

Process Safety Management
Georgia Gulf Corporation, Aberdeen Plant
Old Module Hazard and Operability Study

Start Date: March 15, 2000
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Distribution: PSM Steering Team

Memo

To: PSM Steering Team
From: Kelly Wood
Date: 07/13/00
Re: Old Module Hazop Report

Enclosed is the completed Old Module Hazop report. This is the 2nd Hazop to be performed on the Old Module. Performing a 2nd Hazop was preferred rather than a revalidation of the 1st Hazop because:

1. Significant changes to the Old Module area since the previous Hazop, due mainly to the EXPRESS project.
2. Hazop software (PHAPRO 3.0) was available. The software helps facilitate Hazop thoroughness and improved hazard documentation. The software is expected to provide the same benefits for future revalidations.

A list of hazards identified can be found in Section VIII. Hazards were identified during the preliminary hazard review, the human factors review, and the P&ID/Operating procedure review.

Preliminary Hazard Review, Section VIII.A.

Ten items were identified. Although the identified items do not receive a risk ranking, they do have to be reviewed and their resolution has to be documented.

Human Factors Review, Section VIII.C.

Five items were identified. Although the identified items do not receive a risk ranking, they do have to be reviewed and their resolution has to be documented.

P&ID/Operating Procedure Review Section VIII.D.

In this section, hazards (also called consequences) are risk ranked. No hazards were found to have risk rankings of 1, 2, or 3. Six hazards were found having a risk ranking of 4. A risk ranking of 4 requires the hazard be evaluated. If the evaluation determines no mitigation is required, documentation of the reasons why is needed. Otherwise, mitigation is required. All other hazards had risk rankings of 5 and require no mitigation. Explanation of risk ranking and required mitigation can be found in Appendix D of the Condea Vista Corporate Safety and Health Standard. Condea Vista's Corporate Safety and Health Standard can be found in Appendix G of this document.

List of Recommendations, Section IX.

The list of recommendations are listed by category similar to the list of hazards identified. Recommendations resulting from the P&ID/Operating procedure review are referenced to a study node. Recommendations are to be handled as described in Appendix E of the Condea Vista Corporate Safety and Health Standard.

Post Hazop Communications

See section 8.3 of the Condea Vista Corporate Safety and Health Standard.

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**PROCESS SAFETY MANAGEMENT
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OLD MODULE HAZOP**

I. Purpose

The Old Module Hazop was conducted for the following purposes:

- Provide Management and Operations personal with the knowledge of where potential hazards exist.
- Provide safe operation documentation for the system.
- Provide a quantitative assessment of the risks involved with the operation of the system.
- Provide documentation that risk management is taking place at the Aberdeen Plant.
- Provide training on Hazop methodology and techniques for Vista personal.
- Make recommendations, which the team feels should reduce the risks identified.
- Comply with the Process Hazard Analysis requirements , paragraph (e), of the OSHA Process Safety Management of Highly Hazardous Chemicals regulation, 29 CFR 1910.119.

Performing a Hazop study is generally an assurance that if procedural and/or engineering modifications are implemented to mitigate risk, the area will then operate under some lower risk. It is not, however, a guarantee that hazardous events or operating problems will not be encountered.

II. Rationale

Hazop was chosen to fulfill OSHA's 29 CFR 1910.119 PHA revalidation requirement because of the size and complexity of the revisions made to the Old Module during the EXPRESS project. In addition, it was desirable to have the Hazop documented on a PHA facilitating computer software program to benefit subsequent revalidations.

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III. Scope

The scope of this PHA covers the part of the Aberdeen Plant known as the Old Module.

The Old Module Hazop study comprises all colored lines on the P&ID's in appendix A, as well as applicable associated operating procedures listed in the table below.

The following P&ID's and Operating Procedures were examined during the Hazop study.

P&ID Number	Revision	P&ID Title
OM-090100-PID-D	4	FVCM RECEIVER
OM-090101-PID-D	1	HOT WATER CHARGE & RINSE
OM-090102-PID-D	4	REACTOR RX-300
OM-090103-PID-D	4	REACTOR RX-400
OM-090104-PID-D	4	REACTOR RX-500
OM-090105-PID-D	3	REACTOR RX-600
OM-090106-PID-D	3	REACTOR RX-700, 1 OF 2
OM-090107-PID-D	1	BME METERING POTS
OM-090108-PID-D	3	RECOVERY KNOCKOUT DRUMS
OM-090109-PID-D	6	RECOVERY COMPRESSORS & VACUUM PUMPS
OM-090109A-PID-D	2	RECOVERY COMPRESSORS 506/111
OM-090110-PID-D	6	SEAL WATER SEPARATORS & COOLERS
OM-090111-PID-D	6	RECOVERED VCM CONDENSERS
OM-090112-PID-D	4	RVCM RECEIVERS
OM-090113-PID-D	5	EMISSION RECOVERY SYSTEM, 1 OF 3
OM-090114-PID-D	4	EMISSION RECOVERY SYSTEM, 2 OF 3
OM-090115-PID-D	3	EMISSION RECOVERY SYSTEM, 3 OF 3
OM-090116-PID-D	0	OLD SLURRY DUMP SYSTEM
OM-090117-PID-D	0	WET CALCIUM STEARATE
OM-090118-PID-D	2	LOW MOLE SLURRY DUMP SYSTEM
OM-090119-PID-D	6	BATCH WATER STRIPPING
OM-090120-PID-D	2	MSPW & HPSW SYSTEMS, 1 OF 2
OM-090121-PID-D	1	EMERGENCY KILL SYSTEMS
OM-090122-PID-D	1	STEAM & REACTOR EVAC. SYSTEM
OM-090123-PID-D	0	BRINE TANKS
OM-090124-PID-D	1	SEAL OIL SYSTEM
OM-090125-PID-D	1	REFRIGERATION SYSTEM FOR RVCM RECEIVER'S KNOCKBACK CONDENSERS
OM-090126-PID-D		REMOVED FROM SERVICE
OM-090127-PID-D	0	MSPW & HPSW SYSTEMS, 2 OF 2
OM-090128-PID-D	0	NORMAL KILL SYSTEMS
OM-090129-PID-D	2	CLEAN WALL SUPPLY SYSTEMS
OM-090130-PID-D	4	REACTOR RX-700, 2 OF 2

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P&ID Number	Revision	P&ID Title
OM-090132-PID-D	2	HIGH MOLE SLURRY STRIPPER
OM-090134-PID-D	2	DUMP PUMPS & STRAINERS
OM-090135-PID-D	2	HIGH MOLE DUMP TANK
OM-090136-PID-D	4	HIGH MOLE STRIPPER FEED TANK
OM-090137-PID-D	1	RECYCLED CENTRATE DISTRIBUTION
DY-090119-PID-D	3	CENTRATE SYSTEM
DY-090133-PID-D	5	INCINERATOR FLAME ARRESTOR SYSTEM
DY-090135-PID-D	1	EAST INCINERATOR
DY-090136-PID-D	1	WEST INCINERATOR

Procedure Number	Revision	Procedure Title
VINYL-RM-SD003	1	Prepare The Charge Water Tank For Entry and Put Back In Service
VINYL-RM-SD004	2	Prepare the Decal Charge Water Tank For Changing Out Resin & Coal Beds
VINYL-RM-ESD006	1	Operation of Module emergency Shutdown Switch
VINYL-OM-E001	0	Split One Reactor Into Another Due To VCM Escaping from the Top of the Reactor to the Atmosphere
VINYL-OM-E002	0	VCM Leak/Release on the Bottom of Reactor Due to Gasket or Seal Failure
VINYL-OM-E003	0	Steps Taken In the Event of a Power Failure
VINYL-OM-E004	0	Operation of Automatic Shutdown/Isolation System
VINYL-OM-E006	1	Operation of the Halon System in the Vinyl Control Room
VINYL-OM-E007	1	Operation of the Emergency Generator for Vinyl Control Room
VINYL-OM-E008	0	Operation of Deluge Water to Emergency Cooling Water System
VINYL-OM-E009	0	Operation of Reactor Agitator On/Off/Auto Switch
VINYL-OM-SD001	2	Prepare a Batch Water Stripper for Entry
VINYL-OM-SD002	2	Prepare VCM Condenser for Cleaning Tubes/Acid Treating Jacket
VINYL-OM-SD005	0	Schedule Shutdown/Turnaround
VINYL-OM-ESU001	0	Start-Up of Old Module After an Emergency Shutdown
VINYL-OM-SU001	0	How to Start-Up After Scheduled Shutdown/Turnaround
VINYL-OM-NSU002	0	How to Pressure Check Entire Recovery System and Put Back in Service

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The Hazop study focused on the following potential hazards:

Personal Injury/Death Resulting From	Equipment/Property Damage Resulting From	Production Loss Resulting From	Environmental/Community Impact Resulting From
Fire	Fire	Equipment Damage	Spills
Explosion	Explosion	Power Failure	Vapor Releases
Toxic Exposure	Corrosion	Maintenance	Emissions
Chemical Contact	Misoperation	Turnarounds	Fire
Thermal Burns	Overpressure	Equipment Failure	Explosion
Asphyxiation	Overheating	Instrument Failure	
Impact Injury	Freezing	Misoperation	

- Human Factors
- Past Incidents
- Facility Siting
- Failure of Engineering and Administrative Controls

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OLD MODULE HAZOP**

IV. Team Members and Qualifications

Selection of the Hazop team is consistent with OSHA requirements and the requirements outlined in the Condea Vista Company, Corporate Safety & Health Standard, PSM-004, "Process Hazard Analysis", section 4.7.2, July 30, 1998.

Name	Title	Expertise	Qualifications
Kelly Wood	Facilitator	Engineering & Operations	Kelly has six years experience in the Aberdeen Plant and has performed two previous Hazop studies. Kelly has had formal Hazop team leader training.
David Covington	Vinyl Operations Supervisor	Vinyl Operations	David has 18 years experience in vinyl unit operations.
Ed Mize	"A" Mechanic	Maintenance	Ed has 25 years experience at the Aberdeen Plant
Rusty Prillhart	Mechanic	Vinyl Operations	Rusty has 14 years experience in Plant operations, 11 of which have been in the vinyl dept.
Shea Sargent	Plant Hygienist	Plant Hygiene	Shea has 1 year experience at the Aberdeen Plant.
Bob Newman	Vinyl Lead Operator	Vinyl Operations	Bob has 28 years experience in vinyl operations.
David Nolen	Instrument Technician	Maintenance	David has 30 years experience in maintenance at the Aberdeen Plant.
Charlie Peden	Instrument Technician	Maintenance	Charlie has 29 years experience in maintenance at the Aberdeen Plant.
Jeff Shields	Vinyl Shift Supervisor	Vinyl Operations	Jeff has 20 years experience in vinyl unit operations.
Nathaniel Wilson	Chief Lead Operator	Vinyl Operations	Nate has 27 years experience in vinyl unit operations.
Milton Threadgill	Mechanic	Maintenance	Milton has 30 years experience at the Aberdeen Plant, 4 of which have been in the maintenance dept.
Craig English	Engineer	Engineering & Maintenance	Craig has 12 years experience in the Aberdeen Plant.

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V. Team Orientation

A. Methodology

The methodology used to perform the Hazop study is outlined in the Condea Vista Company, Corporate Safety & Health Standard, PSM-004, "Process Hazard Analysis", section 5, July 30, 1998.

B. Risk Ranking Tables

Risk Ranking of identified process hazards was completed per the instructions and information provided in the Condea Vista Company, Corporate Safety & Health Standard, PSM-004, "Process Hazard Analysis", Appendix D, July 30, 1998.

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OLD MODULE HAZOP**

C. Hazop Execution Plan

- Gather required pre-work material (Appendix D).
- Select appropriate team members
- Post memo to all employees stating that a Hazop study will be done. Memo includes what area or process the Hazop will focus on, team members, meeting place, and meeting times.
- Hold Team Orientation Meeting. The orientation meeting is used to set the tone for the Hazop. It includes a review of the following:
 - Purpose and Scope of the Hazop
 - Rationale for choosing Hazop for the PHA
 - Hazop Execution Plan
 - Methodology
 - Process Description
 - Pre-work material
 - Site Specific Hazards of the Process
 - Previous Incidents
 - Human Factors
 - Facility Siting
- Perform line by line analysis of process nodes. Includes P&ID's and operating procedures.
 - Identify Hazards of the Process
 - Rank Hazards By How Much Risk They Exhibit
 - Recommend Actions to Mitigate Risks
- Compile all team findings during Hazop into a report.

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D. Human Factors Checklist

Equipment			Observed Practice
Labeling	equipment clearly labeled	mislabeled or not labeled	
Access	immediately at hand	hard to reach or access	
Operability	power assisted operation	difficult to operate/change	
Layout	well-planned, logical arrangement	confusing/inconsistent arrangement	
Uniqueness	only component of its kind in area	several components look similar	

Controls			Observed Practice
Labeling	controls clearly labeled; uniform coding	mislabeled or not labeled	
Mode	fully automatic; well-tuned	manual operation; many manual steps	
Involvement	operator continually involved	operator detached from process	
Displays	clear, simple, representational	unclear, complex, non-representational	
Displays	immediant, unambiguous	none or potentially misleading	

Deviations			Observed Practice
Alarms	first-out; safety critical alarms	many simultaneous or false alarms	
Coverage	dual operator coverage at all times	operator not always present	
Time	no time pressure for response	inadequate time for response	
Preparedness	periodic simulation exercises	no drills or simulation of scenarios	
Last-Resort	shutdown not discourage; fast access	shutdown discouraged or unsafe	

Transient			Observed Practice
Procedures	complete, accurate, current, verified	incomplete/too general/out of date	
Identifying	ID, location of devices/actions given	ambiguous device/action identification	
Format	graphical identification aids	confusing/inconsistent; difficult to read	
Aids	checklist or supervisory check	task sequence done by memory	

“+” = FACTORS BEYOND STANDARD PRACTICE; MAY REDUCE HUMAN ERROR OR INADEQUATE RESPONSE LIKELIHOOD.

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"-" = FACTORS THAT MAY TEND TO INCREASE THE LIKELIHOOD OF OF HUMAN ERROR OR INADEQUATE RESPONSE.

Scheduling	+	-	Observed Practice
Overtime		extreme enough to affect performance	
Consistency	permanent shift assignments	inconsistent shift rotations/schedules	
# of Tasks	tasks, work force, and skills matched	tasked required exceed time available	
Task Frequency	routine tasks	very infrequent; no expertise base	
Intensity	regular tasks at normal pace	differing tasks in rapid succession	

Communicate	+	-	Observed Practice
Shift Changes	status communicated verbally, plus turnover sheet used	inadequate communication of plant status between shifts	
Field/Control	constant communication with field operator	no communication with field operator	
Supervision	frequent supervisory communication	little or no supervisory checks	
Emergency	rapid, unambiguous plant alarm system	no distinction between area/type	

Environment	+	-	Observed Practice
Noise Level	office environment noise level	area where hearing protection required	
Climate	indoors, climate controlled	temperature/humidity/precipitation/wind extremes	
Visibility	visibility enhancement of some kind	visibility limitation of some kind	
Lighting		inadequate lighting for task	

"+" = FACTORS BEYOND STANDARD PRACTICE; MAY REDUCE HUMAN ERROR OR INADEQUATE RESPONSE LIKELIHOOD.

"-" = FACTORS THAT MAY TEND TO INCREASE THE LIKELIHOOD OF OF HUMAN ERROR OR INADEQUATE RESPONSE.

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E. Team Orientation Meeting Review Checklist

Reviewed		Review Topic
Yes	No	
X		1. Purpose of Hazop
X		2. Rationale for choosing Hazop for the PHA
X		3. Scope of Hazop
X		4. Hazop Execution Plan
X		5. Methodology
X		6. Process Description
X		7. Pre-work material
X		8. Site Specific Hazards of the Process
X		9. Previous Incidents
X		10. Human Factors
	X	11. Facility Siting (Refer to Plant Facility Siting Study)

F. Attendance Records

Old Module Hazop

Georgia Gulf Corp

	3/15/100	3/16/100	3/17/100	3/20/100	3/21/100	3/22/100	3/23/100	3/24/100	3/27/100	3/28/100	3/29/100	3/30/100	4/3/100
Covington, David	-	-	-	-		-	-	-	-	-	-	-	-
English, Craig													
Mize, Ed	-	-	-	-	-	-	-	-	-	-	-	-	-
Newman, Bob	-	-	-	-	-		-	-	-	-	-	-	-
Nolen, David								-	-	-	-	-	-
Peden, Charlie	-	-	-	-	-	-	-						
Prillhart, Rusty								-					
Sargent, Shea													
Shields, Jeff	-	-	-	-	-	-		-	-				
Threadgill, Milton	-	-	-	-	-	-	-		-	-	-	-	-
Wilson , Nathaniel	-	-			-	-	-	-		-	-	-	-
Wood, Kelly													

F. Attendance Records

Old Module Hazop

Georgia Gulf Corp

	4/4/100	4/5/100	4/6/100	4/11/100	4/12/100	4/13/100
Covington, David	-	-	-		-	-
English, Craig						
Mize, Ed	-	-	-			
Newman, Bob	-	-	-	-	-	-
Nolen, David	-	-	-			
Peden, Charlie				-	-	-
Prillhart, Rusty				-	-	-
Sargent, Shea						
Shields, Jeff				-		
Threadgill, Milton	-	-	-	-	-	-
Wilson , Nathaniel	-	-	-	-	-	-
Wood, Kelly						

**PROCESS SAFETY MANAGEMENT
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VI. General Process Description

The polymerization reaction of vinyl chloride monomer (VCM) to form polyvinyl chloride (PVC) resin is a batch suspension process in which VCM, water, suspension agents, and reaction initiator are the primary constituents. The exothermic reaction takes place under pressure and is held at a constant temperature throughout the reaction. The mixture is kept in suspension by mechanical agitation. At the conclusion of the reaction, unused VCM is drawn off, compressed, condensed, and stored for reuse. The slurry is steam stripped to decrease the amount of residual VCM. Modifying reaction temperature, suspending agents, initiators, and recovery pressure can vary resin properties.

VII. HAZARDS ANALYSIS

A. Hazards of the Process

The hazards associated with the process are the usual ones, i.e.:

- Loss of containment of a potentially hazardous chemical, with consequent exposure of personnel.
- Loss of containment of a flammable and/or explosive chemicals, with consequent fire and/or explosion.
- Loss of containment of an environmentally hazardous chemical, with the consequent environmental impact.

There are a number of chemicals, part of the process, which were identified as potentially hazardous from a safety and/or environmental point of view. The hazards associated with each of these chemicals are summarized in the next section.

The potential scenarios leading to the hazards shown above were extensively analyzed during the formal HAZOP sessions, and their causes and consequences are shown in the HAZOP table, Section VIII, E.

B. Potential Safety and Health Effects

In estimating the effects of the potential hazards, the properties of the chemicals involved were considered. These properties are shown in the Material Safety Data Sheets. See Appendix C (Pre-work Materials) for location of MSDS's.

The effects of inadvertent mixing of the chemicals have also been analyzed, but no hazards were identified.

C. Engineering and Administrative Controls

The following engineering controls were identified as relevant:

- Instrumentation, controls, alarms, interlocks
- Area detection and analyzer devices
- Emergency shutdown system of the generating facility to a safe condition
- Emergency shutdown button
- Relief system to safe header (in some places)
- Ventilation system in control room

- Fire fighting equipment (both within the plant and from the local fire department)
- HAZMAT gear
- Dikes on storage area
- Explosion hatches on the storage tanks, baghouses
- Overflow lines on storage tanks
- Vent lines to safe location
- Deluge systems
- Backup emergency power system
- Breathing equipment throughout the plant
- Backup cooling water (firewater)

A number of administrative controls intended to provide a safe work place were identified, such as:

- Safe work practices (lockout/tagout), hot work permit, use of respirators in hazardous areas, use of personal detection badges, etc.)
- Emergency response plan/team
- Preventive/predictive/proactive maintenance program and procedures
- Operating procedures
- Maintenance procedures
- Training program for operators, maintenance personnel, contractors, firefighting activities, emergency personnel, etc.
- Restricted access to hazardous areas, thus reducing potential exposure
- HAZMAT training and procedures
- Management of change system
- Evacuation procedures after maintenance
- Color coding of utilities lines
- Use of generally accepted standards (for engineering, piping, painting, etc.)
- Company standards, based on years of experience in working with the chemicals involved in this process, for its safe handling, storage, and processing
- Use of hand-held detection devices
- Periodic noise surveys

During the PHA meetings, credit was taken for the safeguards provided by specific and generic controls, as shown in the HAZOP table, Section VIII, E.

D. Consequence of Failure of Controls

The potentially hazardous conditions which could lead to the hazards identified in section A are systematically addressed in the formal HAZOP processes, and listed in the Hazop tables, Section VIII, E. The

consequences listed in this table assume failure of controls, which are then listed as safeguards for either reducing the probability of the event or mitigating its consequences. Whenever these safeguards were deemed sufficient by the team members, action items were included to further improve the safety of the system. Refer to the enclosed HAZOP table for specific scenarios of potential hazards, the risks associated with them, and the engineering and administrative control listed under safeguards, which reduce the associated risk.

E. Previous Relevant Incidents

A list of previous relevant incidents is enclosed in Appendices of this report. The recommendations arising from the analysis of the previous incidents are included in the List of Recommendations.

F. Facility Siting

The possible safety considerations associated with layout and siting are addressed by the Aberdeen Plant's Facility Siting Report dated Dec., 1998. Therefore the team chose not consider Facility Siting issues in the Hazop report. See Appendix C for information regarding the location of the Facility Siting report.

G. Human Factors

Human factors and their impact on the safe operation and maintenance of the process were addressed at all stages of the analysis. To insure more complete coverage of this important issue, a human factors checklist was used to establish the team's mindset in considering human factors and is shown in the Team Orientation section of this report. Recommendations arising from the analysis of this checklist is included in the List of Recommendations section.

H. General Deviations

In addition to the deviations listed in the HAZOP table, Section VIII, E. Some deviations of a general nature were also considered, i.e., compatibility of vent streams, external leak and rupture, contamination, external fire, external events, effects of emergency operation, shutdown, etc. Recommendations arising from the teams' discussion can be found in the List of Recommendations section.

LIST OF HAZARDS

**PROCESS SAFETY MANAGEMENT
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OLD MODULE HAZOP**

VIII. List of Hazards Identified

A. Preliminary Hazard Review

1. Location of Rust trailer relative to the VCM tankfarm. The trailer is not explosion proof.
2. Deluge house by open dump system, north of stripper, and in NE corner of recovery building have seemingly light protection. Also, the two older deluge valves have manual valves that are hard to operate.
3. Crane outrigger placement points can be placed on sewers.
4. Setting up crane to work on stripper.
5. Not enough electrical outlets to avoid using long extension cords.
6. Relief valve discharge locations on catalyst charge pots.
7. Hot work permit does not address restarting vehicles in unit once they have been shut off for a significant amount of time.
8. Some equipment may need individual fire protection.
9. Plant alarm system is inadequate in some areas.
10. One exit exists for the OM recovery building addition.

B. Human Factors Review

1. Equipment and line labeling poor.
2. Rx-700 cooling water supply and return valves are in a hard to access location.
3. Some controls are local and not on the DCS.
4. Changing VCM filters while charging a reactor.
5. Lighting is poor under the reactors, on top of the reactors, and at filter packs.

C. Past Incidents Review

No hazards identified.

D. P&ID/Operating Procedure Review

See PHAPRO output starting on next page. Hazards with risk rankings of 4 are:

Nodes

1.1.2

1.2.3

1.4.2

1.5.2

8.4.4

9.4.1

Node: 1. DM-013, FVCM Receiver	
Type: Vessel	Drawing: OM-090100-PID-D
Design Conditions/Parameters: MAWP: 150 psig; MOC CS	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
1.1 High Pressure							
	1. Fire and explosion 2. Lift relief valve 3. Blow gasket	S/E S/E S/E	3 3 4	D C C	5 4 5	1. Pressure transmitter, 81p746 2. relief valve 3. Equalization line	1. Pump malfunction 2. Equalization line plugged 3. instrument failure
1.2 High Temperature							
	1. Fire and explosion 2. High pressure 3. Lift relief valve	S/E S/E S/E	3 4 3	D C C	5 5 4	1. Operating procedures 2. relief valve 3. Temperature gauge	1. Fire 2. Heat tracing on in warm weather
1.3 Low Temperature							
	1. Water freeze in receiver bottom	S/E	4	C	5	1. Heat tracing 2. Operating procedures 3. Temperature gauge	1. Cold weather 2. Heat trace off or not enough heat trace
1.4 High Level							
	1. High pressure 2. Lift relief valve	S/E S/E	4 3	C C	5 4	1. relief valve 2. sight glass 3. level instrument, 81I745/81I749	1. Level transmitter failure 2. Pump malfunction
1.5 Leak							
	1. Fire and explosion 2. Personnel exposure	S/E S	3 3	D C	5 4	1. Fixed point monitor 2. general monitor 3. Fire Protection System 4. Engineering standard for material compatibility 5. level/pressure indication, 81I745/81p746	1. Pressure gauge failure 2. High pressure 3. Gasket failure 4. High level
1.6 Start-up/Shutdown Hazards							
	1. Personel Exposure	S	3	D	5	1. Maintenance & operating procedures	1. Not recovered sufficiently 2. Not pressure checked 3. Not blanked out properly

Node: 2. FVCM Charge Pump Suction Line And Relief Valve/RV Discharge Line	
Type: Line	Drawing: OM-090100-PID-D
Design Conditions/Parameters: 800 GPM, Ambient temp, Pipe Spec A2-22	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
2.1 High Pressure							
	1. Lift relief valve 2. Blow gasket 3. Valve packing leak	S/E S/E S/E	4 4 4	C B A	5 5 5	1. relief valve 2. Fire Protection System 3. Fixed point monitor 4. general monitor	1. External heat 2. Closed valve 3. Relief valve plugged
2.2 High Temperature							
	1. Fire and explosion 2. High pressure 3. Lift relief valve 4. Personnel exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System	1. Fire
2.3 Low Temperature							
	1. Line freeze	S/E	4	C	5	1. winter shelter	1. Cold weather

Node: 3. FVCM Charge Pump	
Type: Centrifugal Pump	Drawing: OM-090100-PID-D
Design Conditions/Parameters: 3x6-13-10 7/8, Ductile Iron, 800 GPM @ 196 psi, Double Mechanical Seal	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
3.1 High Pressure							
	1. Seal failure 2. Blow gasket 3. Pump case failure 4. High temperature	S/E S/E S/E S/E	4 4 3 4	B C D D	5 5 5 5	1. recirculation line locked open	1. Recirculation line closed/plugged 2. discharge blocked/plugged
3.2 Leak							
	1. Personal exposure 2. Fire/Explosion	S S/E	4 3	B D	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor	1. Seal failure 2. Gasket failure 3. Pump casing failure
3.3 High Temperature							
	1. Seal failure 2. Fire/explosion	S/E S/E	4 3	C D	5 5	1. Fire Protection System 2. Equalization line	1. Discharge blocked 2. recirculation line blocked 3. plugged filter 4. External heat

Node: 4. FVCM Charge Pump Discharge Line To FVCM Filters

Type: Line

Drawing: OM-090100-PID-D

Design Conditions/Parameters: Pipe spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
4.1 High Pressure							
	1. Lift relief valve 2. Blow gasket 3. Valve packing leak	S/E S/E S/E	4 4 4	C C B	5 5 5	1. relief valve 2. DCS interlocks, valve 81hv706/ 707 3. Operating procedures	1. Plugged filter pack 2. Plugged relief valve 3. external heat 4. Valve blocked in/closed
4.2 High Temperature							
	1. High pressure 2. Lift relief valve	S/E S/E	4 4	C C	5 5	1. Fire Protection System 2. relief valve	1. External heat
4.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Winterization	1. Cold weather
4.4 Low/No Flow							
	1. High pressure	S/E	4	C	5	1. Operating procedures	1. Plugged filter 2. Recovery Line Open 3. Plugged Line

Node: 5. FVCM Filters and Relief Valve/Relief Valve Discharge Line

Type: Vessel

Drawing: OM-090100-PID-D

Design Conditions/Parameters: MAWP 300 psig @ 150 F, 316 ss

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
5.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Equalization line	1. Plugged Filter
	2. Lift relief valve	S/E	4	B	5	2. Operating procedures	2. Equalization Line Plugged
	3. Personal exposure	S	4	C	5	3. relief valve	3. Closed Outlet Valve
	4. Blown O-Ring	S/E	4	C	5	4. Pressure Gauge	4. External Heat
5.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Operating procedures	
	3. Lift relief valve	S/E	4	B	5	3. relief valve	
	4. Personnel exposure	S	4	C	5		
5.3 Low Temperature							
	1. Frozen Line	S/E	3	D	5	1. Operating procedures	1. Cold weather
	2. No flow	S/E	4	C	5	2. Heat tracing on recovery line	
	3. High pressure	S/E	4	C	5		
5.4 Start-up/Shutdown Hazards							
	1. Personal exposure	S	4	C	5	1. Personal Protective Equipment	1. Operator error
	2. VCM release	S/E	3	D	5	2. Operating procedures	2. O-ring not installed
						3. Operator training	3. Lid bolts not tight

Node: 6. FVCM Filter Outlet Line To Reactors

Type: Line

Drawing: OM-090100-PID-D

Design Conditions/Parameters: Pipe Spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
6.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line plugged
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Valve closed
	3. Personal exposure	S	4	C	5	3. general monitor	3. External heat
	4. VCM release	S/E	3	D	5	4. Operating procedures	
						5. Personal Protective Equipment	
						6. Pressure Gauge	
						7. relief valve	
6.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	
	3. Lift relief valve	S/E	4	B	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Personal Protective Equipment	
	5. VCM release	S/E	3	D	5	5. relief valve	
						6. Temperature gauge	
						7. Temperature transmitter, 811748	
6.3 Low Temperature							
	1. Line freeze	S/E	4	C	5	1. Operating procedures	1. Cold weather
6.4 Reverse/Misdirected Flow							
	1. Overpressure batchwater stripper	S/E	3	D	5	1. Equipment Preventive Maintenance Program	1. Faulty relief valve
	2. Lift relief valve	S/E	4	C	5		

Node: 7. DM-013, FVCM Receiver Equalization Line

Type: Line

Drawing: OM-090100-PID-D

Design Conditions/Parameters: Pipe Spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
7.1 High Pressure							
	1. Personal exposure	S	4	C	5	1. Fire Protection System	1. Line plugged
	2. VCM release	S/E	3	D	5	2. Fixed point monitor	2. Valve closed
	3. Valve packing leaking	S/E	4	B	5	3. general monitor	3. External heat
	4. Gasket failure	S/E	4	C	5	4. DCS interlock, valve 81xv708	
7.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM release	S/E	3	D	5	5. Personal Protective Equipment	
7.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Pipe routing prevents standing water	1. Cold weather

Node: 8. DM-013, FVCM Receiver Drain Line	
Type: Line	Drawing: OM-090100-PID-D
Design Conditions/Parameters: Pipe Spec A2-22	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
8.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Valve packing leaking 4. VCM release	S/E S/E S/E S/E	3 4 4 3	D B B D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. Cold weather 2. Line blocked in with external heat (thermal expansion)
8.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. Valve packing leaking 5. VCM release	S/E S/E S/E S/E S/E	3 3 4 4 3	D D C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat
8.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Heat tracing 2. Operating procedures 3. Operator training	1. Cold weather
8.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure batchwater stripper 4. Personal exposure 5. VCM release	S/E S/E S/E S/E S/E	3 4 3 3 4	D C D C C	5 5 5 4 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. Operator error 2. Valve failure

Node: 9. FVCM Charge System Bypass Line	
Type: Line	Drawing: OM-090100-PID-D
Design Conditions/Parameters: Pipe Spec A2-22	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
9.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. Valve packing leaking 5. VCM release	S/E S/E S/E S/E S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Line plugged 3. Valve closed 4. Operator error
9.2 High Temperature							
	1. Fire and explosion 2. High pressure 3. Personal exposure 4. VCM release	S/E S/E S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Personal Protective Equipment	1. External heat
9.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Personal exposure 4. VCM release	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. Cold weather
9.4 Reverse/Misdirected Flow							
	1. If valve is left open and vcm transfer pumps are running , can't isolate unit.	S/E	3	C	4	1. Operating procedures 2. Operator training	1. Operator error

Node: 10. DM-013 Fill Line From FVCM Transfer Pumps	
Type: Line	Drawing: OM-090100-PID-D
Design Conditions/Parameters: Pipe Spec A2-22	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
10.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock, valve 81hv701	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fire Protection System	2. Line plugged
	3. Personal exposure	S/E	4	C	5	3. Fixed point monitor	3. Operator error
	4. Valve packing leaking	S/E	4	B	5	4. general monitor	4. Valve closed
	5. VCM release	S/E	3	D	5	5. Operating procedures	
						6. Personal Protective Equipment	
10.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock	1. External heat
	2. Personal exposure	S/E	4	C	5	2. Fire Protection System	
	3. VCM release	S/E	3	D	5	3. Fixed point monitor	
						4. general monitor	
						5. Operating procedures	
						6. Personal Protective Equipment	
10.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fire Protection System	
	3. Personal exposure	S/E	4	C	5	3. Fixed point monitor	
	4. VCM release	S/E	3	D	5	4. general monitor	
						5. Operating procedures	
						6. Personal Protective Equipment	

Node: 11. FVCM Charge Pump Recirculation Line	
Type: Line	Drawing: OM-090100-PID-D
Design Conditions/Parameters: Pipe Spec A2-22	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
11.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. Valve packing leaking 5. VCM release	S/E S/E S/E S/E S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge	1. External heat 2. Line plugged 3. Operator error 4. Valve closed 5. Valve failure
11.2 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S/E S/E	3 4 3	D C D	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat
11.3 Low Temperature							
	1. Frozen Line 2. High pressure 3. Fire and explosion 4. Personal exposure 5. VCM release	S/E S/E S/E S/E S/E	4 4 3 4 3	D C D C D	5 5 5 5 5	1. Operating procedures 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Personal Protective Equipment	1. Cold weather

Node: 12. MSPW Line To FVCM Charge Pumps	
Type: Line	Drawing: OM-090100-PID-D
Design Conditions/Parameters: Pipe Spec A2-3	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
12.1 High Temperature							
	1. Seal failure	S/E	4	D	5	1. Fire Protection System	1. External heat
12.2 Low Pressure							
	1. Seal failure 2. VCM Leak	S/E S/E	4 4	C C	5 5	1. Fire Protection System 2. Equipment Preventive Maintenance Program 3. Fixed point monitor 4. Operating procedures 5. Operator training 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Valve closed 4. Valve failure 5. Filter plugged 6. Power Failure
12.3 Low Temperature							
	1. Frozen Line 2. No flow 3. Seal failure 4. VCM Leak	S/E S/E S/E S/E	4 4 4 4	C D C C	5 5 5 5	1. Heat tracing 2. Fixed point monitor	1. Cold weather
12.4 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S/E S/E S/E	3 4 4 4	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Valve closed 4. Valve failure 5. Regulator failure

Node: 13. FVCM Charge Pump Recovery Line

Type: Line

Drawing: OM-090100-PID-D

Design Conditions/Parameters: Pipe Spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
13.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Overpressure batchwater stripper	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S/E	4	C	5	3. general monitor	3. Operator error
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	4. Valve closed
						5. Operator training	5. High pressure in batch water stripper
						6. Personal Protective Equipment	
						7. Pressure Gauge	
13.2 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Heat tracing	1. Cold weather
13.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Equipment Preventive Maintenance Program	1. Operator error
	2. Overpressure batchwater stripper	S/E	3	D	5	2. Operating procedures	2. Valve failure
	3. Personal exposure	S/E	4	C	5	3. Operator training	
	4. VCM release	S/E	4	C	5		

Node: 14. Recirculation Line Off FVCM Charge Filters

Type: Line

Drawing: OM-090100-PID-D

Design Conditions/Parameters: Pipe Spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
14.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S/E	4	C	5	3. general monitor	3. Operator error
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM release	S/E	4	C	5	5. Operator training	5. Valve failure
						6. Personal Protective Equipment	
						7. Pressure Gauge	
14.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Personal exposure	S/E	4	C	5	2. Fixed point monitor	
	3. VCM release	S/E	3	D	5	3. general monitor	
						4. Operating procedures	
						5. Personal Protective Equipment	
14.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM release	S/E	4	C	5	5. Personal Protective Equipment	

Node: 15. Relief Valve and RV discharge line off RVCM charge pump discharge line

Type: Line

Drawing: OM-090100-PID-D

Design Conditions/Parameters: Pipe Spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
15.1 High Pressure							
	1. Create heat in RVCM pump 2. Blow seal in RVCM pump 3. Fire and explosion 4. VCM Leak	S/E S/E S/E S/E	4 4 3 4	C C D C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Personal Protective Equipment 5. relief valve 6. Locking devices on relief valves 7. Operating procedures	1. External heat 2. High pressure in batch water stripper 3. Line plugged 4. Valve closed
15.2 High Temperature							
	1. Fire and explosion 2. High pressure 3. Personal exposure 4. VCM release	S/E S/E S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Personal Protective Equipment	1. External heat
15.3 Low Temperature							
	1. Frozen Line 2. No flow 3. VCM Leak	S/E S/E S/E	4 4 3	C C D	5 5 5	1. none 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Personal Protective Equipment	1. Cold weather

Node: 16. Recirculation header from VCM charge equipment to DM-013

Type: Line

Drawing: OM-090100-PID-D

Design Conditions/Parameters: Pipe Spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
16.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High pressure in batch water stripper
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Lift relief valve	S/E	4	C	5	3. general monitor	3. Valve closed
	4. Personal exposure	S/E	4	C	5	4. Locking devices on relief valves	
	5. VCM release	S/E	3	D	5	5. Personal Protective Equipment	
						6. relief valve	
						7. DCS interlock, valve 81xv709	
16.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	
	3. Overpressure batchwater stripper	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S/E	3	D	5	4. Personal Protective Equipment	
	5. VCM Leak	S/E	3	D	5	5. relief valve	
16.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	
	3. No flow	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Personal Protective Equipment	
	5. VCM Leak	S/E	4	C	5		

