

CHLOR - ALKALI 2

1994

REACTIVE CHEMICALS REVIEW

CHLORINE AREA

DO A 029570
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POWER & UTILITIES

POTENTIAL PROBLEMS

POSSIBLE EXPLOSION/FIRE DUE TO
METHANE - OXYGEN MIXTURE IN PIPE
OR VESSEL

POSSIBLE EXPLOSION/FIRE DUE TO
METHANE - OXYGEN MIXTURE IN GAS
TURBINE DURING STARTUP OR
SHUTDOWN

POSSIBLE EXPLOSION/FIRE DUE TO
HYDROGEN - OXYGEN MIXTURE IN
FILL SYSTEM AND COOLING SYSTEM
FOR GENERATORS

POSSIBLE EXPLOSION/FIRE DUE TO
HYDROGEN FROM SEAL OIL SYSTEM
ENTERING INTO LUBE OIL SUMP

PREVENTIVE MEASURES

1 - Established procedures on purging fuel gas lines with nitrogen before taking out of service or returning to fuel gas service.

1 - Double block & bleed system integrated with startup and shutdown sequence.

2 - Compressor discharge press switch to insure adequate air supply before injecting fuel gas.

3 - Flame monitors to detect presence of flame in combustion section. Trips unit if flame not detected.

4 - Manual Air solenoid with time out function to enable fuel gas valves only during startup operation.

1 - Procedure for connecting/disconnecting hydrogen trailers from Air Products.

2 - Sampling procedure to verify H₂ purity.

3 - Purge procedures for pressuring/depressuring generators.

1 - Seal oil system is backed up by the gas turbine oil pumps.

2 - Hydrogen vapor extractor removes H₂ gas before oil reaches lube oil sump. System is protected by a dip leg to prevent gas from entering sump.

3 - Lube oil reservoir has a blower to remove hydrogen gas/oil vapor from sump.

POWER & UTILITIES

POTENTIAL PROBLEMS

FIRE INSIDE LINES CAUSED BY
RESTRICTION OF AIR FLOW DUE TO OIL
IN COOLING AIR SYSTEM

PREVENTIVE MEASURES

- 1 - Seal air system has low pressure alarm to prevent oil leakage.
- 2 - Cooling air flow indication with high/low temperature alarms.
- 3 - Auto swap on plant air to seals for startup and shutdown.

POWER AREA CRITICAL INSTRUMENTS

Compressor discharge pressure transmitter - Initiates ignition at pressures greater than 18" water.

Over-speed trip diaphragm pressure switch monitors position of over-speed trip valve and is a permissive for the fuel gas over-speed trip valve. Trip is set at 35 psi.

High fuel gas pressure transmitter will trip turbine at 215 psi, provided 100 % speed has not been reached.

Low fuel gas pressure transmitter will trip turbine at 110 psi, provided the operator selector switch is not in SPIN position.

Starting valve reset is a permissive for the turbine ignition sequence.

High turbine exhaust blade bath temperature transmitters trip turbine at 1010 F. Both transmitters must be greater than setpoint to trip turbine.

High turbine exhaust blade manifold temperature transmitters trip turbine at 1010 F. Both transmitters must be greater than setpoint to trip turbine.

High disc cavity temperature transmitters trip generator at 550 F for first set and 800 F for remaining sets. It takes both transmitters in each set to trip the generator.

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09/27/94

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CDC AREA

POTENTIAL PROBLEMS

TITANIUM IN THE PRESENCE OF DRY CL₂ WILL BURN. BOTH CL₂ EXCHANGERS, E-201 AND E-202, CONTAIN TITANIUM TUBES.

WET CL₂ REACTS WITH STEEL IN A VERY CORROSIVE MANNER.

WEAK H₂SO₄ IS VERY CORROSIVE WHEN CONTACTED WITH STEEL.

PREVENTIVE MEASURES

- 1 - Exchangers are in wet Cl₂ service.
 - 2 - Water is continually sprayed into the Cl₂ side of both of these exchangers. This flow is monitored and alarmed.
 - 3 - Titanium parts in security storage.
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- 1 - All piping in wet Cl₂ service is of lined pipe material.
 - 2 - All vessels in wet Cl₂ service are fiberglass.
 - 3 - Mist eliminating elements in D-209 A are fiberglass.
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- 1 - The first drying tower, T-201, is a fiberglass vessel, with PVC trays.
 - 2 - Acid strengths / flows / temperature are monitored in both drying towers.
 - 3 - Tray temperatures are monitored in both towers.

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CDC AREA

POTENTIAL PROBLEMS

CL₂ - IRON REACTION AT COMPRESSOR
C-201 A / B.

CL₂ - IRON REACTION IN PIPING.

CL₂ - LUBE OIL REACTION.

CL₂ - ORGANIC CHEMICAL REACTION.

PREVENTIVE MEASURES

1 - Interstage coolers to keep Cl₂ temperature down.

2 - High temperature trip on the compressor. Triple redundant temperatures on 2nd and 3rd stages. Trips on two thermocouples at 325 F on 2nd or 3rd stage.

3 - Deluge system.

4 - Interstage and discharge temperatures alarmed and monitored.

5 - Moisture monitored and alarmed off of discharge.

1 - No steam tracing - only electrical.

2 - Drying procedures prior to startup.

1 - Bearing housing separated from compressor seals.

2 - N₂ purge on compressor seals; air purge on bearing housing.

1 - Prohibit use of hydrocarbon based compounds inside Cl₂ vessels and piping.

2 - Use Fluorolube as gasket lubricant and DP cell fill fluid.

3 - Use only water or steam for cleaning of equipment used in Cl₂ service.

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PURIFICATION AREA

POTENTIAL PROBLEMS

NITROGEN TRICHLORIDE EXPLOSION IN
TAFFY POT.

