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Fourth Quarter 2018 Issue No. 29

enviro news

Environmental Protection Department

(Photo Source: Abdullah Alsuhaibany)

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For questions, comments or any other inquiries regarding Enviro News, please contact Rana M. Al-Ghamdi at rana.ghamdi@aramco.com or (013) 880-0491

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A Message

from Omar S. Abdulhamid

EPD Manager

If there's one clear takeaway from this issue of Enviro News regarding the reach and richness of Company efforts to reduce its environmental footprint, it's the fact that everyone in Saudi Aramco is pushing ahead on all fronts to conserve resources and protect health and biodiversity in all of our affairs.

Take the facility level. In this issue, we'll learn more about the steps Haradh Gas Plant Department is taking to address flaring, while Berri Gas Plant will share its success with Leak Detection & Repair ("LDAR"). Meanwhile at Yanbu' Refinery, read up on water conservation techniques. All three instances illustrate how a blend of new technologies, best practices and a genuine concern for protecting the environment can make a difference.

Elsewhere, our work to both protect and enhance biodiversity continues to move forward, even beyond our successful Shaybah Wildlife Sanctuary. New survey activities across Company lands have revealed striking levels of biodiversity, with seven sites now having been designated as Biodiversity Protection Areas totaling 854 km^2 of land.

Also be sure to read up on nutrition labeling requirements appearing on food items in Saudi Arabia and what they mean for your health and waistline. And speaking of health matters, find out how technology is allowing the Company to provide fresh orange juice and all its nutrients in remote areas where such offerings may not have been possible in the past. And on the industrial hygiene front, learn more about the many activities that can result in hand-arm vibration and how to protect yourself.

As always, the Environmental Protection Department invites you to browse our latest success stories and share with us your own (previous issues of the magazine can be found internally on the EPD site or externally at https://www.saudiaramco.com/en/news-media/publications). So keep us informed to help the Company illustrate to the world how Saudi Aramco considers environmental protection to be an integral pillar of its social license to operate.

horizons

To the last drop

Conserving water for a healthier environment at Yanbu' Refinery

Maddala Bhanumurthy, YRD

Everyone knows water is vital to life and for sustainable ecosystems. Thanks to water resources, trees grow and flourish, releasing oxygen in the process while absorbing carbon dioxide at the same time. They shelter and shade, which are very welcome in desert climates like Saudi Arabia's, though they require water from irrigation to survive. That said, excessive demand for water, even in our gardens, can be bad for the environment, so one can imagine the importance of conserving water in big oil-and-gas operations. This concern is heightened in the Middle East, where natural sources of fresh water are limited and even stressed under expanding populations. As a result, dependence on desalination — the conversion of salty ocean water into fresh water — increases.

Sea water is abundantly available for desalination efforts, including those that supply Yanbu' Refinery Department (YRD). Yet due to high costs, energy intensiveness and the environmental footprints this process entails, many view desalination as a last resort for providing fresh water.

Desalination produces large quantities of brine, a salty and environmentally toxic byproduct and often at very high ambient temperatures. This double whammy of being overheated and containing residues stemming from pretreatment and cleaning chemicals merits concern. Why? For every one gallon of freshwater produced, two gallons of brine must be disposed, and failure to do so properly can wreak havoc on marine ecosystems, especially if dumped carelessly. Fortunately, desalination facilities associated with Saudi Aramco do not dump brine or chemicals into the marine environment. As part of environmentally responsible business practices, brine can be safely discharged into the marine environment if treated and managed properly, or cleaning may be conducted in a closed loop in which all waste is trucked and sent outside a refinery for proper handling and discharge.

Separately, energy consumed to desalinate seawater can reach up to 6 kWh/m^3, and this figure increases by 45 Kwh after factoring in energy consumed indirectly in the processes, such as crude extraction from wells and refining into fuels used for electricity generation to power desalination plants. Each 1kwh in savings can eliminate 440 grams CO_2 associated with desalination.

Bottom line: desalination is an energy-intensive business, so it cannot be stressed enough that individuals in areas serviced by desalination plants must do their part to save water. A drop of water leaking per second can waste 6m^3 per year, a sum that required hefty amounts of energy to produce. Hence, every individual at home, at work and wherever possible must measure, monitor and optimize water use by promoting efficiency and eliminating wastage.

With this in mind, Yanbu Refinery prioritized water conservation and implemented several projects as part of its broader environmental roadmap. YRD evaluated an innovation idea to resolve summer cooling limitations and avoid showering (i.e., spraying water on hot equipment to cool down.

Consequently, the refinery executed an in-house design project and created a new closed loop circulating the supplement cooling water system. As a result, boiler makeup water was diverted through compressors to recover heat with water and conserved 90 million gallons of water with enhanced compressor efficiency and reliability.

(Photo Source: Shutterstock)

Instrument Air System

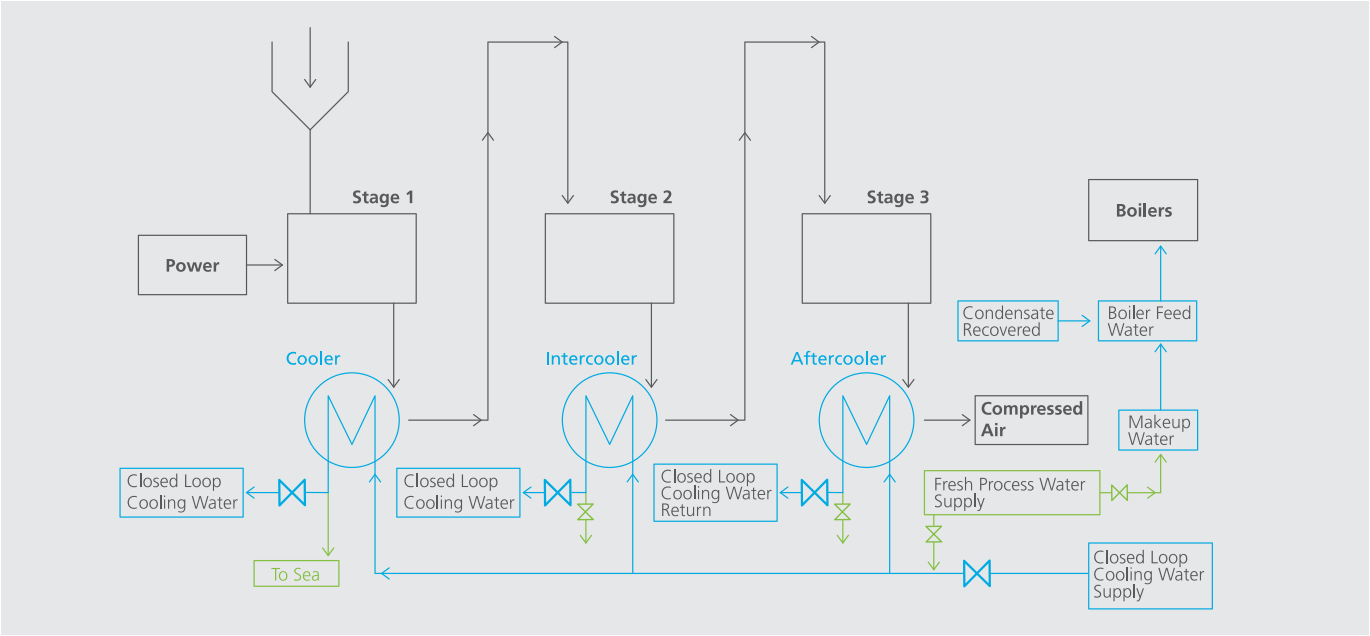


Fig.1. Process water feeding compressor coolers and then drained to the sea. It was modified to the process in Figure 2.

Creating a Closed Loop System Innovatively

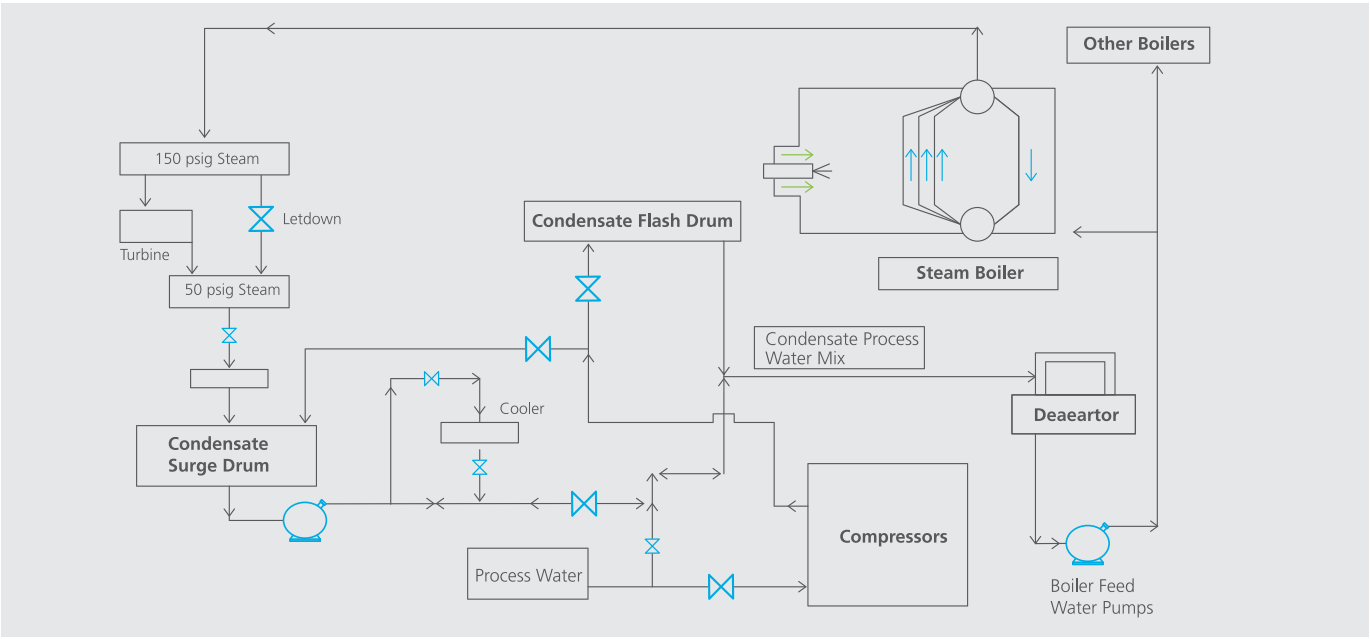


Fig. 2. Innovation Idea implemented: Process water makeup to boilers was diverted to compressor coolers and collected in a condensate flash drum to ultimately use as preheated makeup water. It provided supplement cooling water for use as an independent and redundant cooling source to avoid compressor trips due to cooling deficiencies.

Photo 1: Yanbu Refinery, seen here, receives two awards, a Global Water Conservation Award in Platinum Category and the Global Innovation in Water Technology Award in Gold category on United Nations World Water Day. (Photo Source: Saudi Aramco)

This project reduced process water intake from outside sources by 50% and therefore avoided energy otherwise consumed to desalinate water.

YRD reduced desalinated water booked capacity from 5500 m^3/hr to 2500m^3/day by halting draining/showering and recovering cooling water after cooling compressed air to boilers as makeup water.