Node: 17. RVCM Charge Pump Discharge Line to FVCM Charge Pump Suction

Type: Line

Drawing: OM-090100-PID-D

Design Conditions/Parameters: Pipe Spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
17.1 High Pressure							
	1. Blow gasket	S/E	4	C	5	1. DCS interlocks, valve 81hv703	1. external heat
	2. Lift relief valve	S/E	4	C	5	2. Operating procedures	2. Plugged filter pack
	3. Valve packing leak	S/E	4	C	5	3. relief valve	3. Plugged relief valve
							4. Valve blocked in/closed
17.2 High Temperature							
	1. High pressure	S/E	4	C	5	1. Fire Protection System	1. External heat
	2. Lift relief valve	S/E	4	C	5	2. relief valve	
	3. Fire and explosion	S/E	3	D	5	3. Fixed point monitor	
	4. Personal exposure	S/E	3	D	5	4. general monitor	
						5. Personal Protective Equipment	
17.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Fire Protection System	1. Cold weather
	2. Fire and explosion	S/E	3	D	5	2. Fixed point monitor	
	3. Personal exposure	S/E	3	D	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Personal Protective Equipment	

Node: 18. Recovery Line Off FVCM Charge Filters

Type: Line

Drawing: OM-090100-PID-D

Design Conditions/Parameters: Pipe Spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
18.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Overpressure batchwater stripper	S/E	4	B	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Personal exposure	S/E	4	C	5	3. general monitor	3. Line plugged
	4. VCM Leak	S/E	4	B	5	4. Operating procedures	4. Operator error
						5. Operator training	5. Valve closed
						6. Personal Protective Equipment	
						7. Pressure Gauge	
18.2 Low Temperature							
	1. Frozen Line	S/E	4	B	5	1. Heat tracing	1. Cold weather
							2. Valve leaking through
							3. Heat tracing failure
18.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Equipment Preventive	1. Operator error
	2. Overpressure batchwater stripper	S/E	4	B	5	Maintenance Program	2. Valve failure
	3. Personal exposure	S/E	4	C	5	2. Operating procedures	
	4. VCM release	S/E	3	D	5	3. Operator training	
	5. Send VCM to recovery system	S/E	4	B	5	4. Fire Protection System	
						5. Fixed point monitor	
						6. general monitor	
						7. Personal Protective Equipment	

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 19. Steam Supply Line to charge water pick heater

Type: Line

Drawing: OM-090101-PID-D

Design Conditions/Parameters: pipe spec a2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
19.1 High Pressure							
	1. Gasket failure	S	4	B	5	1. Operating procedures	1. Line plugged
	2. Valve packing leaking	S	4	B	5	2. Operator training	2. Valve failure
	3. Line rupture	S	4	B	5	3. Pressure Gauge	3. Valve leaking through
	4. Scald hazard	S	4	B	5	4. Line insulation	
19.2 Low Pressure							
	1. Reverse flow of water into steam line resulting in water hammer and line rupture	S	4	B	5	1. Pressure Gauge	1. Cold weather 2. Operator error 3. Valve closed 4. Control Valve failure
19.3 Low Temperature							
	1. Frozen Line	S	4	B	5	1. Equipment Preventive Maintenance Program 2. Operator training	1. Cold weather

Node: 20. Charge water supply line to charge tank and process water filter

Type: Line + Vessel

Drawing: OM-090101-PID-D

Design Conditions/Parameters: Pipe Spec a2-3; Filter MAWP 300 psig @ 200 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
20.1 High Pressure							
	1. Gasket failure 2. Lift relief valve 3. Overpressure filter pack	S S S	4 4 4	C B C	5 5 5	1. relief valve 2. Operating procedures 3. Operator training	1. Line blocked in with external heat (thermal expansion)
20.2 Low Pressure							
	1. Reverse flow of steam into water line resulting in water hammer and line rupture	S	4	C	5	1. Operating procedures 2. Operator training 3. Pressure Gauge	1. Valve closed 2. Line plugged
20.3 High Temperature							
	1. Line rupture	S	4	C	5	1. Operator training 2. relief valve	1. Line blocked in with external heat (thermal expansion)
20.4 Low Temperature							
	1. Frozen Line 2. Gasket failure 3. Line rupture 4. No flow	S S S S	4 4 4 4	C C C B	5 5 5 5	1. Line insulation 2. Operating procedures 3. Operator training	1. Cold weather

Node: 21. Charge water pick heater and outlet line to charge tank TK-023

Type: Heat Exchanger + Line

Drawing: OM-090101-PID-D

Design Conditions/Parameters: Pipe Spec a13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
21.1 High Pressure							
	1. Line rupture 2. Valve packing leaking 3. Make hot water tank vibrate	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Operating procedures 2. Operator training	1. Line blocked in with external heat (thermal expansion) 2. Line plugged 3. Operator error 4. Valve closed 5. Valve failure 6. Valve leaking through
21.2 High Temperature							
	1. Gasket failure 2. High pressure 3. Line rupture 4. Overpressure filter pack 5. Valve packing leaking	S S S S S	4 4 4 4 4	B B C C B	5 5 5 5 5	1. Operating procedures 2. Temperature Indication 81T026	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Line plugged 4. Operator error 5. Valve closed 6. Valve leaking through
21.3 Low Temperature							
	1. Frozen Line	S	4	C	5	1. Line insulation	1. Cold weather

Node: 22. Hot water supply line to Brine Tank, TK-313

Type: Line

Drawing: OM-090101-PID-D

Design Conditions/Parameters: Pipe Spec a13-1, ss

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
22.1 High Pressure							
	1. Gasket failure 2. Line rupture	S S	4 4	C C	5 5	1. Operating procedures	1. External heat
22.2 High Temperature							
	1. Gasket failure 2. Line rupture	S S	4 4	C C	5 5	1. Operating procedures	1. External heat
22.3 Low Temperature							
	1. Frozen Line	S	4	C	5	1. Line insulation	1. Cold weather

Node: 22. Hot water supply line to Brine Tank, TK-313

Type: Line

Drawing: OM-090101-PID-D

Design Conditions/Parameters: Pipe Spec a13-1, ss

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
22.1 High Pressure							
1. Gasket failure 2. Line rupture		S S	4 4	C C	5 5	1. Operating procedures	1. External heat
22.2 High Temperature							
1. Gasket failure 2. Line rupture		S S	4 4	C C	5 5	1. Operating procedures	1. External heat
22.3 Low Temperature							
1. Frozen Line		S	4	C	5	1. Line insulation	1. Cold weather

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 23. Hot water charge tank, TK-023	
Type: Tank	Drawing: OM-090101-PID-D
Design Conditions/Parameters: 35,000 Gallon Atmos. Tank, Insulated	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
23.1 High Pressure							
	1. Tank rupture	S	4	C	5	1. Operating procedures 2. sight glass 3. Vents 4. Overflows 5. Temperature Indicator 81T008 6. Level Indicator 81L006	1. Overflow plugged 2. vent plugged 3. External heat
23.2 High Temperature							
	1. Tank rupture	S	4	C	5	1. Temperature Indicator 81T008 2. sight glass 3. Tank insulation	1. External heat 2. Valve failure 3. Water addition valve failure- 81H007

Node: 24. Hot water supply line to rinse pump	
Type: Line	Drawing: OM-090101-PID-D
Design Conditions/Parameters: Pipe Spec a2-3	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
24.1 High Pressure							
	1. Gasket failure 2. Line rupture 3. Valve packing leaking	S S S	4 4 4	C D C	5 5 5	1. Operating procedures	1. Line plugged 2. Valve closed 3. Valve failure 4. Valve leaking through
24.2 High Temperature							
	1. Gasket failure 2. Line rupture 3. Valve packing leaking	S S S	4 4 4	C D C	5 5 5	1. Operating procedures	1. External heat
24.3 Low Temperature							
	1. Frozen Line	S	4	C	5	1. Heat tracing 2. Operator training	1. Cold weather

Node: 25. Hot water charge line from charge tank through charge pumps and charge filters

Type: Centrifugal Pump + Line + Vessel

Drawing: OM-090101-PID-D

Design Conditions/Parameters: Pipe spec a13-1; Pumps 3x4-13-11, 450 GPM @ 150 psig; Filter MAWP 300 psig @ 190 F.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
25.1 High Pressure							
	1. Gasket failure	S	4	C	5	1. Operating procedures	1. External heat
	2. Lift relief valve	S	4	A	5	2. Pressure Gauge	2. Line plugged
	3. Line rupture	S	4	D	5	3. relief valve	3. Valve closed
	4. Overpressure filter pack	S	4	C	5		4. Valve failure
	5. Seal failure	S	4	C	5		5. Filter plugged
	6. Valve packing leaking	S	4	C	5		
25.2 High Temperature							
	1. Gasket failure	S	4	C	5	1. Operating procedures	1. External heat
	2. Lift relief valve	S	4	B	5	2. relief valve	
	3. Line rupture	S	4	D	5	3. Temperature Indicator 81T020	
	4. Seal failure	S	4	C	5		
	5. Valve packing leaking	S	4	C	5		
25.3 Low Temperature							
	1. Frozen Line	S	4	C	5	1. Line insulation	1. Cold weather

Node: 26. Decal System; includes filters, decal tank, and piping

Type: Line + Vessel

Drawing: OM-090101-PID-D

Design Conditions/Parameters: filters MAWP 300 psig @ 190 F, Decal tank MAWP 250 psig, pipe spec a13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
26.1 High Pressure							
	1. Gasket failure	S	4	C	5	1. Operating procedures	1. External heat
	2. Lift relief valve	S	4	B	5	2. relief valve	2. Filter Plugged
	3. Line rupture	S	4	D	5		3. Line plugged
	4. Tank rupture	S	4	D	5		4. Valve closed
							5. Valve failure
							6. Valve leaking through
26.2 High Temperature							
	1. Gasket failure	S	4	C	5	1. Line insulation	1. External heat
	2. High pressure	S	4	C	5	2. Operating procedures	2. Filter Plugged
	3. Lift relief valve	S	4	B	5	3. Operator training	3. Line plugged
	4. Line rupture	S	4	C	5	4. Pressure Gauge	4. Operator error
	5. Seal failure	S	4	C	5	5. relief valve	5. Valve closed
	6. Tank rupture	S	4	C	5	6. Tank insulation	6. Valve failure
						7. Temperature gauge	7. Valve leaking through
26.3 Low Temperature							
	1. Frozen Line	S	4	C	5	1. Heat tracing	1. Cold weather
						2. Line insulation	
						3. Tank insulation	

Node: 27. Cold water Supply to charge water pumps. Also supplies wet calcium stearate and brine tank.

Type: Line

Drawing: OM-090101-PID-D

Design Conditions/Parameters: Pipe spec a2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
27.1 High Pressure							
	1. Gasket failure 2. Line rupture 3. Valve packing leaking	S S S	4 4 4	C D C	5 5 5	1. Operating procedures	1. Control Valve failure 2. Line plugged 3. Operator error 4. Valve closed 5. Valve failure 6. Valve leaking through
27.2 High Temperature							
	1. Gasket failure 2. Line rupture 3. Seal failure 4. Valve packing leaking	S S S S	4 4 4 4	C D C C	5 5 5 5	1. Line insulation 2. Operating procedures	1. Control Valve failure 2. External heat 3. Line plugged 4. Valve closed 5. Valve failure
27.3 Low Temperature							
	1. Frozen Line	S	4	C	5	1. Heat tracing 2. Line insulation	1. Cold weather

Node: 28. Hot water make-up from centrate heat recovery system to hot water charge tank.

Type: Line + Vessel

Drawing: OM-090101-PID-D

Design Conditions/Parameters: 250 GPM, 200 Deg F, Pipe spec A2-3 to FL-102, A13-1 from FL-102. FL-102, MAWP 150 psig @ 500 F.
MOC CS.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
28.1 High Pressure							
	1. Gasket failure 2. Lift relief valve 3. Line rupture	S S S	4 4 4	C B C	5 5 5	1. Operating procedures 2. relief valve	1. External heat 2. Filter Plugged 3. Valve closed 4. Relief Valve failure
28.2 High Temperature							
	1. Gasket failure 2. High pressure 3. Lift relief valve 4. Overpressure filter pack	S S S S	4 4 4 4	C C B C	5 5 5 5	1. Operating procedures 2. relief valve	1. External heat
28.3 Low Temperature							
	1. Frozen Line	S	4	C	5	1. Line insulation	1. Cold weather

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 29. Process water supply to charge pumps. Intent is a back-up water source.

Type: Line

Drawing: OM-090101-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
29.1 High Pressure							
1. Line rupture		S	4	C	5	1. Operating procedures	1. External heat 2. Line plugged
29.2 Low Temperature							
1. Frozen Line		S	4	C	5	1. Line insulation	1. Cold weather

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 30. Decal water supply line to rinse tank.

Type: Line

Drawing: OM-090101-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
30.1 High Pressure							
	1. Gasket failure 2. Line rupture 3. Valve packing leaking	S S S	4 4 4	C D C	5 5 5	1. Operating procedures 2. Pressure Gauge	1. External heat 2. Filter Plugged 3. Line plugged 4. Valve closed 5. Valve failure 6. Valve leaking through
30.2 Low Temperature							
	1. Frozen Line	S	4	C	5	1. Line insulation	1. Cold weather

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 31. Decal Tank drain line from rinse tank.

Type: Line

Drawing: OM-090101-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
31.1 High Pressure							
1. no consequences							
31.2 Low Temperature							
1. Frozen Line		S	4	C	5	1. Line insulation	1. Cold weather

Node: 32. Brine supply line to Decal tank from brine make-up	
Type: Line	Drawing: OM-090101-PID-D
Design Conditions/Parameters: Pipe spec A13-1	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
32.1 Low/No Flow							
	1. no consequences						
32.2 Reverse/Misdirected Flow							
	1. No consequences						
32.3 High Pressure							
	1. No consequences						

Node: 33. Old Module reactors: 300,400,500,600,700.

Type: Reactor

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: RX-300-600, MAWP 200 psig @ 200 F; RX-700 25 psig @ 250 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
33.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Seal failure 6. Valve packing leaking 7. Vessel rupture 8. O-Ring failure 9. Valve failure 10. Condenser Tube failure	S/E S/E S/E S S S S/E S/E S/E S/E	3 4 4 4 4 4 3 4 4 4	D C C C D B D C C C	5 5 5 5 5 5 5 5 5 5	1. Fire Protection System 2. Equipment Preventive Maintenance Program 3. Fixed point monitor 4. general monitor 5. Maintenance & operating procedures 6. Operator training 7. Personal Protective Equipment 8. Pressure Gauge 9. multiple relief valves 10. Temperature gauge 11. Temperature Indication 81T164 12. Temperature Indication 81T161 13. Temperature Indication 81T156A 14. Pressure Indication 81P162 15. Pressure Indication 81P163 16. Agitator Run Indication 81H170 17. Amp Indication 81I172 18. Auto Kill Program- activates on high pressure 19. Emergency Manual Kill Procedure	1. External heat 2. Operator error 3. Relief Valve failure 4. Valve closed 5. Valve failure 6. Valve leaking through 7. Instrument failure 8. Agitator failure 9. Power failure 10. Steam Control Valve failure 11. Cooling Water Control Valve failure 12. Catalyst water addition valve left on 13. Too much catalyst 14. Charging System Malfunction 15. Too many inerts 16. Too much lip seal water 17. Too much spray head flow 18. Recovery line plugged 19. Inert Vent line plugged
33.2 High Temperature							
	1. See High Pressure					1. See High Pressure	1. See High Pressure
33.3 Low Pressure							
	1. none					1. none	1. none
33.4 Low Temperature							
	1. High pressure 2. High temperature 3. Fire and explosion 4. Personal exposure 5. Vessel rupture 6. Lift relief valve	S/E S/E S/E S S/E S/E	4 4 3 4 3 4	B B D C D C	5 5 5 5 5 5	1. Operating procedures 2. Operator training 3. Temperature Indication 81T164 4. Temperature Indication 81T156A 5. Agitator Amp indication 81I172	1. Possible batch separation
33.5 High Level							
	1. Fire and explosion 2. High pressure 3. High temperature 4. Lift relief valve 5. O-Ring failure 6. Personal exposure 7. Seal failure 8. VCM Leak	S/E S/E S/E S/E S/E S S/E S/E	3 4 4 3 4 4 4 4	D C C D C C D C	5 5 5 5 5 5 5 5	1. Redundant charge meters 2. Operating procedures 3. Dump line bulls-eye	1. Operator error 2. Charge meter failure 3. Too much flush water 4. Incomplete dump

Node: 34. VCM Charge line to RX-300,400,500,600,700	
Type: Line	Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D
Design Conditions/Parameters: Pipe spec A2-22	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
34.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Instrument failure
	3. Line rupture	S/E	3	D	5	3. general monitor	3. Line plugged
	4. No flow	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	5. Valve closed
	6. VCM Leak	S/E	4	C	5	6. DCS interlock-abort charge on high reactor pressure	6. High Pressure in Reactor
34.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. O-Ring failure	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
34.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Fire Protection System	1. Cold weather
	2. VCM Leak	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
						3. general monitor	
						4. Operating procedures	
						5. Personal Protective Equipment	
34.4 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High Pressure in Reactor
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Instrument failure
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Operator error
						4. Maintenance & operating procedures	4. Valve failure
						5. Personal Protective Equipment	5. Pump failure
						6. DCS interlock - vcm charge valves cannot be open at the same time as dump and rinse valves.	
						7. Low flow shutdown	
						8. DCS interlock - abort vcm charge on low flow.	

Node: 35. Water charge line to RX-300,400,500,600,700

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
35.1 High Pressure							
	1. Gasket failure 2. Fire and explosion 3. VCM Leak	S/E S/E S/E	4 3 4	C D C	5 5 5	1. DCS interlock- charge program shutdown on high reactor pressure 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Personal Protective Equipment	1. External heat 2. Line plugged 3. Operator error 4. Pump failure 5. Valve closed 6. Valve failure 7. Check valve failure 8. High Pressure in Reactor
35.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. High pressure 4. O-Ring failure 5. Personal exposure 6. VCM Leak	S/E S/E S/E S/E S S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Operator error
35.3 Low Temperature							
	1. Frozen Line 2. High pressure	S/E S/E	4 4	C C	5 5	1. Line insulation	1. Cold weather
35.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak	S/E S/E S/E	3 4 4	D C D	5 5 5	1. DCS interlock- charge water valve can only open during charge and open dump mode. 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Low flow shutdown 6. Maintenance & operating procedures 7. Personal Protective Equipment 8. DCS interlock- abort water charge on low flow.	1. High Pressure in Reactor 2. Instrument failure 3. Operator error 4. Pump failure 5. Valve failure

Node: 36. Rinse water line to RX condenser, shell, and dump header. RX-300,400,500,600,700.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A2-3,A13-2

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
36.1 High Pressure							
	1. Gasket failure 2. Line rupture 3. Valve packing leaking	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Operating procedures 2. Operator training 3. Recycle line on rinse pump, pp-229, thru valve, 81h018.	1. External heat 2. High Pressure in Reactor 3. Line plugged 4. Valve closed 5. Valve leaking through
36.2 High Temperature							
	1. High pressure 2. Line rupture	S/E S/E	4 4	C C	5 5	1. Fire Protection System 2. Operating procedures 3. Operator training	1. External heat
36.3 Low Temperature							
	1. Frozen Line 2. Line rupture 3. Valve failure	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Line insulation 2. Operating procedures 3. Operator training	1. Cold weather
36.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. High pressure 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. DCS interlock - valve 81h145 will open if RX pressure < 120 psig and all other reactor flush header valves are closed. 2. DCS interlock - valve 81hv138. Won't open unless RX in dump and all other RX rinse valves closed 3. Fire Protection System 4. Fixed point monitor 5. general monitor 6. Operator training 7. Personal Protective Equipment 8. Check valve	1. High Pressure in Reactor 2. Operator error 3. Power failure 4. Pump failure 5. Valve failure 6. Valve leaking through

Node: 37. F-50 charge line to RX-300,400,500,600,700.	
Type: Line	Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D
Design Conditions/Parameters: Pipe spec A13-1	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
37.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training 8. Personal Protective Equipment	1. Cold weather 2. External heat 3. Filter Plugged 4. High Pressure in Reactor 5. Line plugged 6. Operator error 7. Valve closed 8. Valve failure
37.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. High pressure 4. Line rupture 5. Personal exposure 6. Valve packing leaking 7. VCM Leak	S/E S/E S/E S/E S/E S/E S/E	3 4 4 4 4 4 4	D C C C C C C	5 5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Heat tracing failure 3. Operator error
37.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. No flow 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Heat tracing 8. Line insulation	1. Cold weather
37.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak 4. VCM release	S/E S/E S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Check valve 2. DCS interlock - valve 81hv110. Won't open unless RX in charge and all other RX F-50 valves closed 3. Fire Protection System 4. Fixed point monitor 5. general monitor 6. Operator training 7. Personal Protective Equipment 8. DCS interlock - abort F-50 charge on low flow	1. High Pressure in Reactor 2. Operator error 3. Power failure 4. Pump failure 5. Valve failure 6. Valve leaking through

Node: 38. Alcotex charge line to RX-300,400,500,600,700.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
38.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. External heat
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Filter Plugged
	4. Personal exposure	S/E	4	C	5	4. Heat tracing	4. High Pressure in Reactor
	5. VCM Leak	S/E	4	C	5	5. Line insulation	5. Line plugged
						6. Operating procedures	6. Operator error
						7. Operator training	7. Valve closed
						8. Personal Protective Equipment	8. Valve failure
38.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. High pressure	S/E	4	C	5	3. general monitor	3. Operator error
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S/E	4	C	5	5. Operator training	
	6. Valve packing leaking	S/E	4	C	5	6. Personal Protective Equipment	
	7. VCM Leak	S/E	4	C	5		
38.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Heat tracing	
	5. VCM Leak	S/E	4	C	5	5. Line insulation	
						6. Operating procedures	
						7. Operator training	
						8. Personal Protective Equipment	
38.4 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. High Pressure in Reactor
	2. Personal exposure	S/E	4	C	5	2. DCS interlock - valve 81hv111.	2. Operator error
	3. VCM Leak	S/E	4	C	5	Won't open unless RX in charge	3. Power failure
	4. VCM release	S/E	3	D	5	or poly and all other RX Alcotex	4. Pump failure
						valves closed	5. Valve failure
						3. Fire Protection System	6. Valve leaking through
						4. Fixed point monitor	
						5. general monitor	
						6. Operator training	
						7. Personal Protective Equipment	
						8. DCS interlock - Abort alcotex	
						charge on low flow.	

Node: 39. Alcotex line to rinse header.

Type: Line

Drawing: OM-090102-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
39.1 High Pressure							
	1. Gasket failure	S/E	4	C	5	1. Operating procedures	1. External heat
	2. Line rupture	S/E	4	C	5	2. Operator training	2. High Pressure in Reactor
	3. Valve leaking	S/E	4	C	5		3. Line plugged
							4. Operator error
							5. Valve closed
39.2 High Temperature							
	1. Gasket failure	S/E	4	C	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Operating procedures	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. Operator training	3. Operator error
	4. Valve packing leaking	S/E	4	C	5	4. Personal Protective Equipment	
39.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Heat tracing	1. Cold weather
	2. Line rupture	S/E	4	C	5	2. Line insulation	
	3. No flow	S/E	4	C	5	3. Operating procedures	
						4. Operator training	

Node: 40. External Dump Line. Rx-300,400,500,600,700.	
Type: Line	Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D
Design Conditions/Parameters: Pipe spec B13-22	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
40.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. External heat 2. High Pressure in Reactor 3. Instrument failure 4. Line plugged 5. Operator error 6. Valve closed
40.2 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak	S/E S/E S/E	3 4 4	D C C	5 5 5	1. DCS interlock - Dump valve can only be open in closed dump mode. 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Maintenance & operating procedures 6. Personal Protective Equipment 7. Dump line bullseye 8. Dump pump amp indication	1. Instrument failure 2. Operator error 3. Pump failure 4. Valve failure 5. High pressure in dump tank
40.3 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. High pressure 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Operator error

Node: 41. Atmospheric Dump Line. Rx-300,400,500,600,700.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A13-5

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
41.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Instrument failure
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Line plugged
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Operator error
						6. DCS interlock - Dump valve can only be open in atmospheric dump mode.	6. Valve closed
						7. Pressure Gauge	7. Valve failure
							8. Valve leaking through
41.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 42. Seal Oil supply and return lines to Rx-300,400,500,600,700.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A13-2, J16-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
42.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Filter Plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Heat tracing failure
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Instrument failure
	5. Seal failure	S/E	4	B	5	5. Operator training	5. Line plugged
	6. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	6. Operator error
						7. Pressure Gauge	7. Valve closed
						8. relief valve	8. Valve failure
						9. Pressure transmitter, 81P171	
42.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Instrument failure
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Line blocked in with external heat (thermal expansion)
	5. Seal failure	S/E	4	C	5	5. Operator training	
	6. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	
42.3 Low Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. No flow	S/E	4	C	5	2. Fixed point monitor	2. Power failure
	3. Personal exposure	S/E	4	C	5	3. Operating procedures	3. Pump failure
	4. Reverse flow	S/E	4	C	5	4. Operator training	4. Seal failure
	5. Seal failure	S/E	4	C	5	5. Personal Protective Equipment	5. Valve closed
	6. Valve leaking	S/E	4	C	5	6. Pressure Gauge	6. Valve leaking through
	7. VCM Leak	S/E	4	C	5	7. Pressure transmitter, 81P171	7. Line leak/rupture
							8. Instrument failure
42.4 Low Temperature							
	1. High pressure	S/E	4	C	5	1. Fire Protection System	1. Heat tracing failure
	2. Fire and explosion	S/E	3	D	5	2. Fixed point monitor	2. Instrument failure
	3. Gasket failure	S/E	4	C	5	3. general monitor	3. Cold weather
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S/E	4	C	5	5. Operator training	
	6. Seal failure	S/E	4	C	5	6. Pressure transmitter, 81P171	
	7. VCM Leak	S/E	4	C	5	7. Heat tracing	
						8. Line insulation	

Node: 43. Cooling Water supply and return lines for RX condenser & jacket. Rx-300,400,500,600,700.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
43.1 High Temperature							
	1. Run away reaction		3	D	5	1. Fire Protection System 2. general monitor 3. Auto/emergency kill system 4. Auto kill program 5. Flow indication, 81F156A/B 6. Temperature indication, 81T156B 7. Temperature gauge	1. Cooling Water Control Valve failure 2. External heat 3. Line plugged 4. Operator error 5. Power failure 6. Pump failure 7. Valve closed
43.2 High Pressure							
	1. Gasket failure 2. Lift relief valve 3. Line rupture 4. Control valve failure 5. Damage condenser	S/E S/E S/E S/E S/E	4 4 4 4 4	C C C C C	5 5 5 5 5	1. Operating procedures 2. Operator training 3. relief valve	1. Cooling Water Control Valve failure 2. External heat 3. Instrument failure 4. Line plugged 5. Operator error 6. Relief Valve failure 7. Valve closed

Node: 44. MSPW flush line to Rx seal. Rx-300,400,500,600,700.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A13-1, J16-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
44.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fixed point monitor	1. Control Valve failure
	2. Line rupture	S/E	4	C	5	2. general monitor	2. Instrument failure
	3. Seal failure	S/E	4	C	5	3. Operating procedures	3. Line plugged
	4. Valve leaking	S/E	4	C	5	4. Operator training	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve closed
						6. Pressure Gauge	6. Valve failure
44.2 High Temperature							
	1. High pressure	S/E	4	C	5	1. Operating procedures	1. External heat
						2. Operator training	2. Line blocked in with external heat (thermal expansion)
44.3 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fixed point monitor	1. Control Valve failure
	2. Line rupture	S	4	C	5	2. general monitor	2. Instrument failure
	3. Seal failure	S	4	C	5	3. Operating procedures	3. Line plugged
	4. Valve leaking	S	4	C	5	4. Operator training	4. Operator error
	5. VCM Leak	S	4	C	5	5. Personal Protective Equipment	5. Valve closed
						6. Flow meter	6. Valve failure

Node: 45. Clean wall supply line. Rx-300,400,500,600,700.	
Type: Line	Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D
Design Conditions/Parameters: Pipe spec A13-1	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
45.1 High Pressure							
	1. Gasket failure 2. Line rupture	S/E S/E	4 4	C C	5 5	1. Maintenance & operating procedures 2. Pressure Gauge at pump 3. relief valve at pump	1. Line plugged 2. Valve closed 3. Valve leaking through 4. RX nozzle plug 5. High Pressure in Reactor
45.2 High Temperature							
	1. Gasket failure 2. High pressure 3. Line rupture	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Pressure Gauge	1. External heat 2. Line leak/rupture 3. Line plugged 4. Operator error 5. RX nozzle plug 6. Valve closed 7. Valve leaking through
45.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Line insulation	1. Cold weather
45.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Line rupture 5. Personal exposure 6. VCM Leak 7. No flow	S/E S/E S/E S/E S/E S/E S/E	3 4 4 4 4 4 4	D C C C C C C	5 5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. Line leak/rupture 2. Line plugged 3. Operator error 4. Power failure 5. Pump failure 6. RX nozzle plug 7. Valve leaking through

Node: 46. Auto Kill (Isonox) line to Rx. RX-300,400,500,600.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D

Design Conditions/Parameters: Pipe Spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
46.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training 8. Personal Protective Equipment	1. High Pressure in Reactor 2. Line plugged 3. Operator error 4. Valve closed 5. RX nozzle plug 6. Valve leaking through
46.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Line plugged 3. Operator error 4. Valve closed
46.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. No flow 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training 8. Personal Protective Equipment	1. Cold weather
46.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. DCS interlock - Auto kill valve on other reactors must be closed to open 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Pressure Gauge	1. High Pressure in Reactor 2. Line leak/rupture 3. Operator error 4. Power failure 5. Pump failure 6. Valve failure 7. Valve leaking through

Node: 47. MSPW Flush line to rinse nozzle & slow vent. Rx-300,400,500,600,700.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
47.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. High Pressure in Reactor 3. Line blocked in with external heat (thermal expansion) 4. Operator error
47.2 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak 4. Hydro fill the reactor 5. VCM release	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Check valve 2. DCS interlock-All RX slow vent valves must be closed & recovery system discharge pressure is < 110 psig (81p759) before slow vent flush valve will open. 3. Fire Protection System 4. Fixed point monitor 5. Flow meter 6. general monitor 7. Operating procedures 8. Operator training 9. Personal Protective Equipment	1. Line leak/rupture 2. Operator error 3. Valve leaking through 4. Pump failure
47.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Gasket failure 4. Line rupture 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation	1. Cold weather 2. Valve leaking through

Node: 48. Reactor recovery line including slow vent. Rx-300,400,500,600,700	
Type: Line	Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D
Design Conditions/Parameters: Pipe spec A2-22	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
48.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Line plugged 3. Valve closed 4. Valve leaking through 5. Operator error
48.2 Low/No Flow							
	1. Overpressure reactor	S/E	4	C	5	1. Operating procedures 2. Operator training	1. Line plugged 2. Operator error 3. Valve closed
48.3 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S/E S/E	3 4 4	D C C	5 5 5	1. DCS interlock - vent valve won't open unless in poly (similar on all rx's); main recovery valve, 81H131, won't open unless atmospheric vent closed and evac valve closed (similar on all rx); condenser recovery valve will not open unless similar valve on other rx's closed. 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. Operator error 2. Valve leaking through

Node: 49. Atmospheric Vent. RX-300,400,500,600,700.	
Type: Line	Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D
Design Conditions/Parameters: Pipe spec A2-22	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
49.1 Low/No Flow							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure reactor 4. Personal exposure 5. VCM release 6. Can't completely dump reactor	S/E S/E S/E S/E S/E S/E	3 3 3 4 4 4	D D D C D C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. relief valve 7. Abort charge on high pressure if reactor was not emptied 8. Agitator amps would indicate reactor not empty 9. Dump timer would indicate abnormally long dump	1. Line plugged 2. Valve failure
49.2 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S/E S/E	3 4 3	D C D	5 5 5	1. DCS interlock-vent won't open unless rx pressure < 8 psig and main recovery valve closed, 81H131. similar on all rx. 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure indication, 81P162/163	1. Operator error 2. Valve failure 3. Valve leaking through

Node: 50. Rx evacuation line. Rx-300,400,500,600,700

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A2-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
50.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. VCM Leak	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. DCS interlock - Won't open unless Evac header pressure less than 5 psig (81P080) and main recovery valve closed, 81H131.	1. Line plugged 2. Operator error 3. Valve failure 4. Valve leaking through
50.2 Low/No Flow							
	1. Can't evac reactor 2. High pressure during next charge	S/E S/E	4 4	C C	5 5	1. Abort charge on high pressure if reactor was not emptied 2. Operator training	1. Line plugged 2. Operator error 3. Valve closed 4. Valve failure 5. Steam jets broke
50.3 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. VCM Leak	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. DCS interlock - Won't open unless Evac header pressure less than 5 psig (81P080) and main recovery valve closed, 81H131. 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Valve position indicator on valve stem	1. Line plugged 2. Operator error 3. Valve failure 4. Valve leaking through

Node: 51. Nitrogen line to emergency kill valves. Rx-300,400,500,600,700.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec B2-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
51.1 Low Pressure							
	1. Valves won't open	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Fire and explosion	S/E	3	D	5	2. Fixed point monitor	2. Line leak/rupture
	3. Lift relief valve	S/E	4	D	5	3. general monitor	3. Line plugged
	4. Overpressure reactor	S/E	4	C	5	4. Operating procedures	4. Valve failure
	5. Personal exposure	S/E	4	C	5	5. Operator training	5. Nitrogen bottle empty
	6. VCM release	S/E	4	C	5	6. Personal Protective Equipment	6. Operator error
						7. Valve indication	
51.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Overpressure reactor	S/E	3	D	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM release	S/E	4	C	5	5. Operator training	
	6. Solenoid failure	S/E	4	C	5	6. Personal Protective Equipment	
						7. Valve indication	
51.3 High Pressure							
	1. Line rupture	S/E	4	C	5	1. Operating procedures	1. External heat
	2. O-Ring failure	S/E	4	C	5	2. Operator training	2. Instrument failure
	3. Actuator failure	S/E	4	C	5		3. Line plugged
							4. Operator error
							5. Valve failure

Node: 52. Emergency kill (AMS) line to Rx-300,400,500,600,700. W/ nitrogen operated valves.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec B2-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
52.1 High Pressure							
	1. Line rupture	S/E	4	C	5	1. Fire Protection System	1. Instrument failure
	2. Valve failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Fire and explosion	S/E	4	C	5	3. general monitor	3. Line leak/rupture
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	4. Valve failure
	5. AMS release	S/E	4	C	5	5. Operator training	5. Operator error
						6. Pressure Gauge	
						7. HNU unit	
52.2 Low Pressure							
	1. No flow	S/E	4	C	5	1. Fire Protection System	1. Line leak/rupture
	2. Fire and explosion	S/E	3	D	5	2. Fixed point monitor	2. Operator error
	3. Lift relief valve	S/E	4	C	5	3. general monitor	3. Valve failure
	4. Line rupture	S/E	4	C	5	4. Operating procedures	4. Valve leaking through
	5. Overpressure reactor	S/E	4	C	5	5. Operator training	
	6. VCM release	S/E	4	C	5	6. Personal Protective Equipment	
						7. Pressure Gauge	
52.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Operating procedures	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Operator training	2. Valve leaking through
	3. Lift relief valve	S/E	4	C	5		
	4. Overpressure reactor	S/E	4	C	5		
	5. Personal exposure	S/E	4	C	5		
	6. VCM release	S/E	4	C	5		

Node: 53. Emergency kill (AMS) line to Rx-300,400,500,600,700. W/ manual operated valves.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec B2-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
53.1 Low Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line leak/rupture
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve failure
	4. No flow	S/E	4	C	5	4. Operating procedures	4. Valve leaking through
	5. Overpressure reactor	S/E	4	C	5	5. Operator training	
	6. VCM release	S/E	4	C	5	6. Personal Protective Equipment	
53.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Operating procedures	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Operator training	2. Valve leaking through
	3. Lift relief valve	S/E	4	C	5		
	4. Overpressure reactor	S/E	3	D	5		
	5. Personal exposure	S/E	4	C	5		
	6. VCM release	S/E	4	C	5		
53.3 High Pressure							
	1. AMS release	S/E	4	C	5	1. Fire Protection System	1. Instrument failure
	2. Fire and explosion	S/E	3	D	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line leak/rupture
	4. Valve failure	S/E	4	C	5	4. HNU unit	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	5. Valve failure
						6. Operator training	
						7. Pressure Gauge	

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 54. Steam supply to Rx jacket on Rx-300,400,500,600.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
54.1 High Flow							
1. No consequences							
54.2 Low/No Flow							
1. No consequences							
54.3 Reverse/Misdirected Flow							
1. No consequences							

Node: 55. Stripping steam supply line to Rx-300,400,500,600,700.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
55.1 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak 5. Overpressure reactor	S/E S/E S/E S/E S	3 4 4 4 3	D C C C D	5 5 5 5 5	1. DCS interlock-steam supply valve will not open unless steam pressure > 120 psig and recovery valves, 81H130 & 81H131 are open 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Personal Protective Equipment	1. Line leak/rupture 2. Line plugged 3. Valve closed 4. Low steam pressure 5. Valve leaking through
55.2 High Pressure							
	1. Line rupture 2. Reverse flow 3. Fire and explosion 4. Personal exposure 5. VCM release	S/E S/E S/E S/E S/E	4 4 3 4 4	C C D C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. External heat 2. Line plugged 3. Valve failure 4. Valve leaking through 5. Operator error

Node: 56. Catalyst charge line to Rx-300,400,500,600,700.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec B13-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
56.1 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Operating procedures	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Operator training	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. Personal Protective Equipment	3. Line plugged
	4. Personal exposure	S/E	4	C	5	4. Fire Protection System	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Fixed point monitor	
						6. general monitor	
56.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Heat tracing	
						7. Line insulation	
56.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. High Pressure in Reactor
	2. Line rupture	S/E	4	C	5	2. DCS interlock-Valve will only open in poly mode, must have enable from lead operator, and has timer to alert lead operator that charge valve has been open a long time.	2. Line leak/rupture
	3. Personal exposure	S/E	4	C	5	3. Fire Protection System	3. Operator error
	4. VCM Leak	S/E	4	C	5	4. Fixed point monitor	4. Power failure
						5. general monitor	5. Valve failure
						6. Operating procedures	6. Valve leaking through
						7. Operator training	7. Low HPSW pressure
						8. Personal Protective Equipment	
						9. Valve indication	
56.4 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Line blocked in with external heat (thermal expansion)
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Ram valve	

Node: 57. Water line to reactor stripping steam line. Rx-500	
Type: Line	Drawing: OM-090104-PID-D
Design Conditions/Parameters: Pipe spec A2-3	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
57.1 No Items							
1. Node found not to exist during Hazop analysis.							

