing and consuming food.
- **USE** separate, clean chopping boards and utensils for preparing raw foods and ready-to-eat foods.
- **COOK** all meat, poultry and fish thoroughly.
- **THROW** it away if in doubt!!!!



Swine Flu



Awareness and Preventive Measures for Saudi
Aramco Contractors

Remember:

- Personal Hygiene will reduce risk of infection.
- Avoid crowded areas.
- See a doctor if you develop flu symptoms, especially if you were travelling.
- Inform your boss about your sickness.
- Seek immediate medical assistance if you develop respiratory problems or major health complications.

Protect Yourself and Others



Wash your hands frequently using soap and water, or hand sanitizer.



Cover your nose and mouth with tissue, or with a cloth when coughing or sneezing.



Throw dirty tissues into the waste basket.



Avoid touching your mouth, eyes or nose.



Avoid handshaking with sick people.



Avoid close contact with others.



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Abstracts Acceptance	10 Nov 2009
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- Groundwater
- Marine Environmental Impact & Protection
- Naturally Occurring Radioactive Materials
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