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Environmental Protection Department

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a message from
Omar S. Abdulhamid

EPD Manager

Saudi Aramco is committed to confront major environmental challenges, such as greenhouse gas emissions and industrial waste, fulfilling its obligations to the Kingdom's policies, regulations and international agreements. This is made possible by assuring compliance at different company facilities, implementing standards, improving monitoring, and technically supporting operations. In addition, Saudi Aramco has been supporting programs to ensure the highest health and safety standards in the workplace.

Saudi Aramco had made great efforts in preserving the Kingdom's natural habitats, where some of the best habitats in the Kingdom are found on Company land. Our fenced areas have protected the local ecosystem from overgrazing, hunting, firewood collection, and off-road driving. The Environmental Protection Department is working closely with numerous proponents to identify the highest priority patches of habitat on Company land. Together we identified 18 sites of high biodiversity value as of the first quarter of 2019.

In addition, the Company has installed over 2,728 artificial reefs throughout the Arabian Gulf, a number that will continue to rise, to rebuild marine ecosystems as well as support local fisheries industries. Coral reefs are home to thousands of marine species in the world, and they play a vital role in the global economy by providing resources and services worth billions of dollars yearly.

Saudi Aramco continues its efforts to minimize hydrocarbon flaring, through new technologies, best practices, and research, for a more environmentally friendly approach to our operations. A journey that Saudi Aramco will continue to do to achieve business efficiency, and protect the environment.

Horizons

Well Completion Green Site

Ahmad N. AL-Duaij, Khalid A. Al-Saleem, and Abdulrahman G. AL-Harthi, Southern Area Well Completion Operations Department

SA Well Completion Operation Department (SAWCOD) is looking to fulfil Saudi Aramco's obligations as a National Company, investing its efforts to demonstrate its commitment to environmental responsibility. One of the main initiatives is the Green Site, which was a project initiated to identify the practices in well completion sites responsible for gas emissions and industrial waste. To pilot this project, SAWCOD selected two locations to conduct the initial study, to determine their diesel consumption rate and the level of emissions before and after applying green site practices. The results were outstanding. The project was started in January 2018, and extended to cover all SAWCOD well completion sites in three phases. Beginning with studies on the current environmental impact of the selected locations on the environment, and development of initiatives to effectively mitigate and reduce their footprints. These initiatives were then implemented with a campaign and their adaptation into operations and daily activities. The result was a more environmentally friendly approach. The main objectives of this project were to seek

opportunities of converting the site into an energy efficient and cost-effective site, offering ways of minimizing our impact on the environment, by optimizing equipment and consumables in an eco-friendly way.

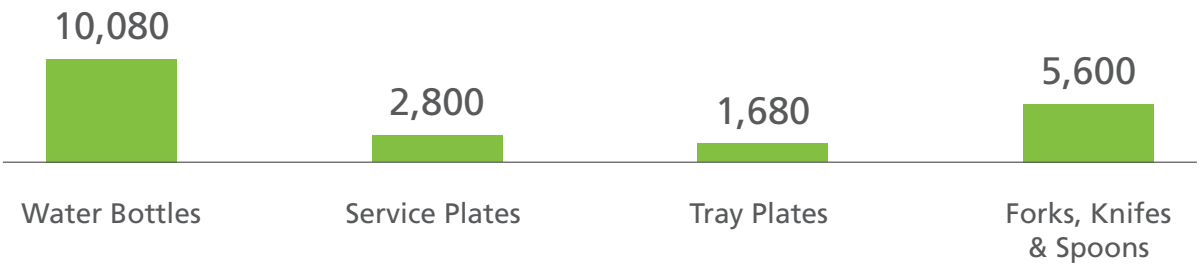
Reducing Co_2 Emissions & Diesel Consumption

Carbon dioxide (CO_2) accounts for the bulk of greenhouse gas emissions resulting from the Company's industrial activities. In addition, emissions of all other greenhouse gases from the main process operations are proportional to CO_2 emissions (Khurshid, 2009). This is why our Company-SAWCOD pays special attention to CO_2 emissions. To reduce CO_2 emissions, we use two methods:

- Reduction of energy consumption with constant volume of production. SAWCOD analyzed its diesel consumption for one tower light, and determined a monthly diesel cost of SAR338.4, which will result in an annual cost of SAR4,060.8.

- Reducing CO_2 emissions through

Plastic Waste



the use of low carbon sources of electricity; wind or solar energy.

Reducing energy consumption means getting more results at lower cost. For many years, our enterprises have focused on the energy management system to increase the energy efficiency of equipment, as well as improved working methods to reduce energy losses.

In addition, the site was able to change halogen floodlights to LED floodlights, which helped to reduce power consumption. The site currently has solar powered tower lights, and we are working to bring a hybrid generator.

Reducing Plastic Waste

Plastic waste represents 67% of site waste. To reduce plastic waste, the site obtained water dispensers with recyclable water bottles. This has significantly reduced the plastic waste generated at the SAWCOD site.

Reducing Paper Waste

With the passage of time, the issue of recycling paper waste has not lost its relevance. No matter how far recycling technologies have progressed in the field, no matter how often a person currently uses electronic gadgets to access the world of information, no matter how quickly the bureaucratic apparatus is transferred to electronic variants of relationships with service consumers, one thing remains unchanged; paper waste is still produced.

Almost 90% of large enterprises have resolved their paper waste problem to their advantage (Uitto, 2014). Mini paper presses are widespread, and for companies the only problem is the storage of waste paper. Contracts with paper processing enterprises make it possible not only to hand over paper waste for money, but also to receive discounts in exchange for products made from this waste paper, such as packaging material.

Paper Waste represents 19% of SAWCOD site waste. To reduce it, several initiatives were implemented. Two-sided prints are made to reduce paper use. Also, paper that used one time is being collected for reuse if blank pages are found. In addition, the information and bulletin boards at the site have been converted to digital media and are displayed on screens, eliminating need for printed paper.

Reducing Hazardous Waste

The first method of reducing the release of toxic substances is the production of durable goods and materials. Rechargeable batteries are growing in popularity. For example, a rechargeable battery pack costs $25. According to statistics, every family spends $20 on batteries annually. Therefore, rechargeable batteries will pay for themselves in two years. In many countries, there are special taxes levied on ordinary disposable batteries that are discarded after use. There are economic incentives to buying rechargeable batteries instead of single use batteries. Charging rechargeable batteries costs approximately $4 per year. Long-term, it is much cheaper to buy rechargeable batteries instead of single use batteries.

The second method is the collection and isolation of materials containing toxic substances. Therefore, it is necessary to collect recyclables, as reserves create demand. The third method is the collection and isolation of waste containing toxic substances. Thus, the amount of waste that is thrown away is reduced.

Reducing Food Waste

On a global scale, hunger is one of the world's major problems. However it can be solved if even only half of the loss or waste is reduced. This reduction in losses would also result in a reduction in losses of land, energy, labor, and water resources. In order to find the right solution to the problem

of processing and disposing of food waste, it is necessary to conduct research on its origin, composition, and actual quantity (Khurshid, 2009). That, in turn, will have many positive results, i.e., our losses will be profitable for us, both in the material and in the ecological sense. A food compost machine used in converting food waste to fertilizer can be used for plant cultivation, while at the same time sustaining the environment.

Glycol Bulker Tank Supply

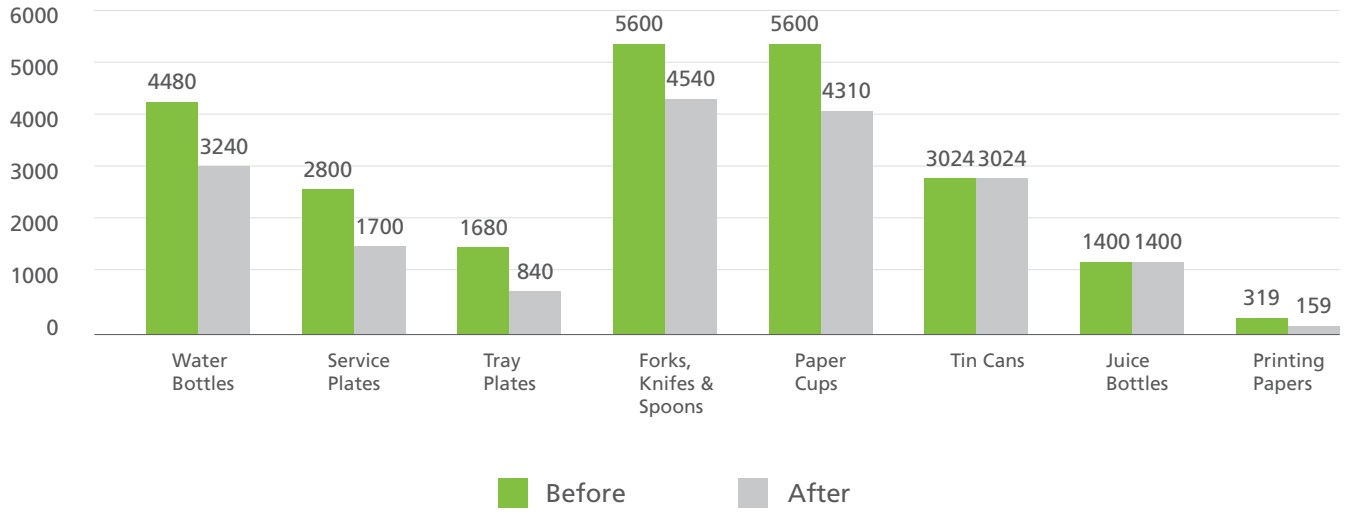
The use of ethylene glycol at the SAWCOD site, is based on ethylene glycol's ability to lower the freezing temperature in solutions by 25 – 45 °C, during the flowback operation. Therefore ethylene glycol is used mainly as an additive to improve the nonfreezing properties of substances.

In addition, multicomponent mixtures based on ethylene glycol can significantly improve the technical and mechanical properties of materials — increasing their service life and reliability. Ethylene glycol's ignition property is used in the manufacture of explosives. For this reason, it is proposed to supply and store it in bulk tanks instead of in drums. This will ensure the elimination of residual volume, and reduce both the number of waste drums, and the potential for chemical spills.

Outcome

Overall results of the application of these practices, in addition to the environmental awareness of employees and contractors, resulted in a general reduction of solid waste, food waste, and CO2 emissions. The following figure shows a one site per month comparison of data, before and after applying Green Site practices.