Node: 58. Low Mole Sweco (atmospheric) dump line. Rx-600,700.

Type: Line

Drawings: OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A13-5

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
58.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock - Dump valve can only be open in atmospheric dump mode.	1. External heat
	2. Gasket failure	S/E	4	C	5		2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5		3. Instrument failure
	4. Personal exposure	S/E	4	C	5	2. Fire Protection System	4. Line plugged
	5. VCM Leak	S/E	4	C	5	3. Fixed point monitor	5. Operator error
						4. general monitor	6. Valve closed
						5. Operating procedures	7. Valve failure
						6. Personal Protective Equipment	8. Valve leaking through
						7. Pressure Gauge	
58.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 59. GH-20 charge line. Rx-600,700.

Type: Line

Drawings: OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
59.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. External heat
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Filter Plugged
	4. Personal exposure	S/E	4	C	5	4. Heat tracing	4. High Pressure in Reactor
	5. VCM Leak	S/E	4	C	5	5. Line insulation	5. Line plugged
						6. Operating procedures	6. Operator error
						7. Operator training	7. Valve closed
						8. Personal Protective Equipment	8. Valve failure
59.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. High pressure	S/E	4	C	5	3. general monitor	3. Operator error
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S/E	4	C	5	5. Operator training	
	6. Valve packing leaking	S/E	4	C	5	6. Personal Protective Equipment	
	7. VCM Leak	S/E	4	C	5		
59.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Heat tracing	
	5. VCM Leak	S/E	4	C	5	5. Line insulation	
						6. Operating procedures	
						7. Operator training	
						8. Personal Protective Equipment	
59.4 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. High Pressure in Reactor
	2. Personal exposure	S	4	C	5	2. DCS interlock - Abort GH-20 charge on low flow.	2. Operator error
	3. VCM Leak	S/E	4	C	5	3. DCS interlock - valve 81hv412. Won't open unless RX in charge and all other RX GH-20 valves closed	3. Power failure
	4. VCM release	S/E	4	C	5	4. Fire Protection System	4. Pump failure
						5. Fixed point monitor	5. Valve failure
						6. general monitor	6. Valve leaking through
						7. Operator training	
						8. Personal Protective Equipment	

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 60. Branch cooling water line to Rx jacket from cooling water supply header. Rx-600,700.

Type: Line

Drawings: OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
60.1 High Pressure							
	1. Damage condenser	S/E	4	C	5	1. Operating procedures	1. Cooling Water Control Valve failure
	2. Gasket failure	S/E	4	C	5	2. Operator training	2. External heat
	3. Lift relief valve	S/E	4	C	5	3. relief valve	3. Instrument failure
	4. Line rupture	S/E	4	C	5		4. Line plugged
							5. Operator error
							6. Relief Valve failure
							7. Valve closed
60.2 High Temperature							
	1. Run away reaction	S/E	4	C	5	1. Auto kill program	1. Cooling Water Control Valve failure
						2. Auto/emergency kill system	2. External heat
						3. Fire Protection System	3. Line plugged
						4. Flow indication, 81F456A	4. Operator error
						5. general monitor	5. Power failure
						6. Temperature gauge	6. Pump failure
							7. Valve closed

Node: 61. BME charge line to RX. Rx-600,700.	
Type: Line	Drawings: OM-090105-PID-D, OM-090106-PID-D
Design Conditions/Parameters: Pipe spec B16-1	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
61.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Ram valve	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Line plugged 4. Operator error
61.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Heat tracing failure 3. Line plugged 4. Operator error
61.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training	1. Cold weather 2. Valve leaking through
61.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Check valve 2. DCS interlock-Valve will only open in poly mode, must have enable from A operator, has timer to alert lead operator that charge valve has been open a long time, and has pressure switch enable to allow charge. 3. Fire Protection System 4. Fixed point monitor 5. general monitor 6. Operating procedures 7. Operator training 8. Personal Protective Equipment 9. Valve indication	1. High Pressure in Reactor 2. Line leak/rupture 3. Low HPSW pressure 4. Operator error 5. Power failure 6. Valve failure 7. Valve leaking through

Node: 62. Polyvic charge line to Rx. Rx-600,700.

Type: Line

Drawings: OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
62.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training 8. Personal Protective Equipment	1. Cold weather 2. External heat 3. Filter Plugged 4. High Pressure in Reactor 5. Line plugged 6. Operator error 7. Valve closed 8. Valve failure
62.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. High pressure 4. Line rupture 5. Personal exposure 6. Valve packing leaking	S/E S/E S/E S/E S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Heat tracing failure 3. Operator error
62.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. No flow 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training 8. Personal Protective Equipment	1. Cold weather
62.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Personal exposure	S/E S/E	3 4	D C	5 5	1. Check valve 2. DCS interlock - abort polyvic charge on low flow 3. DCS interlock - valve 81hv418. Won't open unless RX in charge and all other RX polyvic valves closed 4. Fire Protection System 5. Fixed point monitor 6. general monitor 7. Operator training 8. Personal Protective Equipment	1. High Pressure in Reactor 2. Operator error 3. Power failure 4. Pump failure 5. Valve failure 6. Valve leaking through

Node: 63. Auto Kill (Isonox) line to Rx. RX-700.	
Type: Line	Drawing: OM-090106-PID-D
Design Conditions/Parameters: Pipe Spec A13-1	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
63.1 High Pressure							
	1. SEE NODE 46						
63.2 High Temperature							
	1. SEE NODE 46						
63.3 Low Temperature							
	1. SEE NODE 46						
63.4 Low/No Flow							
	1. SEE NODE 46						
63.5 Reverse/Misdirected Flow							
	1. SEE NODE 46						

Node: 64. Emergency kill line to isonox charge line. Rx-700	
Type: Line	Drawing: OM-090106-PID-D
Design Conditions/Parameters: Pipe spec B13-3	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
64.1 High Pressure							
	1. SEE NODE 53						
64.2 High Temperature							
	1. SEE NODE 53						
64.3 Low Temperature							
	1. SEE NODE 53						
64.4 Reverse/Misdirected Flow							
	1. SEE NODE 53						

Node: 65. Steam supply to Rx jacket on Rx-700.	
Type: Line	Drawing: OM-090106-PID-D
Design Conditions/Parameters: Pipe spec A2-3	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
65.1 High Flow							
1. SEE NODE 54							
65.2 Low/No Flow							
1. SEE NODE 54							
65.3 Reverse/Misdirected Flow							
1. SEE NODE 54							

Node: 66. HPSW supply line to RX-600,700 BME charge pot

Type: Line

Drawing: OM-090107-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
66.1 Low Pressure							
	1. Lift relief valve 2. No flow 3. Personal exposure 4. Reverse flow	S/E S/E S S/E	4 4 4 4	C C C C	5 5 5 5	1. DCS interlock-Rx BME charge valve won't open unless adequate pressure 2. Pressure switch, 81P469/569 3. Check valve 4. Pressure Gauge 5. Flow indication, 81F565 6. Operating procedures 7. Operator training 8. Personal Protective Equipment	1. Instrument failure 2. Line leak/rupture 3. Line plugged 4. Operator error 5. Valve failure 6. Valve leaking through
66.2 Low Temperature							
	1. Frozen Line 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Reverse flow 6. Fire and explosion 7. VCM Leak	S/E S/E S/E S/E S/E S/E S/E	4 4 4 4 4 3 4	C C C C C D D	5 5 5 5 5 5 5	1. Heat tracing 2. Line insulation	1. Cold weather
66.3 High Pressure							
	1. Gasket failure 2. Line rupture 3. Valve leaking	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Pressure Gauge 2. Pressure switch, 81P469/569	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Valve closed
66.4 High Temperature							
	1. Gasket failure 2. Line rupture 3. Personal exposure 4. Valve failure	S/E S/E S/E S/E	4 4 4 4	C C C C	5 5 5 5	1. Fire Protection System 2. Operating procedures 3. Operator training 4. Personal Protective Equipment	1. External heat 2. Heat tracing failure 3. Line blocked in with external heat (thermal expansion)

Node: 67. BME supply line to BME charge pots. Rx-600,700.

Type: Line

Drawing: OM-090107-PID-D

Design Conditions/Parameters: Pipe spec B16-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
67.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. High pressure switch - 81P467/ 568 2. Fire Protection System 3. general monitor 4. Operating procedures 5. Operator training 6. relief valve 7. Valve indication	1. External heat 2. Operator error 3. Valve leaking through
67.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Operating procedures 3. Operator training 4. Personal Protective Equipment	1. External heat 2. Operator error
67.3 Low Temperature							
	1. Frozen Line 2. Line rupture 3. Personal exposure	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Heat tracing 2. Line insulation 3. Operating procedures 4. Operator training	1. Cold weather 2. Operator error 3. Heat tracing failure
67.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S/E	3 4 4	D C C	5 5 5	1. DCS interlock-BME addition valve, 81X442, will not open unless charge valves 81X421A/B are closed, 81H443 sewer valve is closed, and 81X442 hand switch is on. Similar on RX-700 charge pot supply line. 2. Fire Protection System 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. Line leak/rupture 2. Operator error 3. Valve failure 4. Valve leaking through

Node: 68. BME charge pots for Rx-600,700. Includes relief valve.

Type: Vessel

Drawing: OM-090107-PID-D

Design Conditions/Parameters: MAWP: 300 psig @ 425 F. MOC: 304SS

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
68.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. VCM Leak 5. Vessel rupture 6. Lift relief valve	S/E S/E S S/E S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. general monitor 3. Operating procedures 4. Operator training 5. Personal Protective Equipment 6. Ram valve 7. relief valve 8. High pressure switch - 81P467/568 9. DCS interlock-Valve will only open in poly mode, must have enable from A operator, has timer to alert lead operator that charge valve has been open a long time, and has pressure switch enable to allow charge.	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Line plugged 4. Operator error 5. Relief Valve failure 6. Valve closed 7. Valve leaking through
68.2 Maintenance Hazards							
	1. Personal exposure	S	4	B	5	1. Operating procedures 2. Operator training 3. Personal Protective Equipment 4. Pressure Gauge	1. Operator error 2. Valve failure 3. Valve leaking through 4. High pressure
68.3 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. Vessel rupture 5. Lift relief valve	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. general monitor 3. Operating procedures 4. Operator training 5. relief valve	1. External heat 2. Operator error
68.4 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. No flow 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. general monitor 3. Operating procedures 4. Operator training	1. Cold weather 2. Operator error

Node: 69. BME pot discharge line to Rx.

Type: Line

Drawing: OM-090107-PID-D

Design Conditions/Parameters: Pipe spec B16-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
69.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Ram valve	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Line plugged 4. Operator error
69.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Heat tracing failure 3. Line plugged 4. Operator error
69.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training	1. Cold weather 2. Valve leaking through
69.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Check valve 2. DCS interlock-Valve will only open in poly mode, must have enable from A operator, has timer to alert lead operator that charge valve has been open a long time, and has pressure switch enable to allow charge. 3. Fire Protection System 4. Fixed point monitor 5. general monitor 6. Operating procedures 7. Operator training 8. Personal Protective Equipment 9. Valve indication	1. High Pressure in Reactor 2. Line leak/rupture 3. Low HPSW pressure 4. Operator error 5. Power failure 6. Valve failure 7. Valve leaking through

Node: 70. Rx recovery header to N. K.O. Tank, DM-027.

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
70.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operator training	5. Power failure
						6. Personal Protective Equipment	6. Relief Valve failure
						7. Valve indication	7. Valve closed
						8. Pressure indication, 81P756	
70.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Steam stripping valve on reactor failed open
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S/E	4	C	5	5. Operator training	
	6. Valve failure	S/E	4	C	5	6. Personal Protective Equipment	
	7. VCM Leak	S/E	4	C	5		
70.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock-Rx main recovery valve can't be open at the same time as the evacuation valve	1. Line leak/rupture
	2. Personal exposure	S	4	C	5	2. Fire Protection System	2. Operator error
	3. VCM release	S/E	4	C	5	3. Fixed point monitor	3. Valve leaking through
						4. general monitor	
						5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	
						8. Valve indication	

Node: 71. Recirculation from recovery compressor to Rx recovery header

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
71.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operator training	5. Power failure
						6. Personal Protective Equipment	6. Relief Valve failure
						7. Valve indication	7. Valve closed
71.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S/E	4	C	5	5. Operator training	
	6. Valve failure	S/E	4	C	5	6. Personal Protective Equipment	
	7. VCM Leak	S/E	4	C	5		

Node: 72. RVCN feedback line from RVCN receivers to Rx recovery header

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
72.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Gasket failure	S/E	4	D	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	D	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Valve indication	
72.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Steam stripping valve on reactor
	3. High pressure	S/E	4	C	5	3. general monitor	failed open
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S/E	4	C	5	5. Operator training	
	6. Valve failure	S/E	4	C	5	6. Personal Protective Equipment	
	7. VCM Leak	S/E	4	C	5		
72.3 Reverse/Misdirected Flow							
	1. Overpressure VCM Receivers	S/E	4	C	5	1. Fire Protection System	1. Line leak/rupture
	2. Fire and explosion	S/E	3	D	5	2. Fixed point monitor	2. Operator error
	3. Lift relief valve	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM release	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Valve indication	

Node: 73. Recovery line from Dump TK to Rx recovery header.

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
73.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operator training	5. Power failure
						6. Personal Protective Equipment	6. Valve closed
						7. Pressure indication, 81P756, 81P628	7. High pressure in dump tank
						8. Valve indication	8. Instrument failure
73.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Reaction occurring in dump tank
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S/E	4	C	5	5. Operator training	
	6. Valve failure	S/E	4	C	5	6. Personal Protective Equipment	
	7. VCM Leak	S/E	4	C	5	7. Dump tank kill system	
73.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line leak/rupture
	2. Personal exposure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. VCM release	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Overpressure dump tank	S/E	4	C	5	4. Operating procedures	
	5. Lift relief valve	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Valve indication	

Node: 74. Recovery line from Dump TK to RVCM condensers

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
74.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operator training	5. Power failure
						6. Personal Protective Equipment	6. Relief Valve failure
						7. Pressure indication, 81P628	7. Valve closed
						8. Valve indication	
74.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Reaction occurring in dump tank
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Dump tank kill system	
74.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line leak/rupture
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Overpressure dump tank	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM release	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Valve indication	

Node: 75. Jumper from RVCM feedback line to Feed Tank and Stripper feedback line.

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
75.1 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. VCM release	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. Line leak/rupture 2. Operator error 3. Valve leaking through
75.2 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure dump tank 4. Personal exposure 5. VCM release	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Dump tank kill system 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. External heat 2. Reaction occurring in dump tank
75.3 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure indication, 81P756, 81P628, 81P606 8. Valve indication	1. External heat 2. High pressure in dump tank 3. High Pressure in Reactor 4. Instrument failure 5. Line plugged 6. Operator error 7. Power failure 8. Valve closed

Node: 76. VCM feedback line to stripper and feed tank.

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
76.1 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Dump tank kill system	2. Reaction occurring in dump tank
	3. Line rupture	S/E	4	C	5	3. Fixed point monitor	
	4. Personal exposure	S/E	4	C	5	4. general monitor	
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	
76.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line leak/rupture
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Personal exposure	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. VCM release	S/E	4	C	5	4. Operating procedures	
						5. Operator training	
						6. Personal Protective Equipment	
						7. Valve indication	
76.3 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line leak/rupture
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Personal exposure	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. VCM release	S/E	4	C	5	4. Operating procedures	
						5. Operator training	
						6. Personal Protective Equipment	
						7. Valve indication	

Node: 77. Dump strainer recovery line to Rx recovery header.

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
77.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external
	3. Line rupture	S/E	4	C	5	3. general monitor	heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operating procedures	3. Operator error
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
77.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external
	3. Personal exposure	S/E	4	C	5	3. general monitor	heat (thermal expansion)
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
77.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S/E	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM release	S/E	4	C	5	3. general monitor	3. Valve leaking through
						4. Operating procedures	
						5. Personal Protective Equipment	

Node: 78. Polishing strainer recovery line to Rx recovery header

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
78.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
78.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
78.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S/E	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM release	S/E	4	C	5	3. general monitor	3. Valve leaking through
						4. Operating procedures	
						5. Personal Protective Equipment	

Node: 79. RVCM feedback line to compressor suction header

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
79.1 Reverse/Misdirected Flow							
	1. No consequence						
79.2 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Indication- 81P806	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Line plugged
79.3 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat

Node: 80. RVCM feedback line from compressor discharge to stripper and feed tank.

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
80.1 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Personal exposure	S/E	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
80.2 Reverse/Misdirected Flow							
	1. No consequence						
80.3 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external
	3. Line rupture	S/E	4	C	5	3. general monitor	heat (thermal expansion)
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	3. Line plugged
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. Pressure indication - 81P628, 81P606	

Node: 81. Feed tank recovery line

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
81.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve failure
						6. Pressure indication- 81P606	
81.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
81.3 Reverse/Misdirected Flow							
	1. Overpressure feed tank	S/E	4	C	5	1. Fire Protection System	1. Operator error
	2. Fire and explosion	S/E	3	D	5	2. Fixed point monitor	2. Valve leaking through
	3. Lift relief valve	ENV	4	C	5	3. general monitor	3. Valve failure
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 82. HPSW supply to KO tank sight glass.	
Type: Line	Drawing: OM-090108-PID-D
Design Conditions/Parameters: Pipe spec A2-3	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
82.1 Low Pressure							
	1. Personal exposure 2. Reverse flow 3. VCM Leak	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Check valve 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Pressure Gauge	1. Filter Plugged 2. Line plugged 3. Operator error 4. Power failure 5. Valve closed 6. Valve leaking through 7. Pump failure
82.2 High Flow							
	1. High Level in knockout tank, See Node 84						

Node: 83. Batch water stripper recovery line to Rx recovery header

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
83.1 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Personal exposure 3. VCM release 4. Overpressure batchwater stripper	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. Operator error 2. Valve failure 3. Valve leaking through
83.2 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Valve packing leaking 6. VCM Leak	S/E S/E S/E S/E S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Operator error 4. High pressure in batch water stripper
83.3 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Valve packing leaking 6. VCM Leak	S/E S/E S/E S/E S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Operator error

Node: 84. North KO tank, DM-027.

Type: Vessel

Drawing: OM-090108-PID-D

Design Conditions/Parameters: MAWP: 150 psig @ 150 F. MOC: A285 CS

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
84.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. relief valve 8. Pressure indicator, 81P756 9. Pressure Gauge 10. Kill system on reactor	1. Control Valve failure 2. Instrument failure 3. Operator error 4. Power failure 5. Relief Valve failure 6. Valve leaking through 7. External heat
84.2 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. VCM release	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Operating procedures 4. Operator training 5. Personal Protective Equipment	1. External heat
84.3 High Level							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. relief valve 8. sight glass 9. Level switch - 81L777A	1. Instrument failure 2. Line plugged 3. Operator error 4. Pump failure 5. Valve failure
84.4 Low Level							
	1. Overpressure batchwater stripper	S/E	4	C	5	1. Operating procedures 2. Level indication - 81L777B	1. Instrument failure 2. Valve failure
84.5 Maintenance Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release 4. Vessel rupture	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment 6. Pressure Gauge 7. sight glass	1. Operator error

Node: 85. RVCM feedback line from feed tank recovery line to stripper.

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
85.1 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Valve packing leaking 6. VCM Leak	S/E S/E S/E S/E S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Operator error
85.2 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S ENV	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. Operator error 2. Valve failure 3. Valve leaking through
85.3 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Operating procedures 4. general monitor 5. Personal Protective Equipment	1. Operator error 2. Valve failure 3. Valve leaking through

Node: 86. Recovery line from N KO tank to vacuum pumps and compressors

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
86.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operator training	5. Power failure
						6. Personal Protective Equipment	6. Relief Valve failure
						7. Pressure indication, 81P756	7. Valve closed
						8. Valve indication	8. High level in Knockout tank, DM-027
86.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Steam stripping valve on reactor failed open
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S	4	C	5	5. Operator training	
	6. Valve failure	S/E	4	C	5	6. Personal Protective Equipment	
	7. VCM Leak	S/E	4	C	5		
86.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock-Rx main recovery valve can't be open at the same time as the evacuation valve	1. Line leak/rupture
	2. Personal exposure	S	4	C	5	2. Fire Protection System	2. Operator error
	3. VCM release	S/E	4	C	5	3. Fixed point monitor	3. Valve leaking through
						4. general monitor	
						5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	
						8. Valve indication	

Node: 87. N. KO tank bypass line. From Rx recovery header to vacuum pumps and compressors.

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
87.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High level in Knockout tank, DM-027
	3. Line rupture	S/E	4	C	5	3. general monitor	3. High Pressure in Reactor
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Line plugged
	5. VCM Leak	S/E	4	C	5	5. Operator training	5. Operator error
						6. Personal Protective Equipment	6. Power failure
						7. Pressure indication, 81P756	7. Relief Valve failure
						8. Valve indication	8. Valve closed
87.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Steam stripping valve on reactor failed open
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S	4	C	5	5. Operator training	
	6. Valve failure	S/E	4	C	5	6. Personal Protective Equipment	
	7. VCM Leak	S/E	4	C	5		

Node: 88. RVCM feedback line from seal water separators to N KO tank. Vacuum Pump inlet pressure control.

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
88.1 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
88.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Valve failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5	6. Check valve	
88.3 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S/E	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. VCM release	S/E	3	D	5	4. Operating procedures	4. High Pressure in Reactor
						5. Personal Protective Equipment	

Node: 89. KO Tank recovery line. To ERS.	
Type: Line	Drawing: OM-090108-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
89.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High pressure in batch water stripper
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Valve leaking through
	5. Valve failure	S/E	4	C	5	5. Operator training	
	6. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	
89.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
89.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM release	S/E	3	D	5	3. general monitor	3. Valve leaking through
						4. Operating procedures	
						5. Personal Protective Equipment	
89.4 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	

Node: 90. Feed Tank recovery line. From S KO tank to compressor.

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
90.1 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S/E	4	C	5	5. Operator training	
	6. Valve failure	S/E	4	C	5	6. Personal Protective Equipment	
	7. VCM Leak	S/E	4	C	5		
90.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Lift relief valve	S/E	3	D	5	2. Fixed point monitor	2. Valve failure
	3. Overpressure feed tank	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
90.3 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve failure
						6. Pressure indication- 81P606	

Node: 91. S KO tank, DM-028.

Type: Vessel

Drawing: OM-090108-PID-D

Design Conditions/Parameters: MAWP: 150 psig @ 150F MOC: A285 CS

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
91.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S S/E	3 4 3 4 4	D C D C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Kill system on reactor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Pressure Gauge 9. Pressure indicator, 81P606 10. relief valve	1. External heat 2. Instrument failure 3. Operator error 4. Power failure 5. Relief Valve failure 6. Valve leaking through 7. Control Valve failure 8. High Level
91.2 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. VCM release	S/E S/E S S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Operating procedures 4. Operator training 5. Personal Protective Equipment	1. External heat
91.3 High Level							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S S/E	3 4 3 4 4	D C D C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Level switch - 81L786A 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. relief valve 9. sight glass	1. Instrument failure 2. Line plugged 3. Operator error 4. Pump failure 5. Valve failure
91.4 Low Level							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S/E S/E	3 4 3 4 4	D C D C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Level switch - 81L786B 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. relief valve 9. sight glass	1. Instrument failure 2. Line plugged 3. Operator error 4. Pump failure 5. Valve failure
91.5 Maintenance Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release 4. Vessel rupture	S/E S S/E S/E	3 4 3 4	D C D C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment 6. Pressure Gauge 7. sight glass	1. Operator error

Node: 92. Drain/Recovery line from DM-027/028 To batch water strippers.

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
92.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
92.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM release	ENV	3	D	5	3. general monitor	3. Valve leaking through
						4. Operating procedures	
						5. Personal Protective Equipment	
92.3 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High pressure in batch water stripper
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve leaking through
	5. Valve failure	S/E	4	C	5	5. Operator training	
	6. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	
92.4 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 93. S KO tank, DM-028, Water recirculation line and pump.

Type: Centrifugal Pump + Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22. Pump 3x2-10-9.5, 155 psi @ 200 GPM.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
93.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. Seal failure	S/E	4	C	5	5. Personal Protective Equipment	5. High pressure in the Knockout tank
	6. Valve packing leaking	S/E	4	C	5	6. Pressure Gauge	
	7. VCM Leak	S/E	4	C	5		
93.2 Reverse/Misdirected Flow							
	1. Overpressure batchwater stripper	S/E	4	C	5	1. Check valve	1. Instrument failure
	2. Overfill/Overpressure DM-027	S/E	4	C	5	2. DCS interlock- batch water stripper can't have high pressure, high level, and the receivers can't be draining	2. Operator error
	3. Fire and explosion	S/E	3	D	5	3. Fire Protection System	3. Valve leaking through
	4. Lift relief valve	S/E	3	D	5	4. Fixed point monitor	4. Check valve failure
	5. Personal exposure	S	4	C	5	5. general monitor	
	6. VCM Leak	S/E	4	C	5	6. Operating procedures	
						7. Personal Protective Equipment	
93.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Pump blocked in and running
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Seal failure	S/E	4	C	5	5. Personal Protective Equipment	
	6. Valve packing leaking	S/E	4	C	5		
	7. VCM Leak	S/E	4	C	5		

Node: 94. N KO Tank water recirculation line from tank to pump to cooler

Type: Centrifugal Pump + Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22. Pump 3x4-8-7.62. 95 psi @ 400 GPM.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
94.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in the Knockout tank
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. Seal failure	S/E	4	C	5	5. Personal Protective Equipment	5. Valve closed
	6. Valve packing leaking	S/E	4	C	5	6. Pressure Gauge	
	7. VCM Leak	S/E	4	C	5		
94.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. Check valve failure
	2. Lift relief valve	S/E	4	C	5	2. DCS interlock- batch water	2. Instrument failure
	3. Overfill/Overpressure DM-027	S/E	4	C	5	stripper can't have high	3. Operator error
	4. Overpressure batchwater	S/E	4	C	5	pressure, high level, and the	4. Valve leaking through
	stripper					receivers can't be draining	
	5. Personal exposure	S	4	C	5	3. Fire Protection System	
	6. VCM Leak	S/E	4	C	5	4. Fixed point monitor	
						5. general monitor	
						6. Operating procedures	
						7. Personal Protective Equipment	
94.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. Check valve failure
	2. Lift relief valve	S/E	4	C	5	2. DCS interlock- batch water	2. Instrument failure
	3. Overfill/Overpressure DM-028	S/E	4	C	5	stripper can't have high	3. Operator error
	4. Overpressure batchwater	S/E	4	C	5	pressure, high level, and the	4. Valve leaking through
	stripper					receivers can't be draining	
	5. Personal exposure	S	4	C	5	3. Fire Protection System	
	6. VCM Leak	S/E	4	C	5	4. Fixed point monitor	
						5. general monitor	
						6. Operating procedures	
						7. Personal Protective Equipment	

Node: 95. EX-340 N KO Tank cooler	
Type: Heat Exchanger	Drawing: OM-090108-PID-D
Design Conditions/Parameters: MAWP: 150 psi @ 400 F	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
95.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Lift relief valve	S/E	3	D	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Relief Valve failure
	6. Vessel rupture	S/E	4	C	5	6. relief valve	
95.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. No cooling water
	3. Lift relief valve	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM release	S/E	3	D	5	6. relief valve	
95.3 Low Temperature							
	1. Tube rupture	S/E	4	C	5	1. Fire Protection System	1. Cold weather
	2. Frozen tubes	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Fire and explosion	S/E	3	D	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. Temperature gauge	

Node: 96. N KO tank water recirculation line from cooler to KO tank.

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
96.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in the Knockout tank
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. Seal failure	S/E	4	C	5	5. Personal Protective Equipment	5. Valve closed
	6. Valve packing leaking	S/E	4	C	5	6. Pressure Gauge	
	7. VCM Leak	S/E	4	C	5		
96.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. Check valve failure
	2. Lift relief valve	S/E	3	D	5	2. DCS interlock- batch water	2. Instrument failure
	3. Overfill/Overpressure DM-027	S/E	4	C	5	stripper can't have high	3. Operator error
	4. Overpressure batchwater	S/E	4	D	5	pressure, high level, and the	4. Valve leaking through
	stripper					receivers can't be draining	
	5. Personal exposure	S	4	C	5	3. Fire Protection System	
	6. VCM Leak	S/E	4	C	5	4. Fixed point monitor	
						5. general monitor	
						6. Operating procedures	
						7. Personal Protective Equipment	
96.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. Check valve failure
	2. Lift relief valve	S/E	3	D	5	2. Fire Protection System	2. Instrument failure
	3. Overpressure batchwater	S/E	4	C	5	3. Fixed point monitor	3. Operator error
	stripper					4. general monitor	4. Valve leaking through
	4. Personal exposure	S	4	C	5	5. Operating procedures	
	5. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	

Node: 97. North and South KO tank blowdown line to batch water stripper.

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
97.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	D	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Instrument failure
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operating procedures	4. Line plugged
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	5. Operator error
	6. VCM Leak	S/E	4	C	5	6. DCS interlock- batch water stripper can't have high pressure, high level, and the receivers can't be draining	6. Valve closed
						7. Pressure Indication- 84P848/845	
97.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. Instrument failure
	2. Lift relief valve	S/E	3	D	5	2. Fire Protection System	2. Operator error
	3. Overpressure batchwater stripper	S/E	4	C	5	3. Fixed point monitor	3. Valve leaking through
	4. Personal exposure	S	4	C	5	4. general monitor	4. External heat
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	
						6. Personal Protective Equipment	
97.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Heat tracing failure
	4. Personal exposure	S	4	C	5	4. Heat tracing	
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	
						6. Personal Protective Equipment	

Node: 98. HPSW supply to mechanical seal on KO tank recirculation pumps PP-489/490.

Type: Line

Drawing: OM-090108-PID-D

Design Conditions/Parameters: Pipe spec A2-3/J16-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
98.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
98.2 High Temperature							
	1. Seal failure 2. Personal exposure 3. VCM Leak	S/E S S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment	1. External heat 2. Operator error
98.3 Low Pressure							
	1. Seal failure 2. VCM Leak	S/E S/E	4 4	C C	5 5	1. Fire Protection System 2. Equipment Preventive Maintenance Program 3. Fixed point monitor 4. Operating procedures 5. Operator training 6. Pressure Gauge 7. Flow meter	1. Filter plugged 2. Line plugged 3. Operator error 4. Power Failure 5. Valve closed 6. Valve failure
98.4 Low Temperature							
	1. Frozen Line 2. No flow 3. Seal failure 4. VCM Leak 5. Personal exposure	S/E S/E S/E S/E S	4 4 4 4 4	C C C C C	5 5 5 5 5	1. Fixed point monitor 2. Heat tracing 3. Personal Protective Equipment 4. Operating procedures	1. Cold weather 2. Operator error

Node: 99. Cooling water supply and return line from N KO tank cooler, EX-340.	
Type: Line	Drawing: OM-090108-PID-D
Design Conditions/Parameters: Pipe spec A2-3.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
99.1 Tube Leak							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment 6. Equipment Preventive Maintenance Program	1. High pressure 2. Relief valve failure 3. Corrosion

Node: 100. HPSW supply to mechanical seals on compressors & vacuum pumps.

Type: Line

Drawings: OM-090109-PID-D, OM-090109A-PID-D

Design Conditions/Parameters: Pipe spec A2-3, J16-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
100.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
100.2 High Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment	1. External heat 2. Operator error
100.3 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C D	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment 4. Flow meter 5. Pressure Gauge	1. Operator error 2. Instrument failure 3. Line plugged
100.4 Low Temperature							
	1. Frozen Line 2. No flow 3. Personal exposure 4. Seal failure 5. VCM Leak	S/E S/E S S/E S/E	4 4 4 4 4	C C C C D	5 5 5 5 5	1. Fixed point monitor 2. Heat tracing 3. Operating procedures 4. Personal Protective Equipment	1. Cold weather 2. Operator error

Node: 101. HPSW supply from mechanical seals on compressors & vacuum pumps.

Type: Line

Drawings: OM-090109-PID-D, OM-090109A-PID-D

Design Conditions/Parameters: Pipe spec A2-3, J16-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
101.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S/E S/E S/E	3 4 4 4	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
101.2 High Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C D	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment	1. External heat 2. Operator error
101.3 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C D	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment 4. Flow meter 5. Pressure Gauge	1. Operator error 2. Instrument failure 3. Line plugged
101.4 Low Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C D	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment 4. Flow meter 5. Pressure Gauge 6. Heat tracing	1. Operator error 2. Instrument failure 3. Line plugged

Node: 102. Recovery line from Dump TK to RVCM condensers

Type: Line

Drawing: OM-090109-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
102.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure indication, 81P628 8. Valve indication	1. External heat 2. High Pressure in Reactor 3. Line plugged 4. Operator error 5. Power failure 6. Relief Valve failure 7. Valve closed
102.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Dump tank kill system 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. External heat 2. Reaction occurring in dump tank
102.3 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure dump tank 4. Personal exposure 5. VCM release	S/E S/E S/E S S/E	3 3 4 4 3	D D C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. Line leak/rupture 2. Operator error 3. Valve leaking through

Node: 103. Stripper recovery line to "B" vacuum pump (VP-502)

Type: Line

Drawing: OM-090109-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
103.1 High Pressure							
	1. High Pressure Control valve failure	S/E	4	C	5	1. DCS interlock- For 81XV724 to open then 81XV726 must be open, and 81PC756 is less then 20 psi.	1. External heat
	2. Fire and explosion	S/E	3	D	5		2. Line plugged
	3. Gasket failure	S/E	4	C	5		3. Operator error
	4. Lift relief valve	S/E	3	D	5	2. Fire Protection System	4. Vacuum Pump failure
	5. Personal exposure	S	4	C	5	3. Fixed point monitor	5. Relief Valve failure
	6. Valve packing leaking	S/E	4	C	5	4. general monitor	6. Valve closed
	7. VCM Leak	S/E	4	C	5	5. Operating procedures	
	8. Overpressure batchwater stripper	S/E	4	C	5	6. Operator training	
						7. Personal Protective Equipment	
						8. Pressure Gauge	
						9. relief valve	
103.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Lift relief valve	S/E	4	C	5	4. Operating procedures	
	5. Line rupture	S/E	4	C	5	5. Personal Protective Equipment	
	6. Personal exposure	S	4	C	5	6. relief valve	
	7. Valve packing leaking	S/E	4	C	5		
	8. VCM Leak	S/E	4	C	5		

Node: 104. RVCM feedback line from compressor discharge to stripper and feed tank.

Type: Line

Drawing: OM-090109-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
104.1 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
104.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM release	S/E	3	D	5	3. general monitor	3. Valve leaking through
						4. Operating procedures	
						5. Personal Protective Equipment	
104.3 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S/E	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM release	S/E	3	D	5	3. general monitor	3. Valve leaking through
						4. Operating procedures	
						5. Personal Protective Equipment	

Node: 105. Vacuum Pump, VP-501 & 502.

Type: Centrifugal Compressor

Drawing: OM-090109-PID-D

Design Conditions/Parameters: 3x4-15, 780 acfm @ 24 inches Hg.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
105.1 High Suction Pressure							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Seal failure 6. VCM Leak	S/E S/E S/E S S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge 7. relief valve 8. DCS interlock- VP-502, 81XM742 will not run unless 81XV725 is open and 81PC648 is less than 20 psi and 81HM730 is started. VP-501, 81XM741 wills not run unless 81XV722 is open and 81HM729 is running, and 81PC756 is less than 20 psi.	1. Instrument failure 2. Operator error 3. Pump failure 4. Relief Valve failure 5. Valve leaking through
105.2 High Discharge Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Seal failure 6. VCM Leak	S/E S/E S/E S S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Amp indicator 8. Motor overloads 9. Pressure Gauge	1. Compressor not pulling 2. Line plugged 3. Operator error 4. Valve closed 5. External heat

Node: 105A. Compressor Cp-503,504,506,111. 4x3-12.5, 400acfm @ 80 psi

Type: Centrifugal Compressor

Drawings: OM-090109-PID-D, OM-090109A-PID-D

Design Conditions/Parameters: 3x4-15, 780 acfm @ 24 inches Hg.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
105A.1 High Suction Pressure							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. Seal failure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. DCS interlock-Compressor must be running to open inlet valve and ring seal water supply valve. 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Personal Protective Equipment 7. Pressure Gauge	1. Instrument failure 2. Operator error 3. Pump failure 4. Valve leaking through
105A.2 High Discharge Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. DCS interlock - RVCM return valve on receiver must be open and ring seal water pump running to start compressor. 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. External heat 2. Line plugged 3. Operator error 4. Valve closed 5. Relief Valve failure
105A.3 Low Suction Pressure							
	1. Seal failure 2. Fire and explosion 3. VCM Leak	S/E S/E S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. Line plugged 2. Operator error 3. Valve closed

Node: 106. Rx recovery line to "A" vacuum pump (VP-501)

Type: Line

Drawing: OM-090109-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
106.1 High Pressure							
1. Fire and explosion	S/E	3	D	5	1. DCS interlock- For 81XV721 to open then 81XV722 must be open, and 81PC756 is less then 20 psi.	1. External heat	
2. Gasket failure	S/E	4	C	5		2. Line plugged	
3. High Pressure Control valve failure	S/E	4	C	5		3. Operator error	
4. Lift relief valve	S/E	4	C	5	2. Fire Protection System	4. Relief Valve failure	
5. Overpressure batchwater stripper	S/E	4	C	5	3. Fixed point monitor	5. Vacuum Pump failure	
6. Personal exposure	S	4	C	5	4. general monitor	6. Valve closed	
7. Valve packing leaking	S/E	4	C	5	5. Operating procedures		
8. VCM Leak	S/E	4	C	5	6. Operator training		
					7. Personal Protective Equipment		
					8. Pressure Gauge		
					9. relief valve		
106.2 High Temperature							
1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat	
2. Gasket failure	S/E	4	C	5	2. Fixed point monitor		
3. High pressure	S/E	4	C	5	3. general monitor		
4. Lift relief valve	S/E	4	C	5	4. Operating procedures		
5. Line rupture	S/E	4	C	5	5. Personal Protective Equipment		
6. Personal exposure	S	4	C	5	6. relief valve		
7. Valve packing leaking	S/E	4	C	5			
8. VCM Leak	S/E	4	C	5			

Node: 107. Vacuum Pump discharge line to compressor suction header.

