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Industrial Waste Management and Water Treatment Opportunities

November 2018

Forum & Exhibition
Dhahran Expo, Khobar, Saudi Arabia
Nov. 26 - 27, 2018





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Agenda - Industrial Waste Management and Water Treatment Investment Opportunities

Session Title	Presenter
Opening	Abdullah Al-Duaiji
Opportunity 1: Waste Management Technologies	Abdullah Al-Duaiji
Opportunity 2: Mobile Waste Management Technologies	Abdullah Al-Duaiji
Opportunity 3: Management of Special Types of Waste	Abdullah Al-Duaiji
Opportunity 4: Water Treatment Technologies	Subhi Al-Jeshi
Opportunity 5: Wastewater Treatment Technologies	Abdulmalik Al-Sabti

Overview

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Environmental Management Services Represent an Attractive Opportunity Given the current gaps, expected demand and localization potential

Objective

To seek local environmentally acceptable and cost effective solutions that would:

- Meet Saudi Aramco and government Environmental regulations,
- Minimize environmental and health risks,
- Recover value from Saudi Aramco generated waste.

Opportunities

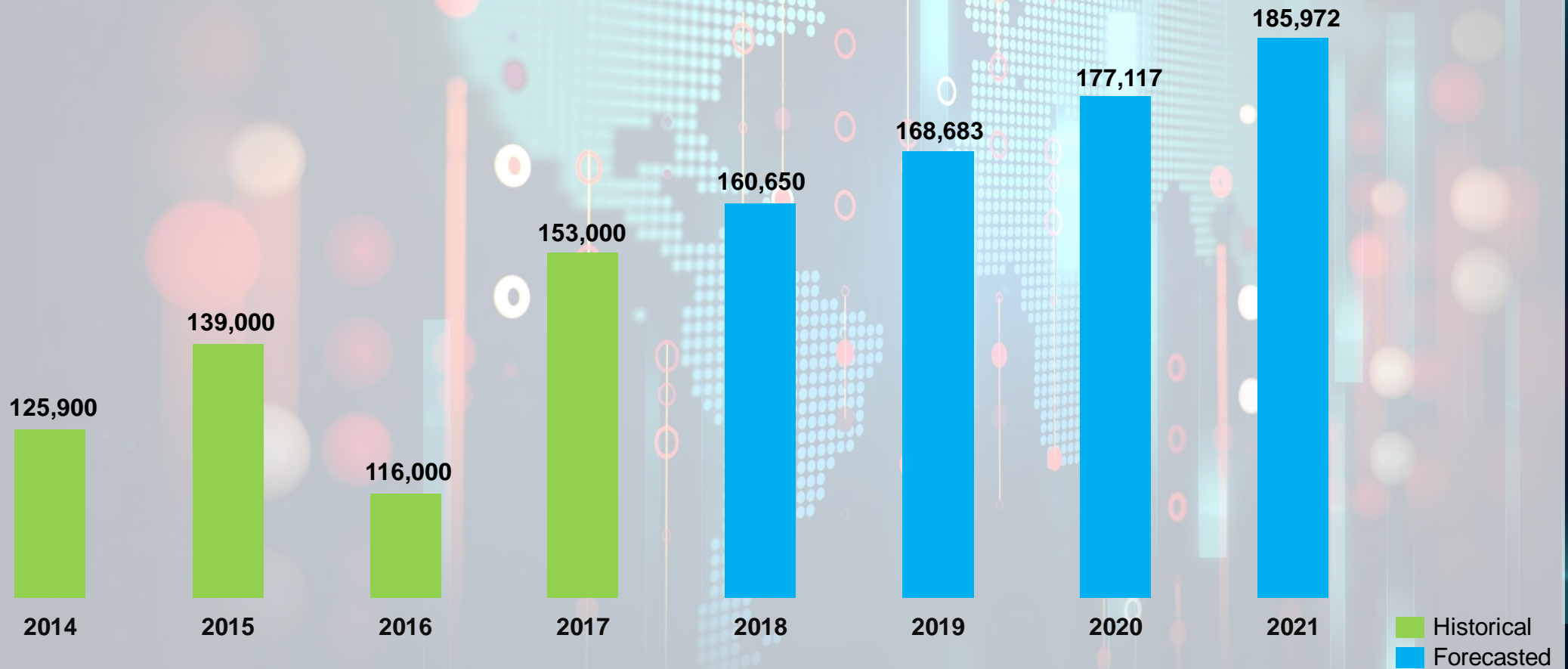
THE WASTE HIERARCHY

Preferred Environmental Option



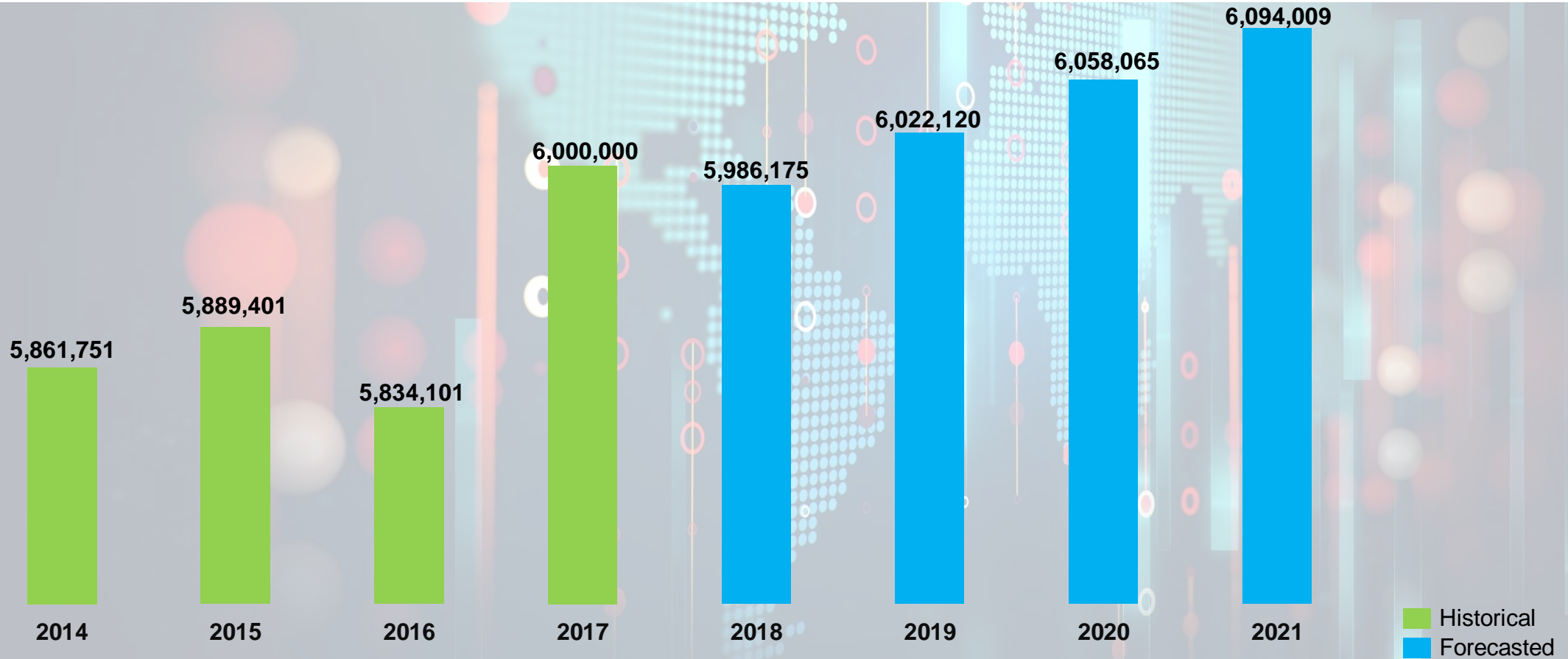
Least Preferred Environmental Option

Historical and Forecasted demand for Industrial Waste in (Tons)



