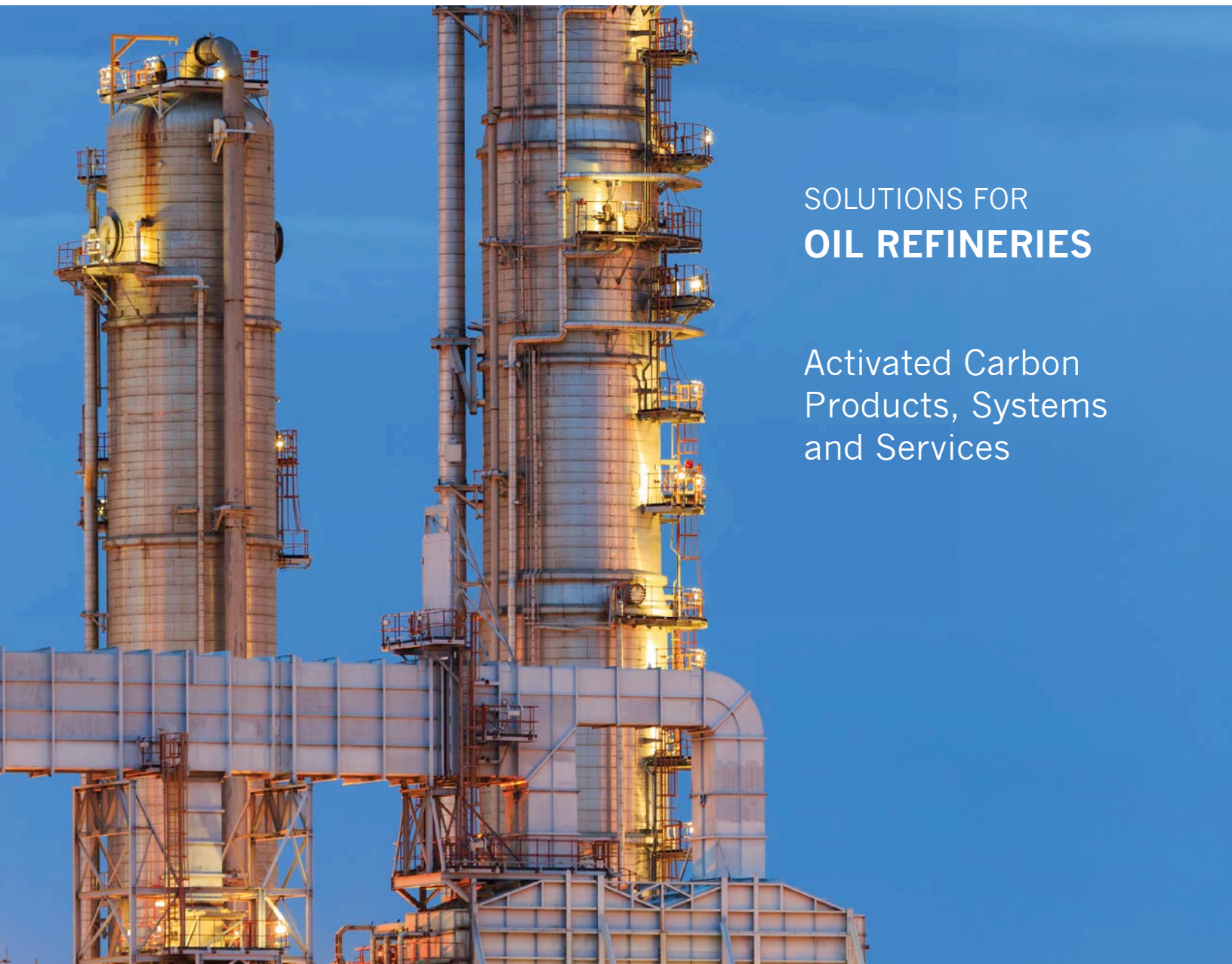




*Pure Water. Clean Air. Better World.*



SOLUTIONS FOR  
**OIL REFINERIES**

Activated Carbon  
Products, Systems  
and Services





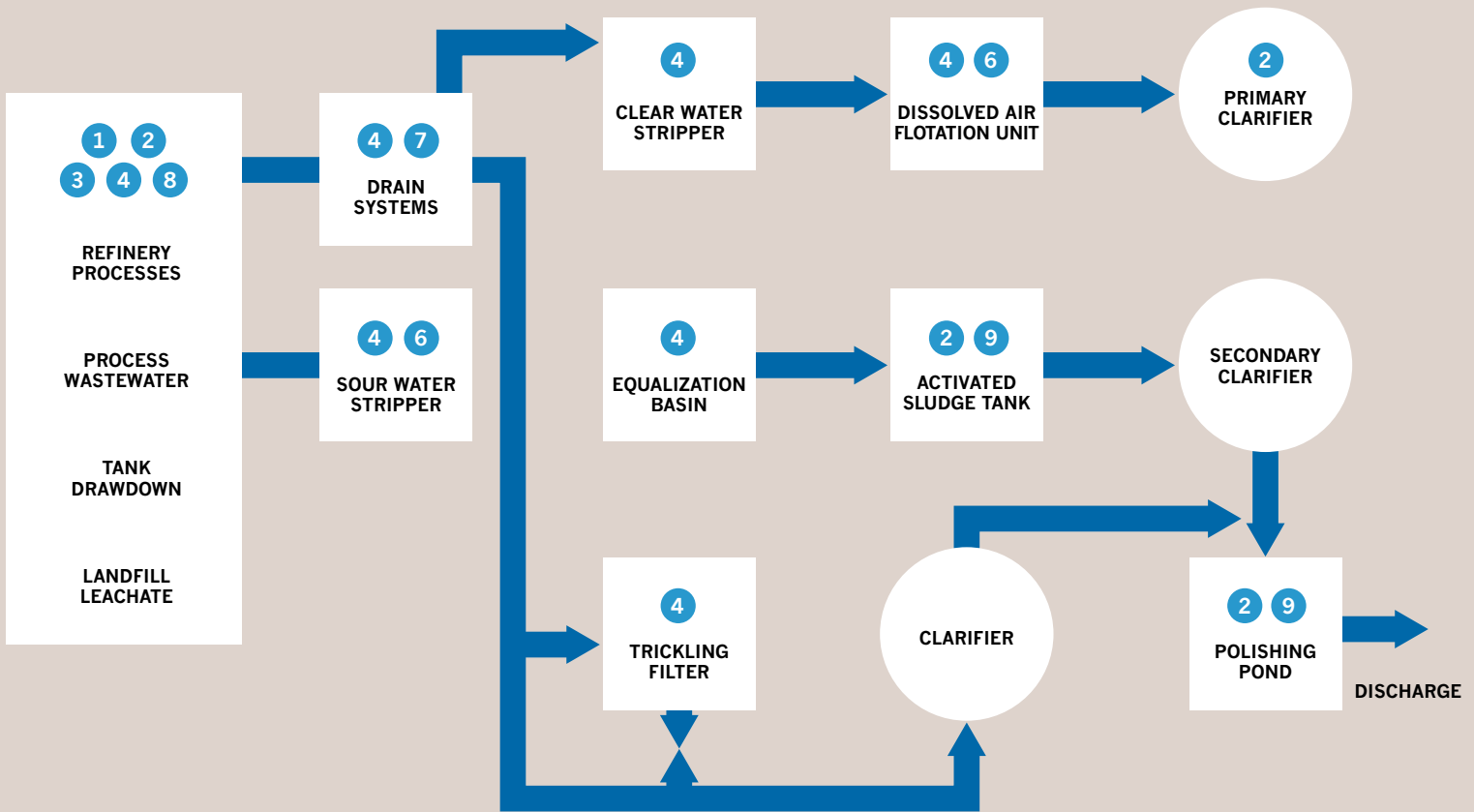
## The Calgon Carbon Advantage

Activated carbon has proven to be an indispensable tool, solving many of the challenges that refineries face, from product purification to pollution control to environmental remediation. Its unique adsorptive capacity makes it ideal for removing a variety of organic contaminants from liquids and gases.