Type: Line

Drawing: OM-090109-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
107.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line plugged
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. High temperature	S/E	4	C	5	3. general monitor	3. Valve closed
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	
	6. Valve packing leaking	S/E	4	C	5	6. DCS interlock- 81XV722/725 will not open unless 81PC756/648 is less than 20 psi	
	7. VCM Leak	S/E	4	C	5		
107.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Lift relief valve	S/E	4	C	5	4. Operating procedures	
	5. Line rupture	S/E	4	D	5	5. Personal Protective Equipment	
	6. Personal exposure	S	4	C	5	6. relief valve	
	7. Valve packing leaking	S/E	4	C	5		
	8. VCM Leak	S/E	4	C	5		

Node: 108. Compressor suction header	
Type: Line	Drawings: OM-090109-PID-D, OM-090109A-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
108.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Power failure
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. relief valve	
108.2 High Temperature							
	1. See High Pressure						

Node: 109. RVCM feedback line to compressor suction header	
Type: Line	Drawing: OM-090109-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
109.1 Reverse/Misdirected Flow							
1. See Node 79							
109.2 High Pressure							
1. See Node 79							
109.3 High Temperature							
1. See Node 79							

Node: 110. Compressor suction line. CP-503,504,506,111.	
Type: Line	Drawings: OM-090109-PID-D, OM-090109A-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
110.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S/E	4	C	5	3. general monitor	3. Power failure
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. relief valve	
110.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Power failure
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. relief valve	
110.3 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Line plugged
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Operator error
	4. Damage compressor	S/E	4	B	5	4. Operating procedures	4. Valve closed
						5. Operator training	
						6. Personal Protective Equipment	
						7. Pressure Gauge	

Node: 111. Compressor discharge line and header to seal water separator. Same on all compressors.

Type: Line

Drawings: OM-090109-PID-D, OM-090109A-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
111.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Valve packing leaking 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. relief valve 9. Pressure Indication - 81P759	1. External heat 2. Line plugged 3. Operator error 4. Valve closed
111.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Valve packing leaking 5. VCM Leak	S/E S/E S S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. relief valve 7. Temperature gauge	1. External heat 2. Line plugged 3. Valve closed

Node: 112. Compressor/Vacuum Pump individual recovery line to batch water stripper.	
Type: Line	Drawings: OM-090109-PID-D, OM-090109A-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
112.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High pressure in batch water stripper
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve leaking through
	5. Valve failure	S/E	4	C	5	5. Operator training	
	6. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	
112.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	3	D	5	5. Operator training	
						6. Personal Protective Equipment	
112.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 113. Compressor discharge relief valve and rv discharge header. Cp-503,504,506,111.

Type: Line

Drawings: OM-090109-PID-D, OM-090109A-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
113.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	5. Relief Valve failure
	6. VCM Leak	S/E	4	C	5	6. relief valve	6. Valve closed
113.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. relief valve	
113.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	B	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5	6. Rupture disc	

Node: 114. Ring seal water supply line to vacuum pumps and compressors. Identical to each .

Type: Line

Drawings: OM-090109-PID-D, OM-090109A-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
114.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5	6. Line insulation	
114.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 115. Pressure equalization line from compressor discharge to Rx recovery header.

Type: Line

Drawing: OM-090109-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
115.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Valve packing leaking 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure Indication - 81P759 / 81P756	1. External heat 2. Line plugged 3. Operator error 4. Valve closed
115.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Valve packing leaking 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Line plugged 3. Valve closed

Node: 116. Recirculation from recovery compressor to Rx recovery header

Type: Line

Drawing: OM-090109-PID-D

Design Conditions/Parameters: Pipe spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
116.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operator training	5. Power failure
						6. Personal Protective Equipment	6. Relief Valve failure
						7. Valve indication	7. Valve closed
116.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S/E	4	C	5	5. Operator training	
	6. Valve failure	S/E	4	C	5	6. Personal Protective Equipment	
	7. VCM Leak	S/E	4	C	5		

Node: 117. Feed Tank recovery line. From S KO tank to compressor.

Type: Line

Drawing: OM-090109A-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
117.1 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. Valve failure	S/E	4	C	5	5. Operator training	
	6. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	
117.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Overpressure feed tank	S/E	4	C	5	2. Fixed point monitor	2. Valve failure
	3. Personal exposure	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
117.3 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve failure
						6. Pressure indication- 81P606	

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 118. Compressor discharge header to seal water separator.

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
118.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Valve packing leaking 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Indication - 81P759	1. External heat 2. Line plugged 3. Operator error 4. Valve closed
118.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Valve packing leaking 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Line plugged 3. Valve closed

Node: 119. Seal Water separators, DM-017, DM-018.

Type: Vessel

Drawing: OM-090110-PID-D

Design Conditions/Parameters: MAWP: 150 psig-FV @ 300F. MOC: SA516

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
119.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Valve packing leaking 5. VCM Leak 6. Lift relief valve	S/E S/E S/E S/E S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure Indication - 81P759 9. relief valve	1. External heat 2. Line plugged 3. Operator error 4. Valve closed 5. Instrument failure
119.2 High Level							
	1. Fire and explosion 2. Personal exposure 3. Valve packing leaking 4. VCM Leak 5. Lift relief valve	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. High Level switch - 81L797 / 81L796 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. relief valve 9. sight glass	1. Instrument failure 2. Line plugged 3. Operator error 4. Pump failure 5. Valve failure
119.3 Maintenance Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release 4. Vessel rupture	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment 6. Pressure Gauge 7. sight glass	1. Operator error

Node: 120. Ring seal water line from separators, thru pumps, to ring seal water filters.

Type: Centrifugal Pump + Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22. Pumps, 20 hp, 2x3-10-5.875, 160 gpm @ 70 psi

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
120.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line plugged
	2. High Level on seal water separator	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Personal exposure	S/E	4	C	5	3. general monitor	3. Valve closed
	4. Seal failure	S/E	4	C	5	4. Operating procedures	4. Seal leaking internally and pump blocked in
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. Seal water flow meters	
120.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Personal exposure	S/E	4	C	5	2. Fixed point monitor	2. Pump blocked in and running
	3. Seal failure	S/E	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Operator training	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
120.3 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Check valve failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Instrument failure
	3. High pressure	S/E	4	C	5	3. Ring Seal Water Flow meter	3. Line plugged
	4. Lift relief valve	S/E	4	C	5	4. general monitor	4. Operator error
	5. Personal exposure	S	4	C	5	5. Motor overloads	5. Power failure
	6. Seal failure	S/E	4	C	5	6. Operating procedures	6. Pump failure
	7. Valve packing leaking	S/E	4	C	5	7. Operator training	7. Valve closed
						8. Pressure Gauge	
						9. relief valve	

Node: 121. Ring seal water filters, FL-120e/w

Type: Vessel

Drawing: OM-090110-PID-D

Design Conditions/Parameters: MAWP: 150 psig @ 500 F; MOC: CS

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
121.1 High Pressure							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. Vessel rupture	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Locking devices on relief valves 5. Operating procedures 6. Operator training 7. Pressure Gauge 8. relief valve	1. Filter Plugged 2. Line blocked in with external heat (thermal expansion) 3. Line plugged 4. Operator error 5. Relief Valve failure 6. Valve closed
121.2 Maintenance Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S/E S/E	3 4 3	D C D	5 5 5	1. Maintenance & operating procedures 2. Operating procedures 3. Operator training 4. Personal Protective Equipment	1. Operator error
121.3 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. Vessel rupture	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Locking devices on relief valves 5. Operating procedures 6. Operator training 7. Pressure Gauge 8. relief valve	1. External heat
121.4 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Personal exposure 4. VCM Leak 5. Vessel rupture	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Heat tracing 2. Line insulation 3. Fire Protection System 4. Fixed point monitor 5. general monitor 6. Locking devices on relief valves 7. Operating procedures 8. Operator training 9. relief valve	1. Cold weather 2. Valve leaking through

Node: 122. Ring seal water filter relief valve and discharge line to DM-017

Type: Line + Relief Valve

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
122.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fire Protection System	2. Valve leaking through
	3. Gasket failure	S/E	4	C	5	3. Equipment Preventive	
	4. Line rupture	S/E	4	C	5	Maintenance Program	
	5. Vessel rupture	S/E	4	C	5	4. Fixed point monitor	
						5. general monitor	
						6. Heat tracing	
						7. Line insulation	
						8. Personal Protective Equipment	
122.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line plugged
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Personal exposure	S	4	C	5	3. general monitor	3. Relief Valve failure
	4. Line rupture	S/E	4	C	5	4. Locking devices on relief valves	4. Valve closed
						5. Operating procedures	
						6. Operator training	
						7. relief valve	

Node: 123. Ring seal water line from filters to coolers

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
123.1 High Pressure							
	1. Fire and explosion 2. High Level on seal water separator 3. Personal exposure 4. Gasket failure 5. Line rupture	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Seal water flow meters	1. Line plugged 2. Operator error 3. Valve closed 4. External heat
123.2 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge	1. External heat
123.3 Low/No Flow							
	1. Fire and explosion 2. Gasket failure 3. High pressure 4. Lift relief valve 5. Personal exposure 6. Valve packing leaking	S/E S/E S/E S/E S S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Pressure Gauge 7. Ring Seal Water Flow meter	1. Line plugged 2. Operator error 3. Valve closed

Node: 124. Seal water coolers, EX-005/006

Type: Heat Exchanger

Drawing: OM-090110-PID-D

Design Conditions/Parameters: MAWP: 150 psig @ 200F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
124.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Personal exposure	S	4	C	5	3. general monitor	3. Line plugged
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. Vessel rupture	S/E	4	C	5	5. Personal Protective Equipment	5. Tubeside blocked in with steam on shell
124.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. No cooling water
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
	5. VCM release	S/E	3	D	5	5. Personal Protective Equipment	
						6. Temperature gauge	
124.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen tubes	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Tube rupture	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. Temperature gauge	

Node: 125. Ring Seal Water pump suction crossover line.

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
125.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line plugged
	2. High Level on seal water separator	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Personal exposure	S	4	C	5	3. general monitor	3. Seal leaking internally and pump blocked in
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	4. Valve closed
						5. Operator training	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
125.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Personal exposure	S/E	4	C	5	2. Fixed point monitor	
	3. Seal failure	S/E	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Operator training	
						6. Personal Protective Equipment	

Node: 126. Ring Seal water line from coolers to compressors/vacuum pumps

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
126.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
126.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. Line insulation	

Node: 127. VCM vapor line from separators to condensers	
Type: Line	Drawing: OM-090110-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
127.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Valve packing leaking 5. VCM Leak	S/E S/E S S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Indication - 81P759 8. Pressure Gauge	1. External heat 2. Line plugged 3. Operator error 4. Valve closed
127.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Valve packing leaking 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat

Node: 128. Seal water separator recovery line to batch water stripper.

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
128.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High pressure in batch water stripper
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve leaking through
	5. Valve failure	S/E	4	C	5	5. Operator training	
	6. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	
128.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
128.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
128.4 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM release	S/E	4	C	5	3. general monitor	3. Valve leaking through
						4. Operating procedures	
						5. Personal Protective Equipment	

Node: 129. RVCM feedback line from seal water separators to N KO tank. Vacuum Pump inlet pressure control.

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
129.1 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Valve packing leaking 6. VCM Leak	S/E S/E S/E S S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Operator error
129.2 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Valve packing leaking 6. VCM Leak	S/E S/E S/E S S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Check valve 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Personal Protective Equipment	1. Operator error 2. Valve failure 3. Valve leaking through
129.3 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak 4. VCM release	S/E S S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. High Pressure in Reactor 2. Operator error 3. Valve failure 4. Valve leaking through

Node: 130. Recovery line from VCM receivers to ERS

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
130.1 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
130.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High Pressure in Reactor
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Operator error
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve failure
	4. VCM release	S/E	3	D	5	4. Operating procedures	4. Valve leaking through
						5. Personal Protective Equipment	

Node: 131. Recovery line from RVCM condensers to ERS

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
131.1 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S	4	C	5		
131.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High Pressure in Reactor
	2. Personal exposure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve failure
	4. VCM release	S/E	3	D	5	4. Operating procedures	4. Valve leaking through
						5. Personal Protective Equipment	

Node: 132. KO Tank recovery line. To ERS

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
132.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak 4. VCM release	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. High Pressure in Reactor 2. Operator error 3. Valve failure 4. Valve leaking through
132.2 High Temperature							
	1. Fire and explosion 2. High pressure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Operator error
132.3 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S S/E	3 4 3	D C D	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. Operator error 2. Valve failure 3. Valve leaking through
132.4 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. No flow 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. Cold weather 2. Valve leaking through

Node: 133. Pressure equalization line from compressor discharge to Rx recovery header.

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
133.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Valve packing leaking 5. VCM Leak	S/E S/E S S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure Indication - 81P759 / 81P756	1. External heat 2. Line plugged 3. Operator error 4. Valve closed
133.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Valve packing leaking 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Line plugged 3. Valve closed

Node: 134. Ring seal water filter recovery line to ERS.	
Type: Line	Drawing: OM-090110-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
134.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. VCM release	S/E	4	C	5	4. Operating procedures	4. High pressure in batch water stripper
						5. Personal Protective Equipment	
134.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Heat tracing	
						8. Line insulation	
134.3 Start-up/Shutdown Hazards							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	
	3. VCM Leak	S/E	4	C	5	3. general monitor	
	4. VCM release	S/E	3	D	5	4. Maintenance & operating procedures	
						5. Personal Protective Equipment	
						6. Pressure Gauge	
134.4 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 135. Recovery line off ring seal water coolers to batch water strippers.

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
135.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak 4. VCM release	S/E S S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. High pressure in batch water stripper 2. Operator error 3. Valve failure 4. Valve leaking through
135.2 High Temperature							
	1. Fire and explosion 2. High pressure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Operator error
135.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. No flow 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training 8. Personal Protective Equipment	1. Cold weather 2. Valve leaking through
135.4 Start-up/Shutdown Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak 4. VCM release	S/E S S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Operator error

Node: 136. North and South KO tank blowdown line to batch water stripper.

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
136.1 High Pressure							
1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Overpressure batchwater stripper 5. Personal exposure 6. VCM Leak	S/E S/E S/E S/E S S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. DCS interlock- batch water stripper can't have high pressure, high level, and the receivers can't be draining 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Personal Protective Equipment 7. Pressure Indication- 84P848/845	1. External heat 2. High pressure in batch water stripper 3. Instrument failure 4. Line plugged 5. Operator error 6. Valve closed	
136.2 High Temperature							
1. Fire and explosion 2. Lift relief valve 3. Overpressure batchwater stripper 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Instrument failure 3. Operator error	
136.3 Low Temperature							
1. Fire and explosion 2. Frozen Line 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Operating procedures 6. Personal Protective Equipment 7. Line insulation	1. Cold weather 2. Heat tracing failure 3. Valve leaking through	

Node: 137. Seal water separator blowdown line & separator sight glass recovery line to batch water strippers.

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
137.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock- batch water stripper can't have high pressure, high level, and the receivers can't be draining	1. External heat
	2. Gasket failure	S/E	4	C	5		2. High pressure in batch water stripper
	3. Line rupture	S/E	4	C	5		3. Instrument failure
	4. Overpressure batchwater stripper	S/E	4	C	5	2. Fire Protection System	4. Line plugged
	5. Personal exposure	S	4	C	5	3. Fixed point monitor	5. Operator error
	6. VCM Leak	S/E	4	C	5	4. general monitor	6. Valve closed
						5. Operating procedures	
						6. Personal Protective Equipment	
						7. Pressure Indication- 84P848/845	
137.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Overpressure batchwater stripper	S/E	4	C	5	2. Fixed point monitor	2. Instrument failure
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
137.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Personal exposure	S/E	4	C	5	4. Heat tracing	
	5. VCM Leak	S/E	4	C	5	5. Line insulation	
						6. Operating procedures	
						7. Personal Protective Equipment	

Node: 138. Ring seal water pump recovery line to batch water stripper.

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
138.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Indication- 84P848/845	1. External heat 2. High pressure in batch water stripper 3. Instrument failure 4. Line plugged 5. Operator error 6. Valve closed
138.2 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Personal Protective Equipment	1. Cold weather 2. Heat tracing failure 3. Valve leaking through
138.3 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak	S/E S/E S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Instrument failure 3. Operator error

Node: 139. Hydroquinone pump and supply line to ring seal water pump suction.

Type: Line + Positive Displacement Pump

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
139.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. Valve failure	S/E	4	C	5	5. Personal Protective Equipment	
						6. Check valve	
						7. Pressure Gauge	
						8. sight glass	
139.2 Low/No Flow							
	1. VCM process line pluggage	S/E	4	C	5	1. Fire Protection System	1. Operator error
	2. Poly peroxide formation in stagnant lines	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Fire and explosion	S/E	3	D	5	3. general monitor	3. Pump failure
						4. Operating procedures	4. Valve closed
						5. Personal Protective Equipment	5. Supply tank empty
						6. Pressure Gauge	

Node: 140. HPSW make-up to seal water separators.

Type: Line

Drawing: OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
140.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Power failure
	4. Personal exposure	S	4	C	5	4. Heat tracing	
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	
						6. Personal Protective Equipment	
140.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	

Node: 141. RVCM line from compressors to RVCM condenser

Type: Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
141.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. Pressure Indication - 81P759	
141.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 142. Recovery line from Dump TK to RVCM condensers

Type: Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
142.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operator training	5. Power failure
						6. Personal Protective Equipment	6. Valve closed
						7. Pressure indication, 81P628	
						8. Valve indication	
142.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Dump tank kill system	2. Reaction occurring in dump tank
	3. Line rupture	S/E	4	C	5	3. Fixed point monitor	
	4. Personal exposure	S	4	C	5	4. general monitor	
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	
142.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line leak/rupture
	2. Overpressure dump tank	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Personal exposure	S	4	C	5	3. general monitor	3. Valve leaking through
	4. VCM release	S/E	3	D	5	4. Operating procedures	
						5. Operator training	
						6. Personal Protective Equipment	
						7. Valve indication	

Node: 143. RVCM condensate line from RVCM condensers to RVCM subcooler. Includes transfer pumps PP-110/111.

Type: Centrifugal Pump + Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-22. Pumps, 3x2-7-7, 90 psi @ 150 GPM

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
143.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock- 81X738/737	1. External heat
	2. Gasket failure	S/E	4	C	5	pump won't run unless receiver	2. Line plugged
	3. Line rupture	S/E	4	C	5	valve is open	3. Operator error
	4. Personal exposure	S	4	C	5	2. Fire Protection System	4. Valve closed
	5. Seal failure	S/E	4	C	5	3. Fixed point monitor	
	6. VCM Leak	S/E	4	C	5	4. general monitor	
						5. Operating procedures	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. Recirculation line	
143.2 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. Seal failure	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Pump blocked in and running
						6. Recirculation line	
						7. DCS interlock- 81X738/737	
						pump won't run unless receiver	
						valve is open	

Node: 144. RVCM Subcooler, EX-102, and subcooler bypass.

Type: Heat Exchanger + Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: MAWP: shell 150 psig @ 250 F, tube 300 psig @ 250 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
144.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Lift relief valve	S/E	3	D	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Relief Valve failure
	6. Vessel rupture	S/E	4	C	5	6. relief valve	
144.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. No cooling water
	3. Lift relief valve	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM release	S/E	3	D	5	6. relief valve	
144.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen tubes	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Tube rupture	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak		4	C	5	5. Personal Protective Equipment	
						6. Temperature gauge	

Node: 145. RVCM transfer pump recirculation line

Type: Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
145.1 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. Seal failure	S/E	4	C	5	4. Operating procedures	4. Pump blocked in and running
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve closed
145.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. Seal failure	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	

Node: 146. RVCM condensate line from RVCM subcooler to RVCM receivers.

Type: Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
146.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. Seal failure	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	
						7. Recirculation line	
146.2 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. Seal failure	S/E	4	C	5	4. Operating procedures	4. Pump blocked in and running
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve closed

Node: 147. HPSW supply to RVCM condensers, EX-008/009

Type: Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-3.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
147.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
147.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Power failure
	4. Personal exposure	S	4	C	5	4. Heat tracing	
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	
						6. Personal Protective Equipment	

Node: 147A. RVCM Condensers, Ex-008/009.

Type: Heat Exchanger

Drawing: OM-090111-PID-D

Design Conditions/Parameters: MAWP: shell/tube, 150 psig @ 400F.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
147A.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Lift relief valve	S/E	3	D	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Relief Valve failure
	6. Vessel rupture	S/E	4	C	5	6. relief valve	
147A.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. No cooling water
	3. Lift relief valve	S/E	3	D	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM release	S/E	3	D	5	6. relief valve	
147A.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen tubes	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Tube rupture	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. Temperature gauge	
147A.4 Maintenance Hazards							
	1. Fire and explosion	S/E	3	D	5	1. Maintenance & operating procedures	1. Poor access
	2. Personal exposure	S	4	C	5	2. Fire Protection System	2. Not blanked out
	3. VCM Leak	S/E	4	C	5	3. Fixed point monitor	3. Operator error
	4. VCM release	S/E	4	C	5	4. general monitor	
	5. Personal injury due to falling, bumping head, or straining back.	S	4	C	5	5. Personal Protective Equipment	

Node: 148. Cooling water supply & return lines for EX-008/009.

Type: Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-3.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
148.1 High Temperature							
	1. Fire and explosion	S/E	4	C	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. High pressure	S/E	4	C	5	3. general monitor	3. Operator error
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	4. Exchanger blocked in with
						5. Operator training	external heat (thermal
						6. Pressure Gauge	expansion)
148.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external
	3. Line rupture	S/E	4	C	5	3. general monitor	heat (thermal expansion)
	4. Overpressure VCM Receivers	S/E	4	C	5	4. Operating procedures	3. Line plugged
	5. Personal exposure	S/E	4	C	5	5. Operator training	4. Valve closed
	6. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	
						7. Pressure Gauge	
148.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fixed point monitor	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. general monitor	2. Valve leaking through
	3. High pressure	S/E	4	C	5	3. Operating procedures	
	4. Personal exposure	S/E	4	C	5	4. Operator training	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. Fire Protection System	

Node: 149. EX-008/009 relief valve.

Type: Line + Relief Valve

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
149.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Overpressure VCM Receivers	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. Personal exposure	S/E	4	C	5	5. Operator training	5. Relief Valve failure
	6. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. relief valve	
149.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Exchanger blocked in with external heat (thermal expansion)
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. External heat
	3. High pressure	S/E	4	C	5	3. general monitor	3. Line plugged
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	4. Operator error
						5. Operator training	
						6. Pressure Gauge	
149.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	

Node: 150. Recovery lines from RVCM condensers to ERS.

Type: Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
150.1 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
150.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S/E	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM release	S/E	4	C	5	3. general monitor	3. Valve leaking through
						4. Operating procedures	
						5. Personal Protective Equipment	
150.3 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High Pressure in Reactor
	2. Personal exposure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve failure
	4. VCM release	S/E	4	C	5	4. Operating procedures	4. Valve leaking through
						5. Personal Protective Equipment	
150.4 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	

Node: 151. Inert vent from RVCM condenser recovery line to RVCM receivers.

Type: Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
151.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S/E	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. VCM release	S/E	3	D	5	4. Operating procedures	4. Line blocked in with external heat (thermal expansion)
						5. Personal Protective Equipment	
151.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
151.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	

Node: 152. Inert vent from RVCM condenser relief valve inlet line to RVCM receivers.

Type: Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
152.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line blocked in with external heat (thermal expansion)
	2. Personal exposure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve failure
	4. VCM release	S/E	4	C	5	4. Operating procedures	4. Valve leaking through
						5. Personal Protective Equipment	
152.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
152.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	

Node: 153. HPSW supply to mechanical seal on RVCN transfer pumps PP-110/111.

Type: Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-3/J16-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
153.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
153.2 High Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment	1. External heat 2. Operator error
153.3 Low Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment 4. Heat tracing 5. Line insulation	1. Operator error 2. Cold weather
153.4 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment 4. Pressure Gauge 5. Flow meter	1. Operator error 2. Line plugged 3. Instrument failure

Node: 154. Recovery line from RCVN transfer pumps to ERS.

Type: Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
154.1 High Pressure							
1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. High pressure in DM-701 3. Instrument failure 4. Line plugged 5. Operator error 6. Valve closed	
154.2 Low Temperature							
1. Fire and explosion 2. Frozen Line 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Personal Protective Equipment	1. Cold weather 2. Heat tracing failure 3. Valve leaking through	
154.3 Reverse/Misdirected Flow							
1. Fire and explosion 2. Personal exposure 3. VCM Leak 4. VCM release	S/E S S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. Operator error 2. Valve leaking through	
154.4 High Temperature							
1. Fire and explosion 2. Personal exposure 3. VCM Leak	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Instrument failure 3. Operator error	

Node: 155. RVCM condensate line from ERS condensers to RVCM transfer pump discharge line.

Type: Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
155.1 High Pressure							
1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Line plugged 3. Operator error 4. Valve closed	
155.2 Reverse/Misdirected Flow							
1. Fire and explosion 2. High pressure 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Check valve	1. Instrument failure 2. Line plugged 3. Operator error 4. Valve closed	
155.3 Low Temperature							
1. Fire and explosion 2. Frozen tubes 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. Cold weather 2. Valve leaking through	
155.4 High Temperature							
1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. VCM Leak 5. VCM release	S/E S/E S S/E S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat	

Node: 156. RVCM condensate line from RVCM condensers to RVCM subcooler.

Type: Line

Drawing: OM-090111-PID-D

Design Conditions/Parameters: Pipe spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
156.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock- 81X738/737	1. External heat
	2. Gasket failure	S/E	4	C	5	pump won't run unless receiver	2. Line plugged
	3. Line rupture	S/E	4	C	5	valve is open	3. Operator error
	4. Personal exposure	S	4	C	5	2. Fire Protection System	4. Valve closed
	5. Seal failure	S/E	4	C	5	3. Fixed point monitor	
	6. VCM Leak	S/E	4	C	5	4. general monitor	
						5. Operating procedures	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. Recirculation line	
156.2 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock- 81X738/737	1. Instrument failure
	2. High pressure	S/E	4	C	5	pump won't run unless receiver	2. Line plugged
	3. Personal exposure	S	4	C	5	valve is open	3. Operator error
	4. Seal failure	S/E	4	C	5	2. Fire Protection System	4. Pump blocked in and running
	5. VCM Leak	S/E	4	C	5	3. Fixed point monitor	5. Valve closed
						4. general monitor	
						5. Operating procedures	
						6. Personal Protective Equipment	
						7. Recirculation line	

Node: 157. RVCM receivers, DM-011, DM-012.

Type: Vessel

Drawing: OM-090112-PID-D

Design Conditions/Parameters: MAWP: 150 psig @ 100 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
157.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture 6. Overpressure batchwater stripper	S/E S/E S/E S S/E S/E	3 4 4 4 3 4	D C C C D C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure indication, 81P750/753 9. relief valve	1. External heat 2. Instrument failure 3. Line blocked in with external heat (thermal expansion) 4. Line plugged 5. Operator error 6. Relief Valve failure 7. Valve closed 8. vent plugged 9. No cooling water on knockback condenser
157.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Overpressure batchwater stripper 5. Personal exposure 6. Vessel rupture	S/E S/E S/E S/E S S/E	3 4 4 4 4 3	D C C C C D	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. relief valve	1. External heat 2. No cooling water on knockback condenser 3. Temperature indication on chiller
157.3 High Level							
	1. Fire and explosion 2. High pressure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. relief valve 9. Level indication, 81L755/761, 81LSH752 10. sight glass	1. Instrument failure 2. Operator error 3. Valve leaking through
157.4 Start-up/Shutdown Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S S/E	3 4 3	D C D	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Maintenance & operating procedures 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. Operator error 2. Valve leaking through

Node: 158. RVCM charge pump relief valve and discharge header.

Type: Line + Relief Valve

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
158.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High pressure in batch water stripper
	2. Lift relief valve	S/E	4	C	5	2. Equalization line	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. Fixed point monitor	3. Line plugged
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Locking devices on relief valves	4. Operator error
	5. Personal exposure	S	4	C	5	5. Operator training	
	6. Seal failure	S/E	4	C	5	6. relief valve	
	7. VCM Leak	S/E	4	C	5	7. Equipment Preventive Maintenance Program	
158.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. Operator training	
158.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. VCM Leak	S/E	4	C	5	3. general monitor	
	4. VCM release	S/E	3	D	5	4. Operating procedures	
	5. Overpressure batchwater stripper	S/E	4	C	5	5. Personal Protective Equipment	
						6. Equipment Preventive Maintenance Program	

Node: 159. RVCM condensate line from RVCM subcooler to RVCM receivers.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
159.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. Seal failure	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	
						7. Recirculation line	
159.2 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock- 81X738/737	1. Instrument failure
	2. High pressure	S/E	4	C	5	pump won't run unless receiver	2. Line plugged
	3. Personal exposure	S/E	4	C	5	valve is open	3. Operator error
	4. Seal failure	S/E	4	C	5	2. Fire Protection System	4. Pump blocked in and running
	5. VCM Leak	S/E	4	C	5	3. Fixed point monitor	5. Valve closed
						4. general monitor	
						5. Operating procedures	
						6. Personal Protective Equipment	
						7. Recirculation line	

Node: 160. Inert vent line from RVCM knockback condenser to incinerator.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
160.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Control Valve failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Instrument failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line blocked in with external heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Line plugged
	5. Valve leaking	S/E	4	C	5	5. Personal Protective Equipment	5. Operator error
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	6. Valve failure
160.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
						6. Temperature gauge	

Node: 161. RVCM charge line from RVCM receivers to RVCM charge filters. Includes RVCM charge pumps, PP-477/058.	
Type: Centrifugal Pump + Line	Drawing: OM-090112-PID-D
Design Conditions/Parameters: Pipe spec A2-22. Pumps, 2x3-13, 200 GPM @ 35 psi	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
161.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. Seal failure	S/E	4	C	5	5. Personal Protective Equipment	5. Relief Valve failure
	6. VCM Leak	S/E	4	B	5	6. Pressure Gauge	
						7. Recirculation line	
						8. relief valve	
161.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Lift relief valve	S/E	4	C	5	3. general monitor	3. Operator error
	4. Line rupture	S/E	4	C	5	4. Operating procedures	4. Relief Valve failure
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	5. Pump blocked in and running
	6. VCM Leak	S/E	4	C	5		
161.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	B	5	3. general monitor	3. Valve leaking through
	4. No flow	S/E	4	C	5	4. Heat tracing	4. Heat tracing failure
	5. Personal exposure	S	4	C	5	5. Line insulation	
	6. VCM Leak	S/E	4	C	5	6. Operating procedures	
						7. Personal Protective Equipment	
161.4 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. Check valve failure
	2. High Level on Knockout Tank	S/E	4	C	5	2. Fire Protection System	2. High Pressure in Reactor
	3. Lift relief valve	S/E	3	D	5	3. Fixed point monitor	3. Pump failure
	4. Line rupture	S/E	4	C	5	4. general monitor	
	5. Personal exposure	S	4	C	5	5. Operating procedures	
	6. VCM Leak	S/E	4	C	5	6. Operator training	
						7. Personal Protective Equipment	
						8. relief valve	

Node: 162. RVCM charge line from RVCM filters to Rx's.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
162.1 High Pressure							
	1. Lift relief valve 2. Valve packing leak 3. Line rupture 4. Fire and explosion 5. Gasket failure	S/E S/E S/E S/E S/E	4 4 4 3 4	C C C D C	5 5 5 5 5	1. DCS interlocks, valve 81hv703, pump won't run if valve closed 2. Operating procedures 3. Flow indication, 81F744 4. Pressure Gauge	1. external heat 2. Plugged filter pack 3. Plugged relief valve 4. Valve blocked in/closed
162.2 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Personal Protective Equipment	1. Cold weather 2. Valve leaking through
162.3 High Temperature							
	1. Fire and explosion 2. High pressure 3. Lift relief valve 4. Personal exposure	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Personal Protective Equipment 5. relief valve	1. External heat

Node: 163. Inert line from New Module receivers	
Type: Line	Drawing: OM-090112-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
163.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Valve leaking 6. VCM Leak	S/E S/E S/E S S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge 7. Knockback condensers on RVCM receivers	1. Control Valve failure 2. Instrument failure 3. Line blocked in with external heat (thermal expansion) 4. Line plugged 5. Operator error 6. Valve failure
163.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Temperature gauge 7. Chiller unit cooling knockback condensers	1. External heat 2. Heat tracing failure 3. Chiller unit not working
163.3 Low Temperature							
	1. Frozen Line 2. Gasket failure 3. Line rupture 4. Fire and explosion	S/E S/E S/E S/E	4 4 4 3	C C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operator training	1. Cold weather 2. Valve leaking through 3. Heat tracing failure

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 164. Receiver equalization line from fresh receiver.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
164.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak 4. VCM release	S/E S S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure indication, 81P750	1. Line blocked in with external heat (thermal expansion) 2. Operator error 3. Valve failure 4. Valve leaking through 5. High pressure in VCM receivers
164.2 High Temperature							
	1. Fire and explosion 2. High pressure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D D D C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Operator error
164.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. No flow 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. Cold weather 2. Valve leaking through

Node: 165. RVCM charge filter, FL-691.

Type: Vessel

Drawing: OM-090112-PID-D

Design Conditions/Parameters: MAWP: 300 psig @ 650 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
165.1 High Pressure							
	1. Blown O-Ring	S/E	4	C	5	1. Equalization line	1. Closed Outlet Valve
	2. Fire and explosion	S/E	3	D	5	2. Operating procedures	2. Equalization Line Plugged
	3. Lift relief valve	S/E	4	C	5	3. Pressure Gauge	3. External Heat
	4. Personal exposure	S	4	C	5	4. relief valve	4. Plugged Filter
165.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Operating procedures	
	3. Lift relief valve	S/E	4	C	5	3. relief valve	
	4. Personnel exposure	S	4	C	5	4. Fixed point monitor	
						5. general monitor	
						6. Personal Protective Equipment	
165.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Operating procedures	1. Cold weather
	2. High pressure	S/E	4	C	5	2. Fire Protection System	2. Valve leaking through
	3. No flow	S/E	4	C	5	3. Fixed point monitor	
	4. Fire and explosion	S/E	3	D	5	4. general monitor	
						5. Personal Protective Equipment	
165.4 Start-up/Shutdown Hazards							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. VCM release	S/E	3	D	5	3. Flow meter	
						4. Maintenance & operating procedures	
						5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	

Node: 166. RVCM receiver recovery line to batch water stripper.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
166.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High Pressure in Reactor
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Operator error
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve failure
	4. VCM release	S/E	3	D	5	4. Operating procedures	4. Valve leaking through
						5. Personal Protective Equipment	
166.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
166.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	

Node: 167. RVCM Feedback feedback line from RVCM receivers to Rx recovery header. See node 72.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
167.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Valve indication	
167.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Steam stripping valve on reactor failed open
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
167.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line leak/rupture
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Overpressure VCM Receivers	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM release	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Valve indication	

Node: 168. Inert vent from RVCM condenser recovery line to RVCM receivers. See node 151

Type: Line

Drawings: OM-090111-PID-D, OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
168.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line blocked in with external heat (thermal expansion)
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Operator error
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve failure
	4. VCM release	S/E	3	D	5	4. Operating procedures	4. Valve leaking through
						5. Personal Protective Equipment	
168.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
168.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	

Node: 169. Inert vent line from Ex-102 (RVCM Subcooler) to RVCM receivers.

Type: Line

Drawings: OM-090111-PID-D, OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
169.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High Pressure in Reactor
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Operator error
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve failure
	4. VCM release	S/E	3	D	5	4. Operating procedures 5. Personal Protective Equipment	4. Valve leaking through
169.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training 6. Personal Protective Equipment	
169.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM release	S/E	3	D	5	3. general monitor 4. Operating procedures 5. Personal Protective Equipment	3. Valve leaking through
169.4 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 170. RVCM Receiver recovery line to ERS.	
Type: Line	Drawing: OM-090112-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
170.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High Pressure in Reactor
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Operator error
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve failure
	4. VCM release	S/E	3	D	5	4. Operating procedures	4. Valve leaking through
						5. Personal Protective Equipment	
170.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
170.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
						4. Operator training	
						5. Personal Protective Equipment	

Node: 171. RVCM recycle line from RVCM charge pumps to RVCM receivers.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
171.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. Seal failure	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	
171.2 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. Seal failure	S/E	4	C	5	4. Operating procedures	4. Pump blocked in and running
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve closed

Node: 172. Jumper from NM inert line and receiver recovery line to ERS.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
172.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. VCM release	S/E	3	D	5	4. Operating procedures	
						5. Personal Protective Equipment	
172.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	

Node: 173. VCM charge line from NM VCM charge pumps to OM RVCM charge pumps.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
173.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. Seal failure	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
173.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	

Node: 174. DM-013, FVCM Receiver Drain Line to batch water stripper.

Type: Line

Drawings: OM-090100-PID-D, OM-090112-PID-D

Design Conditions/Parameters: Pipe Spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
174.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Valve packing leaking 4. VCM release	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. Cold weather 2. Line blocked in with external heat (thermal expansion)
174.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. Valve packing leaking 5. VCM release	S/E S/E S S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat
174.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Heat tracing 2. Operating procedures 3. Operator training	1. Cold weather
174.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure batchwater stripper 4. Personal exposure 5. VCM release	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. Operator error 2. Valve failure

Node: 175. Inert vent from RVCM condenser relief valve inlet line to RVCM receivers.

Type: Line

Drawings: OM-090111-PID-D, OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
175.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line blocked in with external heat (thermal expansion)
	2. Personal exposure	S	4	D	5	2. Fixed point monitor	2. Operator error
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve failure
	4. VCM release	S/E	4	C	5	4. Operating procedures	4. Valve leaking through
						5. Personal Protective Equipment	
175.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
175.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	

Node: 176. DM-011/012, RVCM Receiver Drain Line to batch water stripper.