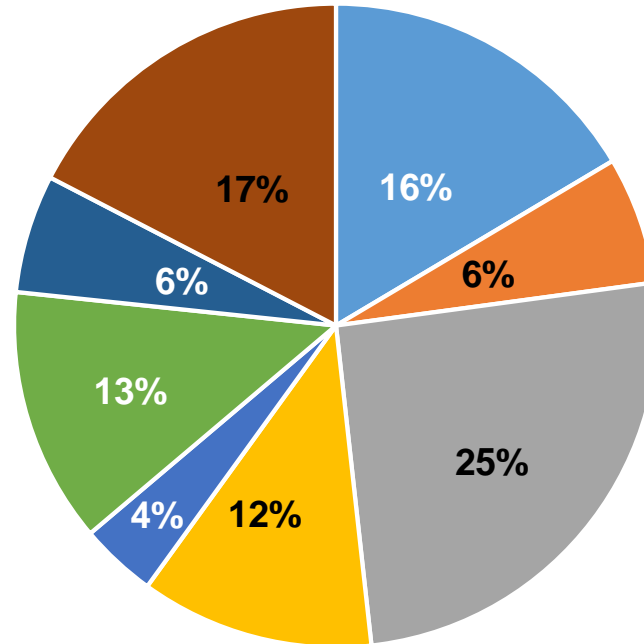
Saudi Aramco's Historical and Forecasted demand for Industrial Waste in (Tons) excluding Drilling and Workover waste.

Historical and Forecasted Demand for Drilling Mixed Waste in (Tons)



Saudi Aramco's Historical and Forecasted Demand for Drilling Mixed Waste in (Tons)

2017 Saudi Aramco Generated Industrial Waste Breakdown



- Contaminated Sand
- Oily wastewater
- Spent dessorpant and adsorpent
- Oil-Based Mud Cuttings
- Spent caustic
- Others
- Oily sludge
- Spent Chemicals

Environmental Investment Opportunities

Industrial Waste Management

Opportunity 1: Waste Management Technologies

Opportunity 2: Mobile Waste Management Technologies

Opportunity 3: Management of Special Types of Waste

Water Treatment

Opportunity 4: Water Treatment Technologies

Opportunity 5: Wastewater Treatment Technologies

Industrial Waste Management Opportunities

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Opportunity 1. Waste Management Technologies



Fully Integrated Waste Management Facilities



Waste to Energy



Recycle/Recover/Regenerate of Spent Catalyst.



Manufacture of rubber substitute

Opportunity 1. Waste Management Technologies

Fully Integrated Waste Management Facilities

Waste to Energy

Recycle/Recover/Regenerate of Spent Catalyst.

Manufacture of rubber substitute



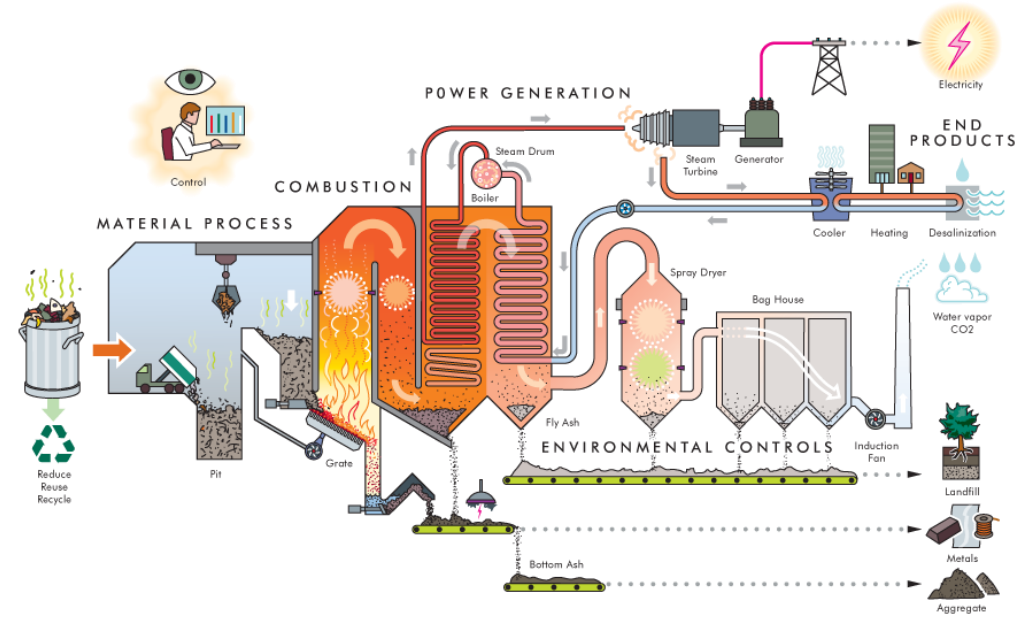
Opportunity 1. Waste Management Technologies