Spent granular activated carbon can be recycled by thermal reactivation, which meets the environmental needs of minimizing waste, reducing CO<sub>2</sub> emissions and limiting the use of the world's resources, while reducing the costs of activated carbon usage.



# TYPICAL OIL REFINERY WASTEWATER SYSTEM



## Activated Carbon Equipment Systems

- More than 40 years of experience designing and manufacturing systems
- Configurations ranging from 1 to 10,000s cfm and 1 to 1000s gpm
- Permanent and movable options



## Full Service

- Equipment installation and setup
- Carbon delivery and exchanges
- Disposal assistance of spent carbon
- Reactivation services
- The Calgon Carbon R&D Group, Applications Engineers, Technical Sales Group and Technical Account Representatives provide initial and ongoing problem solving





# ENVIRONMENTAL SOLUTIONS

## Water and Wastewater Treatment

### Condensate Water Process Water Reuse

Condensate water contaminated by organic compounds that can damage resins and reduce efficiency

#### 1 SOLUTION

High purity coconut activated carbons with low silica content and minimal leachable minerals are excellent for condensate water treatment and reuse

Reduce TOC from makeup water

### Wastewater Treatment

Treat organic chemicals and other aquatic toxic compounds from various sources of wastewater before discharge to surface water or publicly owned wastewater treatment plants

#### 2 SOLUTION

Powdered activated carbon can be applied directly in the biological treatment plant to enhance the removal of bio-resistant organic chemicals and protect microorganisms

Granular activated carbon can be used with pre-engineered adsorption equipment

Computer modeling can determine the feasibility of activated carbon technology and provide appropriate adsorption equipment

### Remove H<sub>2</sub>S from Wastewater

#### 3 SOLUTION

CENTAUR® granular activated carbon oxidizes H<sub>2</sub>S through a catalytic reaction

## Air Pollution Control

### Remove VOC and SVOCs from Off-Gas and Vent Gas

Benzene NESHAP requirements and maintenance shutdown startup emission control — from various vents and exhausts

#### 4 SOLUTION

Calgon Carbon's granular and pellet activated carbon has been demonstrated to achieve greater than 99% benzene reduction

Pre-engineered equipment can be used long term or on a temporary basis

### Flue Gas Treatment for Dioxins and Mercury Compounds

#### 5 SOLUTION

Specialized powdered activated carbon can be introduced directly into the flue gas to remove harmful compounds before discharge to the air

### H<sub>2</sub>S Odor Removal from Off-Gas and Vent Gas

#### 6 SOLUTION

CENTAUR® carbon is safer than caustic impregnated products in a refinery because it has a higher autoignition temperature

## Site Remediation

### Spill Remediation

Quickly recover spilled organic materials before they can be absorbed by soil and contaminate the environment

#### 7 SOLUTION

Vapor phase adsorption equipment in combination with remediation technologies such as vapor extraction and soil venting

The off-gases pass through carbon adsorption equipment to remove the contaminants

### Groundwater Treatment

MTBE, BTEX remediation and H<sub>2</sub>S removal

#### 8 SOLUTION

The pump-and-treat method is designed to prevent the spread of contaminated water

Treatment systems can be designed for each specific case to remove contaminants to non-detectable levels