Type: Line

Drawings: OM-090100-PID-D, OM-090112-PID-D

Design Conditions/Parameters: Pipe Spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
176.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Valve packing leaking 4. VCM release	S/E S/E S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. Cold weather 2. Line blocked in with external heat (thermal expansion)
176.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Valve packing leaking 4. VCM release	S/E S/E S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat
176.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Heat tracing 2. Operating procedures 3. Operator training	1. Cold weather
176.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure batchwater stripper 4. Personal exposure 5. VCM release	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. Operator error 2. Valve failure

Node: 177. Secondary inert vent line from NM RVCM receivers to incinerator.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
177.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Valve leaking 6. VCM Leak	S/E S/E S/E S S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Knockback condensers on RVCM receivers 5. Operating procedures 6. Personal Protective Equipment 7. Pressure Gauge	1. Control Valve failure 2. Instrument failure 3. Line blocked in with external heat (thermal expansion) 4. Line plugged 5. Operator error 6. Valve failure
177.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Chiller unit cooling knockback condensers 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Personal Protective Equipment 7. Temperature gauge	1. Chiller unit not working 2. External heat 3. Heat tracing failure
177.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Gasket failure 4. Line rupture	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operator training	1. Cold weather 2. Heat tracing failure 3. Valve leaking through

Node: 178. Jumper line from secondary inert vent line to batch water stripper line.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
178.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Control Valve failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Instrument failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line blocked in with external heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Knockback condensers on RVCN receivers	4. Line plugged
	5. Valve leaking	S/E	4	C	5	5. Operating procedures	5. Operator error
	6. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	6. Valve failure
						7. Pressure Gauge	
178.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Chiller unit cooling knockback condensers	1. Chiller unit not working
	2. Line rupture	S/E	4	C	5	2. Fire Protection System	2. External heat
	3. Personal exposure	S	4	C	5	3. Fixed point monitor	3. Heat tracing failure
	4. VCM Leak	S/E	4	C	5	4. general monitor	
						5. Operating procedures	
						6. Personal Protective Equipment	
						7. Temperature gauge	
178.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Gasket failure	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Line rupture	S/E	4	C	5	4. Heat tracing	
						5. Line insulation	
						6. Operator training	

Node: 179. Jumper line, primary inert vent from new module to batch water stripper	
Type: Line	Drawing: OM-090112-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
179.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Control Valve failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Instrument failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line blocked in with external heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Knockback condensers on RVCN receivers	4. Line plugged
	5. Valve leaking	S/E	4	C	5	5. Operating procedures	5. Operator error
	6. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	6. Valve failure
						7. Pressure Gauge	
179.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Chiller unit cooling knockback condensers	1. Chiller unit not working
	2. Line rupture	S/E	4	C	5	2. Fire Protection System	2. External heat
	3. Personal exposure	S	4	C	5	3. Fixed point monitor	3. Heat tracing failure
	4. VCM Leak	S/E	4	C	5	4. general monitor	
						5. Operating procedures	
						6. Personal Protective Equipment	
						7. Temperature gauge	
179.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Gasket failure	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Line rupture	S/E	4	C	5	4. Heat tracing	
						5. Line insulation	
						6. Operator training	

Node: 180. Recovery header from RVCM charge filter & RVCM condensers to batch water strippers.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
180.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. Valve leaking	S/E	4	C	5	5. Personal Protective Equipment	5. Valve failure
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	
180.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Gasket failure	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
						6. Temperature gauge	
180.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
						6. Temperature gauge	

Node: 181. Recovery line from trans-unit vcm charge line to batch water stripper.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
181.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. Valve leaking	S/E	4	C	5	5. Personal Protective Equipment	5. Valve failure
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	
181.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
						6. Temperature gauge	
181.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock-Fill valves on batch water stripper will close on high pressure/level.	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	2. Fire Protection System	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. Fixed point monitor	3. Operator error
	4. Overpressure batchwater stripper	S/E	4	C	5	4. general monitor	4. Power failure
	5. Personal exposure	S	4	C	5	5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	
						8. relief valve	
181.4 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Gasket failure	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Line rupture	S/E	4	C	5	4. Heat tracing	
						5. Line insulation	
						6. Operator training	

Node: 182. Recovery line from fresh vcm charge filters FL-008/009.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
182.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Gasket failure	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Line rupture	S/E	4	C	5	4. Heat tracing	
						5. Line insulation	
						6. Operator training	
182.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock-Fill valves on	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	batch water stripper will close on	2. Line plugged
	3. Line rupture	S/E	4	C	5	high pressure/level.	3. Operator error
	4. Overpressure batchwater	S/E	4	C	5	2. Fire Protection System	4. Power failure
	stripper					3. Fixed point monitor	
	5. Personal exposure	S	4	C	5	4. general monitor	
						5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	
						8. relief valve	
182.3 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external
	3. Line rupture	S/E	4	C	5	3. general monitor	heat (thermal expansion)
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	3. Line plugged
	5. Valve leaking	S/E	4	C	5	5. Personal Protective Equipment	4. Operator error
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	5. Valve failure
182.4 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
						6. Temperature gauge	

Node: 183. RVCM charge pump, PP-477/058, recovery line.	
Type: Line	Drawing: OM-090112-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
183.1 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Gasket failure 4. Line rupture	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Line insulation 5. Operator training	1. Cold weather 2. Heat tracing failure 3. Valve leaking through
183.2 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Overpressure batchwater stripper 5. Personal exposure	S/E S/E S/E S/E S	3 4 4 4 4	D C C C C	5 5 5 5 5	1. DCS interlock-Fill valves on batch water stripper will close on high pressure/level. 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. relief valve	1. Instrument failure 2. Line plugged 3. Operator error 4. Power failure
183.3 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Valve leaking 6. VCM Leak	S/E S/E S/E S S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Instrument failure 2. Line blocked in with external heat (thermal expansion) 3. Line plugged 4. Operator error 5. Valve failure
183.4 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Temperature gauge	1. External heat 2. Heat tracing failure

Node: 184. RVCM filter, FL-691, recovery line.	
Type: Line	Drawing: OM-090112-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
184.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Gasket failure	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Line rupture	S/E	4	C	5	4. Heat tracing	
						5. Line insulation	
						6. Operator training	
184.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock-Fill valves on	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	batch water stripper will close on	2. Line plugged
	3. Line rupture	S/E	4	C	5	high pressure/level.	3. Operator error
	4. Overpressure batchwater	S/E	4	C	5	2. Fire Protection System	4. Power failure
	stripper					3. Fixed point monitor	
	5. Personal exposure	S	4	C	5	4. general monitor	
						5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	
						8. relief valve	
184.3 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external
	3. Line rupture	S/E	4	C	5	3. general monitor	heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operating procedures	3. Line plugged
	5. Valve leaking	S/E	4	C	5	5. Personal Protective Equipment	4. Operator error
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	5. Valve failure
184.4 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
						6. Temperature gauge	

Node: 185. Inert vent from RVCM condenser relief valve inlet line to RVCM receivers.

Type: Line

Drawings: OM-090111-PID-D, OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
185.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak 4. VCM release	S/E S S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. Line blocked in with external heat (thermal expansion) 2. Operator error 3. Valve failure 4. Valve leaking through
185.2 High Temperature							
	1. Fire and explosion 2. High pressure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Operator error
185.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. No flow 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. Cold weather 2. Valve leaking through

Node: 186. Relief valve discharge header from RVCM charge filter, FL-691, to batch water stripper.

Type: Line

Drawings: OM-090100-PID-D, OM-090112-PID-D

Design Conditions/Parameters: Pipe Spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
186.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. VCM release	S/E S/E S/E S S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. DCS interlock, valve 81xv709 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Locking devices on relief valves 6. Personal Protective Equipment 7. relief valve	1. High pressure in batch water stripper 2. Line plugged 3. Valve closed
186.2 Low Temperature							
	1. Fire and explosion 2. High pressure 3. No flow 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Personal Protective Equipment	1. Cold weather
186.3 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure batchwater stripper 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Personal Protective Equipment 5. relief valve	1. External heat

Node: 187. ERS inlet KO tank,DM-701, drain line to batch water stripper.

Type: Line

Drawings: OM-090112-PID-D, OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
187.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Filter Plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. High pressure in batch water
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operator training	stripper
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	4. Instrument failure
	6. Seal failure	S/E	4	C	5	6. Pressure Gauge	5. Line blocked in with external heat (thermal expansion)
	7. Vessel rupture	S/E	3	D	5		6. Line plugged
							7. Operator error
187.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Overpressure filter pack	S/E	4	C	5	4. Operator training	
	5. Personal exposure	S	4	C	5		
	6. Seal failure	S/E	4	C	5		
187.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Personal exposure	S/E	4	C	5	3. general monitor	3. Line plugged
						4. Heat tracing	4. Operator error
						5. Line insulation	
						6. Operator training	
187.4 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Filter Plugged
	3. Gasket failure	S/E	4	C	5	3. general monitor	3. Heat tracing failure
	4. Line rupture	S/E	4	C	5	4. Heat tracing	4. High pressure in batch water
	5. Overpressure filter pack	S/E	4	C	5	5. Line insulation	stripper
	6. Seal failure	S/E	4	C	5	6. Operator training	5. Line plugged
	7. Vessel rupture	S/E	3	D	5	7. Personal Protective Equipment	6. Operator error
						8. Pressure Gauge	7. Pump failure
							8. Valve closed

Node: 188. North and South KO tank blowdown line to batch water stripper.

Type: Line

Drawings: OM-090108-PID-D, OM-090112-PID-D, OM-090110-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
188.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Instrument failure
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operating procedures	4. Line plugged
	5. Personal exposure	S/E	4	C	5	5. Personal Protective Equipment	5. Operator error
	6. VCM Leak	S/E	4	C	5		6. Valve closed
188.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Instrument failure
	3. Overpressure batchwater stripper	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. relief valve	
188.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Personal exposure	S	4	C	5	4. Heat tracing	
	5. VCM Leak	S/E	4	C	5	5. Line insulation	
						6. Operating procedures	
						7. Personal Protective Equipment	

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 189. HPSW supply to mechanical seal on RVCM charge pump, PP-477.

Type: Line

Drawing: OM-090112-PID-D

Design Conditions/Parameters: Pipe spec A13-1.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
189.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
189.2 High Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment	1. External heat 2. Operator error
189.3 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Instrument failure 2. Line plugged 3. Operator error
189.4 Low Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Heat tracing 4. Line insulation 5. Personal Protective Equipment	1. Cold weather 2. Operator error

Node: 190. RVCM Receiver recovery line to ERS.

Type: Line

Drawings: OM-090112-PID-D, OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
190.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. VCM release	S/E	4	C	5	4. Operating procedures	4. High pressure in batch water stripper
						5. Personal Protective Equipment	5. Line blocked in with external heat (thermal expansion)
						6. Pressure control valve, 84P857	
190.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
190.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
						4. Operator training	
						5. Personal Protective Equipment	

Node: 191. Batch water stripper recovery line to ERS inlet condenser, EX-351.

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
191.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Instrument failure
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operator training	4. Line blocked in with external heat (thermal expansion)
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	5. Line plugged
							6. Operator error
							7. Valve closed
191.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
191.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Heat tracing failure
						4. Operator training	
						5. Personal Protective Equipment	
						6. Heat tracing	
						7. Line insulation	

Node: 192. ERS inlet VCM condenser, EX-351.

Type: Heat Exchanger

Drawing: OM-090113-PID-D

Design Conditions/Parameters: MAWP: for shell & tubes, 150 psig @ 450 F.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
192.1 High Pressure							
1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat	
2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Exchanger blocked in with	
3. Lift relief valve	S/E	4	C	5	3. general monitor	external heat (thermal	
4. Personal exposure	S	4	C	5	4. Operating procedures	expansion)	
5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	3. Line plugged	
6. Tube leak/rupture	S/E	4	C	5	6. relief valve	4. Operator error	
						5. Relief Valve failure	
192.2 High Temperature							
1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat	
2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. No cooling water	
3. Lift relief valve	S/E	4	C	5	3. general monitor		
4. Personal exposure	S	4	C	5	4. Operating procedures		
5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment		
6. VCM release	S/E	4	C	5	6. relief valve		
192.3 Low Temperature							
1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather	
2. Frozen tubes	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through	
3. Personal exposure	S	4	C	5	3. general monitor		
4. Tube rupture	S/E	4	C	5	4. Operating procedures		
5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment		
					6. Temperature gauge		
192.4 Start-up/Shutdown Hazards							
1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Not blanked out	
2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Operator error	
3. Personal injury due to falling, bumping head, or straining back.	S/E	4	C	5	3. general monitor	3. Poor access	
4. VCM Leak	S/E	4	C	5	4. Maintenance & operating procedures		
5. VCM release	S/E	3	D	5	5. Personal Protective Equipment		

Node: 193. ERS vcm condenser, EX-351, outlet to DM-701.	
Type: Line	Drawing: OM-090113-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
193.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak 4. VCM release	S/E S S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. High pressure in batch water stripper 2. Line blocked in with external heat (thermal expansion) 3. Operator error 4. Valve failure 5. Valve leaking through
193.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Valve packing leaking 6. VCM Leak	S/E S/E S/E S S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Operator error
193.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture	S/E S/E S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment	1. Cold weather 2. Valve leaking through

Node: 194. VCM tank farm recovery line to ERS inlet KO tank.

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
194.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. Valve leaking	S/E	4	C	5	5. Personal Protective Equipment	5. Valve failure
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	
194.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
194.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Gasket failure	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Line rupture	S/E	4	C	5	4. Heat tracing	
						5. Line insulation	
						6. Operator training	

Node: 195. Recovery line from NM Blowdown tank to ERS.

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
195.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Instrument failure
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operator training	4. Line blocked in with external heat (thermal expansion)
	5. Personal exposure	S/E	4	C	5	5. Personal Protective Equipment	5. Line plugged
							6. Operator error
							7. Valve closed
195.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
195.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve leaking through
						4. Heat tracing	
						5. Line insulation	
						6. Operator training	
						7. Personal Protective Equipment	

Node: 196. DM-701 outlet to ERS vacuum pumps & compressors

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
196.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Pressure control valve	1. High pressure in batch water stripper
	2. Gasket failure	S/E	4	C	5	2. Fire Protection System	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. Fixed point monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. general monitor	4. Operator error
						5. Personal Protective Equipment	5. Valve closed
						6. Pressure Gauge	
196.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Valve closed
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operator training	
						5. Personal Protective Equipment	
						6. Temperature gauge	

Node: 197. ERS Inlet KO TK, DM-701.

Type: Vessel

Drawing: OM-090113-PID-D

Design Conditions/Parameters: MAWP: 150 psig @ 350 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
197.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure indicator, 84P855 / 84P857 & pressure control valve 9. relief valve	1. Control Valve failure 2. External heat 3. High Level 4. Instrument failure 5. Operator error 6. Power failure 7. Relief Valve failure 8. Valve leaking through
197.2 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. VCM release	S/E S/E S S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Operating procedures 4. Operator training 5. Personal Protective Equipment	1. External heat
197.3 High Level							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S/E S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Level switch - 1701C 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. relief valve 9. sight glass	1. Instrument failure 2. Line plugged 3. Operator error 4. Pump failure 5. Valve failure
197.4 Start-up/Shutdown Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release 4. Vessel rupture	S/E S S/E S/E	3 4 3 3	D C D D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment 6. Pressure Gauge 7. sight glass	1. Operator error

Node: 198. ERS ring seal water filters recovery line.

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
198.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Instrument failure
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operator training	4. Line blocked in with external heat (thermal expansion)
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	5. Line plugged
							6. Operator error
							7. Valve closed
198.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve leaking through
						4. Heat tracing	
						5. Line insulation	
						6. Operator training	
						7. Personal Protective Equipment	
198.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		

Node: 199. Recovery line from RCVN transfer pumps to ERS.

Type: Line

Drawings: OM-090111-PID-D, OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
199.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Instrument failure
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operator training	4. Line blocked in with external heat (thermal expansion)
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	5. Line plugged
							6. Operator error
							7. Valve closed
199.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve leaking through
						4. Heat tracing	
						5. Line insulation	
						6. Operator training	
						7. Personal Protective Equipment	
199.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		

Node: 200. Recovery line from DM-701 water outlet strainers.	
Type: Line	Drawing: OM-090113-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
200.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Instrument failure
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operator training	4. Line blocked in with external heat (thermal expansion)
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	5. Line plugged
							6. Operator error
							7. Valve closed
200.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
200.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve leaking through
						4. Heat tracing	
						5. Line insulation	
						6. Operator training	
						7. Personal Protective Equipment	

Node: 201. ERS vacuum pumps, VP-703/704.	
Type: Centrifugal Compressor	Drawing: OM-090113-PID-D
Design Conditions/Parameters: 5x5-14, 280 acfm @ 25" hg.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
201.1 High Suction Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Lift relief valve	S/E	4	C	5	3. general monitor	3. Pump failure
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Relief Valve failure
	5. Seal failure	S/E	4	C	5	5. Personal Protective Equipment	5. Valve leaking through
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	
						7. relief valve	
201.2 High Discharge Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Amp indicator	1. Compressor not pulling
	2. Gasket failure	S/E	4	C	5	2. Fire Protection System	2. External heat
	3. Line rupture	S/E	4	C	5	3. Fixed point monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. general monitor	4. Operator error
	5. Seal failure	S/E	4	C	5	5. Motor overloads	5. Valve closed
	6. VCM Leak	S/E	4	C	5	6. Operating procedures	
						7. Operator training	
						8. Personal Protective Equipment	
						9. Pressure Gauge	

Node: 202. ERS vacuum pump, VP-704/704, discharge line and discharge header to DM-702.	
Type: Line	Drawing: OM-090113-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
202.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line plugged
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. High temperature	S/E	4	C	5	3. general monitor	3. Valve closed
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	
	6. Valve packing leaking	S/E	4	C	5		
	7. VCM Leak	S/E	4	C	5		
202.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line plugged
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. High temperature	S/E	4	C	5	3. general monitor	3. Valve closed
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S/E	4	C	5	5. Personal Protective Equipment	
	6. Valve packing leaking	S/E	4	C	5		
	7. VCM Leak	S/E	4	C	5		

Node: 203. ERS vacuum pump bypass line to ERS compressors.

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
203.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Power failure
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
203.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Power failure
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	B	5	5. Personal Protective Equipment	

Node: 204. Ring seal water supply line to ERS vacuum pump.

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
204.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Line insulation	
	5. Personal exposure	S	4	C	5	5. Operating procedures	
	6. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	
204.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 205. HPSW supply line to ERS vacuum pump mechanical seals.

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-3 and J16-1.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
205.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
205.2 High Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment	1. External heat 2. Operator error
205.3 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Instrument failure 2. Line plugged 3. Operator error
205.4 Low Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Cold weather

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 206. HPSW supply line to DM-701 and DM-701 sight glass.

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
206.1 Low Pressure							
	1. Personal exposure 2. Reverse flow 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Check valve 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Pressure Gauge	1. Filter Plugged 2. Line plugged 3. Operator error 4. Power failure 5. Pump failure 6. Valve closed 7. Valve leaking through
206.2 High Flow							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Level switch - 1701C 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. relief valve 9. sight glass	1. Instrument failure 2. Line plugged 3. Operator error 4. Pump failure 5. Valve failure

Node: 207. ERS vacuum pump, VP-703/704, relief valve and RV discharge line.	
Type: Line + Relief Valve	Drawing: OM-090113-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
207.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	5. Relief Valve failure
	6. VCM Leak	S/E	4	C	5	6. relief valve	6. Valve closed
207.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5	6. Rupture disc	
207.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. relief valve	

Node: 208. ERS inlet KO tank,DM-701, drain line to batch water stripper.

Type: Centrifugal Pump + Line

Drawings: OM-090112-PID-D, OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
208.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Filter Plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. High pressure in batch water stripper
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operator training	4. Instrument failure
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	5. Line blocked in with external heat (thermal expansion)
	6. Seal failure	S/E	4	C	5	6. Pressure Gauge	6. Line plugged
	7. Vessel rupture	S/E	3	D	5		7. Operator error
208.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Overpressure filter pack	S/E	4	C	5	4. Operator training	
	5. Personal exposure	S	4	C	5		
	6. Seal failure	S/E	4	B	5		
208.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Personal exposure	S	4	C	5	3. general monitor	3. Line plugged
						4. Heat tracing	4. Operator error
						5. Line insulation	
						6. Operator training	
208.4 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Filter Plugged
	3. Gasket failure	S/E	4	C	5	3. general monitor	3. Heat tracing failure
	4. Line rupture	S/E	4	C	5	4. Heat tracing	4. High pressure in batch water stripper
	5. Overpressure filter pack	S/E	4	C	5	5. Line insulation	5. Line plugged
	6. Seal failure	S/E	4	C	5	6. Operator training	6. Operator error
	7. Vessel rupture	S/E	3	D	5	7. Personal Protective Equipment	7. Pump failure
						8. Pressure Gauge	8. Valve closed

Node: 209. DM-701 and DM-701 sight glass recovery line.	
Type: Line	Drawing: OM-090113-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
209.1 Low/No Flow							
	1. Fire and explosion 2. Frozen Line 3. Gasket failure 4. Line rupture 5. Personal Exposure	S/E S/E S/E S/E S	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operator training 7. Personal Protective Equipment 8. Pressure Gauge	1. Cold weather 2. Filter Plugged 3. Heat tracing failure 4. High pressure in batch water stripper 5. Line plugged 6. Operator error 7. Pump failure 8. Valve closed
209.2 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal Exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operator training 7. Personal Protective Equipment 8. Pressure Gauge	1. Filter Plugged 2. High pressure in batch water stripper 3. Line plugged 4. Operator error 5. Pump failure 6. Valve closed
209.3 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training	1. External heat 2. Heat tracing failure 3. Operator error

Node: 210. Recirculation line from PP-112 discharge to DM-701.

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
210.1 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. Seal failure	S/E	4	C	5	4. Operating procedures	4. Pump blocked in and running
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve closed
210.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. Seal failure	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	

Node: 211. DM-702 blowdown line to DM-701.

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
211.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve leaking through
						6. Pressure Gauge	
211.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		

Node: 212. Jumper from DM-702 blowdown line to DM-701 drain line.

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
212.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Instrument failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line blocked in with external heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operator training	4. Line plugged
						5. Personal Protective Equipment	5. Operator error
						6. Pressure Gauge	
212.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operator training	
212.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Personal exposure	S	4	C	5	3. general monitor	3. Line plugged
						4. Heat tracing	4. Operator error
						5. Line insulation	
						6. Operator training	

Node: 213. DM-703 drain line to DM-701 drain line.	
Type: Line	Drawing: OM-090113-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
213.1 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Personal exposure	S/E S/E S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operator training	1. Cold weather 2. Heat tracing failure 3. Line plugged 4. Operator error
213.2 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Pressure Gauge	1. External heat 2. Filter Plugged 3. Instrument failure 4. Line blocked in with external heat (thermal expansion) 5. Line plugged 6. Operator error
213.3 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. High pressure 4. Line rupture 5. Personal exposure 6. VCM Leak	S/E S/E S/E S/E S S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Heat tracing failure

Node: 214. HPSW supply line to ERS ring seal water pump mechanical seals.

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A13-1.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
214.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
214.2 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Personal Protective Equipment	1. External heat
214.3 Low Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Heat tracing 4. Line insulation 5. Personal Protective Equipment	1. Cold weather 2. Operator error
214.4 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Instrument failure 2. Line plugged 3. Operator error

Node: 215. DM-702 drain/recovery line to DM-701 drain line.

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
215.1 High Pressure							
1. Fire and explosion	S/E	4	C	5	1. Fire Protection System	1. External heat	
2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Filter Plugged	
3. Line rupture	S/E	4	C	5	3. general monitor	3. Instrument failure	
4. Personal exposure	S	4	C	5	4. Operator training	4. Line blocked in with external heat (thermal expansion)	
					5. Personal Protective Equipment	5. Line plugged	
					6. Pressure Gauge	6. Operator error	
215.2 High Temperature							
1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat	
2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure	
3. High pressure	S/E	4	C	5	3. general monitor		
4. Line rupture	S/E	4	C	5	4. Operating procedures		
5. Personal exposure	S	4	C	5	5. Personal Protective Equipment		
6. VCM Leak	S/E	4	C	5			
215.3 Low Temperature							
1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather	
2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure	
3. Personal exposure	S	4	C	5	3. general monitor	3. Line plugged	
					4. Heat tracing	4. Operator error	
					5. Line insulation		
					6. Operator training		

Node: 216. ERS compressor relief valve discharge line.	
Type: Line	Drawing: OM-090113-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
216.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	5. Relief Valve failure
	6. VCM Leak	S/E	4	C	5	6. relief valve	6. Valve closed
216.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5	6. Rupture disc 7. Equipment Preventive Maintenance Program	
216.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment 6. relief valve	

Node: 217. HPSW line to ERS compressor mechanical seal.

Type: Line

Drawing: OM-090113-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
217.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
217.2 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Personal Protective Equipment	1. External heat
217.3 Low Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Heat tracing 4. Line insulation 5. Personal Protective Equipment	1. Cold weather 2. Operator error
217.4 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Instrument failure 2. Line plugged 3. Operator error

Node: 218. ERS vacuum pump, VP-704/704, discharge line and discharge header to DM-702.

Type: Line

Drawings: OM-090113-PID-D, OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
218.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line plugged
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. High temperature	S/E	4	C	5	3. general monitor	3. Valve closed
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	
	6. Valve packing leaking	S/E	4	C	5		
	7. VCM Leak	S/E	4	C	5		
218.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line plugged
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. High temperature	S/E	4	C	5	3. general monitor	3. Valve closed
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	
	6. Valve packing leaking	S/E	4	C	5		
	7. VCM Leak	S/E	4	C	5		

Node: 219. ERS vacuum pump seal water separator, DM-702.

Type: Vessel

Drawing: OM-090114-PID-D

Design Conditions/Parameters: MAWP: 150 psig @ 140 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
219.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S/E S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure indicator controller (PIC) 1301 & PIC 1302 9. relief valve	1. Control Valve failure 2. External heat 3. High Level 4. Instrument failure 5. Operator error 6. Power failure 7. Relief Valve failure 8. Valve leaking through
219.2 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. VCM release	S/E S/E S S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Operating procedures 4. Operator training 5. Personal Protective Equipment 6. Temperature switch/alarm 1702	1. External heat
219.3 High Level							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. relief valve 8. sight glass 9. Level Switch 1702 B/C	1. Instrument failure 2. Line plugged 3. Operator error 4. Pump failure 5. Valve failure
219.4 Start-up/Shutdown Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release 4. Vessel rupture	S/E S S/E S/E	3 4 3 3	D C D D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment 6. Pressure Gauge 7. sight glass	1. Operator error

Node: 220. Ring seal water supply header from DM-702, thru pumps, PP-707/708, filters, FL-050/051, to ring seal water coolers, EX-002/004/311.

Type: Centrifugal Pump + Line + Vessel

Drawing: OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22. Pumps: 2x3-10-8.5, 132 psig @ 90 GPM. Filters: MAWP 150 psig @ 500 F.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
220.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Filter Plugged
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Lift relief valve	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Line rupture	S/E	4	C	5	4. Locking devices on relief valves	4. Operator error
	5. Overpressure filter pack	S/E	4	C	5	5. Operating procedures	5. Relief Valve failure
	6. Personal exposure	S	4	C	5	6. Operator training	6. External heat
	7. Seal failure	S/E	4	C	5	7. Personal Protective Equipment	
						8. Pressure Gauge	
						9. relief valve	
220.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. VCM Leak	S	4	C	5	4. Operator training	
						5. Personal Protective Equipment	
						6. relief valve	
220.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Heat tracing	
						5. Line insulation	
						6. Operator training	
						7. Personal Protective Equipment	
220.4 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Overpressure batchwater stripper	S/E	4	C	5	3. general monitor	
						4. Operating procedures	
						5. Operator training	
						6. Personal Protective Equipment	
						7. relief valve	
						8. DCS interlock - Batch water stripper fill valves close on high pressure/level.	

Node: 221. Ring seal water filter, FL-050/051, relief valve and RV discharge line to ring seal water pump suction line.

Type: Line + Relief Valve

Drawing: OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
221.1 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Equipment Preventive Maintenance Program 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Personal Protective Equipment 7. Rupture disc 8. Line insulation	1. Cold weather 2. Valve leaking through
221.2 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. relief valve	1. External heat 2. Line plugged 3. Relief Valve failure 4. Valve closed
221.3 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. relief valve	1. External heat 2. Operator error 3. Pump blocked in and running

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 222. Ring Seal Water Coolers, EX-311, EX-004, EX-002.

Type: Heat Exchanger

Drawing: OM-090114-PID-D

Design Conditions/Parameters: MAWP: 75 psig @ 400 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
222.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Exchanger blocked in with
	3. Personal exposure	S	4	C	5	3. general monitor	external heat (thermal
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	expansion)
	5. Vessel rupture	S/E	3	C	4	5. Personal Protective Equipment	3. Line plugged
							4. Operator error
							5. Tubeside blocked in with steam
							on shell
							6. Over pressure by ring seal water
							pump
222.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. No cooling water
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
	5. VCM release	S/E	4	C	5	5. Personal Protective Equipment	
						6. Temperature gauge	
222.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen tubes	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Tube rupture	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. Temperature gauge	

Node: 223. ERS ring seal water header from coolers to compressors and vacuum pumps.

Type: Line

Drawing: OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
223.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Line insulation	
	5. Personal exposure	S	4	C	5	5. Operating procedures	
	6. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	
						7. Heat tracing	
223.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 224. VCM vapor from LRS separators

Type: Line

Drawing: OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
224.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
224.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 225. DM-702 vapor outlet to ERS compressors.

Type: Line

Drawing: OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
225.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Operator training	5. Check valve failure
						6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. Pressure Indication - PIC 1302	
225.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 226. Jumper from ring seal water header to DM-702.

Type: Line

Drawing: OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
226.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure Indication - 81P759	1. External heat 2. Line plugged
226.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat

Node: 227. DM-702 blowdown line to DM-701.

Type: Line

Drawings: OM-090113-PID-D, OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
227.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve leaking through
						6. Pressure Gauge	
227.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 228. HPSW supply line to DM-702 and DM-703 and sight glasses on each.

Type: Line

Drawing: OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
228.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
228.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Line insulation	
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	
						6. Personal Protective Equipment	

Node: 229. DM-702 make-up water line.

Type: Line

Drawing: OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-3.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
229.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
229.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Line insulation	
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	
						6. Personal Protective Equipment	
						7. Heat tracing	

Node: 230. DM-703 & DM-702 drain lines to DM-701 drain line.

Type: Line

Drawings: OM-090113-PID-D, OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
230.1 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operator training	1. Cold weather 2. Heat tracing failure 3. Line plugged 4. Operator error
230.2 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Pressure Gauge	1. External heat 2. Filter Plugged 3. Instrument failure 4. Line blocked in with external heat (thermal expansion) 5. Line plugged 6. Operator error
230.3 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. High pressure 4. Line rupture 5. Personal exposure 6. VCM Leak	S/E S/E S/E S S S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Heat tracing failure

Node: 231. ERS ring seal water filters recovery line.

Type: Line

Drawings: OM-090113-PID-D, OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
231.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Line rupture	S/E	4	B	5	3. general monitor	3. Instrument failure
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operator training	4. Line blocked in with external heat (thermal expansion)
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	5. Line plugged
							6. Operator error
							7. Valve closed
231.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve leaking through
						4. Heat tracing	
						5. Line insulation	
						6. Operator training	
						7. Personal Protective Equipment	
231.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		

Node: 232. HPSW supply line to ERS ring seal water pump mechanical seals.

Type: Line

Drawings: OM-090113-PID-D, OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A13-1.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
232.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
232.2 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Personal Protective Equipment	1. External heat
232.3 Low Temperature							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Heat tracing 4. Line insulation 5. Personal Protective Equipment	1. Cold weather 2. Operator error
232.4 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Instrument failure 2. Line plugged 3. Operator error

Node: 233. Hydroquinone addition line to ERS ring seal water supply header.

Type: Line

Drawing: OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-3.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
233.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fire Protection System	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. Fixed point monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. general monitor	4. Valve closed
	5. Valve failure	S/E	4	C	5	5. Operating procedures	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. sight glass	
233.2 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line plugged
	2. Poly peroxide formation in stagnant lines	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. VCM process line pluggage	S/E	4	C	5	3. general monitor	3. Pump failure
						4. Operating procedures	4. Supply tank empty
						5. Personal Protective Equipment	5. Valve closed
						6. Pressure Gauge	

Node: 234. ERS compressor seal water separator, DM-703.

Type: Vessel

Drawing: OM-090114-PID-D

Design Conditions/Parameters: MAWP: 140 psig @ 100 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
234.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S S/E	3 4 3 4 4	D C D C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure switch, PS 1703 9. relief valve	1. Control Valve failure 2. External heat 3. High Level 4. Instrument failure 5. Operator error 6. Power failure 7. Relief Valve failure 8. Valve leaking through
234.2 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. VCM release	S/E S/E S/E S/E	3 3 4 3	D D C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Operating procedures 4. Operator training 5. Personal Protective Equipment 6. Temperature switch/alarm 1702	1. External heat
234.3 High Level							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Level Switch 1702 B/C 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. relief valve 9. sight glass	1. Instrument failure 2. Line plugged 3. Operator error 4. Pump failure 5. Valve failure
234.4 Start-up/Shutdown Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release 4. Vessel rupture	S/E S S/E S/E	3 4 3 3	D C D D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment 6. Pressure Gauge 7. sight glass	1. Operator error

Node: 235. ERS compressor discharge header to DM-703

Type: Line

Drawing: OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
235.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. Pressure Indication - PS 1703	
						9. relief valve	
235.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Valve closed
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. relief valve	
						7. Temperature gauge	

Node: 236. ERS compressor seal water drain line to DM-703.

Type: Line

Drawing: OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
236.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line blocked in with external heat (thermal expansion)
	2. Gasket failure	S	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
236.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 237. DM-703 vapor outlet to ERS recovery condenser, EX-376.

Type: Line

Drawing: OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
237.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. Pressure Indication - PS 1703	
237.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 238. DM-702 pressure feedback line from DM-703.

Type: Line

Drawing: OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
238.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. Pressure Indication - 81P759	
238.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. Pressure Indication - 81P759	

Node: 239. ERS ring seal water balance line from DM-703 to DM-702.

Type: Line

Drawing: OM-090114-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
239.1 Low/No Flow							
	1. Fire and explosion 2. High Level on Knockout Tank 3. Lift relief valve	S/E S/E S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Level indicator controller, LIC 1301	1. Control Valve failure 2. Instrument failure 3. Operator error
239.2 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure switch, PS 1703	1. External heat 2. Line plugged 3. Operator error 4. Valve closed
239.3 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. general monitor 2. Operating procedures 3. Operator training 4. Personal Protective Equipment 5. Fixed point monitor	1. External heat

Node: 240. ERS vacuum pump bypass line to ERS compressors (compressor suction lines and header).

Type: Line

Drawings: OM-090113-PID-D, OM-090115-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
240.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Check valve failure
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. External heat
	3. Personal exposure	S	4	C	5	3. general monitor	3. Line plugged
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operator training	5. Valve closed
						6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. Pressure Indication - PIC 1302	
240.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 241. ERS compressor discharge header to DM-703

Type: Line

Drawings: OM-090114-PID-D, OM-090115-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
241.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Valve packing leaking 5. VCM Leak	S/E S/E S S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure Indication - PS 1703 9. relief valve	1. External heat 2. Line plugged 3. Operator error 4. Valve closed
241.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Valve packing leaking 5. VCM Leak	S/E S/E S S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. relief valve 7. Temperature gauge	1. External heat

Node: 242. ERS compressors, CP-107/108.

Type: Centrifugal Compressor

Drawing: OM-090115-PID-D

Design Conditions/Parameters: 3x3-18.5; 175 scfm @ 110 psig.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
242.1 High Suction Pressure							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock-Compressor must be running to open inlet valve and ring seal water supply valve.	1. Instrument failure
	2. Gasket failure	S/E	4	C	5		2. Operator error
	3. Personal exposure	S/E	4	C	5	2. Fire Protection System	3. Pump failure
	4. Seal failure	S/E	4	C	5	3. Fixed point monitor	4. Valve leaking through
	5. VCM Leak	S/E	4	C	5	4. general monitor	
						5. Operating procedures	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
242.2 High Discharge Pressure							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock - RVCM return valve on receiver must be open and ring seal water pump running to start compressor.	1. External heat
	2. Personal exposure	S	4	C	5		2. Line plugged
	3. Seal failure	S/E	4	C	5	2. Fire Protection System	3. Operator error
	4. VCM Leak	S/E	4	C	5	3. Fixed point monitor	4. Relief Valve failure
						4. general monitor	5. Valve closed
						5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	
242.3 Low Suction Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line plugged
	2. Seal failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve closed
						4. Operating procedures	
						5. Operator training	
						6. Personal Protective Equipment	

Node: 243. ERS compressor relief valve discharge line and RV.	
Type: Line + Relief Valve	Drawings: OM-090113-PID-D, OM-090115-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
243.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	5. Relief Valve failure
	6. VCM Leak	S/E	4	C	5	6. relief valve	6. Valve closed
243.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Equipment Preventive Maintenance Program	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. Fixed point monitor	
	4. No flow	S/E	4	C	5	4. general monitor	
	5. Personal exposure	S	4	C	5	5. Operating procedures	
	6. VCM Leak	S/E	4	C	5	6. Personal Protective Equipment	
						7. Rupture disc	
243.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. relief valve	

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 244. ERS ring seal water header from coolers to compressors.

Type: Line

Drawings: OM-090114-PID-D, OM-090115-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
244.1 Low Temperature							
	1. Fire and explosion	S/E	4	C	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Heat tracing	
	5. Personal exposure	S	4	C	5	5. Line insulation	
	6. VCM Leak	S/E	4	C	5	6. Operating procedures	
						7. Personal Protective Equipment	
244.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. Pressure gauge	
						7. Flow indication, 84FC830 / 833	

Node: 245. ERS compressor seal water drain line to DM-703.

Type: Line

Drawings: OM-090114-PID-D, OM-090115-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
245.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line blocked in with external heat (thermal expansion)
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve failure
						6. Interlock - drain line opens when compressor inlet opens	
245.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 246. DM-703 vapor outlet to ERS recovery condenser, EX-376.

Type: Line

Drawings: OM-090114-PID-D, OM-090115-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
246.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. Pressure Indication - PS 1703	
246.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 247. RVCM condensate line from ERS condensers to RVCM transfer pump discharge line.