Fully Integrated Waste Management Facilities

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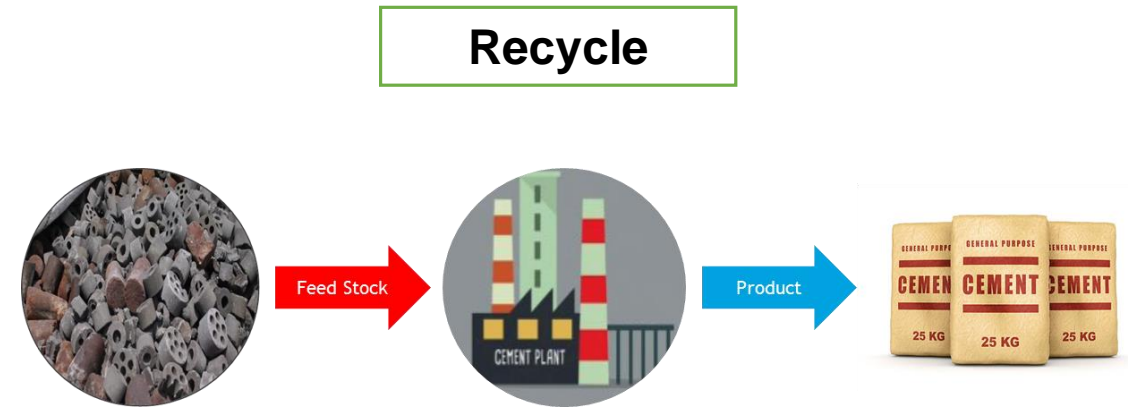
Opportunity 1. Waste Management Technologies

Fully Integrated Waste Management Facilities

Waste to Energy

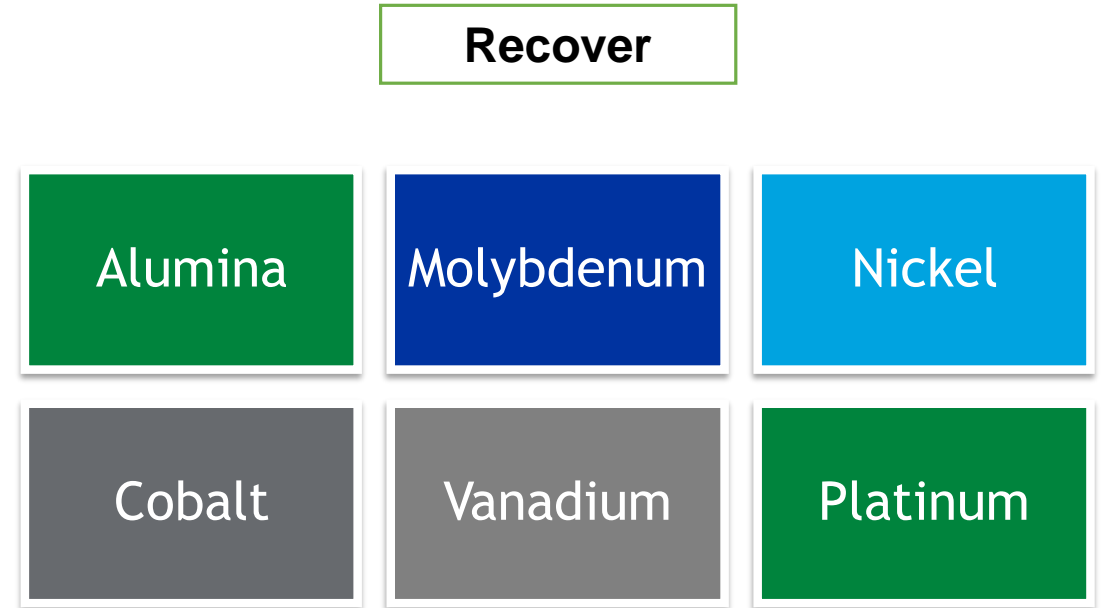
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Opportunity 1. Waste Management Technologies

- Fully Integrated Waste Management Facilities
- Waste to Energy
- Recycle/Recover/Regenerate of Spent Catalyst.
- Manufacture of rubber substitute



