TRANSCLOR

SITE REVIEW & EVOLUTION

November 18th, 2016

Plant Review

- Plant Profile
- Site Evolution
- Process Safety Improvements
- Manufacturing Technology
  - Experiences & Lessons Learned

Plant Profile

- Start Up December 20th 1989
- Headcount 234
- Nominal Capacity
  - Sodium Hydroxide 88,500 Tn/Year (*)
  - Potassium Hydroxide 23,000 Tn/Year (*)
  - Sodium Hypochlorite 265,500 Tn/Year (354,000)
  - Hydrochloric Acid 177,000 Tn/Year
  - Liquid Chlorine 26,600 Tn/Year
  - Polychloride Aluminium 130,000 Tn/Year

  (*) Dry Base

- Total Power Demand 27 MW

Plant Profile

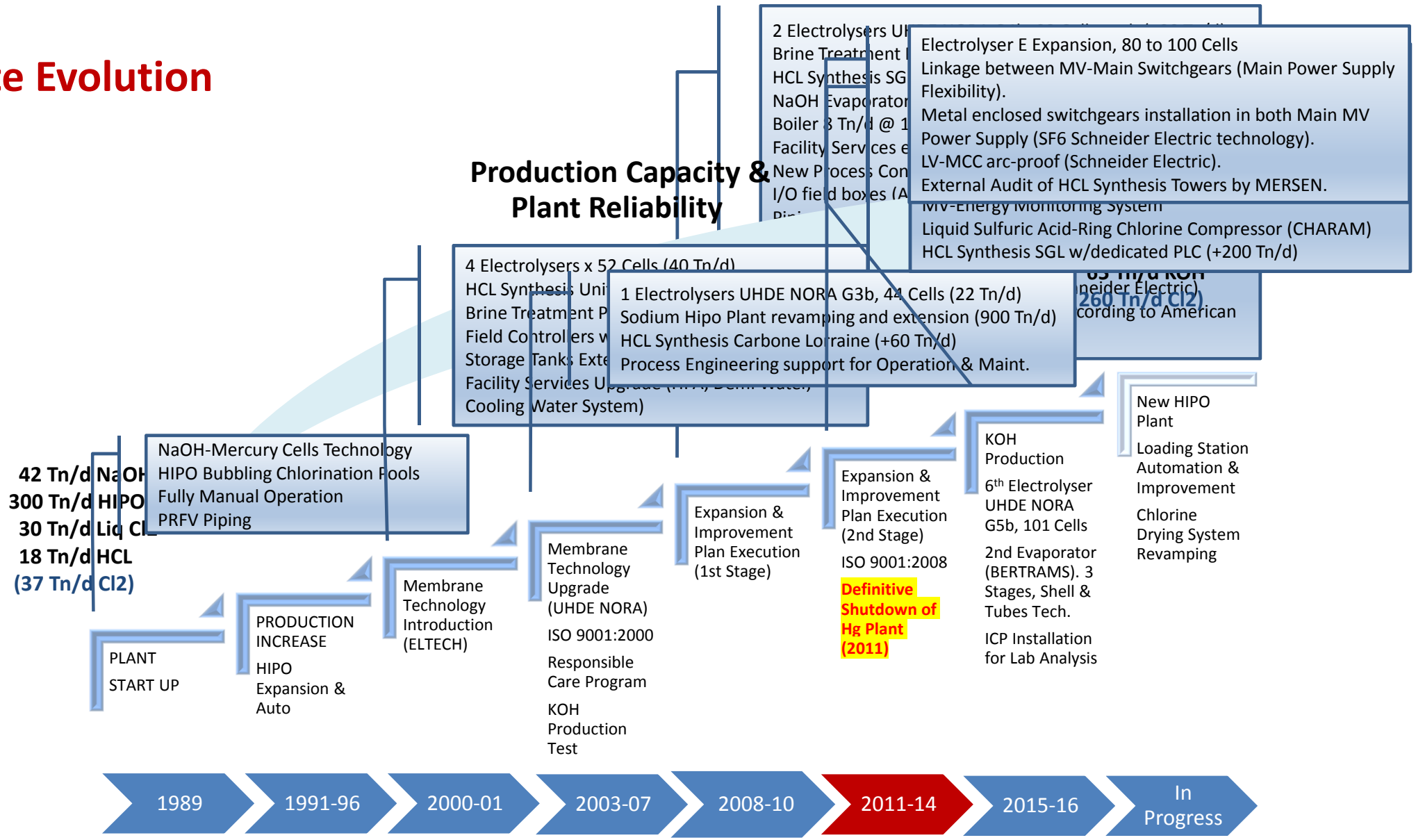
- Up to date technology
  - 6 Electrolysers UHDENORA G4b/5b, w/ Dupont / Asahi membranes
  - Brine Process: US & Dr Müller Filters. Ion Exchange Towers
  - Dual Effect Evaporator Alfa Laval, 150 Tn/d (Plates)
  - Triple Effect Evaporator Bertrams, 240 Tn/d (Shell & Tubes)
  - 2 SGL Carbon Group HCL Synthesis Units, 200 Tn/d @ 32%
  - 2 Mersen HCL Synthesis Units, 50 Tn/d @ 32%
  - 3 Sulphuric Liquid Ring Dry Chlorine Gas Compressors, 55 Tn/d
  - Single Stage Rotary Screw Compressor Mycom for Liquid CL2 cooling
  - Water Chiller w/ Single Rotary Screw Compressor Mycom
  - ICP Perkin Elmer w/ simultaneous operation for Lab Analysis
- Steam Generation
  - 2 Boilers 8 Tn/h @ 10 BarG each w/ Dual Fuel Burner capability (NG/H2; NG/Diesel)