Monthly Solid Waste Reduction



Waste Types	Monthly solid waste before reduction/pcs	Monthly solid waste after reduction/pcs	
1	Water bottles	4480	3240 #
2	Service plates	2800	1700 #
3	Tray plates	1680	840 #
4	Forks, knifes and spoons	5600	4540 #
5	Paper cups	5600	4310 #
6	Tin cans	3024	3024
7	Juice bottles	1400	1400
8	Printing papers	319	159 #

Monthly Solid Waste Minimization:

By using travelling bottles and water dispensers reduced plastic bottles waste.
By using personal mugs reduced paper cups waste.
By using TV screens as digital boards and double-sided printing reduced paper waste.

Food Waste Minimization:

Food composters are used to recycle food waste into organic fertilizer. The unit can produce 2 kg every 24 hours. Each unit will produce an average of 42 kg of organic fertilizer every month.

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Eye in the sky

Mapping coral reefs and detecting oil spills with satellites.

Diego Lozano-Cortés, Khaled Asfahani, Hattan Balkhi, Tyas Hikmawan, & Hamed Al-Ghamdi, EPD

Coral reefs are home to thousands of marine species in the world, and they play a vital role in the global economy by providing resources and services worth of billions of dollars yearly. These ecosystems are highly sensitive to environmental changes and can show signs of distress in response to detrimental conditions almost immediately. For this ability, coral reefs are considered to be an indicator for the health of the world's oceans. Nonetheless, coral reefs are currently disappearing worldwide at an alarming rate due to natural and anthropogenic factors, and scientists are fighting to stop this trend.

In order to protect these ecosystems, the first step we need to complete is to know where coral reefs actually are. Global maps of the distribution of coral reefs have gone largely unchanged since the 18th century from data collected during ocean expeditions, and it was not until recently that coral reef mapping met the modern technology with the arrival of the Landsat 7. The Landsat series of satellites were originally created in 1972 to observe landforms, but version 7 that emerged in the turn of century had a special focus on marine environments, thus allowing the collection of images on marine ecosystems that lead to the Millennium Global Coral Reef Mapping project (NASA Earth Observatory, 2015). Led by the Institute for Marine Remote Sensing at the University of South Florida, this project used a dataset of high-resolution (30 meter) Images, acquired between 1999 and 2003 from the Landsat 7 satellite, and developed the first global uniform map of shallow coral reef ecosystems, in collaboration with the United Nations Environmental Programme World Conservation Monitoring (IMaRS-USF, 2005).

A new generation of satellites (Landsat 8) has improved coral reef mapping, and the current sensors aboard have higher sensitivity, and can simultaneously collect important data (such as sea surface temperatures) to monitor coral reefs, even in the most remote regions. Emerging applications from new satellite capabilities was the creation of the National Oceanic and Atmospheric Administration (NOAA) Coral Reef Watch. This program uses satellite data to provide current reef environmental conditions to quickly identify areas at risk for coral bleaching. Bleaching is the process by which corals lose the symbiotic algae that give them their distinctive colors. If a coral is severely bleached, diseases can attack them, leading to coral death.

Satellites have improved our knowledge on coral reefs, and that technology is currently shaping management decisions, by collecting near-real time information on multiple environmental variables around these ecosystems that cannot be obtained by in situ observations (Eakin et al. 2010). There are still some gaps with existing satellite technology, as they don't provide images that provide the level of quantitative and qualitative data, necessary for creating comprehensive maps of living coral reefs, or detecting changes in their health on a global basis (Planetary Coral Reef Foundation 2012). For these reasons, in 2010 The Coral Reef Satellite Mission (CRSM) was launched by The Planetary Coral Reef Foundation,

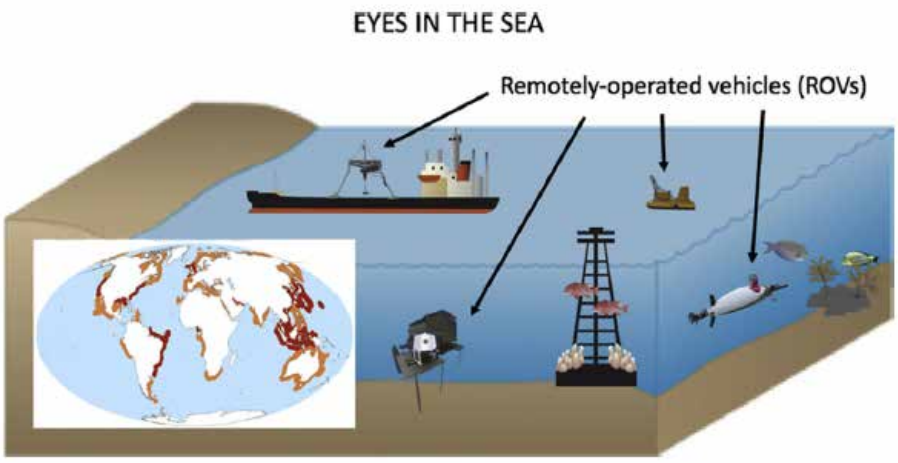

Figure1: Science of the Total Environment (7)

in collaboration with MIT's Center for Space Research, and The Science Operations Center at Scripps Institution of Oceanography, to daily transmit real-time data, about the state of the world's coral reefs, back to Earth. The global baseline map of coral reefs produced by the CRSM facilitated the discovery of hidden reefs and changes to their health. Additionally, the Planetary Coral Reef Foundation (PCRF) is currently streaming via satellite to classrooms and exhibition spaces worldwide, showing close up images of what the satellite cameras are detecting in coral reefs from space. This information is available to the general public and images can be downloaded for free at www.pcrf.org.

Recent advances and applications on satellite technology have been targeted to detect marine oil spills, due to the threat they pose to the economy and the environment. For instance, the satellite Sentinel has been launched for environmental monitoring, specifically for response to natural disasters, including oil-spill monitoring as well as ship surveillance (ESA 2017). This satellite has Synthetic Aperture Radar sensors (SAR) that provide high-resolution images (20m) independent of weather conditions, and allow the identification of oil slicks due to the disruption of ocean backscatter. Ideally, SAR satellite images are used to detect any oil slick that can result from illegal dumping, sabotage incidents, operational failures, etc. Combining SAR technology with an integrated environmental modeling system can be used to remotely track and forecast the spill's Fate, to ensure making the required informed decisions to safeguard people, assets, and the natural environment. The integration of these tools assists the surveillance activities of concerned environmental and governmental organizations. This technological approaches can potentially enable Saudi Aramco to better respond to oil-spill incidents by providing an accurate and proactive oil spill monitoring system. Satellite-based monitoring provides broad advantages, such as rapid spill identification, near real-time imagery for oil spill impact management, and threat assessments.

The Environmental Protection Department (EPD) participated in the latest edition of the International Ocean Colour Science meeting (IOCS) on April 8-12, 2019, in Busan, South Korea. During this conference, the National Aeronautics and Space Administration (NASA) presented its latest open source software (SeaDAS). It enables users to process, visualize, and analyze remote-sensing data on the marine environment (e.g., chlorophyll-a and sea surface temperature). Similarly, new applications using Sentinel data to protect sensitive ecosystems in the Great Barrier Reef (Australia) were unveiled.

While many of these advances on oil spill detection for coral reef protection are promising, there are still gaps that need to be filled. For instance, the current technology only allows users to map coral reefs, inform about changes in the environment around them and detect on-site oil spills. To help better manage and protect the marine environment and its resources, this technology should be integrated with modelling capabilities that allow for the prediction in real time the direction of oil spills to anticipate our responses and minimize impacts. Saudi Aramco has recently triggered the establishment of in-house

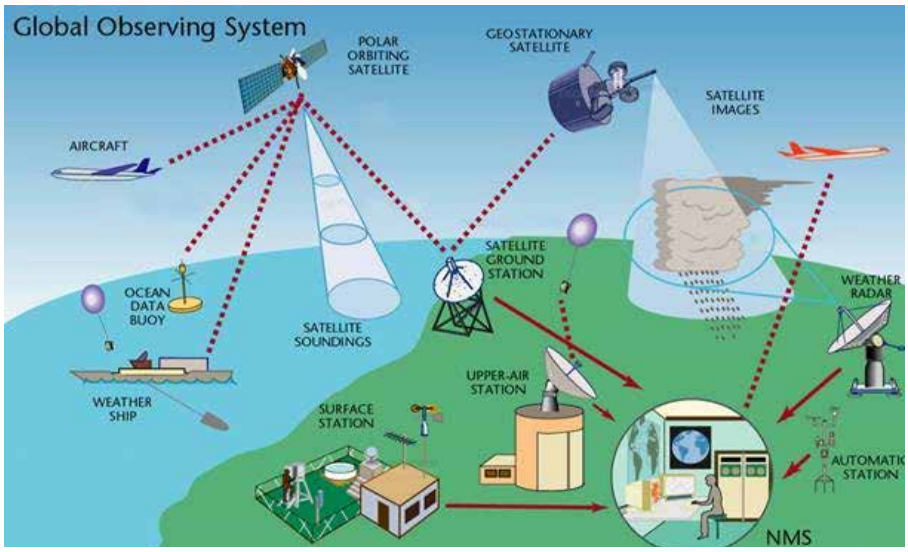

Figure 2: World Meteorological Organization (8)

environmental modeling capabilities, to improve and enhance its modeling capabilities in both the Red Sea and the Arabian Gulf. This modelling will be ready for operation Company-wide by 2021. We are looking forward to integrating these modeling capabilities with SAR technology, as part of our oil spill response capability.

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Did you wash them?

Hand washing prevents disease.

Wash out

A look at hand washing to prevent disease.

James White & Tom Hullock, EPD

About 1.8 million children under the age of 5 die each year from diarrheal diseases and pneumonia. (Source: US Center for Disease Control)

Although people around the world clean their hands with water, very few use soap to wash their hands. Washing hands with soap removes germs much more effectively. Hand washing with soap and clean running water is the most important way to prevent the spread of disease. This practice could protect about 1 out of every 3 young children who get sick with diarrhea.

Guidance from healthcare professionals teaches us to rub our hands together in various ways to make sure the surface of each hand is clean. Hands should be washed for at least 20 seconds in warm water, while the importance of using enough soap to cover the whole surface of the hands cannot be stressed enough.

Saudi Aramco Environmental Health Code standards require that both hot and cold running water must be provided for hand-washing basins. Oil and grease become more liquid at higher temperatures and easier to mix with water, meaning they wash off easier when the temperature of the water rises. To prevent burns from otherwise scalding hot water, temperatures can be thermostatically controlled or anti-scald valves fitted to ensure that the temperature does not exceed 49°C (120°F).