Opportunity 1. Waste Management Technologies

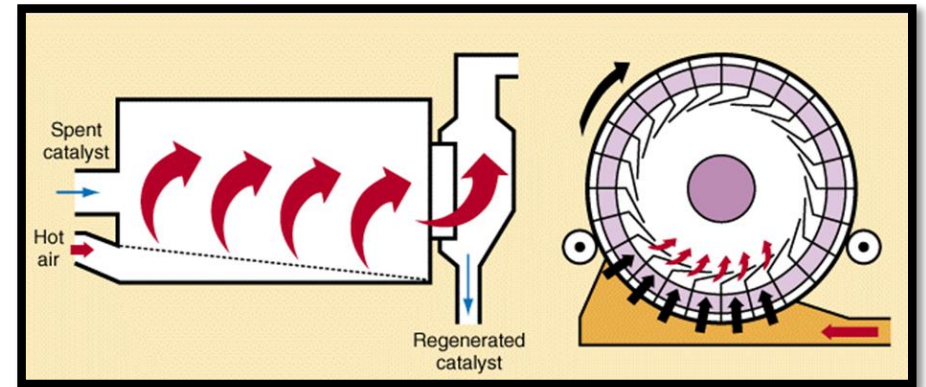
Fully Integrated Waste Management Facilities

Waste to Energy

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Manufacture of rubber substitute

Regenerate



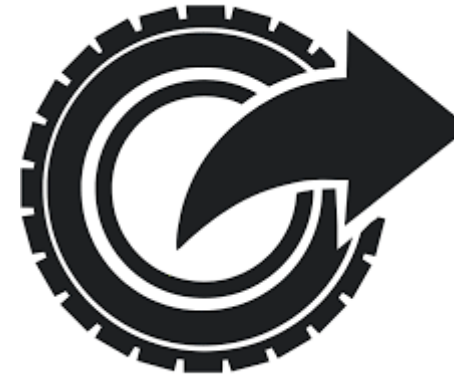
Opportunity 1. Waste Management Technologies

Fully Integrated Waste Management Facilities

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Manufacture of rubber substitute



21 MM Used Tires are generated annually

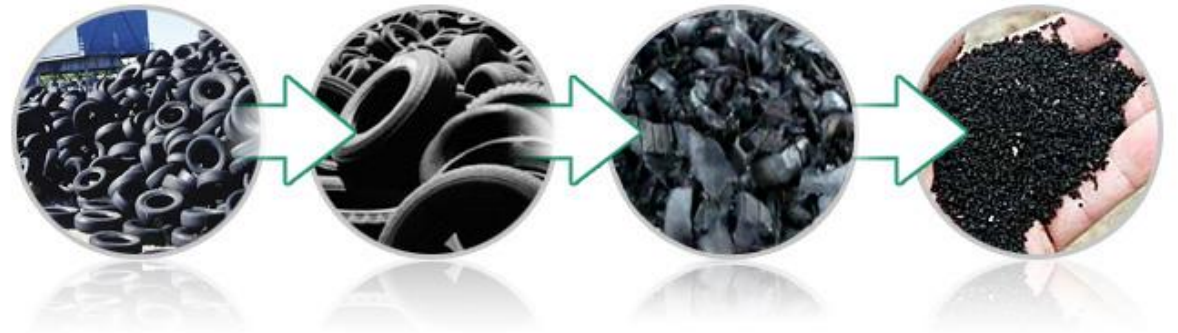
Opportunity 1. Waste Management Technologies

Fully Integrated Waste Management Facilities

Waste to Energy

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Opportunity 2. Mobile Waste Management Technologies

Three-Phase Centrifuge for Recycling Oily sludge

Recover Hydrocarbons from Oil Contaminated Sand

Micro Auto Gasification Technology



Opportunity 2. Mobile Waste Management Technologies

Three-Phase Centrifuge for Recycling Oily sludge

Recover Hydrocarbons from Oil Contaminated Sand

Micro Auto Gasification Technology

A technology designed to separate the oily sludge into three main phases; Oil, Water and solid waste.