PREVENTIVE MEASURES

- 1 - Monitor and alarm temperature in each pot (redundant).
- 2 - Alarm rate of temperature rise in pots.
- 3 - Analyze Brine for NH_3 content bi-monthly (R&D).
- 4 - Analyze Taffy bi-weekly for NCl_3 .
- 5 - Monitor and alarm pressure on each pot (redundant).
- 6 - Lowered PSV setting to 150# to catch pot overpressure.
- 7 - Maintain 80 PPM hypochlorite in the Brine.
- 8 - Maintain level below 40% to allow room for diluent should a reaction take place.
- 9 - Capability to automatically add liquid chlorine to the Taffy Pot in the event of a reaction. Also have capability to add CCl_4 to pots.
- 10- Reboiler temperature controlled to decompose NCl_3 . Given 40 PSIG operating pressure, reboiler temperature set point is set at 170 F, over 30 degrees below the boiling point of the dilutant, CCl_4 .
- 11- Pressure transmitter and an alarm for high pressure "rate of rise" on transfer line.

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PURIFICATION AREA

POTENTIAL PROBLEMS

ORGANIC IMPURITIES; WET CCl_4

CHLORINE - ORGANIC CHEMICAL
REACTION.

PREVENTIVE MEASURES

- 1 - CCl_4 provided by Solvents from "check tank". Check tank analysis to be obtained for each load.
- 2 - In plant capability to analyze each load for organics and H_2O .
- 3 - Dedicated line from Solvent.
- 1 - Prohibit use of hydrocarbon based compounds inside Cl_2 vessels and piping.
- 2 - Use fluorolube as gasket lubricant and DP cell fill fluid.
- 3 - Use only water or steam for cleaning of equipment used in Cl_2 service.

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LIQUEFACTION AREA

POTENTIAL PROBLEMS

HYDROGEN - CHLORINE EXPLOSION IN
TAIL GAS

WATER/MOIST AIR ENTERING
LIQUEFACTION PROCESS FROM BRINE
SCRUBBER CREATING SEVERE
CORROSION PROBLEM

CHLORINE - IRON FIRE FROM LIQUID
CL₂ PUMPS OVERHEATING

HIGH MOISTURE CONTENT IN CL₂
CAUSING ACCELERATED CORROSION
TO CARBON STEEL

H₂O IMPURITIES ADMITTED TO
PROCESS VIA FREON

PREVENTIVE MEASURES

1 - Monitor hydrogen in cell continuously.

2 - Redundant hydrogen analyzers monitor and alarm tail gas to Brine Scrubber (set point - 3.5% H₂ in inerts) analyzers included on critical instrument program ; Generator runback: 4.75%.

3 - Automatic N₂ dilution into tail gas.
Control at 2.4%.

1 - Check valve installation on tail gas line to scrubber.

2 - High pressure alarm on Brine Scrubber.

3 - Moisture analyzer and alarm on T-505 tail gas inlet line.

4 - Liquefaction startup and shutdown procedures, on computer, call for blinding the liquefaction process from the brine scrubber when liquefaction is to be depressured.

1 - Alarm on low cooling flow.

2 - Minimum flow lines provided to prevent dead-heading.

1 - Redundant moisture analyzers monitored and alarmed.

1 - Complete analysis on all freon shipments.

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LIQUEFACTION AREA

POTENTIAL PROBLEMS

CL₂ LEAK INTO R-12 REFRIGERATION
SYSTEM (C-520 LEADING TO REACTION
WITH COMPRESSOR OIL)

PREVENTIVE MEASURES

- 1 - Analyzer monitors and alarms Cl₂ in freon.
This analyzer and alarm scheme is included
in the critical instrument program.
- 2 - Cl₂ - R-12 exchangers have double tube
sheets.

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EVAPORATION AREA

POTENTIAL PROBLEMS

NCL₃ ACCUMULATION IN EVAPORATOR
BOTTOMS

HIGH PURITY GAS CONDENSING IN
USER HEADER

H₂O / IMPURITIES ADMITTED TO
PROCESS VIA FREON

PREVENTIVE MEASURES

1 - Flush evaporator bottoms once daily to
T-204.

1 - Redundant temperature transmitters.

2 - Superheater on R-11 system which operate:
independently of freon compressor.

3 - Computer monitoring of Cl₂ gas header
pressure and temp to calculate dewpoint.
Scam alarm when gas is 10 F from
dewpoint.

4 - Electric heat tracing and good insulation on
gas header to Cl₂ plant. Heat tracing
designed to maintain 100 F heater
temperature.

1 - Complete analysis on all freon shipments.

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CHLORINE AREA CRITICAL INSTRUMENTS

Chlorine EBV Mod 5 self test (Not a critical instrument check)

Liquid chlorine transfer line AOVs

Hydrogen inerts analyzer - run back at 4.5 %

Freon in chlorine analyzers (liquid and gas) - 10 PPM alarm

Chlorine in Freon alarm (switch)

Taffy pot temperature - high temperature alarm at 150 F

Chlorine Compressor

Chlorine compressor discharge valve

Chlorine compressor discharge pressure

Cell header pressure control flow

Flow vs. valve position for chlorine to J-252

Chlorine compressor runback functions

C-201 generator trips

Chlorine compressor trip permissives

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CHLORINE AREA TRIPS / RUNBACKS

Generator

High hydrogen in tail gas (runback)
Low cell head level (4 inches)
Cell header "mega" back pressure

Chlorine Compressor

High interstage temperature - 325 F
Cell header vacuum reaches -9.5 inches water instantaneously
Cell header vacuum reaches -8.0 inches water and holds for ten seconds
Cell header vacuum reaches -8.0 inches water twice in 2 minutes

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