It is also important to dry your hands after washing. Germs can be transferred more easily to and from wet hands. Although the best way to dry hands remains unclear, studies suggest that using a clean towel or air drying hands are best. EPD requires all Company facilities to provide hand driers or paper towels in all bathrooms and food production areas.

By following these simple steps, everyone can help to reduce preventable illness and make our homes and workplaces safer and healthier.

How to wash your hands - according to the experts

washing your hands properly should take about as long as singing Happy Birthday twice (about 20 seconds).

Wet hands and apply enough soap to cover the whole surface of the hand.

Rub palms together with fingers interlaced.

Rub each palm over the back of the other hand with interlaced fingers.

Rub between fingers on each hand.

Rub backs of fingers (interlocked).

Rub around each thumb

Rub both palms with finger tips and then rinse with warm water.

Dry your hands well with a disposable towel.

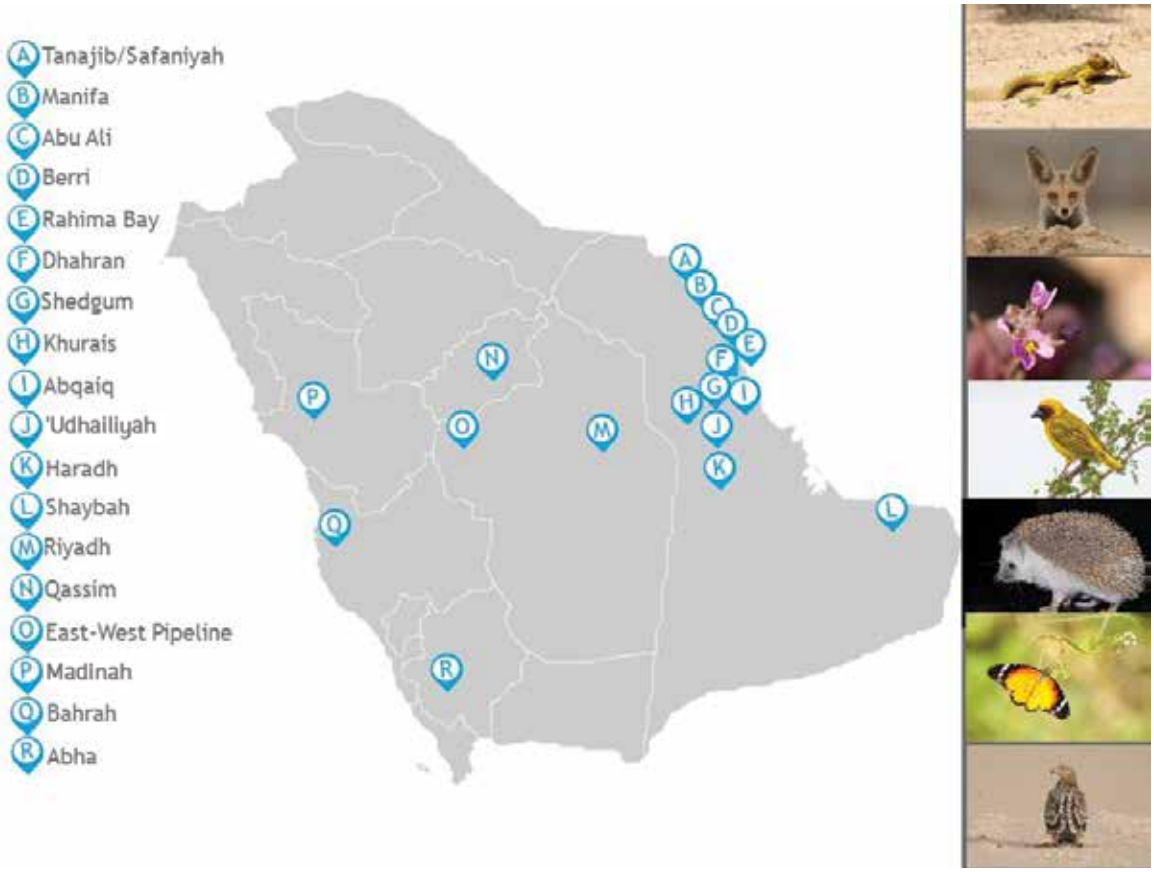
Use a disposable towel to turn off the faucet if not hands free.

In Depth

100,000 wild hectares:

Saudi Aramco's Biodiversity Protection Areas

Christopher R. Boland, EPD



Map 1: Saudi Aramco contains patches of high-value biodiversity across its vast operating areas. To date, 18 sites have been assessed, and many more are likely to be uncovered in the next few years as surveys continue.

As a biologist working for Saudi Aramco, I've been lucky enough to travel around much of this vast and surreal landscape to study its extraordinary desert-adapted plants and animals. Time and time again, I keep finding that some of the best habitat in the Kingdom occurs on Company land, where our fenced areas have protected the local ecosystem from overgrazing, hunting, firewood collection, and off-road driving.

The Environmental Protection Department is working closely with numerous proponent departments to identify the highest priority patches of habitat on Company land. Together we have already identified 18 sites of high biodiversity value as of the first quarter of 2019 (See Map), and eight of these sites have been formally designated as Saudi Aramco Biodiversity Protection Areas (as per SAEP-359).

From Shaybah in the south, to Tanajib in the north, and from

Abu Ali in the east to Abha in the west, these eight protected areas cover 900 km^2 of habitat across a diverse array of ecosystems. We hope to designate three more sites by the end of 2019, bringing the total area protected to more than 1,000 km^2 of habitat

Below is a very brief snapshot of the exceptional diversity of habitats that can be found across Saudi Aramco's vast operating areas. Travelling clockwise around the country, we start with Tanajib/Safaniyah.

A. Tanajib/Safaniyah: A shining coastal jewel

Habitat: Gulf coast lowlands

Proponent: Safaniyah Onshore Producing Department

Size: 29 km^2

Key species: desert truffles, dhub, lesser crested tern, Socotra cormorant, Zygophyllum qatarense (plant)

Sparkling gulf coastline, coastal plains, and sabkhah habitats make up this outstanding eastern lowland site — a reminder of what the Eastern Province once looked like. The area is densely covered with 32 plant species, and a habitat for eight small mammal species, five reptiles, and 48 birds. The site is also a transitory haven every year for dozens of coastal migratory bird species, which revel in the area's rich biodiversity.

B. Manifa: A migratory bird haven

Habitat: Gulf coast lowlands

Proponent: Ras Tanura Refinery Operations Department

Size: 18 km^2

Key species: Cakile arabica (plant), Cheesman's gerbil, dhub, Schismus arabicus (plant), greater flamingo

Each year more than 150 migrating bird species land on Manifa's beautiful coastline, sand flats, coastal depressions, open plateaus, saltmarshes and sabkhah habitats, to share in its lush environment of 41 plant species. The site shelters six mammals, four reptiles, 54 bird species, and hosts dhub lizards translocated from neighboring sites that were about to be cleared for development.

C. Abu Ali: Internationally-recognized bird sanctuary

Habitat: Gulf coast lowlands

Proponent: Ras Tanura Producing Department

Size: 105 km^2

Key species: Cheesman's gerbil, Eurasian curlew, golden jackal, Schismus arabicus (plant)

Designated a globally Important Bird Area by BirdLife International, within the fringes of Abu Ali Island's coastline, countless butterflies flutter across dunes, sandy flats, mangrove swamps, and crunchy and open plain sabkhah. Thriving inside the varied terrain are 32 native plant species, six mammals, two reptiles, 53 birds, and a yet-to-be surveyed number of migratory bird species.

D. Berri: A carpet of wildflowers

Habitat: Sandy-gravel desert

Proponent: Berri Gas Plant Department

Size: 5 km^2

Key species: Arabian toad-headed agamid, dhub, lesser kestrel, Calligonum comosum (plant)

Protected from over-grazing, firewood collection, and off-road driving for more than four decades, Berri's sandy-gravel desert terrain has patches of thriving native vegetation, which shelter habitats for numerous resident and migratory species. The land next to the site's operating infrastructure contains birds such as larks, shrikes, wheatears, and small wetland birds living in treated-wastewater marshes, as well as numerous burrows of the globally vulnerable dhub.

E. Rahima Bay Mangrove Eco-Park: A marine nursery

Habitat: Mangrove forest

Proponent: Northern Area/Western Region Community Services Department

Size: 60 km^2

Key species: grey mangrove, dozens of fish and shrimp species, osprey, greater flamingo

At Rahima Bay Eco-park, old-growth mangrove roots descend into the intertidal mud, breathing fresh vitality into its air and water, nurturing life on the Kingdom's

shores. Saudi Aramco is behind this mangrove Eco-park and is currently constructing an educational visitors' center and mangrove boardwalk around its invaluable mangrove, saltmarsh and intertidal habitats.

F. Dhahran Jebels: Extraordinary plant diversity

Habitat: Jebels

Size: 1.4 km²

Key species: desert hedgehog, Arabian toad-headed and yellow-spotted agamid, Calligonum comosum (plant), desert truffles

Sheltering in the heart of Company headquarters is an abundance of species living in the patch of jebels and sandy gullies northwest of Peninsula Boulevard. An extraordinary 85 native plant species — one of the Eastern Province's most floristically diverse sites — shares the area with at least four mammals, three reptiles and more than 60 birds, including five globally threatened and five endemic species.

G. Shedgum Escarpment: Gorgeous desert gorges

Habitat: Stony escarpment and gorges

Proponent: Southern Area Well Completion Operations Department

Size: 3.9 km²

Key species: Arabian toad-headed agamid, long-legged buzzard, short-toed snake-eagle, Zygophyllum qatarense (plant)

Largely untouched, Shedgum's striking gorges offer shade to a wide diversity of native flowering plants. This gravel escarpment habitat nurtures several endemic plant species, an array of rock-dwelling reptiles, mammals and birds, including nesting long-legged buzzards, blackstart and

rock dove.

K. Khurais: A stopover for migrating birds

Habitat: Sandy-rocky desert

Proponent: Khurais Producing Department

Size: Currently 38 km² to be enlarged to 68 km² by 2020

Key species: Arabian jird, Arabian red fox, Cape hare, Cheesman's gerbil, dhub, lesser jerboa

Life exists in surprising abundance in the classic desert habitat of Khurais. Migratory birds, on their epic global journey, visit this remnant patch of shrubby dense vegetation, which grows among the dunes, gravel plains, and wetland. A refueling stop for the Kingdom's feathered guests, Khurais sustains at least 42 birds, 22 plants, seven mammals, and three reptile species, including the vulnerable dhub lizard.