Type: Line

Drawings: OM-090111-PID-D, OM-090115-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
247.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. Seal failure	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	
						7. Recirculation line	
247.2 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. High pressure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. Seal failure	S/E	4	C	5	4. Operating procedures	4. Pump blocked in and running
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve closed

Node: 248. ERS VCM condenser, EX-376

Type: Heat Exchanger

Drawing: OM-090115-PID-D

Design Conditions/Parameters: MAWP: 150 psig @ 400 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
248.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Lift relief valve	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Relief Valve failure
	6. Vessel rupture	S/E	4	C	5	6. relief valve	
248.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. No cooling water
	3. Lift relief valve	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM release	S/E	4	C	5	6. relief valve	
248.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen tubes	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Personal exposure	S/E	4	C	5	3. general monitor	
	4. Tube rupture	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. Temperature gauge	
248.4 Maintenance Hazards							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Not blanked out
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Operator error
	3. Personal injury due to falling, bumping head, or straining back.	S/E	4	C	5	3. general monitor	3. Poor access
	4. VCM Leak	S/E	4	C	5	4. Maintenance & operating procedures	
	5. VCM release	S/E	4	C	5	5. Personal Protective Equipment	

Node: 249. HPSW supply to ERS compressor mechanical seals.

Type: Line

Drawing: OM-090115-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
249.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
249.2 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Personal Protective Equipment	1. External heat
249.3 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Instrument failure 2. Line plugged 3. Operator error
249.4 Low Temperature							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Heat tracing 4. Line insulation 5. Personal Protective Equipment	1. Cold weather 2. Operator error 3. Heat tracing failure

Node: 250. Rx atmospheric dump line to slurry screener, GR-001.

Type: Line

Drawing: OM-090116-PID-D

Design Conditions/Parameters: Pipe spec A13-5

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
250.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. DCS interlock - Dump valve can only be open in atmospheric dump mode. 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Personal Protective Equipment 7. Pressure Gauge	1. External heat 2. High Pressure in Reactor 3. Instrument failure 4. Line plugged 5. Operator error 6. Valve closed 7. Valve failure 8. Valve leaking through
250.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. High pressure 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Operator error

Node: 251. Slurry screener, GR-001	
Type: Tank	Drawing: OM-090116-PID-D
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
251.1 High Level							
	1. No consequences						
251.2 Low Level							
	1. No consequences						
251.3 Contaminants							
	1. No consequences						

Node: 252. Slurry screener drain line to slurry dump tank, TK-007.

Type: Line

Drawing: OM-090116-PID-D

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
252.1 Low/No Flow							
1. No consequences							

Node: 253. Atmospheric slurry dump tank, TK-007.	
Type: Tank	Drawing: OM-090116-PID-D
Design Conditions/Parameters: 450 Gal.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
253.1 High Level							
1. No consequences							
253.2 Low Level							
1. No consequences							

Node: 254. Atmospheric dump tank drain line and slurry transfer pumps, PP-496/497.

Type: Centrifugal Pump + Line

Drawing: OM-090116-PID-D

Design Conditions/Parameters: Pipe spec A13-5. Pumps, 4x6-10-9.625, 600 GPM @ 40 psi

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
254.1 High Pressure							
	1. Personal exposure	S	4	C	5	1. Operating procedures 2. Operator training 3. Personal Protective Equipment	1. Gasket failure 2. Line plugged 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 255. MSPW supply to slurry transfer pump mechanical seals.	
Type: Line	Drawing: OM-090116-PID-D
Design Conditions/Parameters: Pipe spec A2-3	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
255.1 High Pressure							
	1. No consequences						

Node: 256. Atmospheric dump slurry screener and slurry dump tank exhaust piping and fan, FN-025.

Type: Centrifugal Compressor + Line

Drawing: OM-090116-PID-D

Design Conditions/Parameters: FN-025: 2000scfm @ 0.5" H₂O.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
256.1 High Discharge Pressure							
1. No consequences							
256.2 Low Suction Pressure							
1. No consequences							
256.3 Contaminants Enter Compressor							
1. No consequences							

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 257. Rinse water line to atmospheric slurry screener and slurry dump tank.

Type: Line

Drawing: OM-090116-PID-D

Design Conditions/Parameters: Pipe spec A2-3.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
257.1 Low/No Flow							
1. No consequences							
257.2 Contamination							
1. No consequences							

Node: 258. HPSW supply to slurry dump tank, TK-007, level well.

Type: Line

Drawing: OM-090116-PID-D

Design Conditions/Parameters: Pipe spec A2-3.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
258.1 High Flow							
1. No consequences							
258.2 Low/No Flow							
1. No consequences							
258.3 Contamination							
1. No consequences							

Node: 259. Sample line from dump hdr to slurry dump tank.	
Type: Line	Drawing: OM-090116-PID-D
Design Conditions/Parameters: Pipe spec A13-1.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
259.1 Low/No Flow							
	1. No consequences						
259.2 Contamination							
	1. No consequences						

Node: 262. Wet calcium stearate pump, PP-651	
Type: Positive Displacement Pump	Drawing: OM-090117-PID-D
Design Conditions/Parameters: 250 GPH @ 165 psi.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
262.1 High Pressure							
1. NOT IN SERVICE							

Node: 263. Low mole atm. dump line to screener, GR-601 from Rx-700.	
Type: Line	Drawing: OM-090118-PID-D
Design Conditions/Parameters: Pipe spec A13-5.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
263.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Instrument failure
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Line plugged
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Operator error
						6. Pressure Gauge	6. Valve closed
						7. DCS interlock - Dump valve can only be open in atmospheric dump mode.	7. Valve failure
							8. Valve leaking through
263.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 264. Low Mole atm. dump line and dump pumps, PP-801A/801B, to screener GR-601.

Type: Centrifugal Pump + Line

Drawing: OM-090118-PID-D

Design Conditions/Parameters: Pipe spec A13-5. Pumps, 6x6-18-13. 1000 GPM @ 13 psi.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
264.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock - Dump valve can only be open in atmospheric dump mode.	1. External heat
	2. Gasket failure	S/E	4	C	5		2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5		3. Instrument failure
	4. Personal exposure	S	4	C	5	2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Personal Protective Equipment 7. Pressure Gauge	4. Line plugged 5. Operator error 6. Valve closed 7. Valve failure 8. Valve leaking through
264.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Instrument failure
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Line plugged
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment 6. Pressure Gauge	5. Operator error 6. Valve closed 7. Valve failure 8. Valve leaking through

Node: 265. Low Mole slurry screener	
Type: Line	Drawing: OM-090118-PID-D
Design Conditions/Parameters: Pipe spec A13-5.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
265.1 High Pressure							
1. No consequences							
265.2 Low/No Flow							
1. No consequences							
265.3 Contamination							
1. No consequences							

Node: 266. Low mole atmospheric dump slurry screener and slurry dump tank exhaust piping and fan, FN-026.

Type: Centrifugal Compressor + Line

Drawing: OM-090118-PID-D

Design Conditions/Parameters: FN-026: 4000scfm @ 2" H2O.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
266.1 High Discharge Pressure							
1.	No consequences						
266.2 Low Suction Pressure							
1.	No consequences						
266.3 Contaminants Enter Compressor							
1.	No consequences						

Node: 267. Low mole atmospheric dump tank drain line and slurry transfer pumps, PP-601/602.

Type: Centrifugal Pump + Line

Drawing: OM-090118-PID-D

Design Conditions/Parameters: Pipe spec A13-5. Pumps, 4x6-13-10.625, 1000 GPM @ 38 psi

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
267.1 High Pressure							
	1. Personal exposure	S	4	C	5	1. Operating procedures 2. Operator training 3. Personal Protective Equipment	1. Gasket failure 2. Line plugged 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 268. Low mole atmospheric slurry dump tank, TK-601.	
Type: Tank	Drawing: OM-090118-PID-D
Design Conditions/Parameters: 1000 Gal.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
268.1 High Level							
	1. No consequences						
268.2 Low Level							
	1. No consequences						

Node: 269. MSPW supply to slurry transfer pump mechanical seals.

Type: Line

Drawing: OM-090118-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
269.1 High Pressure							
1. No consequences							
269.2 Low Pressure							
1. No consequences							
269.3 Low/No Flow							
1. No consequences							
269.4 Contamination							
1. No consequences							

Node: 270. Batch water strippers, DM-801/802

Type: Vessel

Drawing: OM-090119-PID-D

Design Conditions/Parameters: MAWP: 150 psig @ 350 F. MOC: SA516 Gr 70.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
270.1 High Pressure							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. VCM Leak 5. Vessel rupture	S/E S/E S S/E S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. Pressure indication, 84P845 / 84P848 / 84P853 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Pressure Gauge 9. Valve indication	1. External heat 2. High Level 3. Instrument failure 4. Line plugged 5. Operator error 6. Power failure 7. Valve failure
270.2 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. VCM Leak 5. Vessel rupture	S/E S/E S S/E S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. Temperature indicator, 84T846 / 84T849 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operator training 6. relief valve 7. Temperature gauge	1. External heat 2. Instrument failure 3. Steam Control Valve failure
270.3 Low Temperature							
	1. Personal exposure 2. Dump water still contains VCM	S S/E	4 4	C C	5 5	1. Temperature indicator, 84T846 / 84T849 2. Operating procedures	1. Instrument failure
270.4 High Level							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. VCM Leak 5. Vessel rupture	S/E S/E S S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. sight glass 8. Level indication, 84L854 / 84L856; Low Level Switch, 84L847 / 84L852; High Level Switch, 84L844 / 84L850	1. Instrument failure 2. Drain line plugged 3. Valve leaking through 4. Operator error
270.5 Start-up/Shutdown Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak 4. VCM release	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment	1. Operator error 2. Valve leaking through 3. Instrument failure

Node: 271. Batch water stripper recovery line to large recovery system.

Type: Line

Drawing: OM-090119-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
271.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Overpressure batchwater stripper	S/E	4	C	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Personal exposure	S	4	C	5	3. general monitor	3. Line blocked in with external heat (thermal expansion)
	4. VCM release	S/E	3	D	5	4. Operating procedures	4. Operator error
						5. Personal Protective Equipment	
271.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
271.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Overpressure batchwater stripper	S/E	4	C	5	2. Fixed point monitor	2. Valve failure
	3. Personal exposure	S	4	C	5	3. general monitor	3. Valve leaking through
	4. VCM release	S/E	3	D	5	4. Operating procedures	
						5. Personal Protective Equipment	

Node: 272. Batch water stripper recovery line, contains pressure control valve.

Type: Line

Drawing: OM-090119-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
272.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Overpressure batchwater stripper	S/E	4	C	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Personal exposure	S/E	4	C	5	3. general monitor	3. Line blocked in with external heat (thermal expansion)
	4. VCM release	S/E	3	D	5	4. Operating procedures	4. Operator error
						5. Personal Protective Equipment	
272.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
272.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Overpressure batchwater stripper	S/E	4	C	5	2. Fixed point monitor	2. Valve failure
	3. Personal exposure	S	4	C	5	3. general monitor	3. Valve leaking through
	4. VCM release	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	

Node: 273. Batch water stripper fill line.

Type: Line

Drawing: OM-090119-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
273.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Valve packing leaking 4. VCM release	S/E S/E S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Double valves at Batch Water Stripper	1. Line blocked in with external heat (thermal expansion) 2. High pressure in batch water stripper 3. Valve failure
273.2 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Heat tracing 2. Operating procedures 3. Operator training 4. Line insulation	1. Cold weather
273.3 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. Valve packing leaking 5. VCM release	S/E S/E S/E S/E S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat
273.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure batchwater stripper 4. Personal exposure 5. VCM release	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. Operator error 2. Valve failure

Node: 274. Batch water stripper (BWS) effluent transfer pumps.	
Type: Centrifugal Pump	Drawing: OM-090119-PID-D
Design Conditions/Parameters: 1.5x3-8-7.375. 150 GPM @ 98 psi.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
274.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. External heat 2. Line plugged 3. Operator error
274.2 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Overpressure batchwater stripper 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. DCS interlock 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Heat tracing 6. Line insulation 7. Operator training 8. Personal Protective Equipment 9. relief valve	1. Cold weather 2. Heat tracing failure 3. Operator error
274.3 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S S/E	3 4 3	D C D	5 5 5	1. DCS interlock - Drain valve won't open unless stripper in dump mode or in manual and stripper pressure below dump pressure. 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Valve indication	1. Instrument failure 2. Operator error 3. Valve leaking through

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 275. HPSW supply to BWS level well.	
Type: Line	Drawing: OM-090119-PID-D
Design Conditions/Parameters: Pipe spec A2-3.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
275.1 Rupture							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. HNU unit 6. Line insulation 7. Operator training 8. Personal Protective Equipment	1. External heat 2. Operator error 3. Cold weather

Node: 276. Steam supply line to BWS sparger.	
Type: Line	Drawing: OM-090119-PID-D
Design Conditions/Parameters: Pipe spec A2-3.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
276.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Check valve 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Line insulation 6. Operator training 7. Personal Protective Equipment 8. Pressure Gauge 9. Steam flow indication, 84F843	1. Line blocked in with external heat (thermal expansion) 2. Valve leaking through 3. Check valve failure 4. Low steam pressure
276.2 Low Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Stripper contents back into steam line	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Check valve 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Steam flow indication, 84F843	1. Line plugged 2. Steam Control Valve failure 3. Valve closed 4. Power failure
276.3 Low Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Frozen Line	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operator training 7. Personal Protective Equipment	1. Cold weather 2. Heat tracing failure

Node: 277. BWS fill line through 3-way valve.

Type: Line

Drawing: OM-090119-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
277.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Valve packing leaking 4. VCM release	S/E S/E S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. High pressure in batch water stripper 2. Line blocked in with external heat (thermal expansion) 3. Valve failure
277.2 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Operating procedures 2. Operator training	1. Cold weather
277.3 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. Valve packing leaking 5. VCM release	S/E S/E S S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat
277.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure batchwater stripper 4. Personal exposure 5. VCM release	S/E S/E S/E S S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. Operator error 2. Valve failure

Node: 278. BWS fill line from ERS equipment.	
Type: Line	Drawing: OM-090119-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
278.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High pressure in batch water stripper
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	
	3. Valve packing leaking	S/E	4	C	5	3. general monitor	2. Line blocked in with external heat (thermal expansion)
	4. VCM release	S/E	3	D	5	4. Heat tracing	3. Valve failure
						5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	
278.2 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Operating procedures	1. Cold weather
						2. Operator training	
278.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	
	5. VCM release	S/E	3	D	5	5. Operator training	
						6. Personal Protective Equipment	
278.4 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Valve failure
	3. Overpressure batchwater stripper	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM release	S/E	3	D	5	5. Operator training	
						6. Personal Protective Equipment	

Node: 279. BWS fill line from large recovery system equipment.

Type: Line

Drawing: OM-090119-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
279.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in batch water stripper
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	5. Valve closed
	6. VCM Leak	S/E	4	C	5		
279.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5	6. Rupture disc	
279.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Valve packing leaking	S/E	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
						6. relief valve	

Node: 280. BWS fill line from RVCM equipment.

Type: Line

Drawing: OM-090119-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
280.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. Valve leaking	S/E	4	C	5	5. Personal Protective Equipment	5. Valve failure
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	
280.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Gasket failure	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Line rupture	S/E	4	C	5	4. Heat tracing	
						5. Line insulation	
						6. Operator training	
280.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
						6. Temperature gauge	
280.4 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Overpressure batchwater stripper	S/E	4	C	5	4. Operating procedures	4. Power failure
	5. Personal exposure	S	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. relief valve	

Node: 281. BWS fill line from VCM tank farm fill line.

Type: Line

Drawing: OM-090119-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
281.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High Pressure in Reactor
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Operator error
	3. VCM Leak	S/E	4	C	5	3. general monitor	3. Valve failure
	4. VCM release	S/E	3	D	5	4. Operating procedures	4. Valve leaking through
						5. Personal Protective Equipment	
281.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		

Node: 282. Recovery line from large recovery system to ERS.

Type: Line

Drawing: OM-090119-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
282.1 High Temperature							
1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Operator error	
282.2 Low Temperature							
1. Fire and explosion 2. Frozen Line 3. Line rupture 4. No flow 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. Cold weather 2. Valve leaking through	
282.3 Reverse/Misdirected Flow							
1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S S/E	3 4 3	D C D	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment	1. Operator error 2. Valve failure 3. Valve leaking through	
282.4 High Pressure							
1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Valve failure 6. VCM Leak	S/E S/E S/E S S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. High pressure in batch water stripper 2. Line plugged 3. Operator error 4. Valve leaking through	

Node: 283. HPSW pumps, PP-010/011.

Type: Centrifugal Pump + Line

Drawing: OM-090120-PID-D

Design Conditions/Parameters: 1.5x3-10-9, 100 psig @ 200 GPM: 130 psig @ 20 GPM.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
283.1 High Temperature							
1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment	1. External heat 2. Operator error	
283.2 Low Pressure							
1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Instrument failure 2. Line plugged 3. Operator error	
283.3 High Pressure							
1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure	
283.4 Low Temperature							
1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge 6. Line insulation	1. Cold weather	

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 284. Line to utility station @ RVCM receiver.	
Type: Line	Drawing: OM-090120-PID-D
Design Conditions/Parameters: Pipe spec A2-3.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
284.1 High Temperature							
	1. Personal exposure	S/E	4	C	5	1. Personal Protective Equipment	1. External heat 2. Heat tracing failure

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 285. HPSW to EX-008/009. See node 147.

Type: Line

Drawing: OM-090119-PID-D

Design Conditions/Parameters: Pipe spec A2-3.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
285.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
285.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Power failure
	4. Personal exposure	S	4	C	5	4. Heat tracing	
						5. Operating procedures	
						6. Personal Protective Equipment	

Node: 286. HPSW supply line to DM-701 and DM-701 sight glass. see node 206.

Type: Line

Drawings: OM-090113-PID-D, OM-090120-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
286.1 High Flow							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure 5. Vessel rupture	S/E S/E S/E S/E S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Level switch - 1701C 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. relief valve 9. sight glass	1. Instrument failure 2. Line plugged 3. Operator error 4. Pump failure 5. Valve failure
286.2 Low Pressure							
	1. Personal exposure 2. Reverse flow 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Check valve 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Pressure Gauge	1. Filter Plugged 2. Line plugged 3. Operator error 4. Power failure 5. Pump failure 6. Valve closed 7. Valve leaking through

Node: 287. HPSW line to LRS KO tanks and recirculation pumps.

Type: Line

Drawing: OM-090120-PID-D

Design Conditions/Parameters: Pipe spec A2-3.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
287.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
287.2 High Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment	1. External heat 2. Operator error
287.3 Low Pressure							
	1. Seal failure 2. VCM Leak	S/E S/E	4 4	C C	5 5	1. Fire Protection System 2. Equipment Preventive Maintenance Program 3. Fixed point monitor 4. Flow meter 5. Operating procedures 6. Operator training 7. Pressure Gauge	1. Filter plugged 2. Line plugged 3. Operator error 4. Power Failure 5. Valve closed 6. Valve failure
287.4 Low Temperature							
	1. Frozen Line 2. No flow 3. Personal exposure 4. Seal failure 5. VCM Leak	S/E S/E S S/E S/E	4 4 4 4 4	C C C C C	5 5 5 5 5	1. Fixed point monitor 2. Heat tracing 3. Operating procedures 4. Personal Protective Equipment	1. Cold weather 2. Operator error

Node: 288. HPSW supply - header section

Type: Line

Drawing: OM-090120-PID-D

Design Conditions/Parameters: Pipe spec A2-3.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
288.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Valve closed 4. Valve failure
288.2 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Personal Protective Equipment	1. External heat
288.3 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge 6. Pressure switch low - 81P055	1. Instrument failure 2. Line plugged 3. Operator error
288.4 Low Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Line insulation 4. Personal Protective Equipment	1. Cold weather 2. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 289. HPSW to DM-027/028

Type: Line

Drawing: OM-090120-PID-D

Design Conditions/Parameters: Pipe spec A2-3.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
289.1 Low Pressure							
	1. Personal exposure 2. Reverse flow 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Check valve 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Pressure Gauge	1. Filter Plugged 2. Line plugged 3. Operator error 4. Power failure 5. Pump failure 6. Valve closed 7. Valve leaking through
289.2 High Flow							
	1. High Level in knockout tank, See Node 84						

Node: 290. HPSW supply line to DM-702 and DM-703 and sight glasses on each.

Type: Line

Drawings: OM-090114-PID-D, OM-090120-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
290.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Line insulation	
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	
						6. Personal Protective Equipment	
290.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 291. HPSW supply from mechanical seals on compressors & vacuum pumps.

Type: Line

Drawings: OM-090109-PID-D, OM-090109A-PID-D, OM-090120-PID-D

Design Conditions/Parameters: Pipe spec A2-3, J16-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
291.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
291.2 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
291.3 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Instrument failure 2. Line plugged 3. Operator error
291.4 Low Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Heat tracing 5. Personal Protective Equipment 6. Pressure Gauge	1. Cold weather 2. Heat tracing failure

Node: 292. HPSW supply to ring seal water pumps PP-491/492	
Type: Line	Drawings: OM-090110-PID-D, OM-090120-PID-D
Design Conditions/Parameters: Pipe spec A2-3.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
292.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line plugged
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Operator error
	3. Seal failure	S/E	4	C	5	3. general monitor	3. Regulator failure
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	4. Valve closed
						5. Personal Protective Equipment	5. Valve failure
						6. Pressure Gauge	
292.2 High Temperature							
	1. Personal exposure	S	4	C	5	1. Fire Protection System	1. External heat
	2. Seal failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. VCM Leak	S/E	4	C	5	3. Personal Protective Equipment	
292.3 Low Pressure							
	1. Seal failure	S/E	4	C	5	1. Fire Protection System	1. Filter plugged
	2. VCM Leak	S/E	4	C	5	2. Equipment Preventive	2. Line plugged
	3. Personal exposure	S	4	C	5	Maintenance Program	3. Operator error
	4. Fire and explosion	S/E	3	D	5	3. Fixed point monitor	4. Power Failure
						4. Flow meter	5. Valve closed
						5. Operating procedures	6. Valve failure
						6. Operator training	
						7. Pressure Gauge	
292.4 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Fixed point monitor	1. Cold weather
	2. No flow	S/E	4	C	5	2. Heat tracing	2. Operator error
	3. Personal exposure	S	4	C	5	3. Operating procedures	
	4. Seal failure	S/E	4	C	5	4. Personal Protective Equipment	
	5. VCM Leak	S/E	4	C	5		

Node: 293. HPSW make-up to seal water separators.	
Type: Line	Drawings: OM-090110-PID-D, OM-090120-PID-D
Design Conditions/Parameters: Pipe spec A2-3	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
293.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Power failure
	4. Personal exposure	S	4	C	5	4. Heat tracing	
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	
						6. Personal Protective Equipment	
293.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Personal exposure	S	4	C	5	3. general monitor	3. Operator error
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	

Node: 294. HPSW supply to mechanical seal on RVCM charge pump, PP-477.

Type: Line

Drawings: OM-090112-PID-D, OM-090120-PID-D

Design Conditions/Parameters: Pipe spec A13-1.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
294.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
294.2 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
294.3 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Instrument failure 2. Line plugged 3. Operator error
294.4 Low Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Heat tracing 4. Line insulation 5. Personal Protective Equipment	1. Cold weather 2. Operator error

Node: 295. HPSW supply to mechanical seal on RVCM transfer pumps PP-110/111.

Type: Line

Drawings: OM-090111-PID-D, OM-090120-PID-D

Design Conditions/Parameters: Pipe spec A2-3/J16-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
295.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	4 4 4 4	C C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
295.2 High Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment	1. External heat 2. Operator error
295.3 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Instrument failure 2. Line plugged 3. Operator error
295.4 Low Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Heat tracing 4. Line insulation 5. Personal Protective Equipment	1. Cold weather 2. Operator error

Node: 296. MSPW Line To FVCM Charge Pumps	
Type: Line	Drawings: OM-090100-PID-D, OM-090120-PID-D
Design Conditions/Parameters: Pipe Spec A2-3	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
296.1 High Temperature							
	1. Seal failure	S/E	4	C	5	1. Fire Protection System	1. External heat
296.2 Low Pressure							
	1. Seal failure	S/E	4	C	5	1. Fire Protection System	1. Filter plugged
	2. VCM Leak	S/E	4	C	5	2. Equipment Preventive Maintenance Program	2. Line plugged
						3. Fixed point monitor	3. Operator error
						4. Operating procedures	4. Power Failure
						5. Operator training	5. Valve closed
						6. Pressure Gauge	6. Valve failure
296.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Fixed point monitor	1. Cold weather
	2. Seal failure	S/E	4	C	5	2. Heat tracing	
	3. VCM Leak	S/E	4	C	5		
296.4 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line plugged
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Operator error
	3. Seal failure	S/E	4	C	5	3. general monitor	3. Regulator failure
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	4. Valve closed
						5. Personal Protective Equipment	5. Valve failure
						6. Pressure Gauge	

Node: 297. HPSW supply to BWS level well.	
Type: Line	Drawings: OM-090119-PID-D, OM-090120-PID-D
Design Conditions/Parameters: Pipe spec A2-3.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
297.1 Rupture							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. HNU unit 6. Line insulation 7. Operator training 8. Personal Protective Equipment	1. Cold weather 2. External heat 3. Operator error

Node: 298. HPSW pumps, PP-874/134	
Type: Centrifugal Pump	Drawing: OM-090120-PID-D
Design Conditions/Parameters: 1x2-10-9	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
298.1 High Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment	1. External heat 2. Operator error
298.2 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Instrument failure 2. Line plugged 3. Operator error
298.3 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
298.4 Low Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Line insulation 5. Personal Protective Equipment 6. Pressure Gauge	1. Cold weather

Node: 299. MSPW supply to slurry transfer pump mechanical seals.	
Type: Line	Drawings: OM-090116-PID-D, OM-090120-PID-D
Design Conditions/Parameters: Pipe spec A2-3	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
299.1 High Pressure							
1. No consequences							

Node: 300. HPSW to Rx hose stations.	
Type: Line	Drawing: OM-090120-PID-D
Design Conditions/Parameters: Pipe spec A2-3.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
300.1 High Temperature							
1. Personal exposure	S	4	C	5	1. Personal Protective Equipment	1. External heat 2. Heat tracing failure	

Node: 301. HPSW supply to Rx catalyst pot.

Type: Line

Drawing: OM-090120-PID-D

Design Conditions/Parameters: Pipe spec A13-1.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
301.1 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Check valve 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Valve indication	1. High Pressure in Reactor 2. Line leak/rupture 3. Low HPSW pressure 4. Operator error 5. Power failure 6. Valve failure 7. Valve leaking through
301.2 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Ram valve	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Line plugged 4. Operator error
301.3 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Heat tracing failure 3. Line plugged 4. Operator error
301.4 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training	1. Cold weather 2. Valve leaking through

Node: 302. HPSW supply line to RX-600,700 BME charge pot

Type: Line

Drawings: OM-090107-PID-D, OM-090120-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
302.1 Low Pressure							
	1. No flow 2. Personal exposure 3. Reverse flow	S/E S S/E	4 4 4	C C C	5 5 5	1. Check valve 2. DCS interlock-Rx BME charge valve won't open unless adequate pressure 3. Flow indication, 81F565 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure switch, 81P469/569	1. Instrument failure 2. Line leak/rupture 3. Line plugged 4. Operator error 5. Valve failure 6. Valve leaking through
302.2 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Gasket failure 4. Line rupture 5. Personal exposure 6. Reverse flow 7. VCM Leak	S/E S/E S/E S/E S S/E S/E	3 4 4 4 4 4 4	D C C C C C C	5 5 5 5 5 5 5	1. Heat tracing 2. Line insulation	1. Cold weather
302.3 High Pressure							
	1. Gasket failure 2. Line rupture 3. Valve leaking	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Pressure Gauge 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Valve closed
302.4 High Temperature							
	1. Gasket failure 2. Line rupture 3. Personal exposure 4. Valve failure 5. VCM Leak	S/E S/E S/E S/E S/E	4 4 4 4 4	C C C C C	5 5 5 5 5	1. Fire Protection System 2. Operating procedures 3. Operator training 4. Personal Protective Equipment	1. External heat 2. Heat tracing failure 3. Line blocked in with external heat (thermal expansion)

Node: 303. HPSW pumps, PP-953/954	
Type: Centrifugal Compressor + Line	Drawing: OM-090120-PID-D
Design Conditions/Parameters: 1.5x2-11-8, 209psi @60 GPM	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
303.1 High Temperature							
	1. High pressure	S/E	4	C	5	1. Operating procedures 2. Operator training	1. External heat 2. Line blocked in with external heat (thermal expansion)
303.2 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fixed point monitor	1. Control Valve failure
	2. Line rupture	S/E	4	C	5	2. Flow meter	2. Instrument failure
	3. Seal failure	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Valve leaking	S/E	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operator training	5. Valve closed
						6. Personal Protective Equipment	6. Valve failure
						7. Low Pressure switch- 81P057	
303.3 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fixed point monitor	1. Control Valve failure
	2. Line rupture	S/E	4	C	5	2. general monitor	2. Instrument failure
	3. Seal failure	S/E	4	C	5	3. Operating procedures	3. Line plugged
	4. Valve leaking	S/E	4	C	5	4. Operator training	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve closed
						6. Pressure Gauge	6. Valve failure

Node: 304. HPSW to Rx rinse nozzle flush	
Type: Line	Drawing: OM-090120-PID-D
Design Conditions/Parameters: Pipe spec A13-1	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
304.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. High Pressure in Reactor 3. Line blocked in with external heat (thermal expansion) 4. Operator error
304.2 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Hydro fill the reactor 3. Personal exposure 4. VCM Leak 5. VCM release	S/E S/E S S/E S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. Check valve 2. DCS interlock-All RX slow vent valves must be closed & recovery system discharge pressure is < 110 psig (81p759) before slow vent flush valve will open. 3. Fire Protection System 4. Fixed point monitor 5. Flow meter 6. general monitor 7. Operating procedures 8. Operator training 9. Personal Protective Equipment	1. Line leak/rupture 2. Operator error 3. Pump failure 4. Valve leaking through
304.3 Low/No Flow							
	1. Fire and explosion 2. Frozen Line 3. Gasket failure 4. Line rupture 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation	1. Cold weather 2. Valve leaking through

Node: 305. MSPW flush line to Rx seal. Rx-300,400,500,600,700.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D, OM-090120-PID-D

Design Conditions/Parameters: Pipe spec A13-1, J16-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
305.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Seal failure 4. Valve leaking 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fixed point monitor 2. general monitor 3. Operating procedures 4. Operator training 5. Personal Protective Equipment 6. Pressure Gauge	1. Control Valve failure 2. Instrument failure 3. Line plugged 4. Operator error 5. Valve closed 6. Valve failure
305.2 High Temperature							
	1. High pressure	S/E	4	C	5	1. Operating procedures 2. Operator training	1. External heat 2. Line blocked in with external heat (thermal expansion)
305.3 Low/No Flow							
	1. Fire and explosion 2. Line rupture 3. Seal failure 4. Valve leaking 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fixed point monitor 2. Flow meter 3. general monitor 4. Low Pressure switch- 81P057 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. Control Valve failure 2. Instrument failure 3. Line plugged 4. Operator error 5. Valve closed 6. Valve failure

Node: 306. AMS drum to AMS transfer pump, PP-020, to AMS kill pot.

Type: Line + Positive Displacement Pump + Tank

Drawing: OM-090121-PID-D

Design Conditions/Parameters: Pipe spec B2-1. PP-020, air driven diaphragm pump, 32 GPM @ 120 120 psig

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
306.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. Check valve failure
	2. Lift relief valve	S/E	4	C	5	2. Fire Protection System	2. External heat
	3. Line rupture	S/E	4	C	5	3. Operator training	3. Line blocked in with external heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Personal Protective Equipment	4. Line plugged
						5. Pressure Gauge	5. Relief Valve failure
						6. relief valve	6. Nitrogen bottle regulator failure
306.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. External heat
	2. Lift relief valve	S/E	4	C	5	2. Fire Protection System	
	3. Line rupture	S/E	4	C	5	3. Operator training	
	4. Personal exposure	S/E	4	C	5	4. Personal Protective Equipment	
						5. Pressure Gauge	
						6. relief valve	
						7. Safety Shower	
306.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. Check valve failure
	2. Lift relief valve	S/E	4	C	5	2. Fire Protection System	2. Nitrogen bottle regulator failure
	3. Line rupture	S/E	4	C	5	3. Operator training	
	4. Personal exposure	S	4	C	5	4. Personal Protective Equipment	
						5. Pressure Gauge	
						6. relief valve	
						7. Safety Shower	

Node: 307. AMS kill pots (RX-300/400/500/600/700/Dump Tank)	
Type: Vessel	Drawing: OM-090121-PID-D
Design Conditions/Parameters: MAWP: 400 psig @ 650 F	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
307.1 High Pressure							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. Vessel rupture	S/E S/E S S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Operator training 3. Personal Protective Equipment 4. Pressure Gauge 5. relief valve 6. Low pressure switch - 81P558	1. External heat 2. Nitrogen bottle regulator failure 3. Relief Valve failure
307.2 Maintenance Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak 4. VCM release	S/E S S/E S/E	3 4 4 3	D C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment	1. Instrument failure 2. Operator error 3. Valve leaking through
307.3 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. Vessel rupture	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Check valve 2. Fire Protection System 3. Operator training 4. Personal Protective Equipment 5. Pressure Gauge 6. relief valve 7. Safety Shower	1. External heat
307.4 Low Level							
	1. Can't emergency kill reactor	S/E	3	D	5	1. Operating procedures 2. Operator training 3. sight glass 4. Low level switch - 81L557 (similar on other reactors)	1. Instrument failure 2. Operator error

Node: 308. Nitrogen supply bottle and supply line to AMS kill pot.

Type: Line + Vessel

Drawing: OM-090121-PID-D

Design Conditions/Parameters: Pipe spec B2-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
308.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Lift relief valve on reactor	S/E	4	C	5	2. Fixed point monitor	2. Instrument failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operator training	4. Valve closed
						5. Personal Protective Equipment	
						6. Pressure Gauge	
						7. relief valve	
						8. Low pressure switch - 81P558	
308.2 Low Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Bottle empty
	2. Lift relief valve on reactor	S/E	4	C	5	2. Fixed point monitor	2. regulator failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Instrument failure
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. Can't emergency kill reactor	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. Low pressure switch - 81P558	

Node: 309. Automatic emergency kill line from AMS pot to RX.

Type: Line

Drawing: OM-090121-PID-D

Design Conditions/Parameters: Pipe spec B2-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
309.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Operating procedures	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Operator training	2. Valve leaking through
	3. Lift relief valve	S/E	4	C	5		
	4. Overpressure reactor	S/E	4	C	5		
	5. Personal exposure	S	4	C	5		
	6. VCM release	S/E	3	D	5		
309.2 High Pressure							
	1. AMS release	S/E	4	C	5	1. Fire Protection System	1. Instrument failure
	2. Fire and explosion	S/E	3	D	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line leak/rupture
	4. Valve failure	S/E	4	C	5	4. HNU unit	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	5. Valve failure
						6. Operator training	
						7. Pressure Gauge	
309.3 Low Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line leak/rupture
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve failure
	4. No flow	S/E	4	C	5	4. Operating procedures	4. Valve leaking through
	5. Overpressure reactor	S/E	4	C	5	5. Operator training	
	6. VCM release	S/E	4	C	5	6. Personal Protective Equipment	
						7. Pressure Gauge	
						8. Low pressure switch - 81P558	

Node: 310. Manual emergency kill line header from AMS pot to RXs.

Type: Line

Drawing: OM-090121-PID-D

Design Conditions/Parameters: Pipe spec B2-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
310.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Operating procedures	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Operator training	2. Valve leaking through
	3. Lift relief valve	S/E	4	C	5		
	4. Overpressure reactor	S/E	4	C	5		
	5. Personal exposure	S	4	C	5		
	6. VCM release	S/E	4	C	5		
310.2 High Pressure							
	1. AMS release	S/E	4	C	5	1. Fire Protection System	1. Instrument failure
	2. Fire and explosion	S/E	3	D	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line leak/rupture
	4. Valve failure	S/E	4	C	5	4. HNU unit	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	5. Valve failure
						6. Operator training	
						7. Pressure Gauge	
						8. Low pressure switch - 81P558, similar other reactors	
310.3 Low Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line leak/rupture
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve failure
	4. Overpressure reactor	S/E	4	C	5	4. Operating procedures	4. Valve leaking through
	5. VCM release	S/E	3	D	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Low pressure switch - 81P558, similar other reactors	

Node: 311. Manual emergency kill line from AMS pot to RX.

Type: Line

Drawing: OM-090121-PID-D

Design Conditions/Parameters: Pipe spec B2-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
311.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Operating procedures	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Operator training	2. Valve leaking through
	3. Lift relief valve	S/E	4	C	5		
	4. Overpressure reactor	S/E	4	C	5		
	5. Personal exposure	S	4	C	5		
311.2 High Pressure							
	1. AMS release	S/E	4	C	5	1. Fire Protection System	1. Instrument failure
	2. Fire and explosion	S/E	3	D	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line leak/rupture
	4. Valve failure	S/E	4	C	5	4. HNU unit	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	5. Valve failure
						6. Operator training	
						7. Pressure Gauge	
311.3 Low Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line leak/rupture
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve failure
	4. Overpressure reactor	S/E	4	C	5	4. Low pressure switch - 81P558, similar other reactors	4. Valve leaking through
	5. VCM release	S/E	4	C	5	5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	

Node: 312. Nitrogen supply lines to Rx's emergency kill valves.

Type: Line

Drawing: OM-090121-PID-D

Design Conditions/Parameters: Pipe spec B2-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
312.1 High Pressure							
	1. Actuator failure 2. Line rupture 3. O-Ring failure	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Operating procedures 2. Operator training	1. External heat 2. Instrument failure 3. Line plugged 4. Operator error 5. Valve failure
312.2 Low Pressure							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure reactor 4. Personal exposure	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. Instrument failure 2. Line leak/rupture 3. Line plugged 4. Nitrogen bottle empty 5. Operator error 6. Valve failure
312.3 Low Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure reactor 4. Personal exposure 5. Solenoid failure	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. Cold weather 2. Valve leaking through

Node: 313. Nitrogen supply lines to dump tank emergency kill valves.