This innovative project accomplished multiple objectives, including enhancing safety and reliability, along with conserving energy, and protecting the environment. Moreover, the project integrates instrument air and water cooling systems with compressors and boilers. The novel solution, designed and executed within YRD, can be applied at many facilities.

Lastly, YRD won two Water Conservation awards in 2018 from the Energy and Environment Foundation at the World Water Summit, New Delhi, sponsored by the Government of India.

So let us conserve water by promoting the efficient use of water through awareness, to protect the environment and save money.

Stop the leaks

A look at Leak Detection & Repair processes that protect our environment

Nader H. Zayer, Berri Gas Plant

In 2011, a Company Leak Detection and Repair Program ("LDAR") was endorsed under Ambient Air Quality and Source Emissions Standards (SAES-A-102). The same year, the program was submitted and accepted as a new technology item. In 2012, Saudi Aramco developed a program called "Gas Leak (Find & Fix)" as a qualitative method that relied on LDAR and began implementing it using in-house resources, which allowed the Company to bypass contracts with external entities. Since then, hundreds of gas leaks have been fixed avoiding contract costs and done so in reasonable timeframes In 2014, the Environmental Protection Department (EPD) issued another LDAR protocol based on Method 21 of 40 CFR, Part 60, which advocates the use of Flame Ionization Detectors (FID) or Photo Ionization Detectors (PID) for detecting component leaks. The "Gas Leak (Find & Fix)" was then later modified as a quantitative method. Both LDAR programs serve the same purpose, which is finding gas leaks and fixing them. This Gas Leak (Find & Fix) program, however, has demonstrated itself to be the preferred program; it is practical, cost-efficient and time-effective as a routine practice based on the following comparison (Table 1)

When there is serious gas leak, huge amounts of gas can be released in a very short time. Here, the safety conerns take priority over environmental impacts at first. These types of leaks must be attended immediately to save lives. When

Table 1: A comparison between both LDAR programs.

	Method 21 of 40 CFR Part 60	Gas Leak (Find & Fix)
Purpose	Stopping or Minimizing Gas Leaks	Stopping or Minimizing Gas Leaks
Emphasis	Environment	Environment & Safety
Procedure	Complicated	Simple
Tools	Gas Detectors	Gas Imaging Cameras and/or Gas Detectors
Detection	Quantitative	Qualitative and/or Quantitative
Repair Criteria	Flammable material and people exposure locations are not considered	Flammable material and people exposure locations are considered
Tagging	Tags with number only	Tags with hazard rating, colors, symbols and film reference numbers
Manpower	Contractor	Facility
Cost	Very costly	Insignificant
Time	Very long time	Short time
Training	Qualified personnel	Minimum

there is a fugitive emission gas leak, small amounts of gas will be released in a very long time. In this case, environmental concerns trump the safety impacts. The Gas Leak (Find & Fix) program was developed to prevent the conversion of fugitive emission gas leaks into serious gas leaks, thus carrying both environmental and safety components with it. Other advantages of conducting routine Gas Leak (Find & Fix) procedures include:

Better Safety:

This is accomplished by eliminating the leakage of toxic and flammable gases that may cause harmful exposure, fire or explosion.

Better Environmental Protection:

When fugitive emissions are controlled, Volatile Organic Compounds (VOC) will be reduced or eliminated. VOCs can be of particular concern because of their health impacts ranging from mild discomfort up to long-term exposure cancer risk, depending on their type. VOCs are the main ingredient for making ground-level ozone, a major air pollution concern in many industrial countries and big metropoles. Ozone is formed when VOCs and nitrogen oxides (NOX) react in the atmosphere in the presence of sunlight. Exposure to ozone is considered harmful to humans, and has been attributed with respiratory infections and heart diseases. Another important advantage is reducing Greenhouse Gases (GHG), which have an impact on global warming.

Better Economy:

Profits may rise via the elimination of lost products.

Better Reputation:

The Company's environmental reputation will be enhanced when the Gas Leak (Find & Fix) is applied regularly.

Repair Criteria:

Taking into consideration the fact that not all detected leaks can be repaired at the same time, criteria were developed to prioritize and expedite repair processes. The criteria depend on the hazard size, or rating, with the higher numbers signifying higher hazards (See Table 2).

Environmental Worksheet (EWS):

Hazard ratings are calculated on Environmental Worksheets (i.e., the sum of the assigned points of each category), and below are some examples of the final EWS. Focusing on safety, high approval authority is recommended for the repair due date, especially for leakages with high hazard ratings. The approver may request Safety and Environmental Hazard Assessments (SEHA) if the repair is going to be delayed long enough to impose safety and environmental impacts. A SEHA team should include Facility, Loss Prevention, Environmental Protection and Fire Department representatives. See Table 3 for an example.

Safety and environmental guidelines:

Warning Sign: "GAS LEAK, AVOID SOURCE OF IGNITION/AVOID EXPOSURE" mobile sign must be placed at each leak point until it is fixed and the repair is confirmed. Also, it should include the film reference number.

Protection Zone:

As an extra precaution, a protection zone must be identified and surrounded by a yellow warning stripe. This measurement is conducted by using two calibrated gas monitors at the same time: the Hydrogen Sulfide (H_2S) and Lower Explosive Limit (LEL) levels starting 10 meters away from the leak point and then reducing the distance towards it. When the detected measurement exceeds the allowable limits at certain distance, then that distance can be considered as the radius of the protection zone. A protection zone is not required if no exceedance is detected at one meter from the leak point.

Note 1: The measurement should be conducted from all access directions to the leak point. And the warning signs should be placed at those accesses near the border of the protection zone.

Note 2: For H_2S leak measurement, respiratory apparatus is required as Personal Protective Equipment

(PPE)..

Note 3: One daily measurement per shift is required around the protection zone to make sure the limits are not expanded beyond the border of that zone.

Gas Leak Monitoring:

Monitoring each leak point is recommended periodically to

make sure the leak is constant and there is no expansion of the gas.

Repair Confirmation:

Before a repair is marked complete, a repair confirmation is required. This is done by using the Gas Imaging Camera.

KPI:

Environmental Key Performance Indicators (KPI) need to be established to track leak-repair progress. Also, the EWS should be reviewed during Quarterly Safety Inspections (QSI).

Emergency Response Plan:

If deemed necessary, an Emergency Response Plan for hazardous leaks should be prepared by the SEHA team. Also, active leaks should be considered within the emergency drill scenarios.

OIM:

Operating Instruction Manual (OIM) should be developed for the Gas Leak (Find & Fix).

Gas Leakage Diagram:

A diagram indicating with the hazard symbols all active leaking points maybe developed and kept in the Disaster Control Center as extra information. The diagram should be updated quarterly.

Gas Leakage Day:

An awareness day needs to be conducted annually to remind employees about the hazard of gas leakage.

By implementing Gas Leak (Find & Fix), Saudi Aramco will be able to enhance safety and protect the environment. Further action on untested locations can be planned annually. The repair criteria will help the Company prioritize repairs based on the hazard-rating calculation. Contract costs will be avoided, and product losses will be prevented.

Table 2: Hazard Ratings by category.

A) Type:

Type	H_2S Concentration (%)	Assigned Points
Acid Gas	> 40	12
Sour Gas (A)	>18	6
Sour Gas (B)	>13	5
Sour Gas (C)	> 8	4
Sour Gas (E)	> 4	3
Sour Gas (F)	> 3	2
Sweet Gas	< 0.01	1

B) Concentration:

Gas Concentration (PPM)	Assigned Points
> 10000	3
> 1000	2
> 500	1

C) Size:

Gas Leaks Size*	Assigned Points
Large	3
Medium	2
Small	1

D) Location:

Flammable / Exposure Location	Assigned Points
Nearby flammable storage tank or sphere	4
Close to office or CCR	3
Within working area	2
Far away from all the above (rarely find workers at the location)	1

** Gas leaks size is detrmined by comparing the films images.*

Table 3. Environmental Worksheet

Plant	Leak location	Gas Conc. (PPM)	Hazard Rating	Repair Requirement	ETC	Status
XYZ	XYZ	>10000	15	Approval if the due date needs to be extended	2012	Fixed
XYZ	XYZ	>10000	12	Approval if the due date needs to be extended	2012	Fixed
XYZ	XYZ	>1000	6	Shutdown	2012	Fixed
XYZ	XYZ	>500	4	Spare parts	2012	Fixed

High priority » 15-19 Low priority 3-6 Medium priority » 7-14 : Flammable : Toxic

Requirements:

#	Requirements
1	Assign an approver for leaks that are going to be kept for a long time before repairing.
2	Assign and train two personnel to perform Gas Leak (Find & Fix).
3	Order or borrow Gas Imaging Camera, Gas Detector and Gas Monitor.
4	Measure H_2S/LEL, surround by warning stripe and install warning signs.
5	Establish Gas Leak (Find & Fix) Key Performance Indicators.
6	Develop Gas Leak (Find & Fix) Operating Instruction.
7	Develop gas leak diagram for the active leaks.
8	Repair the identified gas leaks.
9	Prepare an Emergency Response Plan for hazardous leaks.
10	Consider active leaks within the scenarios of the emergency drills.
11	Conduct annual gas leakage awareness.

Smart vendor

How technology brings nutritious drinks to ‘Udhailiyah

Thomas Hullock, EPD

Vending machines are nothing new. We’ve all used them at one time or another to purchase a soda or a chocolate bar while “on the go.” Tracing their history back to the 1880s when the first vending machines were developed to dispense postcards for holidaymakers in England, vending machines have evolved to a point where everything from life insurance to a pizza can be delivered on demand at the touch of a button. So popular in Japan, it is estimated that there is one vending machine for every twenty-three (23) people in a country with a population of 126 million (SOURCE: Japan Vending Machine Manufacturers Association).

From a food safety perspective, there always remains a concern about temperature control in food vending machines with the chance that high-risk foods can enter the danger zone for the growth of harmful bacteria without anyone knowing. Who can tell when the refrigerator compressor on an unmanned and largely unmonitored device breaks down?

The importance of controlling such parameters in a juice-vending machine cannot be overestimated. Still, pressure is on for the soft drinks industry to provide healthy options, and that can go for vending machines as well, though not at the expense of health safety.

Take fruit.

Figure 1: New technology brings fresh orange juice—and fresh vitamins and nutrients—to ‘Udhailiyah. (Photo Source: Saudi Aramco)

The U.S. Food and Drug Administration recognizes oranges and fresh juices to be a source of foodborne illness, particularly in fresh juice that is not pasteurized. A survey of the presence of Salmonella, and Shigella in freshly squeezed orange juice in Mexico found that of 100 samples, 14% contained Salmonella and 6% contained Shigella (Journal of Food protection, 2006). These high counts may indicate poor sanitation and potential exposure to fecal contamination, either in the raw materials or during the orange-crushing and juice-serving process. There is a real threat of food poisoning from what is perceived to be a healthy option. In Singapore, the importance of good hygiene practices and temperature control for food vending machines, resulted in national regulations being introduced in 2017. They provide a framework for the requirements for food vending machines that extend beyond the machines themselves, to the food handlers who load the machines, and the point of food production.