Opportunity 2. Mobile Waste Management Technologies

Three-Phase Centrifuge for Recycling Oily sludge

Recover Hydrocarbons from Oil Contaminated Sand

Micro Auto Gasification Technology



Opportunity 2. Mobile Waste Management Technologies

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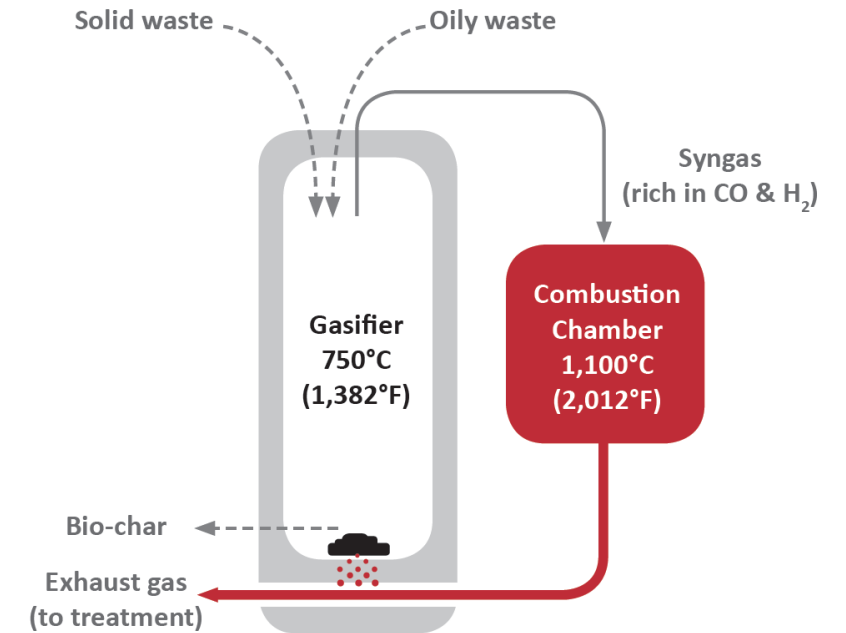


Opportunity 2. Mobile Waste Management Technologies

Three-Phase Centrifuge for Recycling Oily sludge

Recover Hydrocarbons from Oil Contaminated Sand

Micro Auto Gasification Technology

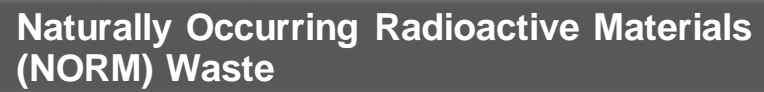




Opportunity 3. Management of Special Types of Waste



Drilling & Workover Waste



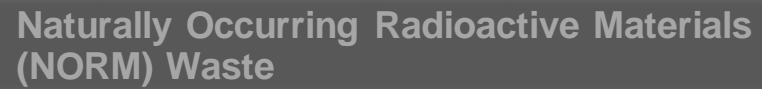
**Naturally Occurring Radioactive Materials
(NORM) Waste**



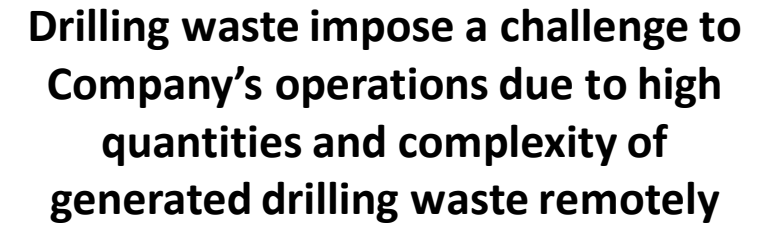
Opportunity 3. Management of Special Types of Waste



Drilling & Workover Waste



Naturally Occurring Radioactive Materials (NORM) Waste



Drilling waste impose a challenge to Company's operations due to high quantities and complexity of generated drilling waste remotely

Opportunity 3. Management of Special Types of Waste

Drilling & Workover Waste

Naturally Occurring Radioactive Materials (NORM) Waste



Water Treatment's Opportunities

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Opportunity 4. Water Treatment Technologies

Cartridge filters are used to remove particulate matter from RO membrane feedwater

MEMBRANE DESALINATION SYSTEMS

WATER DEMINERALIZATION SYSTEMS

WATER DISINFECTION SYSTEMS



CARTRIDGE FILTERS

Cartridge filters are used to remove particulate matter from the feed to RO membranes

They are placed before RO membrane to prevent membrane fouling

The cartridge filters porosity are 5 microns and upwards



WATER TREATMENT & DESALINATION MEMBRANES

Water treatment and desalination membranes include:

RO Membranes:

- Polyamide, cellulose acetate/cellulose triacetate.
- Configuration: Spiral wound.
- Size: 8 inch diameter