I. Abqaiq Wetlands Eco-Park: An oasis in the desert

Habitat: Wetlands

Proponent: Southern Area Oil Operations

Size: 2.5 km²

Key species: Arabian toad-headed agama, Arabian red fox, desert hedgehog, Socotra cormorant

A charming sanctuary of wetlands, sand dunes, and planted tree belt rests in the western shadow of Abqaiq's oil processing facilities. Among dense thickets of reeds, tertiary treated wastewater tops up a naturally-exposed portion of an ancient aquifer, forming a stunning wetland, and retreat for more than 49 bird, 34 plant, four mammal and six reptile species. The site includes the Kingdom's first two birdwatching hides.

J. 'Udhailiyah: Dhub dreamland

Habitat: Sandy-gravel desert

Proponent: Southern Area Gas Producing Department

Size: 2.3 km²

Key species: dhub, Ephedra alata (very rare plant)

The rare traditional medicinal plant, Ephedra alata, absent from the Eastern Province for 20 years, is found at 'Udhailiyah along with 48 other native plant species, 35 birds, six mammals, and seven reptiles, including a healthy population of iconic dhub lizards (which are listed as vulnerable to extinction within our lifetime). 'Udhailiyah has installed the world's first "Slow Down: Dhub Crossing" road signs.

K. Haradh: Small mammals abound

Habitat: Sandy-gravel desert

Proponent: Haradh Gas Plant Department

Size: 8.3 km²

Key species: Acacia tortilis, Arabian red fox, Cheesman's gerbil, dhub, lesser jerboa

Mature acacia tree provide shade among the intermittent wadis within Haradh's open plains, roamed by small mammals, such as jird, gerbil and jerboa. Naturally low vegetation covers the site's compact gravel, sandy and clay soils, creating a habitat for larks, wheatears, and reptiles, including dhub.

L. Shaybah Wildlife Sanctuary: True wilderness

Habitat: Sand seas

Proponent: Shaybah Producing Department

Size: 637 km²

Key species: Arabian oryx, Arabian sand gazelle, Arabian toad-headed agamid, golden eagle, ostrich

Protected within a 104-km long fence are 637 km² of near-pristine Rub' al-Khali wilderness containing 10 native plant, 13 reptile, 18 mammal, and up to 176 bird species, including 169 migratory species. The site includes 10 Arabian endemic species, 39 of Saudi Arabia's 50 high conservation priority species, and 13 regionally threatened species. Thanks to Saudi Aramco, this true wilderness now contains three reintroduced iconic species that were once on the brink of extinction: Arabian oryx, Arabian sand gazelles, and ostriches.

M. Riyadh: A haven in the capital

Habitat: Limestone hills and escarpment

Proponent: Central Region Distribution Department

Size: 53 km²

Key species: Arabian short-fingered gecko, dhub, Arabian red fox, Arabian lark, Arabian green bee-eater

Flowering native plants and large mature acacia trees flourish on attractive limestone hills and a gravel escarpment, creating a beautiful home for reptiles, small mammals, and an estimated 80 bird species, which includes the sand partridge, wheatears, larks, eagles and buzzards.

N. Qassim: Acacia filled wadis

Habitat: Stony escarpment and wadis

Proponent: Central Region Distribution Department

Size: 34 km²

Key species: Arabian green bee-eater, Arabian lark, cinereous vulture, honey badger, pharaoh eagle-owl

Rising within Qassim's magnificent stony, rolling hillsides are acacia-filled wadis, and a wide diversity of native flowering plants. Preliminary surveys show the area proliferates with reptiles, small mammals, and birds, such as blackstart, sand partridge and wheatears, with an estimated 80–100 species of bird are likely to use the site throughout the year.

O. East-West Pipeline: A transect of the Kingdom's diversity

Habitat: Diverse

Proponent: East-West Pipelines Department

Size: To be determined

Key species: Arabian lark, Arabian green bee-eater, Arabian partridge, Cape hare, dhub, Nubian ibex

Crossing Saudi Arabia from east to west, the 1,200-km-long and 400-m-wide pipeline corridor comprises patches representing most of the Kingdom's habitats — eastern coastal lowlands, Ad Dahna sand seas, central plains, rocky escarpment, highlands, and the Western Tihama coastal plains. Each patch supports its own treasure of native plants and animals, as well as archaeological and cultural gems.

P. Abha: Pristine alpine majesty

Habitat: Southwest highlands

Proponent: Western Region Distribution Department

Size: 49 km²

Key species: Arabian sunbird, Philby's partridge, Anderson's blue agama, crested porcupine, steppe eagle

One of the world's 36 endemic biodiversity hotpots, the Asir Mountains is a beautiful, near-pristine wilderness. Surveys reveal the Company's site contains a minimum of 37 plant species, 18 mammals, 61 birds and six reptiles, including 23 of the 50 species listed by the Saudi government as high conservation priority nationally, four internationally threatened species, and 10 regionally endemic species. This is perhaps the best habitat in the world for the rare Philby's partridge.

Q. Bahrah: A patch of exceptional value

Habitat: Sandstone wadis and foothills

Proponent: Western Region Distribution Department

Size: 47 km²

Key species: Arabian babbler, Arabian green bee-eater, Arabian lark, Arabian short-fingered gecko, Arabian spiny mouse

Bahrah's near-pristine mountains, wadis, and sandstone habitats is the Kingdom's most intact biodiversity area within close proximity to Jiddah. Surveys have identified 35 plant species, five mammals, 31 birds and five reptiles, including six high conservation priority species, and 10 regionally endemic species. More than 100 species of bird are estimated to use the site throughout the year, which also contains archaeological and cultural value.

R. Madinah: Inspiring tree-filled wadis

Habitat: Southwest Highlands

Proponent: Western Region Distribution Department

Size: 27 km²

Key species: Arabian lark, Arabian short-fingered gecko, Arabian spiny mouse, Nubian ibex, rock hyrax

With its impressive acacia-rich mountains and wadis, Madinah shelters a habitat of 39 plant species, eight native mammals, 34 birds and four reptiles. This list includes nine nationally high conservation priority species, five regionally endemic species, as well

(Photo Source: Saudi Aramco)

as eight migratory bird species. The site, which also contains archaeological and cultural values, is used by an estimated 100 bird species throughout the year.

Conclusions

As a result of these patches of high quality habitat, I have been able to identify and record over 500 species of birds, reptiles, mammals, butterflies and plants within our communities, operating areas, and reservations. Many of these species are globally endangered; others are highly migratory, flying 15,000 km or more to forage at Company-protected areas; some occur in Arabia and nowhere else on earth – and all of them need our ongoing stewardship.

These protected areas demonstrate that biodiversity and oil and gas operations can occur side by side and hand in hand. This is something that Saudi Aramco can be extremely proud of.

Captions:

- *Photo 1: Saudi Aramco Biodiversity Protection Areas contain at least 55 endemic species or subspecies (that is plants and animals that are found only in the Arabian Peninsula), such as this Arabian Toad-headed Agama at Shaybah (Photo: Chris Boland)*
- *Photo 2: Abha SSSP contains exceptional biodiversity, such as this Philby's Partridge, which occurs in Saudi Arabia and Yemen and nowhere else on earth.*
- *Photo 3: Over 85 species of plants have been recorded in Dhahran Jebels alone, including beautiful endemic species such as this Cakile arabica*
- *Photo 4: Over 30 mammal species have been recorded within Saudi Aramco Biodiversity Protection Areas, which represents more than a third of all of the terrestrial mammals in the Kingdom. The most commonly recorded mammal species is the Arabian Red Fox.*
- *Photo 5: Numerous threatened species occur in Saudi Aramco Biodiversity protection areas, such as the iconic Dhub lizard. Sadly, this amazing animal is formally listed as being vulnerable to extinction.*

Japan's Waste to Energy experience

A viable waste management and renewable opportunity

Abdullah Al-Duaiji (Environmental Protection Department), Abdulaziz Al-Salem (New Business Development) and Abdulrahman Al-Abdulkarim (Industrial Development & Strategic Supply Department)

Addressing proper waste-disposal needs is a huge challenge worldwide, which includes surpassing landfill capacity and dealing with negative health and environmental impacts when waste is not properly managed. According to a World Bank report in 2018, by 2050, the earth is expected to generate 3.40 billion tons of municipal waste annually, increasing an eye-catching 68% from the 2.02 billion tons generated in 2018 (Figure 1). Different types of municipal waste are illustrated in Figure 2. [1]

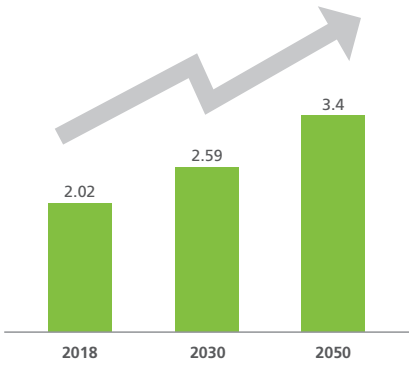


Figure 1: Global Municipal Waste Generation Rate

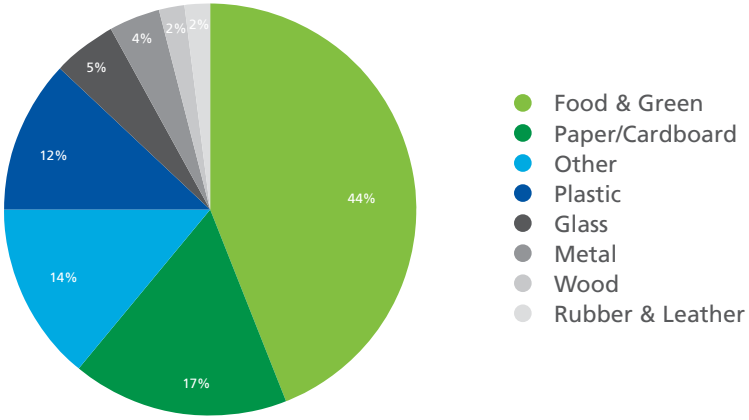


Figure 2: Main Types of Municipal Waste

Waste Management in Japan

Japan has experienced the same waste-management issues now facing developing countries. The country used to lack the infrastructure of proper collecting, sorting, transporting and treating waste. Between 1945 and 1950, waste generation increased drastically due to robust economic and population growth after World War II. [2] Yet due to the lack of waste-management infrastructure, waste began to pile up in open areas, rivers, and in the ocean, which resulted in negative health and environmental impacts. This problem prompted the country to take immediate actions to cope with the waste-management pitfalls that had evolved over the years. The country exerted efforts to elevate the environmental and health conditions, which were the turning point in Japan's environmental policy.

