Management of Hazardous Waste
Bapco Approach

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Presentation Outline

• Introduction to Bapco
• Brief Overview of Waste Management Regulations in Bahrain
• Bapco’s Approach to Waste Management
• Brief description of Waste Management Projects in Bapco, challenges & solutions
• Conclusions
Introduction to Bapco

• Bapco is an integrated oil company established in 1929 and is 100% owned by the Government of Kingdom of Bahrain.
• Bapco facilities include gas distribution, crude oil refining, storage, local and international marketing of petroleum products, service stations, and a Wharf for product shipment.
• The management of environment is an integral part of Bapco’s operating philosophy and is included in Bapco’s Mission and Vision statement.
Development of Key Environmental Legislation in Bahrain

• Bahrain Environmental Law passed in 1996, Amiri Decree No. 21
• Ministerial Order No. 10, Air & Water Regulations issued 1999, updated in 2001
• Ministerial Order No. 3, Management of Hazardous Materials issued in May 2006
• Ministerial Order No. 4, 2006, Management of Hazardous Chemicals.
• Ministerial Order No. 10, 2006, Monitoring of Air Pollutants.
Key Environmental Aspects to be Considered for Legal Compliance

- Waste Management
- Hazardous Substances
- Air Pollution
- Contaminated Land
- Water Pollution
- Accidental Discharges
- Nuisance

Processes

Organization

Aspects

Public Concern

Products Services
Bapco’s Approach to Waste Management

- Identify All Waste Streams
- Establish Waste Inventory
- Categorize Waste
- Use the hierarchy shown:
Bapco’s Approach to Prevent Waste

- Working with Procurement Department to eliminate/minimise packaging waste
- Use of Amine as solvent to treat LPG instead of Caustic
- Recovery of sulphur in RGDP by treating sour gases
- Process Optimization
- Routine inspection of plant
- Preventive maintenance
Identifying Waste Streams
Management of Waste at Bapco

Activity

Waste

Waste is Hazardous?

Yes

Hazardous Segregate Waste

Reuse/Recycle

Treatment

No

Non-Hazardous Segregate Waste

Reuse/Recycle/ Treatment

Direct Disposal

Disposal to Bapco Landfill

Hazardous Wastes to be identified following requirements in Regulations

Non Hazardous Wastes are those that do not meet the Regulatory criteria for Hazardous Waste and includes municipal wastes, non contaminated scrap & inert wastes
## Typical Examples Waste Produced at Bapco & Disposal Route

<table>
<thead>
<tr>
<th>Waste</th>
<th>Fate</th>
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</thead>
<tbody>
<tr>
<td>Catalysts</td>
<td>Recycling through vendors, FCC Catalyst re-use in a cement factory</td>
</tr>
<tr>
<td>Liquid Oily Waste</td>
<td>Processed on Site (Recovery)</td>
</tr>
<tr>
<td>Oily Sludge</td>
<td>Recovery &amp; Re-Cycling by OSREX</td>
</tr>
<tr>
<td>Oily Sludge contaminated with heavy metals</td>
<td>Centrifuged, Treated &amp; Disposed to Bapco Landfill</td>
</tr>
<tr>
<td>Lead acid Batteries</td>
<td>Re-Cycling</td>
</tr>
<tr>
<td>Asbestos</td>
<td>Land filled</td>
</tr>
<tr>
<td>Metal Scrap</td>
<td>Re-Cycling</td>
</tr>
<tr>
<td>Cardboard/Paper</td>
<td>Re-Cycling</td>
</tr>
</tbody>
</table>
Key Environmental Compliance Projects to Treat/Reduce Waste Streams

- Kero-Merox Plant
- Refinery Gas De-Sulphurization
- Wastewater Treatment Plant
- Sewage Treatment Plant (STP)
- Management of Industrial Hazardous Waste
Key Projects to Reduce the Environmental Impact on Water

Refinery Waste Water Treatment Project

- The waste water treatment plant will provide secondary treatment of the wastewater (dissolved solid pollutants) to further improve the effluent discharge quality by using biological treatment.
- Challenge in meeting stringent environmental standards and selection of a suitable technology to address the relatively high temperature and chloride content of the effluent generated in the Refinery.
- Currently being Commissioned.
- Cost of Project is US $110 MM.
Refinery Waste Water Treatment Project

Bapco’s WWTP is developed based on the latest MBR Technology as a secondary treatment process to treat Refinery waste water
Management of Hazardous Waste at Bapco

Construction of Class 1 Hazardous Waste Landfill

- Management of Hazardous Waste is a significant environmental aspect
- The facility was built to US Environmental Protection Agency (EPA) standards at cost of Million US $ 5.4 with a capacity of approximately 68,000 cubic meters.
- Project won the 1st prize under the category of “Excellence in Environmental Technology” at the Off-Shore Arabia Conference organized by RECSO in 2006
Key Features of Bapco Hazardous Waste Management Facility

• Class 1 Landfill Site designed to US EPA standards
• Landfill includes a leachate collection and leak detection system
• An innovative technique has been used to protect the geo-membrane along the dyke slopes by providing a cellular confinement system known as geo-web
• Lined evaporation ponds
• Fully equipped laboratory for fingerprinting waste
• Ground water monitoring boreholes installed
Waste Stabilization Plant

• Installed to treat legacy lead contaminated waste
• Extensive trials carried by ERCO using material Ecobond
• TCLP tests done after treatment and if ok then waste disposed to landfill (< 5mg/l)
Benefits of Waste Management System

- Conservation of natural resources
- Sustainable Development
- Cost Savings – Production cost can be reduced through improved resource efficiency
- Compliance – proactive approach ensures legal compliance
- Risk Reduction – Avoid risk of soil & groundwater contamination from storage/disposal facility
- Commercial Benefits – Customers prefer Eco-friendly products, e.g. low sulphur diesel
Key Waste Management Challenges in Bapco

• Lack of waste treatment & disposal facilities in Bahrain, hence the need to build own waste treatment & disposal facility
• Evolving Legislation at the National & International Level
• Historic waste stored on site included leaded waste which requires pre-treatment
• Waste characterization and pre-treatment not identified as an issue at the start
• Prevention of waste in the first place should be built in the process design
Conclusions

• A systematic but pragmatic approach is required towards waste management.
• Emphasis should be on the prevention and the principles of 3R (Reduce, Re-use and Re-cycle) should be adopted in the project life cycle.
• Ensure that waste management issues are included in strategic planning process to ensure sufficient budget and resource allocation.
• Bapco continues to demonstrate its commitment to the protection of the environment.
• Bapco is spending in excess of 320 Million US $ over a 10 year period since year 2000 to comply with local regulations by embracing best available technology in line with its vision of striving for excellence.
Importance of Waste Management

“\textit{We do not inherit the earth from our ancestors, we borrow it from our children}”

\textit{Native American Proverb}
Thank You
Any Questions?