Here at Saudi Aramco, we have gone a step further. Using Wi-Fi, vending machine operators

(Photo Source: Shutterstock)

now have the ability to have information about their machines delivered instantly to their smartphones. A fresh orange juice vending machine recently approved by the Environmental Protection Department (EPD) for deployment at 'Udhailiyah relies on SMART technology to monitor the machine's vital parameters in real time. The vending unit's operator can know anytime, anywhere how the machine is performing and SMS alerts are sent from the machine, if for example, the temperature of the machine goes out of range. The machine will also shut down if critical limits are exceeded. The machine will also let the operator know how many fruits have been used – essential to ensure that the juice continues to flow but more critically, that the oranges don't stay in the basket too long and start to spoil.

Figure 2: The feeder from the orange hopper to the juicer. (Photo Source: Saudi Aramco)

Figure 3. Removing the juicing parts during routine maintenance. (Photo Source: Saudi Aramco)

In addition, EPD has placed additional requirements on the vending machine operators to make sure that the risks are reduced further, with simple steps such as disinfecting the oranges according to Saudi Aramco Environmental Health Code Standards, before the fruit is placed in the machine, and ensuring that the food handlers are trained in food safety practices.

The benefits of using this type of technology bring the possibility of introducing healthy beverage options to employees and dependents in all parts of the Company, regardless of location, as in the past, fresh vitamin-rich fruit juices were not as available as they are today. EPD continually strives to identify and deliver technology solutions from around the world to further protect the health and wellbeing of our people.

A watchful eye

Monitoring and optimizing flare purge gas to reduce emissions

Selvam Daniel and Abdulrahman O. Lashkar, Haradh Gas Plant Department

Introduction:

Flaring is a common sight at any facility where oil and gas are concerned, either in the field or at the refinery. Flaring occurs when the need arises to safely control waste gas by burning it, thereby minimizing the release of pollutants into the atmosphere.

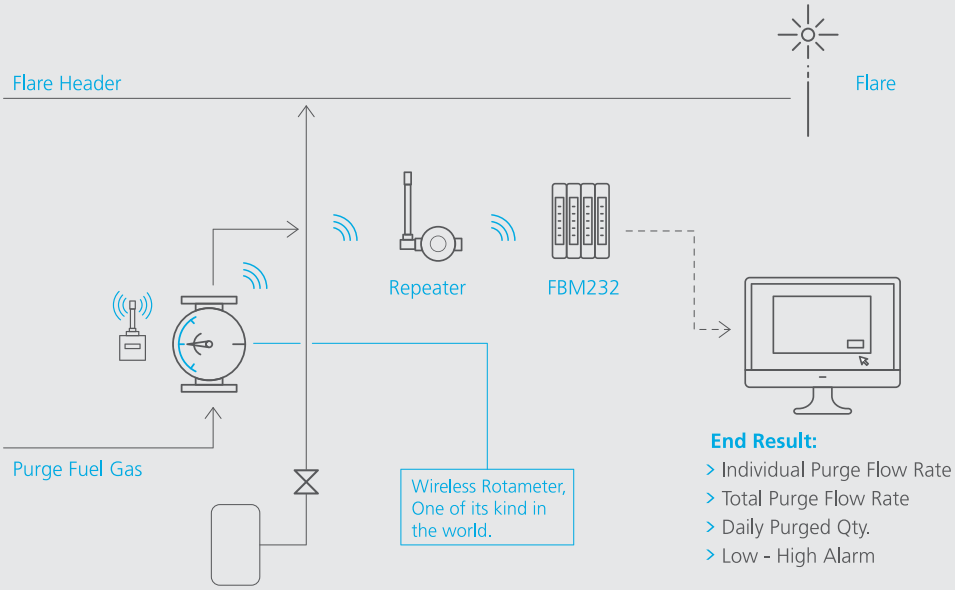
Sometimes, however, safety and other reasons allow for flaring that may result in emissions, though rest assured that Saudi Aramco has one of the lowest flaring rates in the world compared to other international oil companies.

To avoid excessive flaring and ensure adequate purging to reduce gas emissions, Saudi Aramco facilities monitor and optimize the purge fuel gas that is admitted to the flare, a very important task.

In the past, the purge fuel gas to flare network could not be continuously monitored or even optimized due to the use of local rotameters. The meters provided only analog values in field marked by poor resolution and readout uncertainties due to parallax errors. Such technology made it hard for field operators to monitor and report readings needed to control and optimize the purge flow rate. Previously the reading was checked by field operators on weekly basis. Hence, any changes in the reading would go unnoticed and unaccounted, which hindered monitoring and optimization of purge gas to flare.

It may be noted that lowering the purge quantity could create a vacuum in the flare piping

Purge Flow Rotameter- Wireless



network, while higher purge quantities could lead to excess burning of fuel gas and emissions into the atmosphere. Less purging would allow for the ingress of air and moisture that could create problems like pipe corrosion flame out of flare. Higher purge quantities would burn the expensive fuel gas and impact the environmental Key Performance Indicators.

To overcome this situation, Haradh Gas Plant searched for suitable technology, though what was best for our operations was not always available on the market. Thus, the plant embarked on its own to develop a wireless rotameter. Haradh Gas Plant developed a prototype device, tested it successfully, and then the plant installed and commissioned the equipment to measure purge flow quantity.

The apparatus provided digital displays from the field and the wirelessly communicated data to the Distributed Control System (DCS), to monitor the flow rate continuously.

The project will now provide daily and monthly consumption data involving fuel gas. In addition, readings are made available in Plant Information (PI) systems so that the performance of these meters can be monitored periodically from the office itself.

Further the battery life time is also configured in DCS to replace before expiration.

Purpose + Continuous Purging:

The purpose of continuous purging is to:

- Sweep any stagnant sour fluid in the piping network.
- Prevent corrosion and eliminate the liquid accumulation that may condense in the flare network.
- Provide positive pressure to prevent air ingress from the flare tip into the flare network piping.
- Compensate shrinkage effects due to ambient cooling or rapid cooling of gases after hot gas releases.

Challenges in Design:

The first challenge in selecting a purge flow meter was to match the device with the face-to-face dimensions of existing conventional analog rotameters to avoid any hot work such as cutting or welding in the field. The second challenge was that the flow meters must be a smart electronic type with wireless options, to communicate with DCS to avoid laying of cables, scaffolding and DCS input cards. The third challenge was to find the availability of suitable wireless flow meters that would comply with Company standards, such as the Instrument Society of America (ISA) or Highway Addressable Remote Transducer (HART). The fourth challenge analyzed giving batteries longer lifespans (for at least 3 to 4 years) with a reasonable update/scanning rate of wireless flow meters. The fifth challenge was to select the correct wireless interface devices (i.e., modems, converters, etc.), which would allow for communication between field devices and the DCS.

Challenges Overcome:

Haradh Gas Plant is pleased to report that all of the above-mentioned challenges have been met. The following bullets outline some details behind this success story.

Select the flow meters of same face-to-face dimensions: To have aligned dimensions, flange sizes and ratings, a little compromise was reached in measuring flow range without affecting the design and operating values, to match the existing installed flow meter dimensions.

Wireless flow meters in the selected meter: The prototype wireless flow meter was developed by integrating wireless devices with the electronic smart rotameter. This was tested by creating many obstructions and distances.

Finding wireless interface devices: To ensure communication between wireless flow meters and DCS, the interface devices such as access points and field bus modules were integrated through network switches, which were not part of the existing DCS.

Selection of batteries and lifetime: The wireless field devices and repeaters are operating with battery power. If the battery consumption is more, then frequent replacement of batteries is required. Doing so

would increase the maintenance and operating costs in terms of purchasing, man hours and reading interruptions. Hence, a study was conducted to optimize the power consumption, and accordingly the update/scan rate has been decided to get the lifetime of 4 to 5 years for the batteries.

Communication with DCS:
Upon the selection of interface devices, such as the network switch, the field bus module, and the control processor; the plant successfully configured field devices and the DCS to match the data. With the field readings in the DCS, the operators are able to monitor purge flow rates to save fuel gas, and hence address emissions.

Planning and Implementation

After the detailed study, it was planned to procure devices, such as the wireless flow meter, repeaters, the antenna, and access points. In this regard, a field survey was conducted to identify locations for the wireless repeaters to get signals from all installed wireless rotameters, without any major signal loss, to ensure uninterrupted transfer of data from field rotameters to the DCS.

The meters were designed and constructed based on the newly developed Instrumentation Specification Sheets (ISS), complete with details on meter range, dimensions, area classification, process parameters and metallurgy.

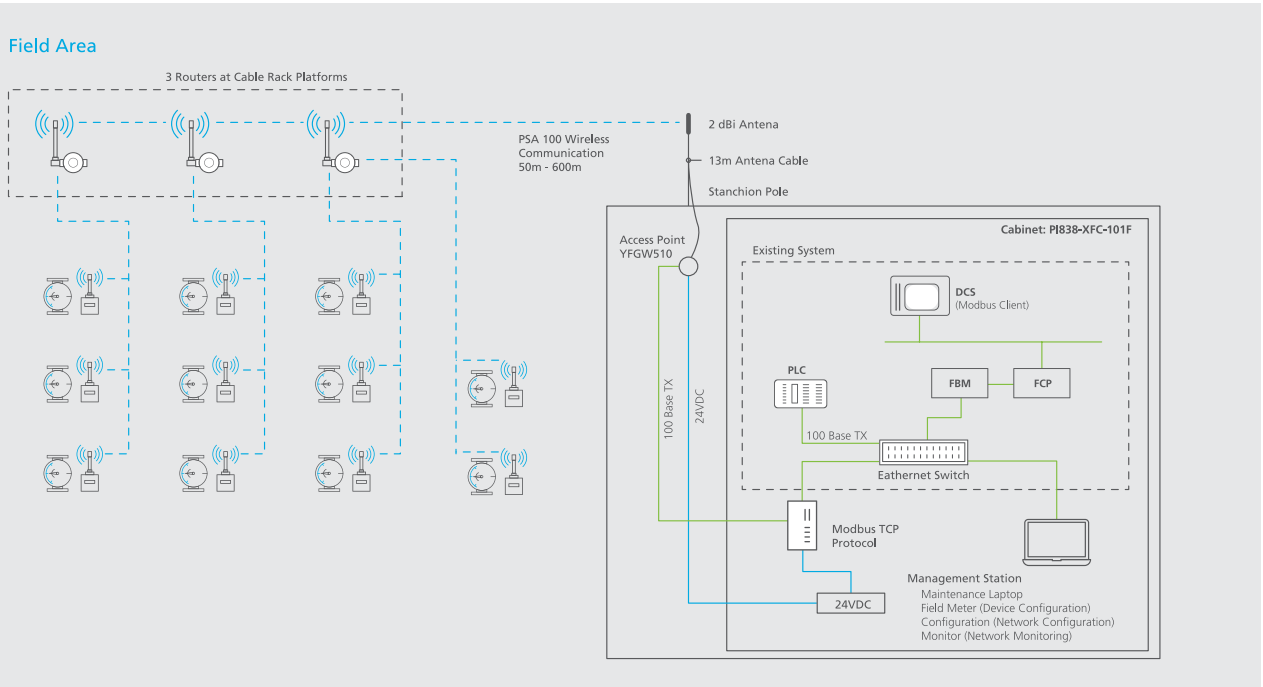
Upon procurement, the meters were installed by removing the local analog meters without cutting, welding or hot work. The transition went smoothly without any major impacts to the flare network's operations.