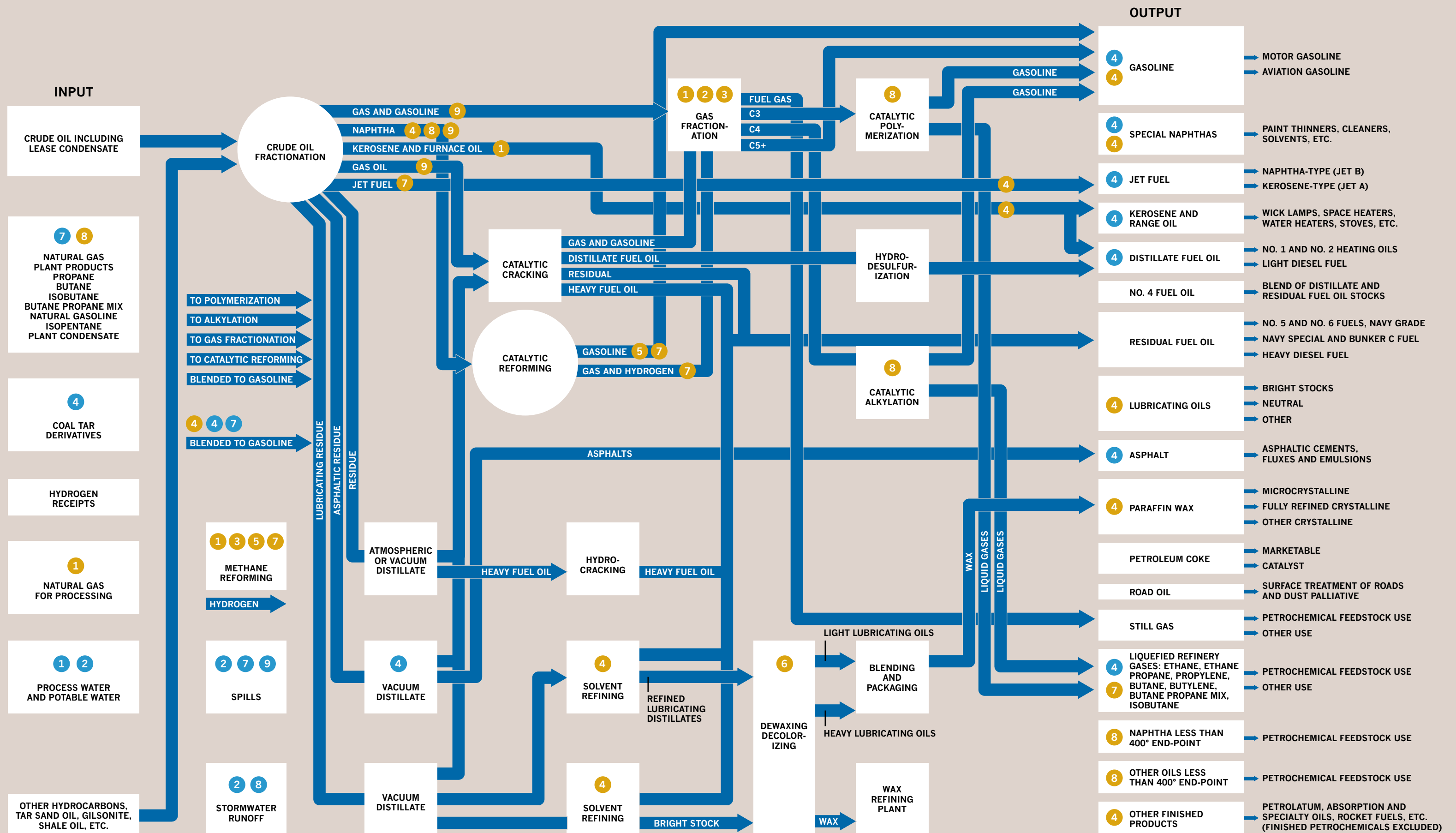
### Soil and Sludge Stabilization

Eliminate the hazards from leaching of sludge and soil contaminated with toxic organic compounds such as BTEX, acidic petroleum compounds and tars