Nano Membranes:

- Polysulfone, cellulose acetate, thin film composite.
- Configuration: Spiral wound, Hollow fine fiber/capillary.
- Size: 4/8/10 inch diameter

Ultrafiltration Membranes:

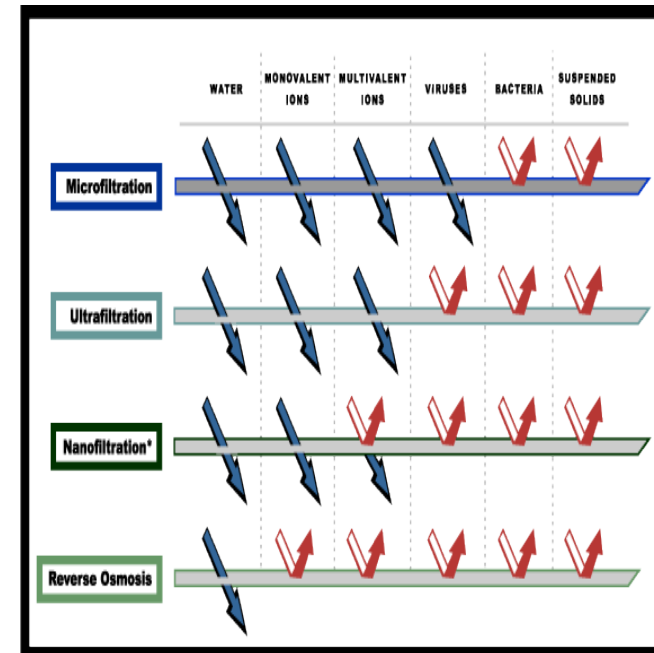
- Configuration: Spiral wound, Hollow fiber/capillary.
- Material: polysulfone, Polyethersulfone, Polyacrylonitrile, cellulose acetate. Pressure rating: < 200 psig

Microfiltration Membranes:

- Configuration: dead-end cartridge filters.
- Rating: nominal or absolute; Size: 1-100 micron.
- String Wound Polypropylene, pleated polypropylene & polyester, Resin Bonded Cellulose, PVDF, polysulfone.



RO Membranes



MEMBRANE DESALINATION SYSTEMS

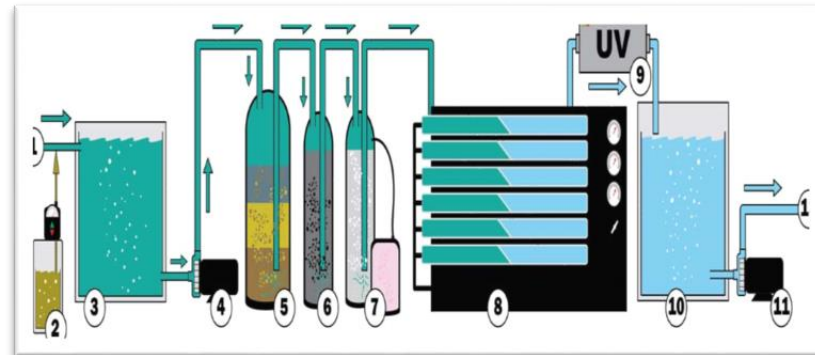
Membrane desalination system includes fully integrated system to desalinate seawater or brackish water. It includes:

Reverse Osmosis (RO) or Nano Filtration (NF) systems. The skid includes:

- Membrane elements housed in pressure vessels and a high pressure pump
- A pretreatment system to achieve the required feed water quality
- A clean in place (CIP) system to facilitate membrane cleaning,
- A post-treatment system to achieve the required product quality.
- The specifications of the system are covered in Saudi Aramco standard 32-SAMSS-033.



RO membrane Desalination



RO desalination Pre-treatment system



RO membrane clean in place (CIP) system

WATER DEMINERALIZATION SYSTEMS

Water demineralization is used in utilities to polish RO desalinated water to produce demineralized makeup water for boiler feed water.