The repeaters were placed at appropriate locations per the survey conducted earlier. The antenna and access point were installed in the control building in such a way that the antenna could receive the signal from repeaters directly. An Ethernet cable was installed between the access point and the network switch. After completion of all the field installation the batteries were placed in all rotameters and repeaters.

From the network switch, through laptop application software, all field devices have been linked to one another wirelessly (with readings stored in the laptop).

System Architecture:

After ensuring communication from field devices to the control room, the next activity was conducted in the DCS by building a face plate and entering the IP address, baud rate, data addresses, etc.

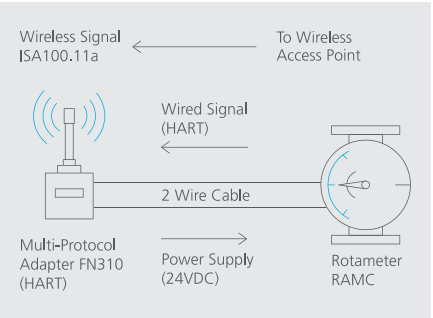


Also, a graphic was built in the DCS to compile all purge flow meter readings into a single page. The graphic was also configured to ensure battery health and longevity in the DCS.

The implementation of wireless purge flow meters reduced gas emissions by cutting fuel gas consumption by 11%.

Technology Resilience

These installations with the latest technology are permanent. These devices are more reliable and efficient in measuring flow rates of purge gas and transmitting the signals accurately to the DCS with minimum delay times. Since the flow rates are not expected to change frequently, any given delays will be considered acceptable and will allow for reasonable readings.



The alarm limits of low and high flow rates have been configured in the DCS to alert operators to take action in case of any deviations in purge quantity. Lower purge rates will result in flare network problems, such as air ingress, corrosion, flameout, while higher flow rates would waste fuel and energy, and also pollute the environment via gas emissions.

Wireless rotameter to measure & optimize purge fuel gas (Flare purge)

TAG NO.	Previous Flow SCFM	Current Flow	Reduction of FG (SCFM)	Reduction %
		SCFM		
Flowmeter #1	60	57.75		
Flowmeter #2	60	56.75		
Flowmeter #3	60	54.25		
Flowmeter #4	250	250.00		
Flowmeter #5	240	139.00		
Flowmeter #6	250	242.00	126.77	11.29
Flowmeter #7	60	56.75		
Flowmeter #8	90	87.50		
Flowmeter #9	45	43.25		
Flowmeter #10	5	5.34		
Flowmeter #11	3	3.63		
Total Flowrate	1123	996		

(Photo Source: Saudi Aramco)

The battery effectiveness has been calculated to get the maximum possible lifetime, by adjusting the update of flow readings without comprising the measurement accuracy.

The effectiveness of this innovative approach would help the operators to optimize the purge flow rate, to save energy, and reduce fuel consumption, in alignment with the Kingdom's Vision 2030.

Sustainability:

In our facility, the purge flow rate readings are obtained in our desktop through the PI system, to periodically monitor the performance of installed meters.

To monitor the lifetime of battery, in DCS the configuration has been conducted for the battery lifetime with a 90-day alarm. That means whenever the battery alarm sounds, the operations and maintenance staff can take action to buy the batteries in advance, before the installed battery surpasses its lifetime. The new batteries can be replaced to ensure the sustainability of the operation of wireless flow meters.

Benefits:

- Avoiding excess flaring
- Ensuring adequate purging
- Optimizing energy consumption
- Monitor daily consumption of fuel gas purge quantity in DCS and PI
- Helps to optimize the purge quantity
- Ensure sweeping of the entire flare header
- No need for the operator to visit field, every shift, to take reading
- Provided flow rate and alarm for deviation
- Low battery alarm for timely replacement
- Guaranteed purging and ensured sweeping of the flare header
- Reduce gas emissions
- Energy savings

Wireless rotameter to optimize purge fuel gas

Battery life time

TAG NO.	Decscription	Battery remaining life (Days)	Remaining life (Months)	Battery low alarm days
FI-001	DS of PZV001A/B/C (FG Pressure Reducing)	809	26.97	90
FI-002	Turbine FG KO Drum PZV 003A/8 and 004A/B	955	31.83	90
FI-003	Turbine FG KO Drum 005A/B and 006A/B	900	30	90
FI-004	SG Metering PZV007A/8/C/0/E	660	22	90
FI-00S	Sweep HP Flare Header	939	31.3	90
FI-006	Sweep HP Flare from Gas Export Launcher	874	29.13	90
FI-007	DS of PZV002A/B (FG Pressure Reducing)	857	28.57	90
FI-008	Sweep LP Flare Header	935	31.17	90
FI-009	Sweep LP Flare from SG Metering	1041	34.7	90
FI-010	Sweep Wet Slowdown	848	28.27	90
FI-011	Sweep Slowdown from SG compressor	870	29	90
RT-001	Repeater 1	1198	39.93	90
RT-002	Repeater 2	1155	38.5	90
RT-003	Repeater 3	1778	59.27	90

Earth Day and the Qomama Initiative

Targeting the root causes of plastic pollution

Richard H. Bodington & Rana M. Al-Ghamdi, Qomama Initiative Members

Photo 1: Large amounts of rubbish ended up in bags for proper disposal and off highway shoulders. (Photo Source: Saudi Aramco)

We all shake our heads when we see litter blowing across our beautiful desert landscapes, but did you ever stop and think about how many people it might take to clean it up? Or closer to home, do you take the time do separate recyclable trash or even ponder whether or not it's properly disposed? Fortunately, there's an organization here in Saudi Arabia that is concerned with such matters.

Since 2017, the Qomama Initiative has asked these and other questions, to address these very pressing environmental issues by tackling the causes of litter in parallel with cleaning it up, all with the aim of making a real difference in Saudi Arabia.

The initiative's first action was to assemble over 120 volunteers from 12 interested organizations (including Saudi Aramco Sanitation Department, Environmental Protection Department, JHAH, SPE, SAVE, among others) on February 10, 2018, to pick up litter discarded alongside the Old Abqaiq Road. In just over an hour, these volunteers collected over 300 bags of litter, mainly plastic bags and bottles, which are not only unsightly, but threaten the health of plants, animals and ecosystems. But as they did so, they were asked to

Photo 2: A participant at the Qomama Initiative's first highway litter cleanup makes a difference by helping to keep our roads cleaner. (Photo Source: Saudi Aramco).

think about the causes of this blight rather than the symptoms.

As a result, the Qomama Initiative's tasks include the following:

- Over the medium-term, Qomama Initiative volunteers will work with a network of schools and local authorities, to promote recycling improvements in the Eastern Province.
- Over the long-term, Qomama Initiative volunteers will support work to identify sustainable commercial waste management solutions for the nation.

Environmental protection campaigns of all sizes across the globe are working to influence rules and regulations to properly dispose of plastics.

That aspiration reflects both Saudi Aramco's and the Qomama Initiative's efforts to encourage prudent use of plastic and to recycle and re-use wherever possible.

Does that mean you, as an individual, can make a difference? Absolutely it does.

To succeed here, everyone must play a role, from educating people about the health and environmental risks associated with the improper disposal of plastics, to getting out there in volunteer groups and picking up trash across our communities.

The Qomama Initiative will continue to curb plastic pollution through its medium- and long-term goals, yet there is always room for more volunteers. If you would like to volunteer to be a part this movement and make lasting transformation to the Kingdom, please ring the Qomama Initiative Hot Line on +966 0500 758983.

in depth

Bright side of life

A look at Saudi Aramco biodiversity protection areas

Dr. Chris Boland, EPD

An astonishing array of biodiversity occurs within Saudi Arabia, including no less than 493 bird species, 107 reptiles, 88 mammals, 8 amphibians, 7 freshwater fish and 2,248 plant species, along with countless invertebrates. Much of this biodiversity can be found on Saudi Aramco's reservation areas, particularly inside fenced areas.

Some of the best habitat in the Kingdom occurs on Company land. The biodiversity within our facilities has been protected from hunting, grazing, firewood collection, off-road driving and illegal dumping. In other words, by building security fences around Company facilities we have

Table 1: High value biodiversity sites on Company land that have been (i) rapidly surveyed by EPD, (ii) comprehensively surveyed by a third party consultant, and/or (iii) designated as a Saudi Aramco Biodiversity Protection Area

Location	Area (km2)	EPD rapid survey	Full survey	Designated
Abu Ali Island Biodiversity Protection Area	105	√	√	2014
Tanajib Biodiversity Protection Area	29	√	√	2015
Shaybah Wildlife Sanctuary	637	√	√	2016
Rahima Bay Mangrove Eco-park	60	√	√	2016
Manifa Biodiversity Protection Area	18	√	√	2017
Abqaiq Wetlands Biodiversity Protection Area	2.5	√	√	2017
'Udhailiyah Biodiversity Protection Area	2.3	√	√	2018
Bahra SSSP	47	√	√	
Abha SSSP	45	√	√	
Khurais	38	√	√	
Madinah SSSP	27	√	√	
Dhahran Jebels	1.3	√	√	
East-West Pipeline	100	√		
Riyadh SSSP	53	√		
Qassim SSSP	34	√		
Haradh	8.3	√		
Aramco Beach Half Moon Bay	1.7	√		
Hida Park (Al-Ahsa)	0.3	√		
TOTAL AREA	1,209			

Photo 1: A sign reminds motorists to slow down to protect 'Udhailiyah Dhub, the first such "Dhub Crossing" sign in the world. (Photo Source: Abdullah Alsuhaibany)

Photo 2: Abqaiq Wetlands Biodiversity Protection Area supports a thriving ecosystem, including this nocturnal Desert Hedgehog. (Photo: Jem Babbington)

inadvertently created biodiversity protection areas throughout the Kingdom.

Over the last 5 years the Environmental Protection Department (EPD) has been working with numerous proponent departments to formally designate high value patches of habitat as Saudi Aramco Biodiversity Protection Areas as per SAEP-359 (detailed below).

As of 2018, seven sites have been designated as Biodiversity Protection Areas (Table 1) totaling 854 km^2 of land. Two of these sites (Abqaiq and 'Udhailiyah) are presented as case studies below.

Abqaiq Wetlands Biodiversity Protection Area

One site recently designated as a Saudi Aramco Biodiversity Protection Area is the Abqaiq Wetlands. This 2.5-km^2 site contains superb wetlands formed from a naturally occurring upwelling of the Neogene aquifer (which otherwise lies below ground) supplemented with tertiary treated wastewater.

