Mercury in Refinery Processes – PURASPEC\textsubscript{JM} Purification Solutions

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Mercury – A Refinery Issue?

- Where can mercury containing crude oil be found?
- Potential issues for refiners
- Mercury transport across refinery processes
- PURASPEC\textsubscript{JM} technology: operating data
- PURACARE\textsubscript{JM} service: responsible care
Mercury Containing Crude - Global

- Mercury exists in “belts” across the planet
- Levels of Hg in crude correspond with majors belts
Potential Issues

- Volatility
- Environmental
- Health
- Operational
- Commercial
Properties of Mercury

- At. No. 80,
- At. Wt. 200.59
- Melting Point of -38.87 C (-39.4 F)
- Boiling Point of 356.58 C (673.8 F)
- Density of 13.35 at 100 C (212 F) (Denser than lead and the Densest Liquid known)
Volatility Issue

- Elemental mercury (Hg) has a high vapor pressure
- Unlike other “heavy” metals, mercury will distribute into lighter products and gaseous streams

![Volatility Issue Diagram](image-url)
Environmental Issues

- Mercury emissions into the environment have been highlighted by the United Nations Environmental programme (UNEP)
- Agreement reached in 2009 to launch negotiations on an international mercury treaty
- The profile of discharges of mercury from all sources appears to be sharply increasing
UNEP “Main Sources”

Primary anthropogenic sources
- Mining
  - Hg mining
  - By-product Hg
  - Ore Hg
- Fossil fuel extraction
  - Oil
  - Coal
  - Gas
- Natural
  - Volcanoes
  - Geothermal
  - Surfaces

Secondary anthropogenic sources
- ASGM
- Products
- Industry

Ecosystems
- Land use change
- Biomass burning
- Surface re-emissions

Remobilisation and re-emissions

Intentional use

Recycling
Health Issues

- Exposure must be limited to conform with US legislated health limits
  - Low-point drains
  - Hot work on contaminated surfaces
  - Treatment & disposal of contaminated equipment
- Future focus on consumer exposure to combusted fuels (cooking, transportation)?
Operational Issues

- Troublesome decontamination, maintenance or cutting of mercury contaminated steel surfaces
- Cracking of copper based trays or valve components
- Corrosion of aluminum surfaces

Most significant issue

High profile issue in petrochemical and natural gas processing plants

Root cause of fire and explosion at Moomba in Australia

Insured loss of $245M

Regional energy crisis
Commercial Issues

- Discounted crude available to refineries which have a mercury treatment strategy in place
- Asian Open-Spec Naphtha reveals potential value

“Friday, Jun 26, 2009: SINGAPORE (Dow Jones). Asian open-spec naphtha market participants said Friday they plan to test the mercury content of more grades to protect the interests of end-users.

Japanese and South Korean petrochemical producers, which are major receivers of open-spec naphtha, recently voiced concerns over high mercury content, considered a contaminant that can damage plants”.
Mercury Transport in Refineries

[Diagram of refinery processes with labels for different sections and components like Tankage, Atmospheric section, Desalter, Hydrocarbon soluble, Water soluble, Asphaltenes, Sediments, LPG, Naphtha, Hydrotreater, CRU, Distillates, Gas oil, Catalytic cracker, Hydrocracker, Heavy ends processes, and Vacuum section.]
Mercury Transport in Refineries

- Tankage
- Atmospheric section
  - Naphtha
  - Distillates
  - Gas oil
  - Hydrotreater
  - LPG
  - CRU
- Vacuum section
  - Gas oil
  - Catalytic cracker
  - Hydrocracker
  - Heavy ends processes

Diagram symbols:
- Hydrocarbon soluble
- Water soluble
- Asphaltenes
- Sediments
Mercury Transport in Refineries
Mercury Transport in Refineries

Tankage

Water treatment

Desalter

Water treatment

Atmospheric section

Naphtha

Hydrotreater

Distillates

CRU

Gas oil

Hydrotreater

Vacuum section

LPG

Catalytic cracker

Heavy ends processes

Puraspec

Johnson Matthey Catalysts
Mercury Transport in Refineries

Tankage → Water treatment → Desalter → Water treatment

Atmospheric section:
- LPG
- Naphtha → Hydrotreater
- Distillates
- Gas oil

Vacuum section:
- Gas oil
- Catalytic cracker
- Distillates
- Heavy ends processes
- CRU
- Hydrocracker

Legend:
- Hydrocarbon soluble
- Water soluble
- Asphaltenes
- Sediments
Crude Column – Hg Data
Naphtha Processes – Hg Data
Naphtha - PURASPEC$^{\text{JM}}$
Naphtha - PURASPEC$_{JM}$
PURASPEC JM Technology

- Robust and proven technology – refinery naphthas, offshore condensates, gaseous & aqueous effluents
PURASPEC\textsubscript{JM} Technology

- Fixed bed, high capacity, adsorbents
  - Saves capital, space, weight
  - Fewer change-outs saves cost & minimises logistical issues
  - No utilities consumption during normal operation
  - Dependable & predictable
  - Ease of loading & unloading
  - Saves time and assures safe operation

- **Expanding range of PURASPEC\textsubscript{JM} technologies for all refinery process and effluent streams**

- Spent absorbent can be reprocessed through the PURACARE\textsubscript{JM} service
Johnson Matthey committed to sustainability in all of its activities

Features of PURACARE\textsubscript{JM}
- Complete commitment to recycling
- No use of landfill or food related reprocessing routes
- Use of facilities that are properly licensed and environmentally audited
- Provision of certificate of consumption
- ISO 14001 & 9001 accredited
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