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11th TECHNICAL SEMINAR
WCC GST SAFETY WORKSHOP
TABLE TOP EXPO
November, 14-16, 2018
Monterrey - Mexico

TRANSCLOR

MERCURY TO MEMBRANE (BAT) TECHNOLOGY CONVERSION

November 16th, 2018

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Summary

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- Why change? (Key Drivers)
- Main Process Requirements & SH&E Considerations
- Mercury Plant Decommissioning
- Highlights to Flawless Execution

Why change ?

- **Eliminate SH&E Concerns related to mercury**
  - Exposure risks to hazard material
  - Elimination of emissions and reducing wastewater discharge from mercury origin
  - Reducing hazardous wastes generation and mud concentration to final disposal (Waste Water Treatment Plant)
  - Reducing transport and disposal of hazardous wastes
  - Removing traces in finished products. Quality improvement based on the nature of the products
- **Reduce Power Usage - Increase efficiency:** *3.4 MWh/Tn NaOH* → *2.3 MWh/Tn NaOH*
  - Needs caustic evaporator to produce 50% NaOH (steam demand increase)
- **Increase Production Capacity**
- **Lower Operation & Maintenance Costs in Cell Room**
  - Reduce operating staff
  - Easier to operate
  - Less maintenance task force

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Main Process Requirements & SH&E Considerations

- **Reduction of capital investment by re-using equipment and process sections such us**
  - Brine Chemical Treatment (Brine Primary Treatment improvement should be evaluated and considered)
  - Chlorine and Hydrogen Handling Systems
  - Sodium Hypochlorite Production
  - Emergency System
- **New Plant Sections**
  - Membrane Cell Room
  - Secondary Brine Treatment
  - Chlorate Destruction
  - Catholyte Circulation
  - Caustic Concentration 32-50% NaOH
  - Automatic Controls Review/Update

Main Process Requirements & SH&E Considerations

- **Secondary Brine Treatment**
  - Ion Exchange Unit Design
  - Heat Exchangers to heat up or cool down separate brine streams for Electrolysers under shutdown or start up
  - Secure uninterrupted brine feed to Electrolysers by automatic start of stand-by pumps and connection to emergency power source

- **Catholyte Circulation**
  - Demineralized Water for catholyte make up
  - Heat Exchangers to heat up or cool down separate catholyte streams for Electrolysers under shutdown or start up
  - Secure uninterrupted caustic feed to Electrolysers by automatic start of stand-by pumps and connection to emergency power source

Main Process Requirements & SH&E Considerations

- **Automatic Control Review/Update**
  - To avoid pressure upsets in Electrolysers
  - To control constant H2-Cl2 differential pressure
  - To secure uninterrupted brine and caustic feed at specified quality
  - To provide automatic purge of H2 and Cl2 in cell headers with N2 after shutdown and before start up
  - To provide interlock trips of Rectifiers when:
    - Cell pressure upsets
    - Cell voltage upsets
    - Electrolyte feed is interrupted
    - High cell temperature

Continuous fast detection of hydrogen concentration increase in hot-wet chlorine at the outlet of the cells plus an additional monitoring system of the possible membrane damages (voltage/current, quality of products, etc.) are strongly recommended

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Main Process Requirements & SH&E Considerations

- **Safety, Health and Environmental Issues**
  - Legislation, Project Management and Contact with Authorities
  - Dismantling and Decontamination of materials and equipment
    - Speciation of Mercury (Metallic – Solid Compounds – Dissolved) and Preliminary Measures
  - Demolition
  - Analysis for Mercury
  - Waste Disposal, Transport and Storage of Materials
  - Residual Contamination/Treatments (above ground aspects, possible subsoil contamination, groundwater remediation)
  - Health & Safety considerations

Guideline for Decommissioning of Mercury Chlor-Alkali Plants – Env Prot 3, 7th Edition, August 2015 – EURO CHLOR PUBLICATION

Guidelines – Medical Surveillance and Hygiene Monitoring Practices for Control of Worker Exposure to Mercury in The Chlor-Alkali Industry – Pamphlet 125, January 2004 Edition 4 – THE CHLORINE INSTITUTE, INC.

Mercury Cell Emission Control – Practices and Techniques Guidelines – April 2001 – THE CHLORINE INSTITUTE, INC.