Much of the wetlands are covered with dense reeds, which provide food, nest sites and hiding spots for at least 100 different species of resident and migratory birds. The area around the wetlands consists of intact sand dunes supporting a diversity of native vegetation, which is crisscrossed by innumerable mammal and reptile tracks. By night, small mammals such as the Desert Hedgehog (Photo 2), Wagner's Gerbil, and Arabian Red Fox feed on invertebrates on the ground, while Kuhl's Pipistrelle Bats feed on insects in the air. By day, dozens of migratory birds feed on invertebrates and small fish in the water. It's a thriving ecosystem of regional significance.

The site has been fenced to prevent illegal dumping and piles of previously dumped debris have been cleared. Feral dogs have been controlled to reduce their impacts on nesting birds. What's more, two bird hides — the first in the Kingdom — have been

Photo 3: 'Udhailiyah Biodiversity Protection Area helps to preserve the iconic Dhub lizard, which is declining globally. (Photo: Jem Babbington)

constructed to allow visitors to watch birds without disturbing the animals.

'Udhailiyah Biodiversity Protection Area

Another patch of habitat that was recently designated as a Biodiversity Protection Area can be found at 'Udhailiyah. A thorough plant survey had revealed that the 2.3-km^2 fenced site contains the very rare Ephedra alata plant, which had not been recorded within the Eastern Province for over 20 years, along with 48 other desert plant species. These plants support a diversity of desert-adapted animals, including at least six mammal species, seven reptiles and 35 birds. For example, many desert-adapted larks occur at the site; in spring, the males broadcast their loud, musical, flute-like tunes that float across the wide-open plains of 'Udhailiyah like a call to prayer, bringing joy to anyone lucky enough to listen.

Significantly, a healthy population of Dhub occurs around 'Udhailiyah. These Spiny-tailed Lizards are formally listed internationally as vulnerable to extinction and decreasing globally, which means these iconic reptiles are at risk of becoming extinct within our lifetime. By establishing the 'Udhailiyah Biodiversity Protection Area, Saudi Aramco is helping to conserve these remarkable reptiles (Photo 3).

Which sites might be next?

Comprehensive surveys have already been conducted at five more sites, all of which contained impressive biodiversity and are thus currently under consideration for designation, including the extraordinary habitat at Abha SSSP (the Saudi Strategic Storage Program, or SSSP, stores petroleum and derivatives in safe, underground locations for use in emergencies or if other situations should disrupt otherwise normal supply. Lands above SSSPs may not be developed and have thus become key biodiversity sites). Exceptional biodiversity has also been recorded during comprehensive surveys at Al Madinah and Bahra SSSPs, and

Photo 4: Abha SSSP provides ideal habitat for this rare and endemic bird, Philby's Partridge. (Photo Source: Jem Babbington)

Photo 5: Comprehensive biodiversity surveys reveal exceptional plant and animal diversity on Company land, such as this field of native flowers in bloom at 'Udhailiyah Biodiversity Protection Area. (Photo Source: Saudi Aramco)

during rapid surveys conducted by EPD at Riyadh and Qassim SSSPs. All of these sites have the potential to be designated as Saudi Aramco Biodiversity Protection Areas according to SAEP-359, because of their outstanding natural values.

In addition, at least six more sites have been identified by EPD as also potentially containing high value habitat. And, no doubt, many more patches containing wonderful biodiversity occur at many other Company sites around the Kingdom – each just waiting to be surveyed and protected.

Exceptional Biodiversity at Abha SSSP

Comprehensive biodiversity surveys have revealed extraordinary biodiversity at Abha SSSP. The surveys consisted of two people searching for tracks, burrows, scats and other traces of mammals. In addition, pitfall traps and pain-free mammal traps were placed in strategic locations around the site, while six remote infrared cameras were set up beside trays of food, to record any animals that came to feed on the free meals during the night. The results were amazing. Over the course of only five days and nights of survey, no less than 21 mammal species were recorded, including Crested Porcupine, Rock Hyrax, White-tailed Mongoose and Asiatic Caracal. In other words, 28% of all of Saudi Arabia's mammals were found in one 45-km^2 Company facility in the space of only five days! A fantastic array of 37 native plant species, 6 reptiles and 61 birds were also recorded. Doubtless many more species will be recorded with additional surveying.

Two leading birdwatchers were brought to Abha SSSP to photograph birds and other animals at the site. Eight of the birds recorded were endemic species – that is they occur in Arabia and nowhere else on earth – which means they have especially high conservation value. For example, Abha SSSP appears to contain the best habitat in the world for the endemic Philby's Partridge (Photo 4). Only 25,000 pairs are thought to exist across its range, but at Abha SSSP they are commonplace.

How Saudi Aramco designates Biodiversity Protection Area

In 2014, EPD developed a Company procedure (SAEP-359 Biodiversity Protection Areas: Designation and Management) that outlines the simple steps required to designate Saudi Aramco Biodiversity Protection

Areas over high quality habitat. Essentially, the procedure requires a third-party consultant to confirm that a proposed site is of sufficient ecological quality to warrant designation as a Saudi Aramco Biodiversity Protection Area. The steps outlined in the procedure can be summarized as follows:

- The proponent department notifies EPD that good quality habitat occurs within the proponent's reservation area (or EPD notifies the proponent that good quality habitat occurs on site).
- EPD conducts a rapid biodiversity assessment of the site.
- EPD provides the proponent with a scope of work for a third party biodiversity consultant to conduct comprehensive surveys.
- The proponent then contracts the biodiversity consultants to conduct the comprehensive biodiversity surveys.
- If the surveys confirm that the site contains significant biodiversity (that is, the site meets criteria outlined below), then the proponent proposes to EPD that the site should be designated as a Saudi Aramco Biodiversity Protection Area.
- EPD assists the proponent to designate a Company Land Use Permit over the habitat patch.
- EPD assists the proponent to develop a Biodiversity Action Plan to help manage the site.

What are the criteria for designating a Saudi Aramco Biodiversity Protection Area?

To ensure that only the best value habitat is protected, SAEP-359 outlines the criteria for determining whether a site contains biodiversity worthy of being designated as a Saudi Aramco Biodiversity Protection Area. Essentially, a site warrants protection if it contains endangered, migratory or endemic species. As per SAEP-359, a site shall be considered for designation if it meets two or more of the following criteria:

a. The area contains one or more species that are listed as Vulnerable, Endangered or Critically Endangered or two or more species that are listed as Near Threatened by the International Union for Nature Conservation's Red List of Threatened Species.

b. The area contains two or more species that are listed as High Conservation Priority by the Saudi Arabian government.

c. The area contains one or more species that are endemic to the Arabian Peninsula (that is they occur in Arabia and nowhere else on earth).

d. The area frequently contains five or more migratory bird species.

e. The area is a traditional colonial nesting site / roosting area / foraging area for resident or migratory fauna.

f. The area plays an integral role in the ecosystem functioning of a valued area.

g. The area has the potential to benefit the education and/or well-being of local residents.

h. The area exhibits potential for restoration of important or rare habitat.

i. The area acts as an important link or ecological corridor between other sites of biodiversity value.

j. The area is a significant source of native seed, or larval and/or juvenile recruits.

k. The area contains landscapes of particularly high aesthetic value.

Conclusions

Almost every Company facility seems to have at least one patch of high quality habitat within its reservation area. These patches of vegetation may be as small as 100 m x 100 m; others may cover many square kilometers. In many cases, this habitat can be protected at very little cost and with very little risk to the Company. Protecting these patches of habitat can be a source of great pride and benefit for the Company and its employees. Together, these patches of high quality habitat help to protect the Kingdom's precious and vulnerable plants and animals. The importance of this cannot be overstated. After all, they need our help.

(Photo Source: Saudi Aramco)

Good vibrations

Protect yourself from hand/arm vibration

Masra Ohali, EPD

What is Hand-Arm vibration?

Hand-arm vibration is a form of physical energy transmitted into a person's hands and arms from sources such as handheld power tools. Examples include but are not limited to, reciprocal saws, angle grinders, impact drivers and weed whackers. Other sources include hand-guided machinery and equipment, such as plate compactors and human-controlled road rollers, or even hand-held work pieces used on equipment such as bench grinders. The power sources of the tools or machines in use can be electrical, hydraulic, pneumatic or gasoline, but the resulting vibration hazard is the same regardless.

Hazards and Risks

What is the hazard?

Prolonged and/or frequent exposure to hand-arm vibration can lead to two ill health conditions: Hand-Arm Vibration Syndrome (HAVS) and Carpal Tunnel Syndrome (CTS). Both conditions are non-reversible and can seriously impact the worker's future employment and lifestyle if not managed correctly.

HAVS has two main physiological components, sensorineural, which affects the peripheral nervous system, and vascular, which affects the peripheral blood vessels. Both components work together and cause the signs and symptoms of HAVS that include:

- A tingling sensation and loss of feeling in the fingers, which can make basic routine tasks difficult to perform, resulting in an inability to do fine detailed work such as assembling small and delicate components, or everyday tasks such as hand writing.
- Loss of grip strength in the hands affecting the ability to hold tools properly.
- Reduced peripheral blood flow to the fingers causing whitening of the fingers also known as blanching (Figure 2) and can result in pain (the effect is more pronounced in cold or wet conditions).

Photo 1 Illustration of HAVS finger blanching. (Photo Source: Shutterstock)

CTS is a musculoskeletal disorder that affects the bones, soft tissue and nerves in the wrist (Figure 3). It can be caused by high grip forces or repetitious gripping of tools and machinery. Symptoms and effects of CTS may include:

- A tingling sensation and loss of feeling in the fingers, which can make basic routine tasks difficult to perform.
- Persistent pain in the hands, wrists and forearms.
- Loss of mobility in the hands and fingers.

Photo 2: Illustration of where carpal tunnel syndrome occurs in the body. (Photo Source: Shutterstock)

HAVS and CTS symptoms are intermittent and sporadic, though if exposure to vibration continues they may become permanent and painful, and in turn lead to

Photo 3: A worker uses a jackhammer, one of many activities that may pose the risk of hand/arm vibration. (Photo Source: Shutterstock)

Vibration magnitude m/s²	15 m	30 m	1 h	2 h	3 h	4 h	5h	6 h	8 h	10 h
45	800									
30	450	900								
25	315	625	1250							
20	200	400	800							
19	180	360	720	1450						
18	160	325	650	1300						
17	145	290	580	1150						
16	130	255	510	1000						
15	115	225	450	900	1350					
14	98	195	390	785	1200					
13	85	170	340	675	1000	1350				
12	72	145	290	575	865	1150	1450			
11	61	120	240	485	725	970	1200			
10	50	100	200	400	600	800	1000	1200		
9	41	81	160	325	485	650	810	970	1300	
8	32	64	130	255	385	510	640	770	1000	1200
7	25	49	98	195	295	390	490	590	785	866
6	18	36	72	145	215	290	360	430	575	720
5.5	15	30	61	120	180	240	305	365	485	605
5	13	25	50	100	150	200	250	300	400	500
4.5	10	20	41	81	120	160	205	245	325	405
4	8	16	32	64	96	130	160	190	225	320
3.5	6	12	25	49	74	98	125	145	195	245
3	5	9	18	36	54	72	90	110	145	180
2.5	3	6	13	25	38	50	63	75	100	125
2	2	4	8	16	24	32	40	48	64	80
1.5	1	2	5	9	14	18	23	27	36	45
1	1	1	2	4	6	8	10	12	16	20
	15 m	30 m	1 h	2 h	3 h	4 h	5h	6 h	8 h	10 h
Daily exposure time										

Figure 1. Vibration points ready reckoner card.

other psychological conditions such as stress and anxiety. Effects may occur after a period of only a few months to several years of vibration exposure.