Plant Profile

- Storage Capacity
  - Sodium Chloride Silo 4,200 Tn
  - Potassium Chloride Silo 650 Tn
  - Sodium Hydroxide 1,100 Tn (*)
  - Potassium Hydroxide 1,100 Tn (*)
  - Sodium Hypochlorite 1,300 Tn
  - Hydrochloric Acid 850 Tn
  - Liquid Chlorine 160 Tn
  - Polychloride Aluminium 700 Tn

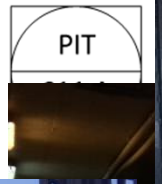
  (*) Dry Base
- Raw Material
  - Sodium Chloride: 3 Local + 1 Foreign Suppliers
  - Potassium Chloride: 1 Foreign Supplier
- Logistic for finished products T&D
  - 44 Trucks & 64 Tanks

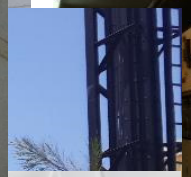
Site Evolution

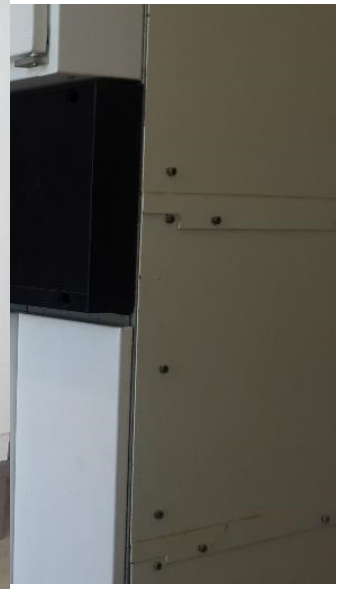


Process Safety Improvements

- quefaction
- terlock in c er
-
-
-
-
-
-
-
-







Manufacturing Technology – Hg to Membrane Learnings – WHY to Migrate?

- **Migration to a "Clean" Manufacturing Technology**
- **Direct Aspects**
  - Elimination of emissions and reducing wastewater discharge from mercury origin
  - People exposure to hazard materials
  - Reducing hazardous wastes generation and mud concentration to final disposal (Waste Water Treatment Plant)
  - Removing traces in finished products. Quality improvement based on the nature of the products
- **Indirect Aspects**
  - Transport of mercury removal
  - Reducing transport and disposal of hazardous waste
- **Energy savings**
  - 3.4 MWh/Tn NaOH → 2.3 MWh/Tn NaOH
  - Steam demand increase for NaOH concentration but less NG cost and H2 utilization as fuel
- **HR Organization. Task force specially trained and exclusive is not required**
- **Maintenance costs reduction (Lower quantity of involved process equipment)**
- **Waste Water Treatment Plant operation for remediation during dismantling process in complete accordance to regulations**

Manufacturing Technology – Hg to Membrane Learnings – Transition Process

- **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 (Safety padding with stabilization and control process)
  - Dismantling and demolition of facility building sent to disposal (Safety padding with stabilization and control process)
  - 755 Tn of materials and pre-treated muds sent to safety padding 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

THANK YOU !

TRANSCLOR