Type: Line

Drawing: OM-090121-PID-D

Design Conditions/Parameters: Pipe spec B2-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
313.1 High Pressure							
	1. Actuator failure	S/E	4	C	5	1. Operating procedures	1. External heat
	2. Line rupture	S/E	4	C	5	2. Operator training	2. Instrument failure
	3. O-Ring failure	S/E	4	C	5	3. Pressure Gauge	3. Line plugged
							4. Operator error
							5. Valve failure
313.2 Low Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Line leak/rupture
	3. Overpressure reactor	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Nitrogen bottle empty
						5. Operator training	5. Operator error
						6. Personal Protective Equipment	6. Valve failure
						7. Valve indication	
						8. Pressure Gauge	
313.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Overpressure reactor	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Solenoid failure	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Valve indication	

Node: 314. Stripping steam supply to rx's.

Type: Line

Drawing: OM-090122-PID-D

Design Conditions/Parameters: Pipe spec A2-3.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
314.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line leak/rupture
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Overpressure reactor	S/E	4	C	5	3. general monitor	3. Low steam pressure
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Operator training	5. Valve leaking through
						6. Personal Protective Equipment	
						7. Valve indication	
						8. Flow indicator controller - 81F083	
						9. Pressure Gauge	
314.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock-steam supply valve will not open unless steam pressure > 120 psig and recovery valves, 81H130 & 81H131 are open	1. Line leak/rupture
	2. Line rupture	S/E	4	C	5	2. Fire Protection System	2. Line plugged
	3. Overpressure reactor	S/E	4	C	5	3. Fixed point monitor	3. Low steam pressure
	4. Personal exposure	S/E	4	C	5	4. general monitor	4. Valve closed
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve leaking through

VIII.D. Hazards Identified - P&ID/Operating Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 315. Brine tank, TK-313	
Type: Tank	Drawing: OM-090123-PID-D
Design Conditions/Parameters: 1000 Gal	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
315.1 High Level							
1. No consequences							

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 316. Brine transfer pump, PP-481.	
Type: Centrifugal Pump	Drawing: OM-090123-PID-D
Design Conditions/Parameters: 1x1.5-8, 80 GPM @ 50 psi.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
316.1 Low/No Flow							
	1. No consequences						

VIII.D. Hazards Identified - P&ID/Operating Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 317. Brine tank, TK-004.	
Type: Tank	Drawing: OM-090123-PID-D
Design Conditions/Parameters: 850 Gal	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
317.1 High Level							
	1. No consequences						
317.2 Low Level							
	1. No consequences						

Node: 318. Brine transfer pump, PP483.	
Type: Centrifugal Pump	Drawing: OM-090123-PID-D
Design Conditions/Parameters: 2x2.5-11.88, 100 GPM @ 300 psi	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
318.1 High Pressure							
	1. No consequences						
318.2 Low/No Flow							
	1. No consequences						

Node: 319. Seal oil reservoir for Rx seal oil system.

Type: Tank

Drawing: OM-090124-PID-D

Design Conditions/Parameters: 140 gal

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
319.1 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. Seal failure	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Temperature indication/alarm - 81T077	1. External heat 2. Heater coil failure 3. Operator error
319.2 Low Temperature							
	1. Fire and explosion 2. High pressure 3. Personal exposure 4. Seal failure	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Temperature indication/alarm - 81T077 7. Heater coil	1. Cold weather 2. Heat tracing failure 3. Operator error 4. Heater coil failure
319.3 Low Level							
	1. Fire and explosion 2. Personal exposure 3. Seal failure	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Low level switch/alarm - 81L069	1. Operator error 2. Instrument failure

Node: 320. Seal oil supply lines and seal oil puppy pump to Rx seals.

Type: Line + Positive Displacement Pump

Drawing: OM-090124-PID-D

Design Conditions/Parameters: Pipe spec A13-2. Pump: Gear 8 GPM @ 220 psi. (PP-472/473)

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
320.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Seal failure	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure transmitter, 81P171, 81P066 9. relief valve	1. External heat 2. Filter Plugged 3. Heat tracing failure 4. Instrument failure 5. Line plugged 6. Operator error 7. Valve closed 8. Valve failure
320.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Seal failure	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Heat tracing failure 3. Instrument failure 4. Line blocked in with external heat (thermal expansion)
320.3 Low Pressure							
	1. Fire and explosion 2. Personal exposure 3. Reverse flow 4. Seal failure 5. VCM Leak	S/E S S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Operating procedures 4. Operator training 5. Personal Protective Equipment 6. Pressure Gauge 7. Pressure transmitter, 81P171, 81P066 8. Bladder 9. Pump On UPS system	1. Instrument failure 2. Line leak/rupture 3. Operator error 4. Power failure 5. Pump failure 6. Seal failure 7. Valve closed 8. Valve leaking through
320.4 Low Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Seal failure 5. VCM Leak	S/E S/E S S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training 8. Pressure transmitter, 81P171	1. Cold weather 2. Heat tracing failure 3. Instrument failure

Node: 321. Seal oil system bladder.

Type: Vessel

Drawing: OM-090124-PID-D

Design Conditions/Parameters: 15 gal capacity @ 220 psig

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
321.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. Vessel rupture	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Nitrogen supply regulator	1. External heat 2. Nitrogen supply regulator failure
321.2 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. Vessel rupture	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor	1. External heat
321.3 Low Pressure							
	1. Fire and explosion 2. Personal exposure 3. Reverse flow 4. Seal failure	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. Line leak/rupture 2. Line plugged 3. Operator error 4. Nitrogen supply regulator 5. Nitrogen bottle empty 6. Valve leaking through

Node: 322. Seal oil system return header including seal oil filters.

Type: Line + Vessel

Drawing: OM-090124-PID-D

Design Conditions/Parameters: Pipe spec A13-2. Filter FL-113/115 MAWP 300 psi @ 200 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
322.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Seal failure	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. relief valve 9. Pressure regulator	1. External heat 2. Filter Plugged 3. Heat tracing failure 4. Instrument failure 5. Line plugged 6. Operator error 7. Valve closed 8. Valve failure 9. Pressure regulator failure
322.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Seal failure	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Heat tracing failure 3. Instrument failure 4. Line blocked in with external heat (thermal expansion)
322.3 Low Pressure							
	1. Fire and explosion 2. Personal exposure 3. Reverse flow 4. Seal failure	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Operating procedures 4. Operator training 5. Personal Protective Equipment 6. Pressure Gauge 7. Pressure regulator	1. Instrument failure 2. Line leak/rupture 3. Operator error 4. Power failure 5. Pump failure 6. Seal failure 7. Valve closed 8. Valve leaking through 9. Pressure regulator failure
322.4 Low Temperature							
	1. Fire and explosion 2. High pressure 3. Personal exposure 4. Seal failure	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training	1. Cold weather 2. Heat tracing failure 3. Instrument failure

Node: 323. Seal oil return header from filters to reservoir.

Type: Line

Drawing: OM-090124-PID-D

Design Conditions/Parameters: Pipe spec A13-2.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
323.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Seal failure	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure regulator 9. relief valve	1. External heat 2. Filter Plugged 3. Heat tracing failure 4. Instrument failure 5. Line plugged 6. Operator error 7. Pressure regulator failure 8. Valve closed 9. Valve failure
323.2 Low Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Seal failure	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Operating procedures 4. Operator training 5. Personal Protective Equipment 6. Pressure Gauge 7. Pressure regulator	1. Instrument failure 2. Line leak/rupture 3. Operator error 4. Power failure 5. Pressure regulator failure 6. Pump failure 7. Seal failure 8. Valve closed 9. Valve leaking through
323.3 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. Seal failure	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Heat tracing failure 3. Instrument failure 4. Line blocked in with external heat (thermal expansion)
323.4 Low Temperature							
	1. Fire and explosion 2. High pressure 3. Personal exposure 4. Seal failure	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training	1. Cold weather 2. Heat tracing failure 3. Instrument failure

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 324. Chiller unit for RVCM Knock Back condensers.

Type: Chiller

Drawing: OM-090125-PID-D

Design Conditions/Parameters: 30 ton, R22 refrigerant.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
324.1 High Temperature							
	1. High pressure on VCM Receivers	S/E	4	C	5	1. Temperature gauge	1. Chiller failure

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 325. Chiller recirculation water hold tank. TK-471	
Type: Tank	Drawing: OM-090125-PID-D
Design Conditions/Parameters: 1750 Gal	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
325.1 High Temperature							
	1. No consequences						
325.2 High Level							
	1. Ethylene glycol release	S/E	4	C	5	1. sight glass	1. Instrument failure 2. Operator error
325.3 Low Level							
	1. no flow 2. High pressure on VCM receivers	S/E S/E	4 4	C C	5 5	1. sight glass 2. Low level switch - 81L800	1. Line leak/rupture 2. Operator error

Node: 326. HPSW supply header.	
Type: Line	Drawing: OM-090127-PID-D
Design Conditions/Parameters: Pipe spec A2-3.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
326.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Gasket failure	S/E	4	C	5	3. general monitor	
	4. Line rupture	S/E	4	C	5	4. Heat tracing	
	5. VCM Leak	S/E	4	C	5	5. Line insulation	
326.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line blocked in with external heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
326.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. Line leak/rupture
	2. Hydro fill the reactor	S/E	4	C	5	2. DCS interlock-All RX slow vent valves must be closed & recovery system discharge pressure is < 110 psig (81p759) before slow vent flush valve will open.	2. Operator error
	3. Personal exposure	S	4	C	5	3. Fire Protection System	3. Pump failure
	4. VCM Leak	S/E	4	C	5	4. Fixed point monitor	4. Valve leaking through
	5. VCM release	S/E	4	C	5	5. Flow meter	
						6. general monitor	
						7. Operating procedures	
						8. Operator training	
						9. Personal Protective Equipment	

Node: 327. MSPW supply header.

Type: Line

Drawing: OM-090127-PID-D

Design Conditions/Parameters: Pipe spec A2-3.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
327.1 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Gasket failure	S/E	4	C	5	3. general monitor	
	4. Line rupture	S/E	4	C	5	4. Heat tracing	
	5. VCM Leak	S/E	4	C	5	5. Line insulation	
327.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line blocked in with external heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
327.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. Line leak/rupture
	2. Hydro fill the reactor	S/E	4	C	5	2. DCS interlock-All RX slow vent valves must be closed & recovery system discharge pressure is < 110 psig (81p759) before slow vent flush valve will open.	2. Operator error
	3. Personal exposure	S	4	C	5	3. Fire Protection System	3. Pump failure
	4. VCM Leak	S/E	4	C	5	4. Fixed point monitor	4. Valve leaking through
	5. VCM release	S/E	4	C	5	5. Flow meter	
						6. general monitor	
						7. Operating procedures	
						8. Operator training	
						9. Personal Protective Equipment	

Node: 328. Normal kill line from kill tank thru transfer pump to kill solution filter.

Type: Line + Positive Displacement Pump

Drawing: OM-090128-PID-D

Design Conditions/Parameters: Pipe spec A2-1. Pump, PP-276, gear, 10 gpm @ 150 psi.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
328.1 High Pressure							
	1. Lift relief valve 2. Personal exposure	S/E S	4 4	C C	5 5	1. Operator training 2. Personal Protective Equipment 3. Pressure Gauge 4. relief valve 5. Recirculation line	1. External heat 2. Line plugged 3. Relief Valve failure 4. Valve closed 5. Filter Plugged
328.2 Low Temperature							
	1. Lift relief valve 2. Personal exposure 3. Frozen Line	S/E S S/E	4 4 4	C C C	5 5 5	1. Operator training 2. Personal Protective Equipment 3. Pressure Gauge 4. Recirculation line 5. relief valve 6. Heat tracing 7. Operating procedures	1. Cold weather 2. Heat tracing failure 3. Operator error
328.3 High Temperature							
	1. Lift relief valve 2. Personal exposure	S/E S	4 4	C C	5 5	1. Operator training 2. Personal Protective Equipment 3. Pressure Gauge 4. Recirculation line 5. relief valve	1. External heat 2. Pump blocked in and running

Node: 329. Normal kill solution filter, FL-395.

Type: Vessel

Drawing: OM-090128-PID-D

Design Conditions/Parameters: MAWP: 150 psig @ 500 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
329.1 High Pressure							
	1. Lift relief valve	S/E	4	C	5	1. Operator training	1. External heat
	2. Personal exposure	S	4	C	5	2. Personal Protective Equipment	2. Filter Plugged
	3. Vessel rupture	S/E	4	C	5	3. Pressure Gauge	3. Line plugged
	4. O-Ring failure	S/E	4	C	5	4. Recirculation line	4. Operator error
						5. relief valve	5. Relief Valve failure
							6. Valve closed
329.2 Start-up/Shutdown Hazards							
	1. Personal exposure	S	4	C	5	1. Maintenance & operating procedures	1. Operator error
							2. Valve leaking through

Node: 330. Normal kill line from filter to catalyst charge pot.	
Type: Line	Drawing: OM-090128-PID-D
Design Conditions/Parameters: Pipe spec A2-1.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
330.1 High Pressure							
	1. Lift relief valve 2. Personal exposure	S/E S/E	4 4	C C	5 5	1. Operator training 2. Personal Protective Equipment 3. Pressure Gauge 4. Recirculation line 5. relief valve	1. External heat 2. Filter Plugged 3. Line plugged 4. Relief Valve failure 5. Valve closed
330.2 High Temperature							
	1. Lift relief valve 2. Personal exposure	S/E S/E	4 4	C C	5 5	1. Operator training 2. Personal Protective Equipment 3. Pressure Gauge 4. Recirculation line 5. relief valve	1. External heat 2. Pump blocked in and running
330.3 Low Temperature							
	1. Frozen Line 2. Lift relief valve 3. Personal exposure	S/E S/E S	4 4 4	C C C	5 5 5	1. Heat tracing 2. Operating procedures 3. Operator training 4. Personal Protective Equipment 5. Pressure Gauge 6. Recirculation line 7. relief valve	1. Cold weather 2. Heat tracing failure 3. Operator error

Node: 331. Rx catalyst charge pot.	
Type: Vessel	Drawing: OM-090128-PID-D
Design Conditions/Parameters: MAWP: 450 psig @ 300 F	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
331.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Vessel blocked in with external heat (thermal expansion)
	3. Vessel rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
						7. Ram valve	
331.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Vessel rupture	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
331.3 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Vessel rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Heat tracing	
	5. VCM Leak	S/E	4	C	5	5. Line insulation	
						6. Operating procedures	
						7. Operator training	
331.4 Start-up/Shutdown Hazards							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. VCM release	S/E	4	C	5	3. general monitor	
						4. Maintenance & operating procedures	

Node: 332. Normal kill line to Rx-300,400,500,600,700.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D, OM-090128-PID-D

Design Conditions/Parameters: Pipe spec B13-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
332.1 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Heat tracing failure 3. Line plugged 4. Operator error
332.2 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training	1. Cold weather 2. Valve leaking through
332.3 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Check valve 2. DCS interlock-Valve will only open in poly mode, must have enable from lead operator, and has timer to alert lead operator that charge valve has been open a long time. 3. Fire Protection System 4. Fixed point monitor 5. general monitor 6. Operating procedures 7. Operator training 8. Personal Protective Equipment 9. Valve indication	1. High Pressure in Reactor 2. Line leak/rupture 3. Low HPSW pressure 4. Operator error 5. Power failure 6. Valve failure 7. Valve leaking through
332.4 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Ram valve	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Line plugged 4. Operator error

Node: 333. HPSW supply to Rx catalyst charge pot.	
Type: Line	Drawing: OM-090128-PID-D
Design Conditions/Parameters: Pipe spec A2-3.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
333.1 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Check valve 2. DCS interlock-Valve will only open in poly mode, must have enable from lead operator, and has timer to alert lead operator that charge valve has been open a long time. 3. Fire Protection System 4. Fixed point monitor 5. general monitor 6. Operating procedures 7. Operator training 8. Personal Protective Equipment 9. Valve indication	1. High Pressure in Reactor 2. Line leak/rupture 3. Low HPSW pressure 4. Operator error 5. Power failure 6. Valve failure 7. Valve leaking through

Node: 334. Cleanwall supply line to Rx's.

Type: Line

Drawing: OM-090129-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
334.1 High Pressure							
	1. Gasket failure 2. Line rupture	S/E S/E	4 4	C C	5 5	1. Maintenance & operating procedures 2. Pressure Gauge at pump 3. relief valve at pump	1. High Pressure in Reactor 2. Line plugged 3. RX nozzle plug 4. Valve closed 5. Valve leaking through
334.2 High Temperature							
	1. Gasket failure 2. High pressure 3. Line rupture	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Pressure Gauge	1. External heat 2. Line leak/rupture 3. Line plugged 4. Operator error 5. RX nozzle plug 6. Valve closed 7. Valve leaking through
334.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Line insulation	1. Cold weather
334.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Line rupture 5. No flow 6. Personal exposure 7. VCM Leak	S/E S/E S/E S/E S/E S/E S/E	3 4 4 4 4 4 4	D C C C C C C	5 5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. DCS Interlock - Cleanwall valve will not open if steam purge valve is open, reactor is not in cleanwall mode, and if any other cleanwall valve on another reactor is open.	1. Line leak/rupture 2. Line plugged 3. Operator error 4. Power failure 5. Pump failure 6. RX nozzle plug 7. Valve leaking through

Node: 335. Steam supply to clean wall nozzle.

Type: Line

Drawing: OM-090129-PID-D

Design Conditions/Parameters: Pipe spec A2-3/A13-1.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
335.1 High Pressure							
	1. Gasket failure 2. Line rupture	S/E S/E	4 4	C C	5 5	1. Maintenance & operating procedures 2. Pressure Gauge at pump 3. relief valve at pump	1. High Pressure in Reactor 2. Line plugged 3. RX nozzle plug 4. Valve closed 5. Valve leaking through
335.2 High Temperature							
	1. Gasket failure 2. High pressure 3. Line rupture	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Pressure Gauge	1. External heat 2. Line leak/rupture 3. Line plugged 4. Operator error 5. RX nozzle plug 6. Valve closed 7. Valve leaking through
335.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Line insulation	1. Cold weather
335.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	4 4 4 4 4	C C C C C	5 5 5 5 5	1. DCS Interlock - Steam valve will not open if reactor is not in cleanwall mode. 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. Line leak/rupture 2. Line plugged 3. Operator error 4. Power failure 5. Pump failure 6. RX nozzle plug 7. Valve leaking through

Node: 336. Steam supply to clean wall nozzle inlet (for nozzle clean out)	
Type: Line	Drawing: OM-090129-PID-D
Design Conditions/Parameters: Pipe spec A13-1	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
336.1 High Pressure							
	1. Gasket failure 2. Line rupture	S/E S/E	4 4	C C	5 5	1. DCS interlock - steam purge and cleanwall supply cannot be open at the same time.	1. High Pressure in Reactor 2. Line plugged 3. RX nozzle plug 4. Valve closed 5. Valve leaking through
336.2 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Line rupture 5. No flow 6. Personal exposure 7. VCM Leak	S/E S/E S/E S/E S/E S/E S/E	3 4 4 4 4 4 4	D C C C C C C	5 5 5 5 5 5 5	1. DCS Interlock - Steam purge will not open unless reactor is in cleanwall mode, and cleanwall supply valve is closed. 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. Line leak/rupture 2. Line plugged 3. Operator error 4. Power failure 5. Pump failure 6. RX nozzle plug 7. Valve leaking through

Node: 337. F-50 charge line to RX-300,400,500,600,700.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D, OM-090130-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
337.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. External heat
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Filter Plugged
	4. Personal exposure	S/E	4	C	5	4. Heat tracing	4. High Pressure in Reactor
	5. VCM Leak	S/E	4	C	5	5. Line insulation	5. Line plugged
						6. Operating procedures	6. Operator error
						7. Operator training	7. Valve closed
						8. Personal Protective Equipment	8. Valve failure
337.2 High Temperature							
	1. Fire and explosion	S/E	4	C	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. High pressure	S/E	4	C	5	3. general monitor	3. Operator error
	4. Line rupture	S/E	4	C	5	4. Operating procedures	
	5. Personal exposure	S/E	4	C	5	5. Operator training	
	6. Valve packing leaking	S/E	4	C	5	6. Personal Protective Equipment	
	7. VCM Leak	S/E	4	C	5		
337.3 Low Temperature							
	1. Fire and explosion	S/E	4	C	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. No flow	S/E	4	C	5	4. Heat tracing	
	5. VCM Leak	S/E	4	C	5	5. Line insulation	
						6. Operating procedures	
						7. Operator training	
						8. Personal Protective Equipment	
337.4 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Check valve	1. High Pressure in Reactor
	2. Personal exposure	S	4	C	5	2. DCS interlock - abort F-50 charge on low flow	2. Operator error
	3. VCM Leak	S/E	4	C	5	3. DCS interlock - valve 81hv110. Won't open unless RX in charge and all other RX F-50 valves closed	3. Power failure
	4. VCM release	S/E	4	C	5	4. Fire Protection System	4. Pump failure
						5. Fixed point monitor	5. Valve failure
						6. general monitor	6. Valve leaking through
						7. Operator training	
						8. Personal Protective Equipment	

Node: 338. F-50 filter, FL-130, for RX-700.

Type: Vessel

Drawing: OM-090130-PID-D

Design Conditions/Parameters: MAWP: 300 psig

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
338.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. VCM Leak 5. Lift relief valve	S/E S/E S S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training 8. Personal Protective Equipment 9. relief valve 10. Differential pressure switch - 81P996	1. Cold weather 2. External heat 3. Filter Plugged 4. High Pressure in Reactor 5. Line plugged 6. Operator error 7. Valve closed 8. Valve failure
338.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Heat tracing failure 3. Operator error
338.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. VCM Leak	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training 8. Personal Protective Equipment	1. Cold weather
338.4 Start-up/Shutdown Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S S/E	3 4 3	D C D	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Operator error 2. Valve leaking through

Node: 339. Outlet line to F-50 filter, FL-130, to Rx-700.

Type: Line

Drawing: OM-090130-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
339.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Lift relief valve	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training 8. Personal Protective Equipment 9. relief valve	1. Cold weather 2. External heat 3. High Pressure in Reactor 4. Line plugged 5. Operator error 6. Valve closed 7. Valve failure
339.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Valve packing leaking	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Heat tracing failure 3. Operator error
339.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. VCM Leak	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training 8. Personal Protective Equipment	1. Cold weather

Node: 340. Inlet line to F-50 filter, FL-130, for Rx-700.

Type: Line

Drawing: OM-090130-PID-D

Design Conditions/Parameters: Pipe spec A13-1.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
340.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training 8. Personal Protective Equipment	1. Cold weather 2. External heat 3. Filter Plugged 4. High Pressure in Reactor 5. Line plugged 6. Operator error 7. Valve closed 8. Valve failure
340.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Valve packing leaking	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Heat tracing failure 3. Operator error
340.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. No flow 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Heat tracing 5. Line insulation 6. Operating procedures 7. Operator training 8. Personal Protective Equipment	1. Cold weather

Node: 341. Slurry feed line from slurry feed pump, PP-511, to interchanger, EX-011.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A13-5.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
341.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Flow indicator controller - 91F622	1. External heat 2. Line plugged 3. Operator error 4. Valve closed 5. High pressure in Feed Tank
341.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Temperature gauge	1. External heat

Node: 342. EX-011, slurry feed side.	
Type: Heat Exchanger	Drawing: OM-090132-PID-D
Design Conditions/Parameters: MAWP: 190 psig @ 400 F	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
342.1 High Pressure							
	1. Gasket failure	S/E	4	C	5	1. Fire Protection System	1. External heat
	2. Channel Failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in Feed Tank
	3. Fire and explosion	S/E	3	D	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operator training	4. Operator error
						5. Personal Protective Equipment	5. Valve closed
						6. Pressure Gauge	6. Slurry feed side blocked in.
342.2 Low Temperature							
	1. Channel Failure	S/E	4	C	5	1. Fire Protection System	1. Cold weather
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Temperature gauge	
342.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S/E	4	C	5	3. general monitor	
						4. Personal Protective Equipment	
						5. Temperature gauge	

Node: 343. Slurry feed line from interchanger, EX-011, to stripper, TW-002.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A13-5

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
343.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Pressure Gauge	1. External heat 2. High pressure in Feed Tank 3. Line plugged 4. Operator error 5. Valve closed
343.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Temperature gauge 7. Temperature indication - 91T627	1. External heat
343.3 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S/E S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment	1. Instrument failure 2. Operator error 3. Valve leaking through

Node: 344. OM Stripping column, TW-002.

Type: Column

Drawing: OM-090132-PID-D

Design Conditions/Parameters: MAWP: 150 psig @ 400 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
344.1 High Pressure							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. Vessel rupture	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Pressure indication - 91P866, 91P867, 91P868, 91P639, 91P869 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Pressure Gauge 9. relief valve	1. Feed Control Valve failure 2. Steam Control Valve failure 3. Recovery valve closed 4. Valve indication failure 5. Instrument failure 6. Rinse valve left open
344.2 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. Vessel rupture	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Temperature indication - 91T638, 91T637	1. Cooling Water Control Valve failure 2. External heat 3. Steam Control Valve failure
344.3 Low Temperature							
	1. Fire and explosion 2. Personal exposure 3. VCM release 4. Inadequately stripped slurry leaves stripper	S/E S S/E S/E	3 4 4 4	D C D C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure indication - 91P866, 91P867, 91P868, 91P639, 91P869 8. Temperature indication - 91T638, 91T637	1. Instrument failure 2. Operator error 3. Steam Control Valve failure
344.4 Start-up/Shutdown hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment	1. Operator error

Node: 345. Outlet line from stripper, TW-002, through bottoms pump, PP-515, to interchanger, EX-011.

Type: Centrifugal Pump + Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A13-5. PP-515: 390 GPM @ 196 ft.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
345.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line blocked in with external heat (thermal expansion)
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. External heat
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. Seal failure	S/E	4	C	5	4. Operator training	
	5. Lift relief valve	S/E	4	C	5	5. Personal Protective Equipment	
						6. relief valve	
						7. Pressure indication - 91P625	
						8. Pressure Gauge	
345.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Lift relief valve	S/E	4	C	5	2. Fixed point monitor	2. Pump blocked in and running
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operator training	
	5. Seal failure	S/E	4	C	5	5. Personal Protective Equipment	
						6. relief valve	
						7. Temperature gauge	

Node: 346. EX-011, stripped slurry side.

Type: Heat Exchanger

Drawing: OM-090132-PID-D

Design Conditions/Parameters: MAWP: 190 psig @ 400 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
346.1 High Pressure							
	1. Channel Failure	S/E	4	C	5	1. Fire Protection System	1. External heat
	2. Fire and explosion	S/E	3	D	5	2. Fixed point monitor	2. Line plugged
	3. Gasket failure	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S/E	4	C	5	4. Operator training	4. Stripped slurry side blocked in.
	5. Lift relief valve	S/E	4	C	5	5. Personal Protective Equipment	5. Valve closed
						6. Pressure Gauge	
						7. Pressure indication - 91P625	
346.2 Low Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Fixed point monitor	
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S/E	4	C	5	4. Line insulation	
						5. Operating procedures	
						6. Personal Protective Equipment	
						7. Temperature gauge	
346.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S	4	C	5	3. general monitor	
						4. Personal Protective Equipment	
						5. Temperature gauge	
						6. relief valve	

Node: 347. Stripped slurry line from EX-011 to blend tanks.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A13-5

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
347.1 High Pressure							
	1. Fire and explosion 2. Lift relief valve 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Pressure Gauge 7. Pressure indication - 91P625 8. relief valve	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Line plugged 4. Valve closed
347.2 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. relief valve 7. Temperature gauge 8. Temperature indication - 91T629	1. External heat
347.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Line insulation 5. Operating procedures 6. Personal Protective Equipment 7. Temperature gauge 8. Temperature indication - 91T629	1. Cold weather

Node: 348. Stripped slurry recycle line to feed tank, DM-079.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A13-5.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
348.1 High Pressure							
	1. Fire and explosion 2. Lift relief valve 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Pressure Gauge 7. Pressure indication - 91P625 8. relief valve	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Line plugged 4. Valve closed
348.2 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. relief valve 7. Temperature gauge 8. Temperature indication - 91T629	1. External heat
348.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Line insulation 5. Operating procedures 6. Personal Protective Equipment 7. Temperature gauge 8. Temperature indication - 91T629	1. Cold weather

Node: 349. HPSW line to bottoms pump, PP-515, mechanical seal.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A13-2

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
349.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge 7. Flow meter 8. Pressure regulator	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
349.2 High Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak 4. Fire and explosion	S S/E S/E S/E	4 4 4 3	C C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment	1. External heat 2. Operator error
349.3 Low Pressure							
	1. Personal exposure 2. Seal failure 3. VCM Leak 4. Fire and explosion	S S/E S/E S/E	4 4 4 3	C C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Instrument failure 2. Line plugged 3. Operator error 4. Valve closed
349.4 Low Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Line insulation 5. Personal Protective Equipment 6. Pressure Gauge	1. Cold weather

Node: 350. Process water flush line to bottoms pump, PP-515, suction line.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A13-2.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
350.1 High Pressure							
	1. Line rupture 2. Personal exposure	S/E S	4 4	C C	5 5	1. Personal Protective Equipment	1. Line blocked in with external heat (thermal expansion)
350.2 High Temperature							
	1. Line rupture 2. Personal exposure	S/E S	4 4	C C	5 5	1. Fire Protection System	1. External heat
350.3 Low Temperature							
	1. Frozen Line 2. Line rupture 3. Personal exposure	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Heat tracing 2. Line insulation	1. Cold weather 2. Heat tracing failure

Node: 351. Process water flush line to bottoms pump, PP-515, discharge line.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A13-2.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
351.1 High Pressure							
	1. Line rupture	S/E	4	C	5	1. Personal Protective Equipment	1. Line blocked in with external heat (thermal expansion)
351.2 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Heat tracing	1. Cold weather
	2. Line rupture	S/E	4	C	5	2. Line insulation	2. Heat tracing failure
	3. Personal exposure	S	4	C	5		

Node: 352. Process water flush line to EX-011 outlet line to stripper.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A13-2.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
352.1 High Pressure							
	1. Line rupture 2. Personal exposure	S/E S	4 4	C C	5 5	1. Personal Protective Equipment	1. Line blocked in with external heat (thermal expansion)
352.2 Low Temperature							
	1. Frozen Line 2. Line rupture 3. Personal exposure	S/E S/E S	4 4 4	C C C	5 5 5	1. Heat tracing 2. Line insulation	1. Cold weather 2. Heat tracing failure

Node: 353. Process water flush line to EX-011 outlet line to blend tanks.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A13-2.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
353.1 High Pressure							
	1. Line rupture	S/E	4	C	5	1. Personal Protective Equipment	1. Line blocked in with external heat (thermal expansion)
353.2 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Heat tracing	1. Cold weather
	2. Line rupture	S/E	4	C	5	2. Line insulation	2. Heat tracing failure
	3. Personal exposure	S	4	C	5		

Node: 354. Process water flush line to top of stripper, TW-002.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A13-2.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
354.1 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Pump failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve closed
	4. Personal exposure	S	4	C	5	4. Operator training	
						5. Personal Protective Equipment	
						6. Valve indication	
354.2 High Pressure							
	1. Line rupture	S/E	4	C	5	1. Personal Protective Equipment	1. Line blocked in with external
	2. Personal exposure	S	4	C	5		heat (thermal expansion)
354.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Heat tracing	1. Cold weather
	2. Line rupture	S/E	4	C	5	2. Line insulation	2. Heat tracing failure
	3. Personal exposure	S	4	C	5		

Node: 355. Process water flush line to top of stripper condenser, TW-002.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A13-2.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
355.1 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Pump failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve closed
	4. Personal exposure	S	4	C	5	4. Operator training	
						5. Personal Protective Equipment	
						6. Valve indication	
355.2 High Pressure							
	1. Line rupture	S/E	4	C	5	1. Personal Protective Equipment	1. Line blocked in with external
	2. Personal exposure	S	4	C	5		heat (thermal expansion)
355.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Heat tracing	1. Cold weather
	2. Line rupture	S/E	4	C	5	2. Line insulation	2. Heat tracing failure
	3. Personal exposure	S	4	C	5		

Node: 356. Antifoam addition line to stripper, TW-002.	
Type: Line	Drawing: OM-090132-PID-D
Design Conditions/Parameters: Pipe spec A13-2	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
356.1 High Pressure							
	1. Gasket failure 2. Line rupture 3. Personal exposure	S/E S/E S	4 4 4	C C C	5 5 5	1. Personal Protective Equipment	1. Line blocked in with external heat (thermal expansion)
356.2 Low Temperature							
	1. Frozen Line 2. Line rupture 3. Personal exposure	S/E S/E S	4 4 4	C C C	5 5 5	1. Heat tracing 2. Line insulation	1. Cold weather 2. Heat tracing failure

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 357. Process water flush line to stripper, TW-002, Antifoam addition line.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A13-2.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
357.1 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Heat tracing	1. Cold weather
	2. Line rupture	S/E	4	C	5	2. Line insulation	2. Heat tracing failure
	3. Personal exposure	S	4	C	5		

Node: 358. Cooling water supply line to stripper condenser, TW-002.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
358.1 High Temperature							
	1. Gasket failure 2. Line rupture	S/E S/E	4 4	C C	5 5	1. Fire Protection System 2. general monitor	1. Cooling Water Control Valve failure 2. External heat 3. Line plugged 4. Operator error 5. Power failure 6. Pump failure 7. Valve closed
358.2 High Pressure							
	1. Damage condenser 2. Gasket failure 3. Line rupture	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Operating procedures 2. Operator training	1. Line plugged 2. Valve closed

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 359. Stripper condenser, TW-002.

Type: Heat Exchanger

Drawing: OM-090132-PID-D

Design Conditions/Parameters: MAWP: 150 psig @ 400 F

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
359.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Tube leak/rupture	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge	1. Condenser blocked in on water side 2. External heat

Node: 360. Cooling water return line from stripper condenser, TW-002.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
360.1 High Pressure							
	1. Damage condenser 2. Gasket failure 3. Line rupture 4. Lift relief valve	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Operating procedures 2. Operator training 3. relief valve	1. Line plugged 2. Valve closed
360.2 High Temperature							
	1. Gasket failure 2. Line rupture 3. Lift relief valve	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. general monitor 3. Temperature indication - 91T649 4. relief valve	1. Cooling Water Control Valve failure 2. External heat 3. Line plugged 4. Operator error 5. Power failure 6. Pump failure 7. Valve closed

Node: 361. VCM Recovery line from stripper condenser, TW-002.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A13-5/A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
361.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Personal exposure	S/E S/E S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure indication - 91P869	1. External heat 2. Line plugged 3. Operator error 4. Relief Valve failure 5. Valve closed
361.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Line rupture 5. Personal exposure 6. Valve packing leaking	S/E S/E S/E S/E S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. relief valve 7. Temperature indication - 91T655	1. External heat

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 362. HPSW line to stripping steam desuperheater for stripper, TW-002..	
Type: Line	Drawing: OM-090132-PID-D
Design Conditions/Parameters: Pipe spec A13-2	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
362.1 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Heat tracing	1. Cold weather
	2. Line rupture	S/E	4	C	5	2. Line insulation	2. Heat tracing failure
	3. Personal exposure	S	4	C	5		

Node: 363. Stripping steam supply to stripper, TW-002.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A2-3/A13-5

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
363.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Overpressure stripper	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Personal Protective Equipment	4. Valve failure
	5. VCM Leak	S/E	4	C	5	5. Pressure indication - 91P643	5. Valve leaking through
363.2 Reverse/Misdirected Flow							
	1. Fire and explosion					1. Fire Protection System	1. Line leak/rupture
	2. Line rupture					2. Fixed point monitor	2. Line plugged
	3. Overpressure reactor					3. general monitor	3. Low steam pressure
	4. Personal exposure					4. Personal Protective Equipment	4. Valve closed
	5. VCM Leak					5. Flow indication - 91F634	5. Valve leaking through

Node: 364. Steam line to polishing strainers, FL-030/031.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
364.1 Reverse/Misdirected Flow							
	1. Line rupture 2. Personal exposure	S/E S/E	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. Operator error 2. Valve failure 3. Valve leaking through
364.2 High Pressure							
	1. Gasket failure 2. Line rupture 3. Personal exposure 4. Fire and explosion	S/E S/E S S/E	4 4 4 3	C C C D	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 365. Steam line to dump tank, DM-075, outlet line.

Type: Line

Drawing: OM-090132-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
365.1 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Check valve 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. Check valve failure 2. Operator error 3. Power failure
365.2 High Pressure							
	1. Gasket failure 2. Line rupture 3. Personal exposure	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Valve at polishing strainer leaking through into steam line

Node: 366. Dump line from Rx's 300/400 to dump pump.	
Type: Line	Drawing: OM-090134-PID-D
Design Conditions/Parameters: Pipe spec B13-22	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
366.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High Pressure in Reactor
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Instrument failure
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Line plugged
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Operator error
						6. Pressure Gauge	6. Valve closed
						7. Pressure indication - 81P867	
						8. Flow switch - 81F866	
366.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. High pressure	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	
366.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock - Dump valve can only be open in closed dump mode.	1. High pressure in dump tank
	2. Personal exposure	S	4	C	5	2. Dump line bullseye	2. Instrument failure
	3. VCM Leak	S/E	4	C	5	3. Dump pump amp indication	3. Operator error
						4. Fire Protection System	4. Pump failure
						5. Fixed point monitor	5. Valve failure
						6. general monitor	
						7. Maintenance & operating procedures	
						8. Personal Protective Equipment	

Node: 367. Reactor dump pump.

Type: Centrifugal Pump

Drawing: OM-090134-PID-D

Design Conditions/Parameters: 1500 GPM @ 175 ft

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
367.1 High Pressure							
	1. Pump casing failure	S/E	4	C	5	1. Amp indicator	1. External heat
	2. Fire and explosion	S/E	3	D	5	2. Fire Protection System	2. Line plugged
	3. Seal failure	S/E	4	C	5	3. Fixed point monitor	3. Valve closed
	4. VCM Leak	S/E	4	C	5	4. general monitor	
						5. Operator training	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
367.2 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Amp indicator	1. Line plugged
	2. High temperature	S/E	4	C	5	2. Fire Protection System	2. Operator error
	3. Personal exposure	S	4	C	5	3. Fixed point monitor	3. Valve closed
	4. Seal failure	S/E	4	C	5	4. general monitor	
						5. Operating procedures	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
367.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Pump blocked in and running
	3. Seal failure	S/E	4	C	5	3. general monitor	
						4. Operating procedures	
						5. Operator training	
						6. Personal Protective Equipment	

Node: 368. HPSW supply line to dump pump mechanical seal.