How do we assess the risk?

Vibration assessments can be either qualitative or quantitative.

Qualitative assessments are relatively easy to do and require no special equipment. A manufacturer's vibration data for a tooling or machinery item can be used together with some basic workplace observations to provide a reasonable estimate of exposure levels.

Quantitative assessments are much more difficult, requiring sophisticated measuring devices and considerable expertise; therefore it is best left to trained and competent people.

Both qualitative and quantitative assessment methods have their

(Photo Source: Shutterstock)

pros and cons, but on balance qualitative assessment is adequate for 90% of situations.

What is vibration frequency?

All power tools or pieces of machinery produce vibration due to the fact they have moving parts. In reality a machine will produce vibrations at many different frequencies. These frequencies are characterized by the number of oscillations per second in just the same way as radio frequencies. The unit of measurement used to define each frequency is the hertz (Hz), and 1 Hz is equivalent to 1 oscillation per second. The total vibration emitted is the combination of all frequencies within any given range of frequencies. Not all frequencies are harmful. The frequencies that give cause for concern are the lower frequencies (i.e., below 20Hz), as they are the frequencies to which the human body is most susceptible. Higher frequencies do not give rise to hand-arm vibration issues. If you observe a construction worker using a jack hammer or vibrating plate compactor, you will see that those kinds of tools produce a vibration frequency of about 5 -15 strikes per second, or put another way, 5-15 Hz.

Is there a safe level?

There is currently no established safe level for hand-arm vibration exposure; there are only guideline values that are set at levels that aim to reduce vibration risks. Individual susceptibility is one of several factors that affect overall risk. Exposure limits vary slightly from one country to another, but all are around the same level.

The most frequently used measurement parameter for hand-arm vibration is acceleration, which is normally expressed in units of meters per second squared (m/s^2) and often referred to as the "vibration magnitude."

Acceleration is not an easy concept to understand, and involves complex mathematical calculations to obtain a result that can be compared against the guidelines. Fortunately, the U.K. Health and Safety Executive (HSE) has produced a system that translates acceleration values into more easily understood vibration points (VPts) system, which can be used as an effective screening tool (Figure 4).

The ready reckoner card is designed to be used in conjunction with both qualitative and quantitative assessments. The vibration magnitude value can be obtained qualitatively from the manufacturer's vibration data supplied with the tool, or quantitatively, through actual vibration measurements. The daily exposure is the total amount of trigger time each day for that tool.

Example: A tool manufacturer's instruction book quotes 5.5 m/s^2 for the vibration magnitude, and the total trigger time is two hours. Reading across from 5.5m/s^2 in the left column and up from 2h on the bottom row, the point where both intersect is 120 points in the yellow zone, indicating that additional control measures are advisable, but the tool is still acceptable for use in that scenario.

The vibration points system can be compared against an Exposure Action Value (EAV) and an Exposure Limit Value (ELV). These values take into account the total amount of vibration transmitted to the user's hands and the actual tool use time (often referred to as trigger time). The exposure action and limit values are:

- A daily EAV of 2.5 m/s^2 A(8) - this is equivalent to 100 VPts spread over an 8-hour period. Below this value the risk is considered low, above this value the risk is considered significant enough to warrant additional control measures.
- A daily ELV of 5 m/s^2 A(8) – this is equivalent to 400 VPts spread over an 8-hour period. It is recommended that workers are not exposed to levels higher than this level.

How do I know if it's a problem in my workplace?

First review each task involving power tools, hand guided machinery or hand-held workpieces. Not all tools, equipment or tasks will produce enough vibration to be problematic, and some that do may not be of sufficient duration or daily recurrence to exceed the EAV.

Typically, work involving regular and frequent exposure to vibration exceeding the EAV can be found in a wide range of industries using certain types of tools, including the following:

- Construction and civil engineering - jack hammers, vibrating plate compactors, floor saws, and road rollers.
- Engineering – nut runners, grinders, reciprocating saws, hammer drills, and belt sanders.
- Forestry – chainsaws.
- Foundries – needle guns, grinders, and powered chipping hammers.
- Woodworkers – sanders, routers, and circular saws.
- Motor vehicle manufacture and repair – nut runners, and orbital sanders.
- Parks and grounds maintenance – lawn mowers, and weed whackers.
- Shipbuilding and repair – grinders, and riveters.

Poorly maintained and badly worn older tools may produce significantly more vibration than stated in the manufacturer's literature. Improper tool use is also a factor to be considered.

Controlling HAVS Risk

How can I control the risk?

Control of hand-arm vibration risk follows the long established hierarchy of controls. The most effective way to control hand-arm vibration risk is to eliminate the vibration hazard by using tools and equipment that can be remotely operated. The next best thing is to reduce vibration sources by purchasing the lowest vibration tool that will do the job satisfactorily. Consider the vibration data supplied with the tool or equipment, and estimate the typical daily trigger time. The total amount for vibration transmitted to a worker's hands is a product of both vibration level and trigger time.

The next step is to reduce the amount of vibration transmitted to the hand and/or reduce the time spent operating and holding

vibrating tools, equipment or work-pieces. If the risk cannot be controlled to below the EAV, then the following actions are recommended:

- Provide information, instruction and training to employees on the vibration hazards and risks they may encounter in their workplaces.
- Assess all handheld or hand-guided tools and machinery prior to purchasing. Reputable tool and mechanical equipment suppliers will supply vibration data in the equipment manual that can be used to make a preliminary assessment.
- Check the equipment manufacturer's vibration data, which is normally found in the instructional handbook.
- Maintain an inventory of vibrating equipment, and include the vibration output for each item.
- Identify groups of workers who will the use handheld tools and hand-guided machines and establish their typical use patterns.
- Adopt work methods that avoid or minimize the use of hand operated vibrating equipment.
- Consider using mountings or jigs to hold work-pieces. Maintain equipment in accordance with its manufacturer's instructions.
- Plan work schedules to minimize vibration exposures and make sure exposures are below the ELV and if possible below the EAV.
- Organize work and design ergonomic workstations to avoid awkward or uncomfortable postures, reduce workpiece handling effort and minimize grip forces.
- In cold or damp work conditions, provide suitable clothing to keep workers hands warm and dry to maintain blood circulation.
- Provide suitable risk-based health monitoring for significantly exposed employees.

What about PPE?

Personal Protective Equipment (PPE), gloves in particular, have yet to be proven effective in reducing hand-arm vibration exposure. This is because harmful low frequencies that cause HAVS are much more difficult to attenuate than higher frequencies, and to make a glove capable of absorbing low frequencies would result in a glove that would be too heavy and thick to be of any practical use.

In cold or wet conditions using gloves to keep the hands warm and dry will aid blood circulation and provide some relief for the wearer.

Summary

Excessive exposure to Hand-Arm vibration can result in permanent disability if the risk is not managed correctly. The medical conditions arising from excessive exposure are HAVS and CTS. Exposure is predominantly but not exclusively among workers who use vibrating tools and/or machinery regularly. Not all tools and machinery are problematic, with low-frequency (below 20Hz) vibrating tools requiring the most attention. Vibration assessments can be either qualitative or quantitative and each method has its pros and cons — for most situations, a simple qualitative assessment is sufficient. In recent years tool manufacturers have made great strides to produce lower-vibration products, while remote control technology can eliminate vibration exposure in some applications. When planning construction, maintenance or demolition work consideration should be given to hand-arm vibration risk and how to control it.

Further Information:

If you believe you may have a potential hand-arm vibration issue, contact the Environmental Protection Department/Workplace Environment Division at 880-0457 for information and assistance.

The facts of life

Learn more about new Saudi food mandatory labeling requirements.

Hassan Zain and Jason R. Hall, EPD

Throughout history, being overweight and or even obese were often indications of wealth and good health. Fortunately for humanity, times have changed. The vast technological developments and astonishing advancements in the fields of medicine and healthcare in the 20th Century resulted in the world having a better and accurate understanding of the human body. The original beliefs surrounding overweightness and obesity have completely changed, going from being a sign of success to a sign of serious health problems. (Eknoyan, 2006).

Obesity or being overweight are harmful yet preventable medical conditions that occur when the energy intake from food and drink is greater than the energy the body needs, resulting in excessive or abnormal accumulation of fats within the body and leading to multiple chronic diseases responsible for lower life expectancies. The Body Mass Index (BMI) is the overall weight of an individual represented in kilograms (kg) divided by the person's height (in meters squared). Those who hold a BMI greater than or equal to 25 are classified as overweight, whereas those who hold a BMI greater or equal to 30 are classified as obese (WHO, 2019). Obesity remains a problem today, as rates show no sign of decline, thus affecting individuals and the healthcare system.

The Global Obesity Crisis

The widespread presence of obesity and overweightness has increased significantly over the past three decades in many countries around the globe (Alqarni, 2016), even described overweightness and obesity as a global epidemic (Al Shehri, Al Fattani and Al Alwan, 2013). It is predicted that by 2030, nearly half of all adults will be either overweight or obese (Mahmood and Arulkumaran, 2012), representing an economic burden on gross domestic product. The percentage of adults (i.e., defined as aged 18 years and older)

who are classified as obese and overweight. These illustrations indicate that since 1975, worldwide obesity among males and females has nearly tripled. In 2016, more than 1.9 billion adults were either obese or overweight (Ritchie and Roser, 2019; WHO, 2018).

The Saudi Arabian Obesity Crisis

Over the past few decades, obesity in the Kingdom of Saudi Arabia has become a prime source of concern with one of the highest obesity and overweight prevalence rates worldwide (De Nicola et al., 2015; Horaib et al., 2013; Al-Hazzaa et al., 2012; Al-Othaimeen, Al-Nozha and Osman, 2007; Khan, 2014), where exactly seven out of 10 Saudi citizens are experiencing the problem (Memish et al., 2014). Figures 1–2 highlight the prevalence of obesity and overweight among adults (i.e., defined as aged 18 years and older) over a period of 40 years. It demonstrates that in 2016, rates of obesity and overweightness among Saudi Arabian males and females have more than tripled since 1975 (Ritchie and Roser, 2019; WHO, 2018).

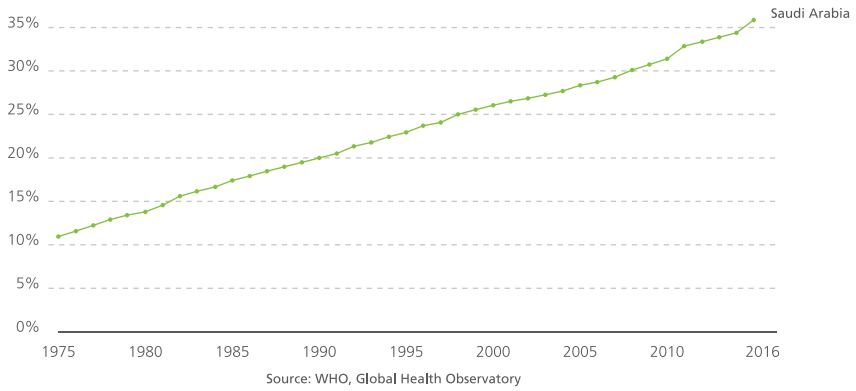


Figure 1 shows the Saudi prevalence of obesity in adults from 1975 to 2016.