Currently, Japan is a global leader in the area of waste management. Environmental regulations there are governed

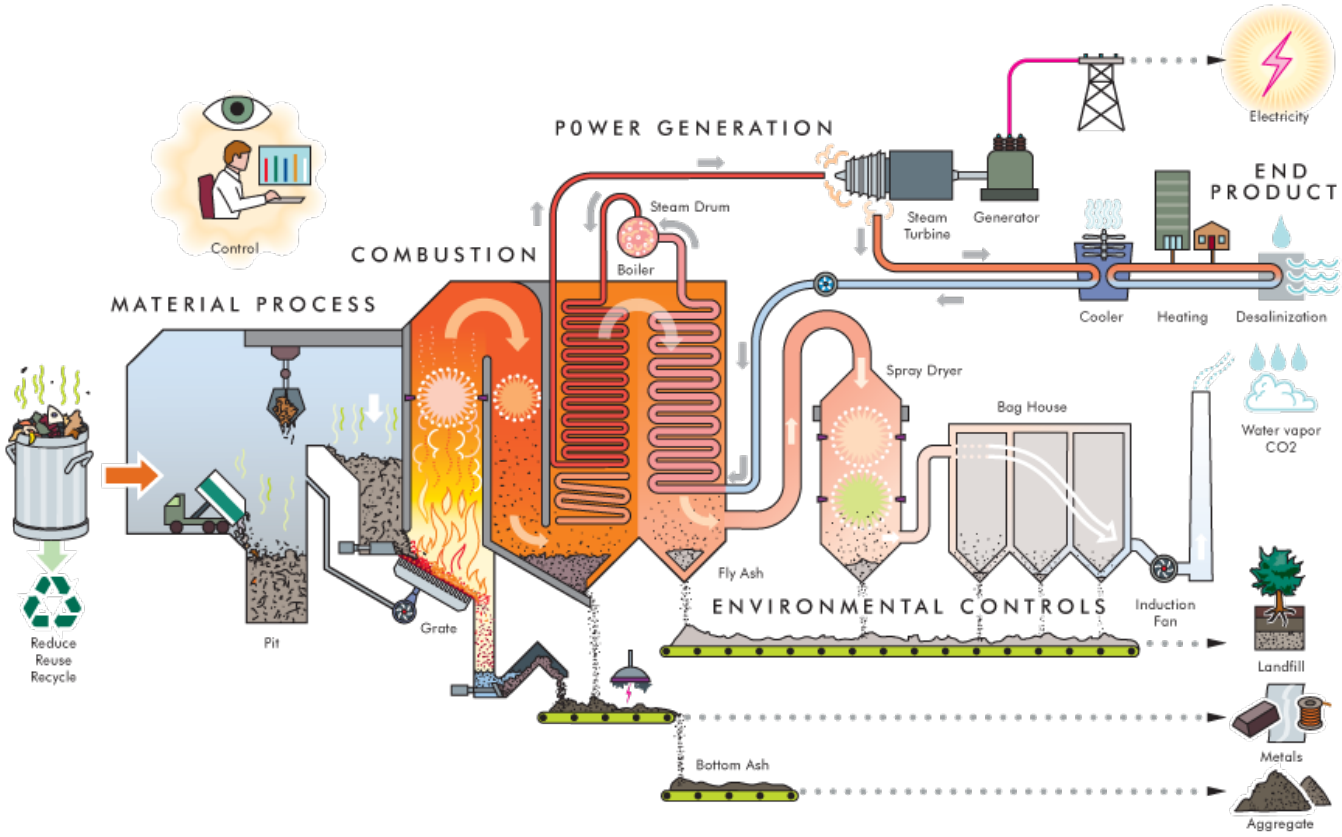


Figure 3: Waste to Energy Process [3]

nationally by the Ministry of Environment and on a state level. Each Japanese prefecture runs its own environmental regulations, while complying with national environmental regulations at the same time. The Clean Authority of Tokyo is the waste-management governor of 23 municipalities in Tokyo Prefecture. Tokyo classifies waste into combustible and incombustible categories to ensure that all waste types are managed efficiently. Combustible waste is directly transferred to Waste to Energy (WtE) plants, while the incombustible waste is transferred to waste-processing centers for reuse and recycle applications [2].

An Overview of WtE

Meeting the rising demand for energy worldwide constitutes a big challenge for all countries, and waste can play an important role here. With a high content of British Thermal Units (BTU), waste can be a reliable renewable energy source through WtE, an environmentally-friendly process of generating energy from burning waste. Burning municipal solid waste can reduce the volume of waste by about 87 percent. [3] Energy can be created in the form of heat or electricity, based on either producing combustible gases (such as methane, hydrogen and carbon monoxide) or heating water to generate steam to run a turbine.

At an initial stage, waste enters an enclosed receiving area, where it is thoroughly mixed in preparation for combustion. The mixed waste then enters a combustion chamber at a very high temperature to assure that waste burns completely. Different available technologies other than combustion can be used such as gasification. The heat that results from the combustion chamber will boil water into steam to drive a turbine to generate energy in the form of electricity. Following strict controls is crucial for the WtE, as the entire process must be managed to optimize combustion's efficiency and environmental factors.

Besides generating power, the

WtE process can reduce waste volume by up to 90 percent, where some of the remaining ash, deemed not hazardous, can be used for other applications.

Japan WtE Facilities Site Visits

Developed countries are adopting this trend of converting waste into energy, Japan especially. In Japan alone there are more than 700 WtE plants. [4] Converting WtE in Japan is technologically and environmentally advanced, as the country is deploying different WtE technologies in its facilities, mainly incineration and gasification technologies.

Representatives fromSaudi Aramco organizations and the Saudi government have visited WtE facilities to witness onsite Japan's experience. The tour included visits to different types of facilities, two of which will be discussed in this article.

Promoting WtE to divert Saudi-Aramco-generated waste from landfills to usable energy where feasible, is something the Company is taking very seriously.

BI-10-01709, an "Integrated Municipal Waste Management Facility (IMWMF)" was approved by upper management. The project will consist of a WtE complex along with other facilities, including a material recovery facility, a composting facility, and an engineered landfill.

Currently, New Business Development (NBD) and EPD are assessing the feasibility of converting Saudi Aramco's generated wastes from industrial operations into useable sources of energy.

Biogas Power Generation from Food Waste:

Tokyo Prefecture has built an industrial town, a so-called Super Eco-Town, complete with an intermediate waste-management facility for non-hazardous waste. The main types of waste received include construction waste, food waste, and contaminated soil waste. (Note: Total throughput and official capacity terms were not disclosed).

A biogas power-generation plant receives food waste from all over Tokyo. Food waste is converted into biogas, a sustainable source of energy, through a methane fermentation process (Figure 4). The process will biologically decompose the biomass into methane under anaerobic conditions. The plant is capable of generating approximately 26,000kWh of power, the equivalent to supply electricity for about 2,600 households per day in Japan. In addition, the plant effectively reduces carbon dioxide

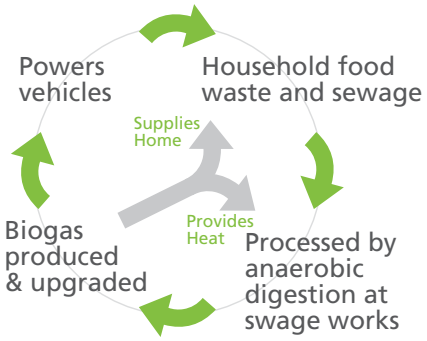


Figure 4: Biogas Energy Cycle [5]

emissions by 5,000 tons annually by producing a green source of energy. [5]

DOWA Industrial Waste to Energy Facility

DOWA Holdings owns and operate the largest Industrial WtE plant in Japan. The plant has a capacity of processing more than 800 tons of industrial waste per day. Different types of industrial waste including sludge, waste oil, acids and other industrial types of waste treated at the plant and converted to a useful source of energy [7]. Capacity and production terms were not disclosed.

The plant process layout is shown in Figure 5. The industrial waste, with high-energy density, is received first into a pretreated area where waste stored in drums are shredded. This process ensures complete thermal exposure of waste in the incineration stage.

At the incineration stage, the rotary kiln incinerator burns the pretreated waste completely. The waste is combusted at a low temperature to assure minimal generation of harmful emissions. However, any produced gases are treated further through several filtration stages prior to release into the atmosphere. The flare stack is closely monitored to assure the facility release minimum amounts of gas. The heat that results from the incineration chamber boils the water into steam, to drive a turbine to generate energy in the form of electricity. The generated electricity is then used according

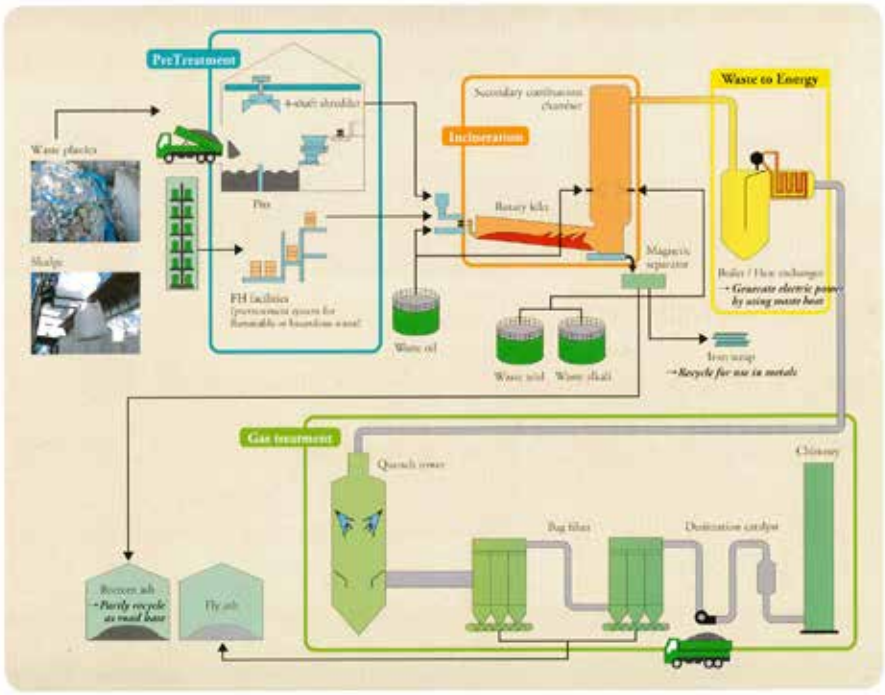


Figure 5: DOWA Waste to Energy Process Layout [7]

to plan, while excess power is sold to the local electricity company.