The system consists mainly of:

I. Ion Exchange Systems

- Cation Exchangers
- Anion Exchangers
- Mixed bed Ion exchangers
- Regeneration Systems

II. Softeners:

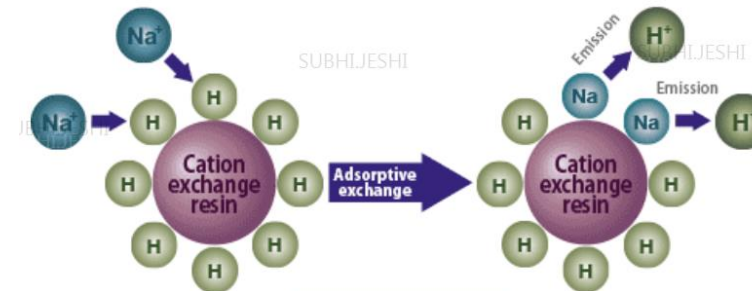
- For hardness removal and water softening

IV. Condensate Polishers:

- For steam condensate polishing



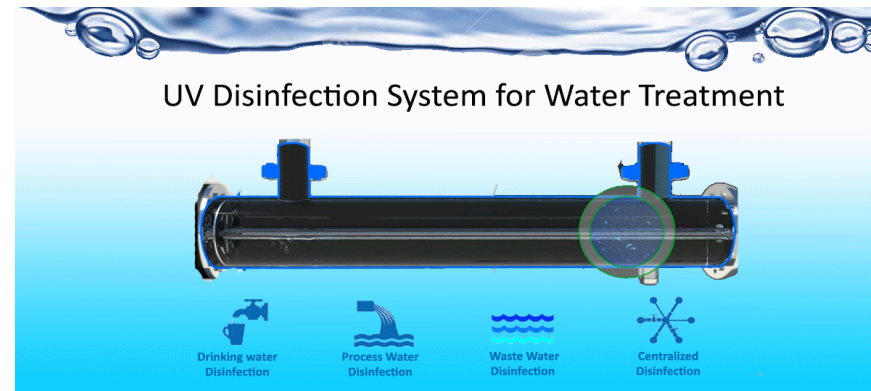
ION EXCHANGE SYSTEM



WATER DISINFECTION SYSTEMS

Water disinfection systems used in Aramco include:

- Sodium hypochlorite generator
- Chlorine dioxide generator
- UV system.



Ozone generator



Chlorine dioxide generator

Wastewater Treatment Opportunities

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Opportunity 5. Wastewater Treatment Opportunities



Wastewater Packaged Treatment Systems



Wastewater Preliminary Treatment & Seawater Screening



Wastewater Media Filters



Wastewater Equipment



Spent Caustic Minimization and Treatment Technology Solutions

Opportunity 5. Wastewater Treatment Opportunities



Wastewater Packaged Treatment Systems

A prefabricated complete biological wastewater treatment system that complies with Saudi Aramco Engineering Standards for Wastewater Treatment, Reuse and Disposal



Opportunity 5. Wastewater Treatment Opportunities



Wastewater Preliminary Treatment & Seawater Screening

- Mechanical Coarse Bar
- Screen Degritter
- Fine Screen
- Sanitary Wastewater Grinder
- Seawater Intake Screening Systems





Wastewater Media Filters

A single or multi-layer bed filter:

- Use one or multiple selected grades of filter media
- Remove suspended solids and other microorganisms from incoming feed water/wastewater



Opportunity 5. Wastewater Treatment Opportunities



Wastewater Equipment

- Water & Wastewater Aeration and Degassing
- Clarifier Solids Collection Equipment
- Sanitary Sludge Dewatering
- Wastewater Odor Control



Opportunity 5. Wastewater Treatment Opportunities



Wastewater Equipment

- Oily Water Primary Separators
- Oil/Water Separation- Dissolved Air Flotation (DAF) / Induced Air Flotation (IAF)
- Oil/Water-Oil Skimmers
- Oily Wastewater Centrifugal



Opportunity 5. Wastewater Treatment Opportunities

Spent Caustic Minimization and Treatment Technology Solutions

Providing environmentally safe and cost-effective treatment technologies of spent caustic waste effluents to reduce the volume of spent caustic generated from Merox unit source



Please Direct All Inquiries To:

Key messages

- Presented investment opportunities in support of establishing multiple services related to Industrial Waste Management and Water Treatment
- Promote in-kingdom acceptable and cost effective Environmental Services.
- We invite interested companies to engage with us and send us their Expression of Interest to establish a local provider for environmental services in Saudi Arabia.

In case you are interested in discussing this opportunity further, please contact



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Thank you

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