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TRANSCLOR's Mercury Plant Decommissioning

- **34 Tn of High-Quality Hg recovered and sold**
  - 24.3 Tn from 27 Operating Cells drained
  - 5.2 Tn from inventory and recovered from equipment washing (1st year)
  - 4.5 Tn from dismantling and cleaning process (2nd year)
- **Materials and Equipment Recycling**
  - Copper cleaning with hydro sandblasting. Recycling and molten
  - PRFV-coated carbon steel Saturator; Decanter; Brine Tanks; Sand Filters and Heat Exchangers recovered and used after deep cleaning process
  - Piping, Cell's parts, Tanks and Pumps sent to disposal after in-situ cleaning process (Landfill with stabilization and control process)
  - Dismantling and demolition of facility building sent to disposal (Landfill with stabilization and control process)
  - 755 Tn of materials and pre-treated muds sent to the right landfills during dismantling process (5 years)
  - Continuous remediation process of the impacted phreatic area

All tasks and transition process were carried on in complete accordance to local regulations

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Highlights to Flawless Execution

- **Set up an experienced, qualified and multidisciplinary team for project planning and execution**
- **Full understanding of the relevant national/regional requirements and legislation**
- **Well documented plan of action for discussion with the authorities (Informed as soon as possible)**
- **Define appropriate layout and time schedule for the project**
- **Strictly follow best practices of control of worker exposure to mercury with continuous medical supervision and emissions measurements through all stages of the project**
- **Disciplined PSM execution at the early stage of the conversion project**
  - Hazard and Operability Study in order to identify, evaluate and mitigate major hazards and risks
  - Proper implementation of a Management of Change
  - Revise and up-date Standard Operating and Emergency Procedures and Maintenance Strategy/Program
  - Full training review of operation, process, quality and maintenance personnel
  - Proper Commissioning Planning and Pre-Start Up Safety Review Execution - OPVT

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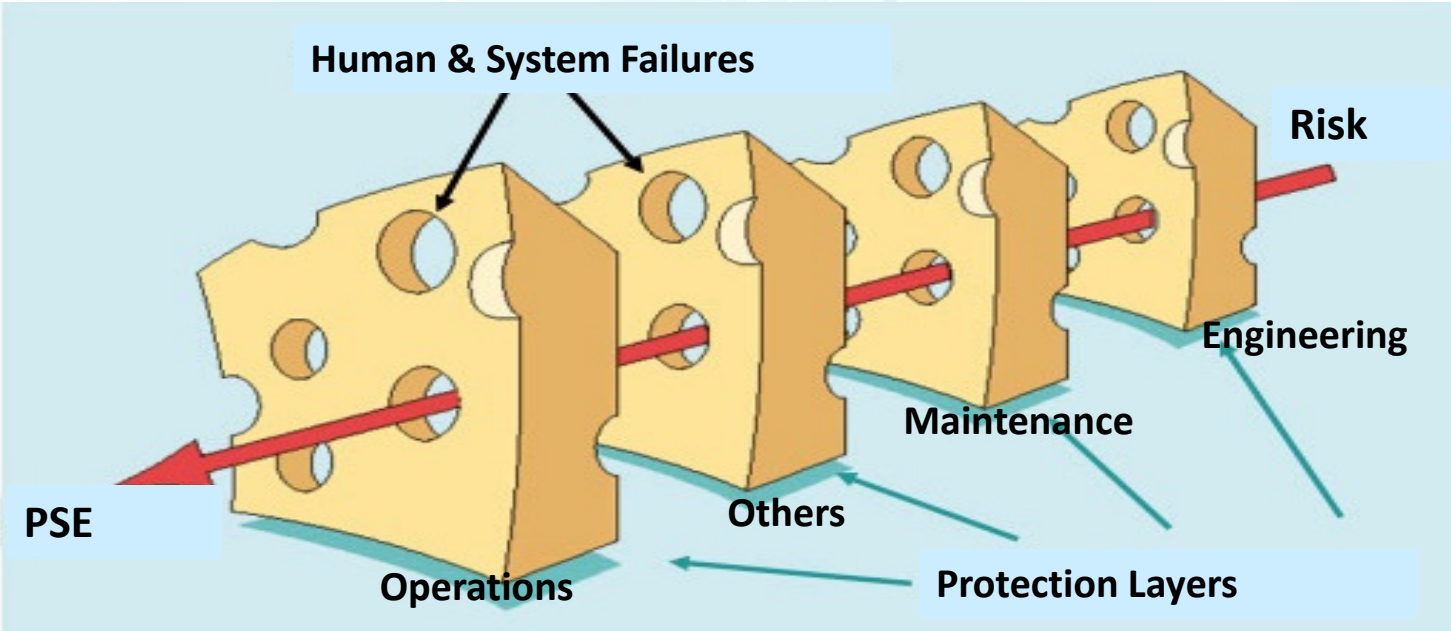
Disciplined PSM Execution

HAZOP

MOC



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Incident Investigation

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THANK YOU !

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