WtE in Saudi Arabia

Every year, Saudi Arabia generates 15 million tons of waste streams such as municipal solid waste (MSW), used tires, sewage sludge, and waste oil, among other sources. [8] These quantities could make meaningful contributions to the Kingdom's energy resources, especially as attention is paid to proper waste-management continues to increase in the Kingdom. Proper waste management now forms part of Saudi Arabia's 2030 vision. The country is targeting increasing the efficiency of waste management through establishing comprehensive recycling projects, reducing all types of pollution, and diverting waste into a useful source of energy.

Saudi Aramco will continue to study the feasibility of the WtE opportunity to achieve environmental sustainability, by increasing the efficiency of waste management.

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In Focus

Petroenvironment 2019, the 9th Symposium and Exhibition on Environmental Progress in the Petroleum and Petrochemical Industry

EPD chaired PetroEnvironment 2019 organized by Environmental Technology Management Association (ETMA) in Al-Khobar from Feb. 19-21, 2019. The event was inaugurated by His Royal Highness, Prince Saud bin Naif bin Abdulaziz Al-Saud, Governor of the Eastern Province, and was supported and principally sponsored by Saudi Aramco. The theme of PetroEnvironment 2019 symposium was "Innovative Technologies for Environmental Sustainability," highlighting the importance of environmental and sustainability issues in the upstream and downstream sectors. PetroEnvironment 2019 offered six interactive pre-symposium workshops attended by more than 125 delegates from Aramco, other industries and government agencies. The symposium program included more than 115 technical presentations and posters in addition to student entries. The technical presentations discussed various environmental areas of significant importance to the region and the petroleum and petrochemical industries such as climate change and the implications of the Paris agreement, water conservation and wastewater management, air pollution monitoring and control, biodiversity conservation, marine protection, economic valuation of natural ecosystems meteorological molding, occupational and environmental health, and other environmental topics. The associated exhibition consists of 45 companies focusing on innovative solutions, technological advancements, sharing best practices and fostering partnerships among various stakeholders to address environmental challenges and support sustainability objectives. Attendance at the conference was higher than any previous PetroEnvironment, with more than 1,500 visitors — from roughly 28 countries representing industries, academia, and the public sector — touring the exhibition.

EPD Arranges Company, Kingdom Stewardship Messaging Efforts at Abu Dhabi Sustainability Week

EPD collaborated with multiple Saudi Aramco and external stakeholders to convey the Company's and Kingdom's efforts to reduce environmental footprints at Abu Dhabi Sustainability Week (ADSW 2019) on Jan. 14-17, 2019. This year, EPD, in addition to other Saudi Aramco organizations, collaborated with the Ministry of Energy, Industry and Mineral Resources (MEIM), and other private and public stakeholders, including SABIC, SEC, KACARE, King Abdulaziz City for Science and Technology (KACST), the Renewable Energy Project Development Office (REPDO), KAPSARC, the Royal Commission for Jubail & Yanbu', MODON, Saudi Industrial Development Fund (SIDF) and the Kingdom's Industrial Investments Company (Dussur). EPD organized technical content from all Company and Kingdom participants to ensure that all relevant material was properly displayed in the event's showcase pavilion. EPD also contributed by delivering two (2) of its own showcases: biodiversity initiatives as well as efforts related to air quality and flaring reduction. Furthermore, EPD facilitated side-event presentations, coordinated technical guidance for moderators and presenters and participated with the media team to develop and verify the accuracy of infographics and other visual aids on display at the venue. EPD representatives coordinated with various SMEs to field questions from pavilion visitors.

EPD Raises Biodiversity Awareness at Riyadh Scouts Association Conference

EPD representatives showcased Saudi Aramco's environmental success stories involving the Shaybah Wildlife Sanctuary and the Mangrove Seed-Planting Initiative to participants at the "Scouting and Environmental Protection" conference organized by the Saudi Arabian Scouts Association in Riyadh on Feb. 12–13, 2019, and inaugurated by Deputy Education Minister, Dr. Abdulrahman Alasimi. EPD's participation included a presentation delivered by Dr. Abdullah Alsuhaibany on Company efforts to protect and enhance the Kingdom's biodiversity. Furthermore, a booth manned by Muayad Aaraj, of

Photo 1: HRH Prince Saud bin Naif bin Abdulaziz Al-Saud receives recognition from PetroEnvironment 2019 Chairman, Dr. Omar Abdulhamid. (Photo Source: Saudi Aramco)

EPD's Environmental Awareness Group, highlighted success stories at the Shaybah Wildlife Sanctuary and the Mangrove Seed-Planting Initiative, the latter of which will absorb noteworthy amounts of carbon dioxide from the atmosphere. National and international scouting organizations were present to support environmental best practices and introduce their own initiatives at the event.

EPD Hosts 29th Environmental Stewardship Workshop

EPD conducted its 29th Environmental Stewardship Workshop on Feb. 27, 2019,

which was attended by around ninety (90) leaders, including Project Managers, Division Heads, Supervisors and Foremen from various Saudi Aramco departments. The workshop covered a wide range of Environmental & Health (E&H) topics, including enhancing compliance programs (i.e., EPA, CEHA, OHHA, RPA, etc.) as well as waste management, climate change & international policy and technology. The workshop also included two (2) open discussion sessions that invited attendees to address concerns and share success stories. It should be noted that the workshop is counted as official training towards attendees' training history. To date, over 1,151 of Saudi Aramco's chief position holders have participated in Environmental Stewardship Workshops, which take place once a year.

EPD Participates In 20th Saudi Aramco Talent Essentials Program

In collaboration with the Academic Programs & Partnerships Department and as part of its talent development efforts, EPD participated in the 20th Cohort of the Saudi Aramco Talent Essentials Program (STEP) on March 7, 2019. EPD subject matter experts delivered a series of topics covering an overview of its functions including its Mission & Vision, Compliance Programs with more emphasis on radiation, wastewater management and water conservation. This interactive component delivered by EPD specialists helps to enhance environmental awareness among newly hired employees in various stewardship sessions that highlight efforts to protect the environment. Some 180 participants attended.

EPD Conducts Special Session for Environmental Coordinators Development Program

EPD conducted a special session for the Environmental Coordinators Development Program on March 17, 2019 to address current training delays and 56 Environmental Coordinators (ECs) attended this session. This two-week course is delivered by EPD SMEs and was designed to specifically address the work tasks ECs are expected to perform in their daily work. The program's goal is to provide ECs with the confidence, the skills and the tools to help them succeed in their position in addition to serving as a means to enhance young employees' business acumen development.

EPD Attends Fourth UN Environment Assembly of the UN Environment Programme

EPD representatives attended the 4th United Nations Environment Assembly of the United Nations Environment Programme (UNEA-4) that took place from 04-15 March 2019 at the UN Offices at Nairobi (UNON), Kenya. The conference attracted a record number of participants, with five Heads of State and Government, 157 ministers and deputy ministers, and almost 5,000 participants from 179 countries attending the Assembly and related events. During the closing plenary, UNEA-4 adopted 29 resolutions calling for accelerated actions, policies and strengthened partnerships on environmental governance; ecosystems and biodiversity management and protection; innovative solutions for environmental challenges, chemicals and waste and many others. The team has successfully prevented the adoption of the Ministerial Declaration requesting to reduce pollutants through decreasing investments in fossil fuels, while supporting the adoption of a technology approach. The team managed to change the calling of "phasing out single-use plastics by 2025" to "reduce." Also, EPD representative has successfully changed the resolution originally titled "Clean and Electric Mobility" to "Sustainable mobility" including full life-cycle assessment and efficient combustion engines. This resolution was focusing solely on electric mobility and referring to policies on air travel and biofuels. EPD's participation forms part of the company's strategy to support the Kingdom in technical and negotiating capacities to ensure Saudi Arabia's interests remain protected in multilateral arenas and minimized TCR-2 TCR-10 risks consequences.

EPD Represents Kingdom at UN Sustainable Development Meeting

An EPD representative attended the High-Level Meeting on the Protection of the Global Climate for Present & Future Generations of Humankind in the Context

Abdullah Tawlah, of EPD, represents Saudi Arabia at UNEA-4 in Nairobi, Kenya. (Photo Source: IISD Media Library)

of the Economic, Social and Environmental Dimensions of the 2030 Agenda for Sustainable Development, from March 28-29, 2019, at the United Nations Headquarters, New York. The meeting's objective was to bridge and align multiple UN climate platforms, such as those associated with COP24 in Poland and in advance of COP25 in Chile in coordination with UNFCCC and other venues. Many themes were discussed during the leaders' roundtables such as energy transition, industry transition, climate finance and carbon pricing. Both Saudi Arabia's and Saudi Aramco's interests were successfully expressed by the EPD representative and were included in the Presidential Summary of the High-Level Meeting.

Enhanced Recycling Program Mulled for Central Community Services Department

In line with the corporate directions to enhance the Company's plastic recycling program, a meeting was held with Central Community Services Department (CCSD), Almutawa waste collection Co. and Seraj

plastic recycling Co. to explore extending support and technical collaboration in this area. During the encounter, EPD representatives captured and highlighted a number of opportunities to enhance the plastic waste collection, transportation and recycling. EPD will continue supporting CCSD to enhance the recycling program by assessing their waste recycling vendors. The successful enhancement to the plastic recycling program will create numerous environmental benefits such as energy savings, natural resources conservation, limiting pollution and generating economical value.

Biodiversity Protection Area Designated at Abha SSSP

EPD and WRDD have partnered to designate Abha SSSP as a Saudi Aramco Biodiversity Protection Area. The 45 km^2 site now protects an extraordinary array of native biodiversity, including over 61 birds, 37 Plants, 18 Mammals, and 6 reptile species. The site contains no less than 24% of all of Saudi Arabia's terrestrial mammal species, 23 species listed as nationally High Conservation Priority, 16 endemic or near endemic species, 12 migratory species, and two internationally threatened species. This is one of the most important sites for biodiversity in the Kingdom. The site contains significant ecological features that are declining in their range, and plays a critical role in the ecological functioning of the area and has particularly high aesthetic value. EPD developed a site-specific Biodiversity Action Plan, which was endorsed by both WRDD and EPD Managers to further protect the site's high value biodiversity. Abha SSSP is now the eighth site formally designated as a Company Biodiversity Protection Area since 2012, bringing the total area protected to 900 km^2. EPD has proposed to designate Medina SSSP and Bahra SSSP as BPAs in 2019.