#### 9 SOLUTION

Calgon Carbon is highly skilled in the use of activated carbon in stabilization/solidification processes

# TYPICAL PETROLEUM REFINING OPERATIONS



# PROCESS SOLUTIONS

## Improve Efficiency of Gas Scrubbers

### Purify Amine

Minimize foaming, improve H<sub>2</sub>S scrubbing efficiency and reduce costs in the amine-regeneration system

#### 1 SOLUTION

Treat a slipstream of the lean amine scrubber solution through a GAC bed to remove heat stable salts, foam-producing and corrosion-causing compounds

CLEAN AMINE® system is a specially designed economical amine treatment

### Purify Glycol

Recover glycol's drying capacity and reduce glycol loss

#### 2 SOLUTION

Remove the longer-chain hydrocarbon contaminants by circulating a split stream of the glycol flow through a GAC adsorber

SGL® is a signature GAC product that helps reduce foaming and minimize glycol loss

### Purify Carbonate

Prevent foaming in hot potassium carbonate solution and maintain capacity for CO<sub>2</sub> removal

#### 3 SOLUTION

Remove heavy hydrocarbon contaminants through a GAC adsorber

## Purifying Refinery Products

### Purify Feedstocks and Decolorize Refinery Products

These include kerosene, gasoline, butane, MTBE, pale oil, lube oil and ethanol

#### 4 SOLUTION

Our specialized activated carbon can effectively remove sulfur compounds and PNA compounds in feedstock

A variety of liquid-phase activated carbon products for color removal

### Purify H<sub>2</sub>

Purify H<sub>2</sub> from steam reforming for reuse in high-purity applications

#### 5 SOLUTION

A dual-bed GAC adsorber is a two-phase pressure swing system that allows continuous hydrogen purification and provides 99% pure hydrogen

### Remove PNA in Microcrystalline Wax

Activated bauxite is used to dry microcrystalline wax products and remove color and PNA, which can cause disposal problems

#### 6 SOLUTION

Our specialized products have a better capacity for PNA removal

The spent carbon can be reactivated with our reactivation services to reduce environmental liability

## Catalyst Protection and Catalyst Support

### Catalyst Protection

The catalyst can be poisoned in steam-methane reforming due to the sulfur compounds contained in the feedstock

#### 7 SOLUTION

FCA and SULFUSORB® were developed specifically to remove hydrogen sulfide and low-molecular-weight organic sulfur compounds from gas streams that do not contain oxygen

### Catalyst Protection

Removal of mercury from liquid and gaseous hydrocarbon streams to extend the life of catalysts and prevent environmental problems

#### 8 SOLUTION

Calgon Carbon patented mercury removal process using HGR®-LH can effectively remove organic, elemental and inorganic mercury complexes from liquid hydrocarbon feedstock

HGR® and HGR-P can effectively remove mercury from gaseous hydrocarbon streams to protect downstream mercury-sensitive catalysts and equipment

### Catalyst Support

Need superior product for catalyst support

#### 9 SOLUTION

MRX-M and MRX 10x30 can be used in the licensed UOP Mercox™ process to provide high-pore-volume support for the cobalt salt-type catalyst and also act as an adsorbent to prevent catalyst poisoning

Specialized low sulfur and high hardness activated carbon such as OVC for impregnation with noble metal catalysts

These specialized products endure high temperatures and pressure and are relatively inert and stable against reactants

# ABOUT CALGON CARBON

Calgon Carbon Corporation is a major supplier of activated carbon and related adsorption systems and services to the petroleum refining industry worldwide. Calgon Carbon, the world leader in activated carbon technology, manufactures different grades of granular, powdered, pelletized and impregnated activated carbons at six production plants in the U.S. and Europe, and operates five reactivation and recycling facilities.

This brochure provides a summary of the uses of activated carbon within a refinery, and shows the benefits it can provide.



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