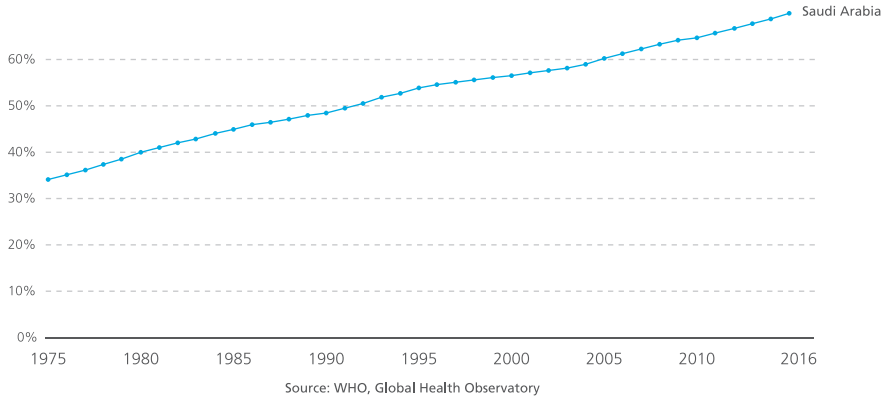


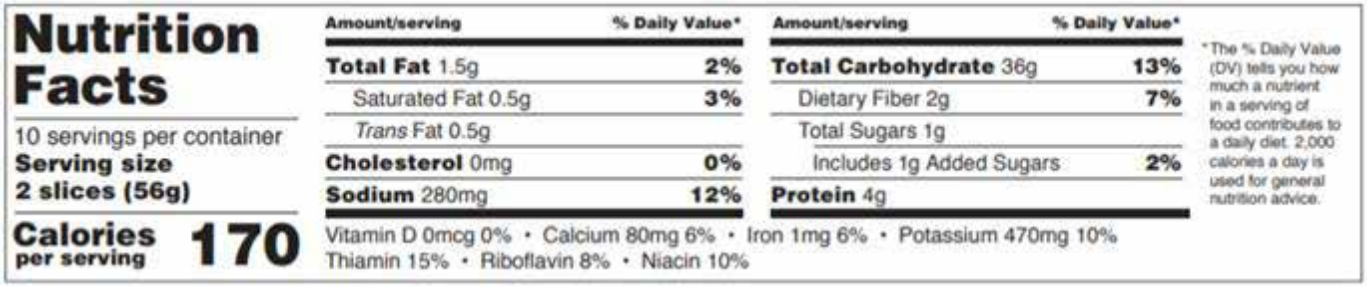
Figure 2 shows the Saudi prevalence of overweight in adults from 1975 to 2016.

The alarming increase in the obesity and overweightness trends in Saudi Arabia have highlighted the need for critical and immediate actions to tackle the obesity crisis in the country, as obesity rates in 2022 are going to be four times higher than obesity rates back in 1992, just 30 years ago (12% for men and 20.7% for women). Saudi Arabia is experiencing a growing obesity crisis, which demands greater focus on healthy eating habits (Alzahrani, Al Khaldi and Alsamghan, 2016).

A New Weapon against Obesity—Food Labels

In October 2017, the Saudi Food and Drug Authority (SFDA) coined the Nutrition Fact Sheets (NFSs) Initiative to be implemented across the country. Once an optional afterthought, these tools aim to crop the obesity and overweight crisis by providing regulatory guidance under which food business providers must comply. The display of NFSs will empower Saudi Arabian citizens to make healthy and informed choices upon selecting food items.

NFSs (Figure 7) provide nutritional information on protein, sugars, salt, fats, saturates and calorie counts. This information supports consumers to understand the food properties, keep track of their daily dietary needs, and live healthier lives by eating a well-balanced diet. Such a diet is a cornerstone of good wellbeing and higher productivity by preventing conditions such as overweightness and obesity. Nutrition is classified as the intake of food in relation to an individual's daily dietary needs. Poor nutrition can be a significant factor in reducing the following: people's susceptibility to disease, productivity, and immunity; a diet and support the development of mental health illness and physical disability (WHO, n.d.). Accurate interpretation of NFSs is a vital step toward diet customization.



Nutrition Facts

10 servings per container
Serving size
2 slices (56g)

Calories per serving **170**

Amount/serving	% Daily Value*	Amount/serving	% Daily Value*
Total Fat 1.5g	**2%**	**Total Carbohydrate** 36g	**13%**
Saturated Fat 0.5g	**3%**	Dietary Fiber 2g	**7%**
Trans Fat 0.5g		Total Sugars 1g	
Cholesterol 0mg	**0%**	Includes 1g Added Sugars	**2%**
Sodium 280mg	**12%**	**Protein** 4g	

Vitamin D 0mcg 0% • Calcium 80mg 6% • Iron 1mg 6% • Potassium 470mg 10%
Thiamin 15% • Riboflavin 8% • Niacin 10%

*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.

Figure 1 shows the Tabular (Horizontal) Format of Nutrition Fact Sheets (USFDA, 2019).

Reading and Understanding Nutrition Fact Sheets

To customize a balanced and healthy diet, food consumers should properly read and interpret NFSs found on the food packaging. It consists of the following four main pieces of nutritional information:

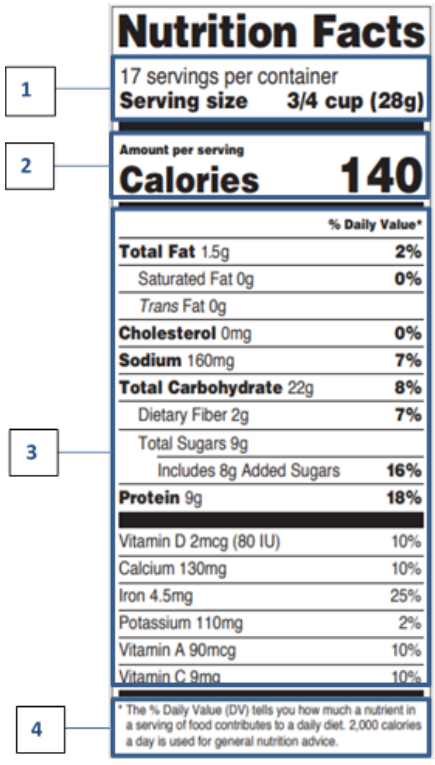


Figure 2: Food Serving Size indicates the amount of food that is designed to be consumed in one serving (i.e., the amount consumers usually eat in one serving). Generally, all the nutrition information listed on NFSs is based on one serving size of the food.

[1.2] Servings per Container: Food Servings per Container indicate the total number of servings that contained within the entire food package — a food package may contain more than one serving size.

[2.0] Calories: Food calories indicate the total amount of "energy" or calories from all the nutritional sources (i.e., Total Saturated and Trans Fats, Cholesterol, Protein and Total Carbohydrates of Dietary Fiber and Total Sugars) present in one serving size of the food package. Generally, a total of 100 calories in one serving size of the food package is considered as moderate, whereas 400 calories in one serving size of the food package is considered as high.

[3.0] Percentage (%) Daily Value: Food % Daily Value shows the overall contribution of a nutrient in one serving size of the food package to consumers' daily diet. Generally, if a Food % Daily Value of a nutrient in one serving size of the food package is 5% or below, it is considered low, whereas 20% and above is considered high.

[4.0] Footnote with Percentage (%) Daily Value: Most of the nutrient's % Daily Value is based on dietary needs of 2,000 calories a day. The number of calories that consumers need is not always fixed to 2,000 calories per day, but rather generally on consumers' dietary needs, gender, age, level of physical activity, height and weight.

Depending on the space available on the food package, food business providers could voluntarily list the recommended daily values on the footnote for selective key nutrients as guidance.

Nutrition Fact Sheets and Healthy Eating: Know Your Food

The United States Food and Drug Administration and the Saudi Food and Drug Authority recommends — for eating a healthy and well-balanced diet — that consumers should aim for the following:

- Calculate and understand the exact daily dietary needs from an approved source, for example, a nutritionist's consultation.
- Read and understand the

properties of food packages through NFSs.

- Ask the food business provider to elaborate on their NFSs if needed.
- Effective management of the daily calories and nutrient intake.
- Select food packages that are low in saturated and trans fats, sodium and added sugars and higher in dietary fiber, vitamin D, potassium, iron and calcium.
- Consume less than 10% of the total daily calories from added sugars.
- Avoid the daily exceedance of 100% the % Daily Value in nutrients that are associated with higher risks of developing obesity and other health related risks (i.e., saturated and trans fats, sodium and added sugars).

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in focus

Photo 1: From left to right, Abdulaziz Ansari (Environmental Protection Department), Tidjani Niass (Technology Strategy Planning Department) and Adel Ghamdi (Environmental Protection Department) showcase Saudi Aramco's efficient internal combustion engine technology to elaborate it's potential to reduce carbon emissions at COP24 in Poland. (Photo Source: Saudi Aramco)

EPD participates at United Nations Climate Change Conference (COP24)

Representatives from the Environmental Protection Department (EPD) along with Kingdom officials participated in the historic 24th Conference of the Parties (COP24) under the United Nations Framework Convention on Climate Change (UNFCCC), in Katowice, Poland, from November 27—December 16, 2018. COP24 was a deadline to complete the Paris Agreement Work Programme (PAWP), also known as the "Paris Rulebook." After more than 2 weeks of intense negotiations, the rulebook containing over 150 pages finally came to fruition. EPD representatives spearheaded several negotiation aspects related to submitting and updating Nationally Determined Contributions (NDCs), reporting the transparency framework, and convening the global stock take to assess the collective progress towards the Paris Agreement's goals. The key elements that serve the best interests of the Kingdom have been successfully anchored in the rulebook, including mitigation co-benefits resulting from adaptation actions and economic diversification. One of the major accomplishments of the Saudi climate negotiators was the establishment of a permanent forum to address the impacts of response measures, including a Katowice Committee of Experts. The forum aims to minimize the socio-economic impacts on oil-producing countries from the Paris Agreement's implementation. Furthermore, the adopted NDC features are consistent with the Kingdom's NDC, which allows Saudi Arabia to submit its upcoming NDCs without further adjustments. The outcome of the meeting also opened the door for different flexibility aspects, to avoid overburdening or interfering with the Kingdom's functions or its national policies.