EPD Biodiversity Research Published in a Scientific Journal

A manuscript authored by EPD scientists has been published in a peer-reviewed journal of ornithology. The manuscript provides genetic evidence that confirms the identity of a unique subspecies of small, mangrove-dwelling bird (Mangrove Reed-warbler) along the Red Sea coast of Saudi Arabia. The manuscript will appear in the next edition of the journal, Zoology of the Middle East. The research provides a useful contribution to biodiversity awareness in the region, highlights the importance of protecting the natural environment, and helps to position EPD as credible experts in biodiversity protection, thus reflecting positively on the Company's reputation.

EPD Participated in the 4th International Ocean Colour Science (IOCS) Meeting

During the IOCS conference in South Korea, the National Aeronautics and Space Administration (NASA) provided a workshop on its latest open source software (SeaDAS) which enables users to process, visualize, and analyze remote-sensing data on the marine environment (e.g., chlorophyll-a and sea surface temperature). Similarly, new applications using the Sentinel satellite data to protect sensitive ecosystems such as the Great Barrier Reef from oil spills impacts were unveiled. However, for better management and protection of the marine environment and its resources, this technology needs to be integrated with modelling capabilities that allow us to predict in real time the direction of spills to anticipate our response and minimize impacts. Saudi Aramco has been recently working to enhance their modeling capabilities in both Red Sea and Arabian Gulf with the installation of surface current mapping systems (CODAR), and will play a role in the development of future technology aiming to fills the aforementioned gaps.

EPD Participation in the 2019 Downstream Global HSE Forum

EPD participated at the 2019 Downstream Global HSE Forum by delivering two presentations about Waste to Energy and Corporate Greenhouse Gas Emissions Management Program (GEMP).

GEMP presentation highlighted the program objectives and discussed the company's seven strategies that positioned the company among the lowest carbon intensities. While the waste to energy presentation shed light on Saudi Aramco efforts to divert Company generated waste from landfills to usable source of energy. The presentations were interactive and brought up environmental discussion related to downstream and joint ventures operations.

EPD Raises Environmental Awareness on Earth Day 2019

EPD raised cognizance surrounding the Company's efforts to protect the environment to coincide with Earth Day, a global awareness platform observed every year on April 22. For 2019, EPD posted awareness videos on the Company's Twitter account showcasing EPD's efforts to protect Saudi Arabia's biodiversity, combat desertification and promote technology and innovation in global climate-change arenas to reduce the country's environmental footprint. Other Earth Day activities included the publishing of an article in EPD's Green Matters column appearing in The Arabian Sun. True to the 2019 Earth Day theme calling for the need to "Protect Our Species," the April Green Matters article highlighted Saudi Aramco's plans to plant 1 million native trees across the Kingdom to combat desertification, sequester carbon, enhance native biodiversity and create attractive shaded areas.

EPD Participates in IMO's Marine Environment Protection Committee (MEPC)

EPD representatives along with Kingdom officials from PTA, MEIM, GAMEP and MAWANI participated in the International Maritime Organization's (IMO) Marine Environment Protection Committee, 74th session (MEPC 74) and the 5th intersessional meeting of the Working Group on Reduction of GHG Emissions from Ships. Both meetings took place at the IMO's headquarters in London on May 7-17, 2019. EPD representatives spearheaded several agenda items designed to address an equitable reduction of GHG emissions from ships as well as global Sulphur-limit regulations. Key elements championed by the Saudi team addressed socio-economic impacts from new norms and lifecycle aspects for all types of fuels in ways that will best serve the Kingdom's economic interests. Supported by other countries, Saudi Arabia also succeeded in deterring the establishment of a sub-committee on reduction of GHG emissions from ships, which lessens the socio-economic impacts on oil-producing countries from early implementation stages of the IMO GHG Strategy. In addition, the Saudi delegation succeeded in preventing a global implementation of a compulsory licensing scheme for fuel oil suppliers. The overall outcome of the meetings also opened the door to different flexibility aspects to avoid overburdening or interfering with the Kingdom's national policies.

Saudi Aramco First Engagement Meeting with Sabic on Plastic Recycling

EPD representatives met with SABIC's Technology & Corporate Sustainability team at SABIC head quarter building in Riyadh to discuss potential area of collaboration on plastic recycling and other waste management programs. SA explored attractive opportunities for plastic waste under SRP-4 and the Non-Metallic corporate initiatives. During the meeting, SABIC has shared their efforts in plastic recycling and circular economy to address the issue of plastic waste. The team demonstrated SABIC expertise in mechanical and chemical recycling of plastic waste. SABIC will implement a project for the chemical recycling of challenging plastic waste with plastic energy Ltd to convert plastic waste, destined for landfilling, back to its original polymer raw material state. SABIC is also partnering with local private and government entities to raise awareness about plastic waste recycling in the Kingdom. In addition, SABIC highlighted their role as a member of the "Alliance to End Plastic Waste" and founding member for "World Plastics Council." The teams agreed to synergize efforts in addressing the plastic issue tackled by both companies for the short- and long-term environmental sustainable approaches.

Congratulations

Excellence Award for Greenhouse Gas Emissions Management Program

Seraj S. Al-Ghamdi, EPD

Photo 1: Mr. Amin H. Nasser, Saudi Aramco President & CEO, third from left, recognizes EPD's Air Quality Team for its efforts to reduce GHG emissions. Representing EPD from left are Khalid A. Al-Binali, Humoud W. Al-Utaibi (EPD Environmental Engineering General Supervisor), and to Mr. Nasser's right are of Ioannis Alexiou, Nadeem Ahmedkhan and Asad F. Al-Sowayeh. (Photo Source: Saudi Aramco)

EPD's Air Quality & Meteorology Unit was recognized for their work in Greenhouse Gas Management at the 2019 Saudi Aramco Excellence Awards on March 13, 2019, in the presence of the Saudi Aramco Board of Directors, and members of senior management.

The award recognizes individuals and teams who make significant new achievements such as creating new technologies, systems, or business solutions that are game changers for the industry.

Saudi Aramco's strong commitment to environmental best practices has positioned the Company as a leader among international oil and gas companies. This reputation enjoyed a significant boosted by a recent EPD initiative to improve the monitoring of the Company's emissions of greenhouse gases. Because of this initiative, Saudi Aramco's decades of good environmental practices are now recognized globally.

A third-party verification of the Company's greenhouse gas data has affirmed that Saudi Aramco is an industry leader in carbon intensity among its international oil and gas industry peers. The key enabler of this success story is an initiative called the Greenhouse Gas Emissions Management Program, which includes a comprehensive Leak Detection and Repair (LDAR) program, engagement in the Oil and Gas Climate Initiative (OGCI), the establishment of a corporate greenhouse gas key performance indicator, and laying the groundwork for a third-party verification of Saudi Aramco's greenhouse gas data and processes.

Maintaining a low carbon intensity is not only aligned with our environmental policy to protect the fragile environment and the communities where we operate, it is also compatible with the Kingdom's sustainable development objectives to achieve its commitments to reduce carbon dioxide emissions by 2030.

Photo 2: The GHG Excellence Award. (Photo Source: Saudi Aramco)

EPD Honors Six Departments at the 2019 President's Excellence Award Ceremony

By Forrest Jones, EPD

EPD co-hosted the annual President's Excellence Awards on April 18, 2019. The ceremony took place in collaboration with the Loss Prevention Department, Maintenance & Reliability Department, Management Professional & Developmental Department, Operational Excellence Department, Joint Ventures and Corporate Affairs. During the event six departments were recognized for their superior performance in protecting the environment and community and worker health in 2018. For that year and in addition to the traditional Facility Environmental Performance parameters, a new award category, Excellence in Greenhouse Gas (GHG) Management, was established to recognize organizations for their performance in this space, which supports the Company's efforts to reduce emissions. The winners for Operating Organizations were Berri Gas Plant Department for the 1st place and Ras Tanura Refinery for the Continuous Improvement. Southern Area Well Completion Operations Department was the winner for Service Organizations. The winners for Excellence in GHG Management were Haradh Gas Plant Department for Gas Operations, Safaniyah Offshore Producing Department for Oil Operations and Yanbu' NGL Fractionation Department for Refining & NGL.

Photo 1: Berri Gas Plant Department, Winner, Best Performing Operating Organization. Department Manager Khalid A. Al Harthi accepts the award. (Photo Source: Saudi Aramco)

Photo 3: Southern Area Well Completion Operations Department, Winner, Best Performing Services Organization. Department Manager Nayef Al Shammari accepts the award. (Photo Source: Saudi Aramco)

Photo 5: Best in GHG Management for Oil Operations: Safaniyah Offshore Producing Department. Department Manager Abdullah Al Qahtani accepts the award. (Photo Source: Saudi Aramco)

Photo 2: Ras Tanura Refinery, Winner, Continuous Improvement Operating Organization. Department Manager Khalid Al Hamid accepts the award. (Photo Source: Saudi Aramco)

Photo 4: Best in GHG Management for Gas Operations: Haradh Gas Plant. Department Manager Tariq Al Turairi accepts the award. (Photo Source: Saudi Aramco)

Photo 6: Best in GHG Management for Refining & NGL: Yanbu' NGL Fractionation Department. Department Manager Mohammed S. Al-Ghamdi accepts the award. (Photo Source: Saudi Aramco)

Abdullah Otaibi

(EPD) Employee Certified as a Qualified Expert in the Field of Industrial Radiation Protection Services

By Forrest Jones, EPD

Abdullah Otaibi, of EPD's Radiation Protection Unit, was recently recognized and certified by the Kingdom's Nuclear & Radiological Regulatory Commission (NRRC) as a Qualified Expert in the field of industrial radiation protection services.

Abdullah becomes one of only 20 highly recognized and accomplished specialists within the Kingdom of Saudi Arabia to be granted the title of Qualified Expert. This accomplishment recognizes Abdullah's extensive expertise and accomplishments in the areas of radiation protection, nuclear gauges, industrial radiography and regulatory matters.

"This certification is testament to Abdullah's dedication and diligence in the performance of his work and underscores the high regard with which the regulatory body has for him," said Saleh Y. Al-Qahtani, Division Head of EPD's Workplace Environmental Division, which houses the Radiation Protection Unit.