On a parallel note, the Kingdom of Saudi Arabia, represented by the Ministry of Industry, Energy and Mineral Resources (MEIM), led the establishment of a GCC pavilion at COP24. Representatives from EPD consolidated, reviewed, and approved the technical content, in collaboration with MEIM and the Corporate Communication Department (CCD). The content consisted of technical presentations and showcase materials developed to enhance awareness and provide exposure of the Kingdom's efforts to combat climate change. Presentation sessions covered important topics such as:

- Water & Wastewater Challenges in the Gulf Region
- Sustainable Development for an Attainable Future
- Emission to Value: Creating Value from CO_2
- Energy Efficiency Applications within the Gulf Region
- R&D for Climate Solutions
- Oil & Gas Technology to address Climate Change Challenges
- Carbon Capture Utilization and Storage (CCUS) Technologies

Each session consisted of several presentations from various experts on subjects representing different industrial, educational and research organizations. Showcase side events included interactive screens on 18 topics, covering four main categories: Economic Diversification, Addressing Emissions, International Collaboration, and Adaptation.

EPD attends Red Sea biodiversity workshop

EPD representatives attended the first Red Sea regional workshop on October 23-25, 2018, at the King Abdullah University of Science and Technology (KAUST). The workshop addressed how much is known about Red Sea biodiversity (e.g., coral reefs in particular), challenges in assessing biodiversity, and the optimal innovative techniques for coral-reef monitoring. This is particularly relevant in the light of anticipated pressures associated with major coastal development plans in the region. The workshop also aimed to establish standardized sampling protocols across Red Sea countries, to make scientific data comparable among them. There were delegates from all nations with access to the Red Sea, as well as international experts who presented on the lessons learned from other regions. The standardization of sampling methods to measure biodiversity in the Red Sea is highly important to the Kingdom, currently due to the fact that upcoming megaprojects (i.e., The Red Sea Project and NEOM) are targeting high revenues based on ecotourism, thus depending on in the preservation of the marine life in the Red Sea. The EPD team highlighted the need to preserve the coastline in these developments, as established by the 400m seatback rule (Royal Decree) as well as utilize new monitoring techniques like environmental DNA, which allows detection of changes in biodiversity faster than traditional methods.

More than 50 Employees Certified as Environmental Professionals

The Environmental Protection Department (EPD), in collaboration with Technical Services Professional Academy (TSPA), successfully conducted the First Live Remote Interactive Teaching Preparatory Course (via WebEx conferencing technology), titled "General Environmental Science," which is required for obtaining the Environmental Professional Intern (EPI) certification.

A total of 51 environmental professionals, including EPD engineers and scientists, as well as Environmental Coordinators, completed the course and the required certification exam with an overall passing rate of 97% (See Table 1).

EPI certification is the first step towards obtaining the more advanced Qualified Environmental Professional (QEP) certification. Achievement of these certifications is considered to be an accomplishment of the highest order, signifying strong professional and ethical standards in the arena of environmental management. Through these certifications, environmental professionals demonstrate the breadth and depth of their knowledge and experience. The exams and certifications were issued and recognized by the Institute of Professional

Environmental Practice (IPEP, USA), an independent organization whose multidisciplinary exams are developed by professionals across all sectors of environmental practice, including: industry, agencies, academia, and consulting organizations.

According to IPEP, Saudi Aramco leads the top ten companies worldwide with the most qualified members. It is worth mentioning the live remote interactive course is the first of its kind for Saudi Aramco and resulted in more than 90% cost avoidance, as compared to normal instructed lead training classes.

Table 1. List of Saudi Aramco employees who passed the General Environmental Science course, and have been internationally certified as an Environmental Professional Intern (EPI).

No.	Name
1	Abdulaziz A. Al-Malki
2	Abdulaziz I. Al-Salem
3	Abdulaziz J. Al-Ansari
4	Abdulaziz K. Al-Ghowainem
5	Abdulla G. Alhamed
6	Abdullah A. Al-Duaiji
7	Abdullah B. Al-Zahrani
8	Abdullah J. Al-Khamis
9	Abdullah S. Al-Subaie
10	Abdulmalik A. Alsabti
11	Abdulrahman K. Al-Jaafari
12	Abdulrahman M. Alabdullatif
13	Abdulrahman A. Alshahwan
14	Ahmed A. Alhomran
15	Ahmed M. Al-Nughairi
16	Ahmad M. Al-Otaibi
17	Diego F. Lozano-Cortés
18	Fahad A. Al-Ghamdi
19	Fahad H. Alhargan
20	Fahad S. Al-Zahrani
21	Fawaz A. Al-Wohaib
22	Fuad A. Bukhari
23	Ganiyu A. Asuni
24	Haithm A. Al-Shareef
25	Hassan A. Alkhunaizi
26	Hassan M. Alzain
27	Hattan J. Balkhi
28	Ibrahim A. Aljabr
29	Ibrahim A. Al-Nemer
30	Ibrahim A. Al-Shayqi
31	Justin M. Shewchuk
32	Khalid A. Al-Masoud
33	Khalid S. Al-Zahrani
34	Krystle A. Pertsch
35	Majed I. Al-Arf
36	Mohammed A. Al-Nami
37	Mohammed A. Al-Mugahwi
38	Muhammad B. Al-Rayaan
39	Mohammad Y. Al-Yagout
40	Muhanned A. Abu Ghdaib
41	Naif A. Alabdullatif
42	Othman S. Alkubaisi
43	Perdana K. Prihartato
44	Rashed F. Alhajri
45	Rayan M. Al-Nasser
46	Saleh M. Al-Qahtani
47	Sibusiso M. Masuku
48	Sohaib B. Alhajhussein
49	Sultan I. Alrubaish
50	Tyas I. Hikmawan
51	Yousef M. Al-Reshaidan

EPD strengthens health impact assessment capacity

In December of 2018, the Environmental Protection Department facilitated a 5-day Knowledge Level course on Health Impact Assessments (HIA), to develop and strengthen competencies among internal staff. These competencies include how to identify and effectively evaluate potential HIAs in accordance with international standards and best practices, principally those pertaining to the International Petroleum Industry Environmental Conservation Association (IPIECA) and the International Finance Corporation (World Bank).

An HIA is an internationally recognized combination of procedures, methods and tools that systematically judges — through the evaluation of available evidence — the potential and sometimes unintended effects of policies, plans, programs or projects on the health of local populations. These effects could,

for example, lead to additional pressure on local water aquifers, disruption of grazing rights or to impacts on local facilities from the inward migration of thousands from a contractor workforce. The HIA then identifies appropriate actions to manage those effects so as to safeguard and enhance the population. HIAs and the broader Environmental, Social & Health Impact Assessments (ESHIAs) are often prerequisites for external funding from international lending banks and multilateral financial institutions.

The course was delivered by Dr. Gary Krieger, an internationally recognized toxicologist and public health expert who has written many of the current international standards and best practices on the subject. The course provided the necessary skills for EPD personnel to effectively screen, scope and evaluate HIAs submitted by outside consultancies as part of the overall Capital Management System, which is the Company's general framework for managing projects. It also promoted Saudi Aramco's social responsibility efforts to support local communities while identifying a number of opportunities for strengthening visibility and alignment with international standards, and these will be taken forward by an internal working group over the next quarter.

EPD hosts environmental discussion workshop for managers

On November 14, 2018, EPD held its second Environmental Discussion Workshop for Managers in Dhahran. Fifty-two participants, including 35 managers, attended. The workshop built on the success of the 2017 Environmental Discussion Workshop under the objective of sharing with management the essential elements of the Company's Environmental and Health (E&H) protection programs, E&H gaps in project execution and addressing success stories, Facility Environmental Performance (FEP) System, and challenges that organizations experience today. The workshop also addressed a proposal to the HSSE Committee regarding E&H coverage in EMSR as well as feedback from 2018 Environmental Coordinators workshops. Six EPD Subject Matter Experts (SMEs) delivered presentations on topics pertinent to Company managers.

EPD hosts informative food safety event to commemorate 2018 World Food Day, 600 attend

EPD hosted a World Food Day event on October 16, 2018, to highlight the need for safe food handling. EPD manned a booth with displays and hosted Environmental Health SME-led presentations on how to avoid illness when handling leftovers. A digital display offered booth attendees a quiz to gauge their knowledge on how to safely buy, prepare and store food. A vendor representative from Al Tamimi Global shared processes used in handling leftovers in Saudi Aramco dining facilities. Last, another vendor representative introduced attendees to waste food recycling processes. More than 600 people attended the event, which took place in the common area of Al Midra Tower.

EPD raises environmental awareness for females at Yanbu' Refinery Department

On November 28, 2018, EPD raised awareness over the need to protect the environment and human health at the Yanbu' Refinery Department's Health, Safety, Security and Environmental Campaign & Exhibition. Subject Matter Experts delivered presentations and participated in showcases to raise environmental, health and safety awareness among families and females in particular. EPD participated at a general environmental awareness booth focusing on Saudi Aramco's efforts to protect the environment. Topics covered at the event included tips on water conservation, recycling, safe handling of chemicals at home and general health. More than 300 people visited the booth.

EPD conducts second Environmental Coordinators Workshop of 2018

EPD hosted its second Environmental Coordinators (EC) Workshop for 2018 on Oct. 25 at the R&D Technical Exchange Center in Dhahran. This biannual workshop forms part of EPD's ongoing efforts to enhance EC environmental capacity-building and to share experiences, exchange information on new technologies, and find solutions

(Photo Source: Shutterstock)

Photo 2. EPD Manager Omar Abdulhamid speaks at the department's Environmental Discussion Workshop for Managers. (Photo Credit: Saudi Aramco)

to concerns and challenges. EPD's management and SMEs conducted an open discussion session that covered topics related to government regulations, and communication with government agencies as well as training, technology issues and other topics. Participants exchanged knowledge and expertise, operating departments concerns with regard to operational excellence, compliance and career advancement as well as new challenges facing Saudi Aramco, such as potentially more stringent governmental environmental regulations, as well international requirements. Other issues such as key performance indicators, marine protection, groundwater protection, waste management, water conservation, and contracting issues were discussed by the 186 Environmental Coordinators who attended the one-day workshop.

enviro snaps

Our brothers from the sea

the dolphins

Abdullah Alsuhaibany, EPD

Dolphins have long played a role in human culture. They are sometimes used as symbols, for instance in heraldry; they have long been known as helpers of humankind. Coastal nations pass down stories of dolphins providing help for those in need in the water, sailors especially. Is this not what brothers and friends do for one another?

Dolphins are widespread and prefer the warmer waters of the tropic zones. There are about 43 species of dolphins in the world, about seven of which are recorded in the Red Sea and Arabian Gulf, feeding largely on fish and squid.

Dolphins are highly social, and scientists are still discovering fascinating details about how these mammals interact with one another. Research shows that in social networks, dolphins have friends. Instead of spending equal time with the dolphins around them, the animals actually segregate themselves into friend groups. Just like humans, dolphins seem to prefer the company of certain peers more than others.

A dolphin's skin looks super smooth and sleek, and this is because the epidermis (outer layer of skin) can be sloughed off and replaced with new skin cells as often as every two hours, which reduces drag as they swim.

Dolphins are at the top of the food chain and play an important role in the overall balance of the marine environment. They can tell us a lot about the health of the ocean, such as the presence of pollution or declines in fish populations. They are also very popular with tourists.

(Photo Source: Abdullah Alsuhaibany)

(Photo Source: Abdullah Alsuhaibany)

(Photo Source: Saudi Aramco)