"Achieving certification of this level is no easy feat, and it will open the door for Abdullah to provide consultations to government officials regarding national radiation protection procedures and contribute to high-level forums and workshops." As a Qualified Expert, Abdullah attended the first national workshop on the application of general instructions for radiation protection hosted by the NRRC. This event also included the cooperation of officials from the International Atomic Energy Agency (IAEA).

EPD Employee Becomes First Saudi National to Obtain Internationally Recognized Environmental Health Certification

By Jason Hall, EPD

EPD employee Hassan Alzain of the department's Environmental Health Unit has obtained professional certification with the U.K. Chartered Institute of Environmental Health (CIEH). Following completion of his BSc in Environmental Health Studies at Liverpool John Moores University in the U.K., where he obtained a First-Class Honors Degree, Hassan successfully obtained professional certification by submitting and passing 25 Portfolio of Professional Practice (PPP) reflective learning reports and a professional peer review interview at the CIEH headquarters in London. Hassan passed his professional exams, PPP and professional interview on his first attempts, thus obtaining a number of distinctions. By becoming certified, Hassan is not only the first young Saudi national to obtain this internationally recognized professional certification, but he is also the first within the GCC to hold this honor.

Hassan Alzain

Fourteen (14) Employees Obtain Qualified Environmental Professional Certification

By Seraj S. Al-Ghamdi, EPD

A total of fourteen (14) environmental professionals, including EPD engineers and scientists as well as Environmental Coordinators, completed the required preparatory courses/ exams to become certified as Qualified Environmental Professionals (QEP) during 2019.

Photo 3: Saudi Aramco environmental professionals during a preparatory course. (Photo Source: Saudi Aramco)

The following lists those employees who certified as QEP:

No.	Name
1	Abdu Naser M. Shhub
2	Areeb R. Khan
3	Bruno Villegas Lira
4	Gavin L. Tait
5	Hamed A. Alghamdi
6	Jasem R. Al-Anazi
7	Javeed Mohammed Abdul
8	Jihad Shana'a
9	Jose L. Llamas
10	Muhammad B. Al-Rayaan
11	Omar Y. Al-Somali
12	Rafaqat A. Khan
13	Romel R. Gapayao
14	Saad H. Al-Qahtani

Certification comes after rigorous scrutiny of experience and qualifications, and satisfactory completion of a two-part written examination in a specific practice area such as air quality, water quality, waste management or other areas in environmental science, management and policy. The QEP is the first and only international credential of its kind. It is a multimedia, multidisciplinary, board-certified credential that requires environmental professionals to see "the big picture" and to have the skills and knowledge to solve "real problems." Through QEP certification, environmental professionals demonstrate the breadth and depth of their knowledge and experience.

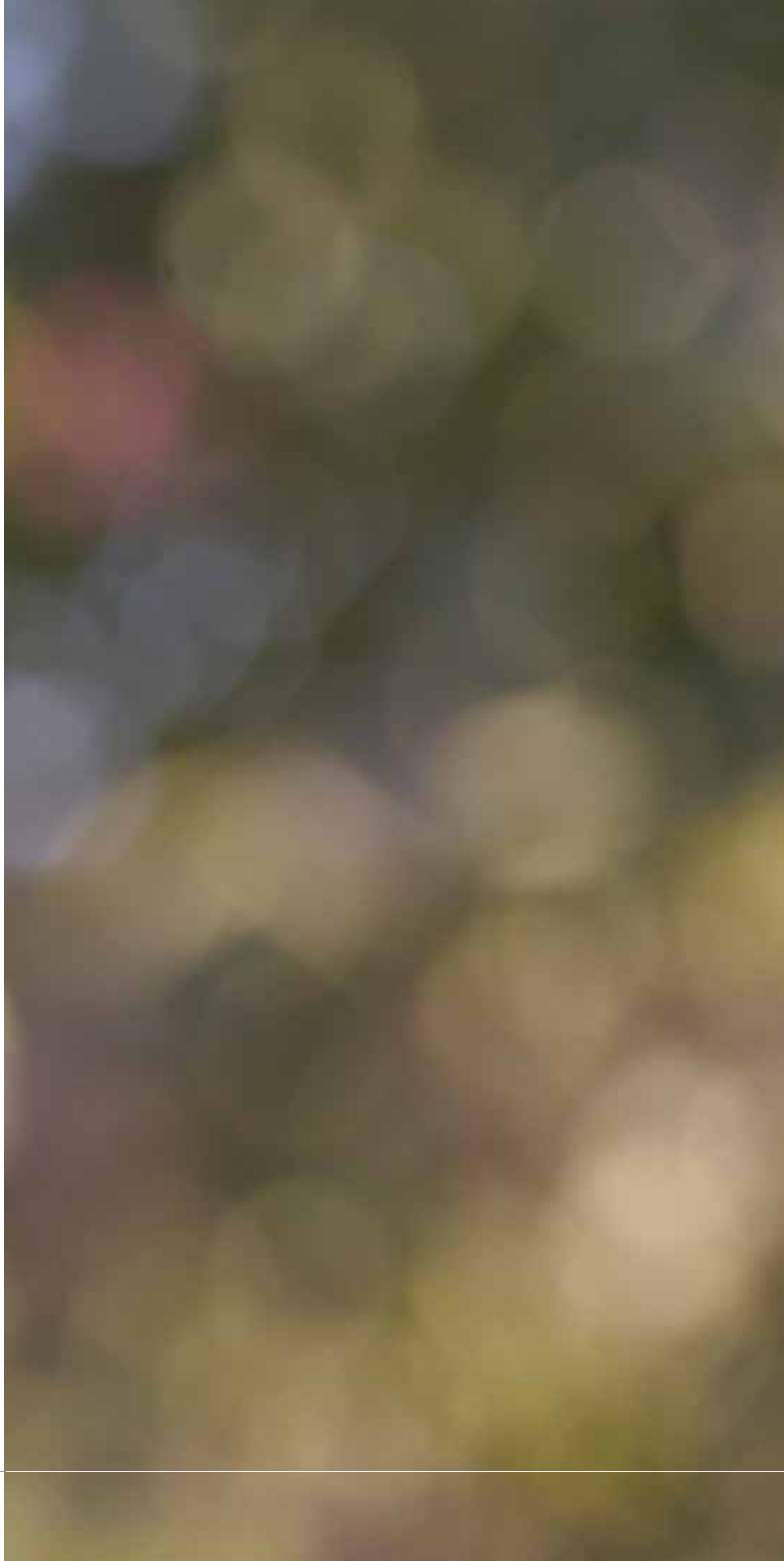
The exams and certifications were issued and recognized by the U.S.-based Institute of Professional Environmental Practice (IPEP), an independent organization whose multidisciplinary exams are developed by professionals across all sectors of environmental practice, including industry, agency, academia and consulting. The IPEP awards approximately 50 certifications annually. According to IPEP, Saudi Aramco leads the top ten companies worldwide with the most qualified members.

It is worth mentioning that EPD in collaboration with Technical Services Professional Academy (TSPA) successfully conducted Live Remote Interactive Teaching Preparatory Course (via WebEx conferencing technology) that is required for obtaining Environmental Professional Intern (EPI) and Qualified Environmental Professional (QEP) certifications. This live course is the first of its kind for Saudi Aramco and resulted in more than 90% cost avoidance as compared to normally instructed lead training classes.

Recognition Ceremonies Held for Manifa Flank I, II & III and SFNY Subsea Cable Repair Projects Completion

By Ali Qasem, EPD

EPD was recognized along other Company organizations for the safe and successful completion of the Manifa Flank I, II and III projects as well as for its role in completing the Safaniyah Offshore Producing Department's Subsea Cable Repair Project. Recognition ceremonies were organized by Manifa Producing Department and Upstream Project Management Team, and they were attended by Northern Area Oil Operations VP, the Saudi Aramco Project Management VP and the Upstream Project Management General Manager, among others in management positions. Integrated project team members were recognized for their outstanding contribution in these projects, with Manifa flank work connecting water supplies with water injection platforms, while the Safaniyah Offshore Subsea Cable Repair Project improved electrical operations. One of EPD's major contributions involved the obtaining of a dredging permit from the Government Dredging Committee in one month, instead of the usual six months needed. EPD also supported the completion of all associated environmental tasks for these projects, including the approval of Environmental Impact Assessments, just a few weeks prior to obtaining the dredging permit.



Dicanthium foveolatum - Spike (Photo Source: Saudi Aramco)

Enviro Snaps

A Coral Bouquet

Saudi Aramco efforts to protect and enhance coral reefs grows

Forrest Jones, EPD

True to its size, Saudi Aramco has taken massive steps to protect and enhance biodiversity. Those include roping off huge swathes of land rich in flora and fauna from development, even reintroducing large-bodied species such as the oryx, gazelle and ostrich in some parts.

The Company has also planted millions of mangrove trees that will absorb noteworthy amounts of CO_2 from the atmosphere, while terrestrial tree-plantings will yield many positive impacts across the Kingdom, including combatting desertification by halting the advance of sand.

But did you know the Company has spent the last several years protecting and enhancing undersea life via the deployment of artificial reefs?

Saudi Aramco has installed tons of artificial reefs throughout the Arabian Gulf to rebuild marine ecosystems as well as support local fisheries industries.

In 2018, artificial reefs were deployed at both Safaniyah and Al Khafji — 1,220 artificial reef units were deployed at Safaniyah and 459 artificial reef units were deployed at Al Khafji. This effort contributes to the Company's total deployment of over 2,728 artificial reefs throughout the Arabian Gulf to date, a number that will continue to rise.

At a higher level, partnerships with organizations such as the Smithsonian Institution have helped the Company develop a deeper understanding of critical factors needed to ensure and promote conservation of biodiversity in Saudi Arabia, including artificial reefs.

Academic circles figure in here as well.

EPD in collaboration with the Saudi Aramco-KAUST center for Marine Environmental Observations presented a research paper on coral-reef monitoring in the Red Sea during the 4th Asia-Pacific Coral Reef Symposium in 2018. This five-day symposium was hosted by the University of the Philippines, the Department of Environment and Natural Resources, and the Philippine Association of Marine Science. The symposium grouped participants from more than thirty 30 countries to develop solutions to better manage coral reefs. This event greatly emphasized current trends to estimate biodiversity on coral reefs, management of marine protected areas, sustainable fisheries and habitat restoration techniques such as coral transplantation and nurseries. The topics of this symposium were highly relevant to Saudi Aramco due to the amount of Company activities near coral reefs, as well as the ongoing biodiversity studies that the department is conducting with partner universities.