Type: Line

Drawing: OM-090134-PID-D

Design Conditions/Parameters: Pipe spec A13-2

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
368.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. general monitor 5. Operating procedures 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure regulator	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
368.2 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment	1. External heat 2. Operator error
368.3 Low Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	4 4 4 4	C C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Instrument failure 2. Line plugged 3. Operator error 4. Valve closed
368.4 Low Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Line insulation 5. Personal Protective Equipment 6. Pressure Gauge	1. Cold weather

Node: 369. Dump line from dump pump to dump strainer.

Type: Line

Drawing: OM-090134-PID-D

Design Conditions/Parameters: Pipe spec B13-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
369.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operator training	
						5. Personal Protective Equipment	
						6. Pressure Gauge	
						7. Pressure indication - 81P870	
369.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Low steam pressure
	4. Personal exposure	S	4	C	5	4. Operating procedures	
						5. Operator training	
						6. Personal Protective Equipment	

Node: 370. Dump strainer	
Type: Vessel	Drawing: OM-090134-PID-D
Design Conditions/Parameters: MAWP: 300 psig @ 365 F	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
370.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Vessel rupture	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge/transmitter (local) 8. Temperature gauge	1. Unrecovered strainer blocked in with recovery steam applied 2. Line plugged 3. Valve closed 4. Steam valve leaking through to blocked in strainer
370.2 Start-up/Shutdown Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment 6. Pressure Gauge 7. Valve indication	1. Operator error 2. Valve failure 3. Valve leaking through
370.3 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. Vessel rupture	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Temperature gauge	1. External heat 2. Steam valve leaking through to blocked in strainer 3. Unrecovered strainer blocked in with recovery steam applied
370.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Personal exposure 3. Vessel rupture	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge/transmitter (local) 8. Temperature gauge	1. Operator error

Node: 371. Dump line from dump strainer to dump tank.

Type: Line

Drawing: OM-090134-PID-D

Design Conditions/Parameters: Pipe spec B13-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
371.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operator training	
						5. Personal Protective Equipment	
						6. Pressure Gauge	
						7. Pressure indication - 81P872	
371.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Low steam pressure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Valve leaking through
	4. Personal exposure	S	4	C	5	4. Operating procedures	
						5. Operator training	
						6. Personal Protective Equipment	

Node: 372. Steam line to dump strainer for recovery.

Type: Line

Drawing: OM-090134-PID-D

Design Conditions/Parameters: Pipe spec A2-3/A13-22/B13-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
372.1 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	4	C	5	1. DCS interlock - steam valve to strainer will not open if strainer is in service.	1. Operator error
	2. Gasket failure	S/E	4	C	5		2. Low steam pressure
	3. Line rupture	S/E	4	C	5		
	4. Personal exposure	S	4	C	5	2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Valve indication 9. Check valve	
372.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. External heat
	3. Personal exposure	S	4	C	5	3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure Gauge/transmitter (local)	3. VCM backing into the steam line

Node: 373. VCM recovery line from dump strainers.

Type: Line

Drawing: OM-090134-PID-D

Design Conditions/Parameters: Pipe spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
373.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure Gauge/transmitter (local)	1. External heat 2. Operator error 3. VCM blocked in between strainer and recovery system.
373.2 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. DCS interlock - Recovery valve to strainer will not open if strainer is in service. 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Valve indication	1. Operator error 2. Valve leaking through
373.3 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Temperature gauge	1. External heat 2. Operator error 3. VCM blocked in between strainer and recovery system.

Node: 374. VCM recovery line from dump pump.

Type: Line

Drawing: OM-090134-PID-D

Design Conditions/Parameters: Pipe spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
374.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure Gauge/transmitter (local)	1. External heat 2. Operator error 3. VCM blocked in between pump and recovery system.
374.2 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. Operator error 2. Valve leaking through

Node: 375. Flush water flush line to dump strainers.

Type: Line

Drawing: OM-090134-PID-D

Design Conditions/Parameters: Pipe spec A13-2

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
375.1 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Check valve 2. DCS interlock - rinse valve to strainer will not open if strainer is in service, the rinse valve to opposite strainer is open, the steam supply valve is open, or the recovery valve is open. 3. Fire Protection System 4. Fixed point monitor 5. general monitor 6. Operating procedures 7. Operator training 8. Personal Protective Equipment 9. Valve indication	1. Low water pressure 2. Operator error 3. Valve leaking through
375.2 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Operator error 3. VCM backing into the rinse line
375.3 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Temperature gauge	1. External heat

Node: 376. Dump line from dump strainers to dump tank.

Type: Line

Drawing: OM-090135-PID-D

Design Conditions/Parameters: Pipe spec B13-5

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
376.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operator training	
						5. Personal Protective Equipment	
						6. Pressure Gauge	
						7. Pressure indication - 81P872	
376.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Valve leaking through
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Pump failure
	4. Personal exposure	S	4	C	5	4. Operating procedures	
						5. Operator training	
						6. Personal Protective Equipment	
						7. Amp indicator and run indication on dump pump	
						8. sight glass	

Node: 377. Dump tank, DM-075.	
Type: Vessel	Drawing: OM-090135-PID-D
Design Conditions/Parameters: MAWP: 150 psig @ 400 F ; 50,000 Gal	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
377.1 High Pressure							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. Vessel rupture 5. Seal failure	S/E S/E S S/E S/E	3 4 4 3 4	D C C D C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. relief valve 8. Pressure indication - 91P671, 91P871 9. Kill system on dump tank	1. Instrument failure 2. Operator error 3. Outlet Line plugged 4. Reaction in dump tank 5. High Pressure in Reactor 6. Relief Valve failure
377.2 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Kill system on dump tank 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Temperature indication - 91T668 9. relief valve	1. External heat 2. Operator error - steam line open into dump tank 3. Reaction in dump tank
377.3 High Level							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Kill system on dump tank 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Level indication - 91L669 9. relief valve 10. Level switch - 91L653, 91L670 11. DCS interlock - Can't dump to dump tank if dump tank level > 60%	1. Instrument failure 2. Operator error 3. Rinse valve failure 4. Outlet Line plugged
377.4 Start-up/Shutdown Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment	1. Operator error

Node: 378. Dump tank outlet line to feed tank.

Type: Line

Drawing: OM-090135-PID-D

Design Conditions/Parameters: Pipe spec A13-5

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
378.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High pressure in dump tank
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in Feed Tank
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line blocked in with external heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operator training	
						5. Personal Protective Equipment	
378.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Operator error - steam line open into dump tank
	3. Gasket failure	S/E	4	C	5	3. general monitor	3. Reaction in dump tank
	4. Line rupture	S/E	4	C	5	4. Operator training	
						5. Personal Protective Equipment	

Node: 379. Recovery line from Dump TK to Rx recovery header.

Type: Line

Drawings: OM-090108-PID-D, OM-090135-PID-D

Design Conditions/Parameters: Pipe spec A2-22.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
379.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure indication, 81P756, 81P628 8. Valve indication	1. External heat 2. High pressure in dump tank 3. High Pressure in Reactor 4. Instrument failure 5. Line plugged 6. Operator error 7. Power failure 8. Valve closed
379.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Valve failure 6. VCM Leak	S/E S/E S/E S S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Dump tank kill system 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. External heat 2. Reaction occurring in dump tank
379.3 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure dump tank 4. Personal exposure 5. VCM release	S/E S/E S/E S S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. Line leak/rupture 2. Operator error 3. Valve leaking through

Node: 380. Rinse water supply to dump tank rinse nozzle.

Type: Line

Drawing: OM-090135-PID-D

Design Conditions/Parameters: Pipe spec A13-2

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
380.1 High Pressure							
	1. Line rupture	S/E	4	C	5	1. Fire Protection System	1. External heat
	2. No flow	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Overpressure dump tank	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operator training	4. Valve leaking through
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Line plugged
380.2 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Fire Protection System	1. Cold weather
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S	4	C	5	3. general monitor	
						4. Line insulation	
						5. Personal Protective Equipment	

Node: 381. Process water flush line to dump tank outlet line.

Type: Line

Drawing: OM-090135-PID-D

Design Conditions/Parameters: Pipe spec A13-2

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
381.1 High Pressure							
	1. Line rupture	S/E	4	C	5	1. Fire Protection System	1. External heat
	2. No flow	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Overpressure dump tank	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operator training	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve leaking through
381.2 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Fire Protection System	1. Cold weather
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S	4	C	5	3. general monitor	
						4. Line insulation	
						5. Personal Protective Equipment	

Node: 382. Antifoam addition line to dump tank	
Type: Line	Drawing: OM-090135-PID-D
Design Conditions/Parameters: Pipe spec A13-2	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
382.1 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Heat tracing	1. Line blocked in with external heat (thermal expansion)
	2. Line rupture	S/E	4	C	5	2. Line insulation	2. Cold weather
	3. Personal exposure	S	4	C	5		3. Heat tracing failure
382.2 High Pressure							
	1. Gasket failure	S/E	4	C	5	1. Personal Protective Equipment	1. Line blocked in with external heat (thermal expansion)
	2. Line rupture	S/E	4	C	5		
	3. Personal exposure	S	4	C	5		

Node: 383. Emergency kill addition line.

Type: Line

Drawing: OM-090135-PID-D

Design Conditions/Parameters: Pipe spec B2-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
383.1 High Pressure							
	1. AMS release	S/E	4	C	5	1. Fire Protection System	1. Instrument failure
	2. Fire and explosion	S/E	3	D	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line leak/rupture
	4. Valve failure	S/E	4	C	5	4. HNU unit	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Operating procedures	5. Valve failure
						6. Operator training	
						7. Pressure Gauge	
383.2 Low Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line leak/rupture
	2. Lift relief valve on dump tank	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. No flow	S/E	4	C	5	3. general monitor	3. Valve failure
						4. Operating procedures	4. Valve leaking through
						5. Operator training	
						6. Personal Protective Equipment	
						7. Pressure Gauge	
383.3 Low Temperature							
	1. Fire and explosion	S/E	4	C	5	1. Operating procedures	1. Cold weather
	2. Frozen Line	S/E	4	C	5	2. Operator training	2. Valve leaking through
	3. Lift relief valve on dump tank	S/E	4	C	5		
	4. Overpressure dump tank	S/E	4	C	5		
	5. Personal exposure	S	4	C	5		
	6. VCM release	S/E	4	C	5		

Node: 384. Nitrogen line to emergency kill valves.

Type: Line

Drawing: OM-090135-PID-D

Design Conditions/Parameters: Pipe spec B2-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
384.1 High Pressure							
	1. Actuator failure 2. Line rupture 3. O-Ring failure	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Operating procedures 2. Operator training	1. External heat 2. Instrument failure 3. Line plugged 4. Operator error 5. Valve failure
384.2 Low Pressure							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure dump tank 4. Personal exposure 5. Valves won't open 6. VCM release	S/E S/E S/E S S/E S/E	4 4 4 4 4 4	C C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. Instrument failure 2. Line leak/rupture 3. Line plugged 4. Nitrogen bottle empty 5. Operator error 6. Valve failure
384.3 Low Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure dump tank 4. Personal exposure 5. Solenoid failure 6. VCM release	S/E S/E S/E S S/E S/E	4 4 4 4 4 4	C C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. Cold weather 2. Valve leaking through

Node: 385. MSPW to mechanical seal on dump tank agitator.

Type: Line

Drawing: OM-090135-PID-D

Design Conditions/Parameters: Pipe spec A13-2

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
385.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Seal failure 4. Valve leaking 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fixed point monitor 2. general monitor 3. Operating procedures 4. Operator training 5. Personal Protective Equipment 6. Pressure Gauge 7. Pressure regulator	1. Control Valve failure 2. Instrument failure 3. Line plugged 4. Operator error 5. Valve closed 6. Valve failure
385.2 High Temperature							
	1. High pressure	S/E	4	C	5	1. Operating procedures 2. Operator training	1. External heat 2. Line blocked in with external heat (thermal expansion)
385.3 Low/No Flow							
	1. Fire and explosion 2. Line rupture 3. Seal failure 4. Valve leaking 5. VCM Leak	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fixed point monitor 2. Flow meter 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Flow switch - 91F660	1. Control Valve failure 2. Instrument failure 3. Line plugged 4. Operator error 5. Valve closed 6. Valve failure

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 386. Steam line to dump tank outlet line. Used for steam injection during recovery for entry.

Type: Line

Drawing: OM-090135-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
386.1 High Pressure							
	1. Gasket failure	S/E	4	C	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Valve at polishing strainer
	3. Personal exposure	S	4	C	5	3. general monitor	leaking through into steam line
	4. Fire and explosion	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	
386.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	4	C	5	1. Check valve	1. Check valve failure
	2. Line rupture	S/E	4	C	5	2. Fire Protection System	2. Operator error
	3. Personal exposure	S	4	C	5	3. Fixed point monitor	3. Power failure
						4. general monitor	
						5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	

Node: 387. Oil reservoir unit for dump tank agitator

Type: Tank

Drawing: OM-090135-PID-D

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
387.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Pressure Gauge 6. Pressure regulator	1. Operator error 2. Pressure regulator failure
387.2 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training	1. External heat
387.3 Low Level							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. sight glass 7. Level switch - 91L620	1. Line leak/rupture 2. Seal leaking
387.4 Low Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Pressure Gauge 6. Pressure regulator	1. Operator error 2. Pressure regulator failure 3. Line leak/rupture 4. Line plugged 5. Valve closed 6. Nitrogen bottle empty

Node: 388. Feed tank, DM-079, inlet line from dump tank, DM-075.

Type: Line

Drawing: OM-090136-PID-D

Design Conditions/Parameters: Pipe spec A13-5

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
388.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. High pressure in dump tank
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. High pressure in Feed Tank
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line blocked in with external heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operator training	
						5. Personal Protective Equipment	
388.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error - steam line open into dump tank
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Reaction in dump tank
	4. Personal exposure	S	4	C	5	4. Operator training	
						5. Personal Protective Equipment	

Node: 389. Feed tank, DM-079	
Type: Vessel	Drawing: OM-090136-PID-D
Design Conditions/Parameters: MAWP: 150 psig @ 230 F ; 8600 Gal	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
389.1 High Pressure							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure 4. Seal failure 5. Vessel rupture	S/E S/E S S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure indication - 91P605, 91P872, 91P873, 91P874 8. relief valve	1. Instrument failure 2. Operator error 3. Outlet Line plugged 4. Relief Valve failure
389.2 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. relief valve 8. Temperature indication - 91T802	1. External heat 2. Operator error - steam line open into feed tank
389.3 High Level							
	1. Fire and explosion 2. Lift relief valve 3. Personal exposure	S/E S/E S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Level indication - 91L601, 91L600 5. Level switch - 91L673 6. Operating procedures 7. Operator training 8. Personal Protective Equipment 9. relief valve	1. Instrument failure 2. Operator error 3. Outlet Line plugged 4. Rinse valve failure
389.4 Start-up/Shutdown Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S S/E	3 4 3	D C D	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment	1. Operator error

Node: 390. Stripped slurry recycle line to feed tank, DM-079.

Type: Line

Drawings: OM-090132-PID-D, OM-090136-PID-D

Design Conditions/Parameters: Pipe spec A13-5.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
390.1 High Pressure							
	1. Fire and explosion 2. Lift relief valve 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Pressure Gauge 7. Pressure indication - 91P625 8. relief valve	1. External heat 2. Line blocked in with external heat (thermal expansion) 3. Line plugged 4. Valve closed
390.2 High Temperature							
	1. Fire and explosion 2. Lift relief valve 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. relief valve 7. Temperature gauge 8. Temperature indication - 91T629	1. External heat
390.3 Low Temperature							
	1. Fire and explosion 2. Frozen Line 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Line insulation 5. Operating procedures 6. Personal Protective Equipment 7. Temperature gauge 8. Temperature indication - 91T629	1. Cold weather

Node: 391. Feed tank outlet line including stripper feed pump, PP-511.

Type: Centrifugal Pump + Line

Drawing: OM-090136-PID-D

Design Conditions/Parameters: Pipe spec A13-5; Pump 365 gpm @ 189 ft

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
391.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. High pressure in Feed Tank
	3. Personal exposure	S	4	C	5	3. Flow indicator controller - 91F622	3. Line plugged
	4. Seal failure	S/E	4	C	5	4. general monitor	4. Operator error
						5. Operator training	5. Valve closed
						6. Personal Protective Equipment	
391.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Pump blocked in and running
	3. Personal exposure	S	4	C	5	3. general monitor	
						4. Operator training	
						5. Personal Protective Equipment	
						6. Temperature gauge	

Node: 392. Stripper feed line from feed pump to polishing strainers.

Type: Line

Drawing: OM-090136-PID-D

Design Conditions/Parameters: Pipe spec A13-5

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
392.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow indicator controller - 91F622, 91P608 4. general monitor 5. Operator training 6. Personal Protective Equipment	1. External heat 2. High pressure in Feed Tank 3. Line plugged 4. Operator error 5. Valve closed
392.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Temperature gauge	1. External heat

Node: 393. Polishing strainer, FL-130/131	
Type: Vessel	Drawing: OM-090136-PID-D
Design Conditions/Parameters: MAWP: 300 psig @ 365 F	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
393.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Vessel rupture	S/E S S/E	3 4 3	D C D	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge/transmitter (local) 8. Temperature gauge	1. Line plugged 2. Steam valve leaking through to blocked in strainer 3. Unrecovered strainer blocked in with recovery steam applied 4. Valve closed
393.2 Start-up/Shutdown Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S S/E	3 4 3	D C D	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment 6. Pressure Gauge 7. Valve indication	1. Operator error 2. Valve failure 3. Valve leaking through
393.3 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. Vessel rupture	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Temperature gauge	1. External heat 2. Steam valve leaking through to blocked in strainer 3. Unrecovered strainer blocked in with recovery steam applied
393.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Personal exposure 3. Vessel rupture	S/E S S/E	3 4 3	D C D	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Pressure Gauge/transmitter (local) 8. Temperature gauge	1. Operator error

Node: 394. Stripper feed line from polishing strainers to stripper.

Type: Heat Exchanger

Drawing: OM-090136-PID-D

Design Conditions/Parameters: Pipe spec A13-5

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
394.1 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Pressure indicator - 91P875 4. general monitor 5. Operator training 6. Personal Protective Equipment	1. External heat 2. High pressure in Feed Tank 3. Line plugged 4. Operator error 5. Valve closed
394.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Temperature gauge	1. External heat

Node: 395. Nitrogen supply to Dump tank & feed tank oil reservoir.

Type: Line + Vessel

Drawings: OM-090136-PID-D, OM-090135-PID-D

Design Conditions/Parameters: Pipe spec H16-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
395.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Pressure regulator failure
	3. Seal failure	S/E	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operator training	
						5. Pressure Gauge	
						6. Pressure regulator	
395.2 Low Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line leak/rupture
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Seal failure	S/E	4	C	5	3. general monitor	3. Nitrogen bottle empty
	4. VCM Leak	S/E	4	C	5	4. Operator training	4. Operator error
						5. Pressure Gauge	5. Pressure regulator failure
						6. Pressure regulator	6. Valve closed

Node: 396. Rinse water supply to feed tank rinse nozzle.

Type: Line

Drawing: OM-090136-PID-D

Design Conditions/Parameters: Pipe spec A13-2

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
396.1 High Pressure							
	1. Line rupture	S/E	4	C	5	1. Fire Protection System	1. External heat
	2. No flow	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Overpressure dump tank	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operator training	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve leaking through
396.2 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Fire Protection System	1. Cold weather
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S	4	C	5	3. general monitor	
						4. Line insulation	
						5. Personal Protective Equipment	

Node: 397. Flush water flush line to polishing strainers, FL-030/031.

Type: Line

Drawing: OM-090136-PID-D

Design Conditions/Parameters: Pipe spec A13-2

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
397.1 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Check valve 2. DCS interlock - rinse valve to strainer will not open if rinse water is being used elsewhere. 3. Fire Protection System 4. Fixed point monitor 5. general monitor 6. Operating procedures 7. Operator training 8. Personal Protective Equipment 9. Valve indication	1. Low water pressure 2. Operator error 3. Valve leaking through
397.2 High Pressure							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Operator error 3. VCM backing into the rinse line
397.3 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure.	S/E S/E S/E S	3 4 4 4	D D C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Temperature gauge	1. External heat

Node: 398. Antifoam addition line to feed tank	
Type: Line	Drawing: OM-090136-PID-D
Design Conditions/Parameters: Pipe spec A13-2	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
398.1 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Heat tracing	1. Cold weather
	2. Line rupture	S/E	4	C	5	2. Line insulation	2. Heat tracing failure
	3. Personal exposure	S	4	C	5		3. Line blocked in with external heat (thermal expansion)
398.2 High Pressure							
	1. Gasket failure	S/E	4	C	5	1. Personal Protective Equipment	1. Line blocked in with external heat (thermal expansion)
	2. Line rupture	S/E	4	C	5		
	3. Personal exposure	S	4	C	5		

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 399. HPSW flush to antifoam addition line, feed tank.	
Type: Line	Drawing: OM-090136-PID-D
Design Conditions/Parameters: Pipe spec A13-2	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
399.1 Low Temperature							
	1. Frozen Line 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Heat tracing 2. Line insulation	1. Cold weather 2. Heat tracing failure

Node: 400. Process water flush line to feed tank outlet line.

Type: Line

Drawing: OM-090136-PID-D

Design Conditions/Parameters: Pipe spec A13-2

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
400.1 High Pressure							
	1. Line rupture	S/E	4	C	5	1. Fire Protection System	1. External heat
	2. No flow	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Overpressure dump tank	S/E	4	C	5	3. general monitor	3. Line plugged
	4. Personal exposure	S	4	C	5	4. Operator training	4. Operator error
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	5. Valve leaking through
400.2 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Fire Protection System	1. Cold weather
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S	4	C	5	3. general monitor	
						4. Line insulation	
						5. Personal Protective Equipment	

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 401. Process water flush line to stripper recirculation line from stripper.

Type: Line

Drawing: OM-090136-PID-D

Design Conditions/Parameters: Pipe spec A13-5

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
401.1 High Pressure							
	1. Line rupture	S/E	4	C	5	1. Fire Protection System	1. External heat
	2. No flow	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external
	3. Overpressure dump tank	S/E	4	C	5	3. general monitor	heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operator training	3. Line plugged
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	4. Operator error
							5. Valve leaking through
401.2 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Fire Protection System	1. Cold weather
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S	4	C	5	3. general monitor	
						4. Line insulation	
						5. Personal Protective Equipment	

Node: 402. HPSW supply line to stripper feed pump mechanical seal.

Type: Line

Drawing: OM-090136-PID-D

Design Conditions/Parameters: Pipe spec A13-2

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
402.1 High Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. general monitor 5. Operating procedures 6. Personal Protective Equipment 7. Pressure Gauge 8. Pressure regulator	1. Line plugged 2. Operator error 3. Regulator failure 4. Valve closed 5. Valve failure
402.2 High Temperature							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Personal Protective Equipment	1. External heat 2. Operator error
402.3 Low Pressure							
	1. Fire and explosion 2. Personal exposure 3. Seal failure 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Personal Protective Equipment 5. Pressure Gauge	1. Instrument failure 2. Line plugged 3. Operator error 4. Valve closed
402.4 Low Temperature							
	1. Personal exposure 2. Seal failure 3. VCM Leak	S S/E S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow meter 4. Line insulation 5. Personal Protective Equipment 6. Pressure Gauge	1. Cold weather

Node: 403. Feed tank recovery line	
Type: Line	Drawings: OM-090108-PID-D, OM-090136-PID-D
Design Conditions/Parameters: Pipe spec A2-22.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
403.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. External heat 2. Instrument failure 3. Line plugged 4. Operator error 5. Power failure 6. Valve closed
403.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. Valve failure 6. VCM Leak	S/E S/E S/E S S/E S/E	3 4 4 4 4 4	D C C C C C	5 5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat
403.3 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Lift relief valve 3. Overpressure dump tank 4. Personal exposure 5. VCM release	S/E S/E S/E S S/E	3 3 4 4 3	D D C C D	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Valve indication	1. Line leak/rupture 2. Operator error 3. Valve leaking through

Node: 404. VCM recovery line from stripper feed pump.

Type: Line

Drawing: OM-090136-PID-D

Design Conditions/Parameters: Pipe spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
404.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
404.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM release	S/E	3	D	5	3. general monitor	3. Valve leaking through
						4. Operating procedures	
						5. Personal Protective Equipment	
404.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
	5. VCM Leak	S/E	4	C	5	5. Operator training	
						6. Personal Protective Equipment	

Node: 405. VCM recovery line from polishing strainers.

Type: Line

Drawing: OM-090136-PID-D

Design Conditions/Parameters: Pipe spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
405.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external
	3. Line rupture	S/E	4	C	5	3. general monitor	heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operating procedures	3. Operator error
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		
405.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Operator error
	2. Personal exposure	S/E	4	C	5	2. Fixed point monitor	2. Valve failure
	3. VCM release	S/E	3	D	5	3. general monitor	3. Valve leaking through
						4. Operating procedures	
						5. Personal Protective Equipment	
405.3 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external
	3. Line rupture	S/E	4	C	5	3. general monitor	heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operating procedures	3. Operator error
	5. Valve packing leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5		

Node: 406. Steam line to polishing strainer for recovery.

Type: Line

Drawing: OM-090136-PID-D

Design Conditions/Parameters: Pipe spec A2-3/A13-22/B13-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
406.1 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Line rupture 3. Personal exposure	S/E S/E S	3 4 4	D C C	5 5 5	1. Check valve 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment	1. Check valve failure 2. Operator error 3. Power failure
406.2 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment	1. External heat 2. Valve at polishing strainer leaking through into steam line

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 407. Recycled centrate tank, TK-014.	
Type: Tank	Drawing: OM-090137-PID-D
Design Conditions/Parameters: MOC: FRP 18,000 Gal	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
407.1 Reverse/Misdirected Flow							
	1. Personal exposure	S	4	C	5	1. Maintenance & operating procedures 2. Personal Protective Equipment	1. Operator error

Node: 408. Rinse water pump, PP-229, and discharge line to rinse water filter, FL-103.

Type: Centrifugal Pump + Line

Drawing: OM-090137-PID-D

Design Conditions/Parameters: Pipe spec A2-3; Pump 3x4-11.25-11 800 GPM @ 220 psig

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
408.1 High Pressure							
	1. Gasket failure	S/E	4	C	5	1. Operating procedures	1. External heat
	2. Line rupture	S/E	4	C	5	2. Pressure Gauge	2. Filter plugged
	3. Overpressure filter pack	S/E	4	C	5		3. Line plugged
	4. Seal failure	S/E	4	C	5		4. Valve closed
	5. Valve packing leaking	S/E	4	C	5		5. Valve failure
408.2 High Temperature							
	1. Gasket failure	S/E	4	C	5	1. Operating procedures	1. External heat
	2. Line rupture	S/E	4	C	5	2. Personal Protective Equipment	2. Pump blocked in and running
	3. Seal failure	S/E	4	C	5	3. Pressure Gauge	
	4. Valve packing leaking	S/E	4	C	5		
408.3 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Line insulation	1. Cold weather

Node: 409. Charge water line from rinse tank.

Type: Line

Drawings: OM-090101-PID-D, OM-090137-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
409.1 High Pressure							
	1. Gasket failure 2. Line rupture 3. Valve packing leaking	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Operating procedures 2. Pressure Gauge	1. External heat 2. Filter plugged 3. Line plugged 4. Valve closed 5. Valve failure
409.2 Low Temperature							
	1. Frozen Line	S/E	4	C	5	1. Line insulation	1. Cold weather

Node: 410. Rinse water line to RX condenser, shell, and dump header. RX-300,400,500,600,700.

Type: Line

Drawings: OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D

Design Conditions/Parameters: Pipe spec A2-3,A13-2

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
410.1 High Pressure							
	1. Gasket failure 2. Line rupture 3. Lift relief valve 4. O-Ring failure 5. Overpressure filter pack	S/E S/E S/E S/E S/E	4 4 4 4 4	C C C C C	5 5 5 5 5	1. Operating procedures 2. Operator training 3. Recycle line on rinse pump, pp-229, thru valve, 81h018.	1. External heat 2. High Pressure in Reactor 3. Line plugged 4. Valve closed 5. Valve leaking through 6. Filter Plugged 7. Relief Valve failure
410.2 High Temperature							
	1. High pressure 2. Line rupture	S/E S/E	4 4	C C	5 5	1. Fire Protection System 2. Operating procedures 3. Operator training	1. External heat
410.3 Low Temperature							
	1. Frozen Line 2. Line rupture 3. Valve failure	S/E S/E S/E	4 4 4	C C C	5 5 5	1. Line insulation 2. Operating procedures 3. Operator training	1. Cold weather
410.4 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. High pressure 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Check valve 2. DCS interlock - valve 81h145 will open if RX pressure < 120 psig and all other reactor flush header valves are closed. 3. DCS interlock - valve 81hv138. Won't open unless RX in dump and all other RX rinse valves closed 4. Fire Protection System 5. Fixed point monitor 6. general monitor 7. Operator training 8. Personal Protective Equipment	1. High Pressure in Reactor 2. Operator error 3. Power failure 4. Pump failure 5. Valve failure 6. Valve leaking through

Node: 411. Old module stripper rinse header	
Type: Line	Drawing: OM-090137-PID-D
Design Conditions/Parameters: Pipe spec A13-2	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
411.1 High Pressure							
	1. Line rupture 2. Personal exposure	S/E 4	4 4	C C	5 5	1. Personal Protective Equipment	1. Line blocked in with external heat (thermal expansion)
411.2 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operator training 5. Personal Protective Equipment 6. Valve indication	1. Operator error 2. Pump failure 3. Valve closed
411.3 Low Temperature							
	1. Frozen Line 2. Line rupture 3. Personal exposure	S/E S/E S	4 4 4	C C C	5 5 5	1. Line insulation	1. Cold weather

Node: 412. Rinse Pump, PP-547	
Type: Centrifugal Pump	Drawing: OM-090137-PID-D
Design Conditions/Parameters: 510 GPM @ 190 ft	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
412.1 High Pressure							
	1. Gasket failure 2. Seal failure	S/E S/E	4 4	C C	5 5	1. Operating procedures 2. Operator training 3. Pressure indication - 81P856 4. Recirculation line	1. Line plugged 2. Operator error 3. Valve closed
412.2 High Temperature							
	1. Gasket failure 2. Seal failure	S/E S/E	4 4	C C	5 5	1. Operating procedures 2. Operator training	1. External heat 2. Pump blocked in and running

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 413. Centrate collection tank, TK-138	
Type: Tank	Drawing: DY-090119-PID-D
Design Conditions/Parameters: 15,000 Gal	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
413.1 Reverse/Misdirected Flow							
	1. Personal exposure	S/E	4	C	5	1. Maintenance & operating procedures	1. Operator error

Node: 414. Caustic addition line to Centrate pumps, PP-546/545

Type: Line

Drawing: DY-090119-PID-D

Design Conditions/Parameters: Pipe spec A2-23

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
414.1 High Pressure							
	1. Gasket failure 2. Line rupture 3. Personal exposure	S/E S/E S	4 4 4	C C C	5 5 5	1. Operating procedures 2. Operator training 3. Personal Protective Equipment 4. Pressure Gauge 5. relief valve 6. Caustic pump and supply tote located in diked area	1. Line plugged 2. Operator error 3. Valve closed 4. Line blocked in with external heat (thermal expansion)
414.2 Low Temperature							
	1. Gasket failure 2. Line rupture 3. Personal exposure 4. Frozen Line	S/E S/E S/E S/E	4 4 4 4	C C C C	5 5 5 5	1. Caustic pump and supply tote located in diked area 2. Operating procedures 3. Operator training 4. Personal Protective Equipment 5. Pressure Gauge 6. relief valve 7. Heat tracing 8. Line insulation	1. Cold weather 2. Heat tracing failure

Node: 416. Sodium Hypochlorite addition line to centrate pump suction.

Type: Line

Drawing: DY-090119-PID-D

Design Conditions/Parameters: Pipe spec Q41-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
416.1 High Pressure							
	1. Line rupture 2. Personal exposure	S/E S	4 4	C C	5 5	1. Operating procedures 2. Operator training 3. Personal Protective Equipment 4. Pressure Gauge	1. Line blocked in with external heat (thermal expansion) 2. Operator error
416.2 Low Temperature							
	1. Frozen Line 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S	4 4 4 4	C C C C	5 5 5 5	1. Operating procedures 2. Operator training 3. Personal Protective Equipment 4. Pressure Gauge	1. Cold weather

Node: 415. Chlorine/Water solution addition line to centrate pump suction.

Type: Line

Drawing: DY-090119-PID-D

Design Conditions/Parameters: Pipe spec Q41-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
415.1 High Pressure							
	1. Line rupture 2. Personal exposure	S/E S	4 4	C C	5 5	1. Operating procedures 2. Operator training 3. Personal Protective Equipment 4. Pressure Gauge	1. Line blocked in with external heat (thermal expansion) 2. Operator error
415.2 Low Temperature							
	1. Frozen Line 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S	4 4 4 4	C C C C	5 5 5 5	1. Operating procedures 2. Operator training 3. Personal Protective Equipment 4. Pressure Gauge	1. Cold weather

Node: 417. Centrate pump, PP-545/546, including suction & discharge line.

Type: Centrifugal Pump + Line

Drawing: DY-090119-PID-D

Design Conditions/Parameters: Capacity 950 GPM @ 222 ft

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
417.1 High Pressure							
	1. Gasket failure 2. Seal failure	S/E S/E	4 4	C C	5 5	1. Operating procedures 2. Operator training 3. Recirculation line	1. Line plugged 2. Operator error 3. Valve closed
417.2 High Temperature							
	1. Gasket failure 2. Seal failure	S/E S/E	4 4	C C	5 5	1. Operating procedures 2. Operator training	1. External heat 2. Pump blocked in and running

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 418. MSPW line to centrate pump mechanical seals and TK-138 level transmitter impulse line.

Type: Line

Drawing: DY-090119-PID-D

Design Conditions/Parameters: Pipe spec A13-2

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
418.1 Low/No Flow							
	1. Seal failure	S/E	4	C	5	1. Operating procedures 2. Operator training 3. Flow meter 4. Heat tracing 5. Line insulation	1. Line plugged 2. Operator error 3. Valve closed

Node: 419. Centrate flocculating tank, DM-001	
Type: Vessel	Drawing: DY-090119-PID-D
Design Conditions/Parameters: 1000 Gal, MAWP: 150 psig @ 200 F	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
419.1 High Pressure							
	1. Gasket failure	S/E	4	C	5	1. Operating procedures	1. Vessel blocked in with external heat (thermal expansion)
	2. Lift relief valve	S/E	4	C	5	2. Operator training	2. Line plugged
	3. Personal exposure	S	4	C	5	3. Personal Protective Equipment	3. Relief Valve failure
	4. Vessel rupture	S/E	4	C	5	4. relief valve	4. Valve closed
419.2 Start-up/Shutdown Hazards							
	1. Personal exposure	S	4	C	5	1. Maintenance & operating procedures	1. Operator error

Node: 420. Inerts line from plant RVCM receivers

Type: Line

Drawing: DY-090133-PID-D

Design Conditions/Parameters: Pipe spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
420.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Control Valve failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Instrument failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line blocked in with external heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Line plugged
	5. Valve leaking	S/E	4	C	5	5. Personal Protective Equipment	5. Operator error
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	6. Valve failure
						7. High pressure switch - 81P739, 84P103	
						8. Flow indication - 84F102	
420.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	2. Heat tracing failure
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
						6. Temperature gauge	

Node: 421. Inerts supply line from plant. Bypasses flow control

Type: Line

Drawing: DY-090133-PID-D

Design Conditions/Parameters: Pipe spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
421.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Control Valve failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Instrument failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line blocked in with external heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Line plugged
	5. Valve leaking	S/E	4	C	5	5. Personal Protective Equipment	5. Operator error
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	6. Valve failure
421.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Chiller unit cooling knockback condensers	1. Chiller unit not working
	2. Line rupture	S/E	4	C	5	2. Fire Protection System	2. External heat
	3. Personal exposure	S	4	C	5	3. Fixed point monitor	3. Heat tracing failure
	4. VCM Leak	S/E	4	C	5	4. general monitor	
						5. Operating procedures	
						6. Personal Protective Equipment	
						7. Temperature gauge	

Node: 422. Liquid flame arrester	
Type: Vessel	Drawing: DY-090133-PID-D
Design Conditions/Parameters: MAWP: 150 psig @ 200 F	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
422.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. VCM Leak 5. VCM release	S/E S/E S/E S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge 7. relief valve 8. DCS interlock - valve 84H104 will close on high pressure in flame arrester 9. Pressure indicator - 84P105	1. Control Valve failure 2. External heat 3. High Level 4. Instrument failure 5. Operator error 6. Relief Valve failure 7. Flash back from incinerator
422.2 High Temperature							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Personal Protective Equipment 5. relief valve	1. External heat 2. Flash back from incinerator
422.3 Start-up/Shutdown Hazards							
	1. Fire and explosion 2. Personal exposure 3. VCM release	S/E S S/E	3 4 3	D C D	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Personal Protective Equipment	1. Operator error 2. Valve leaking through
422.4 High Level							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. sight glass 8. Level Transmitter 28, High level switch 28	1. Instrument failure 2. Operator error 3. Valve failure 4. Valve leaking through
422.5 Low Level							
	1. Fire and explosion 2. Gasket failure 3. Lift relief valve 4. Personal exposure	S/E S/E S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Level Transmitter 28, Low level switch 28 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. sight glass	1. Instrument failure 2. Operator error 3. Valve failure 4. Valve leaking through

Node: 423. Flame arrester outlet to incinerator	
Type: Line	Drawing: DY-090133-PID-D
Design Conditions/Parameters: Pipe spec A2-22	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
423.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Control Valve failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Instrument failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line blocked in with external heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Line plugged
	5. Valve leaking	S/E	4	C	5	5. Personal Protective Equipment	5. Operator error
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	6. Valve failure
423.2 High Temperature							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. External heat
	2. Line rupture	S/E	4	C	5	2. Fixed point monitor	
	3. Personal exposure	S	4	C	5	3. general monitor	
	4. VCM Leak	S/E	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
						6. Temperature gauge	
423.3 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. DCS interlock - valves to incinerator will open if incinerator is selected, incinerator has run permissive, incinerator temperature is > 1800 F, pressure on flame arrester tank is < 15 psig, and fuel gas hi fire permissive is met.	1. Instrument failure
	2. Line rupture	S/E	4	C	5		2. Operator error
	3. Personal exposure	S	4	C	5		3. Incinerator not in operation
	4. VCM Leak	S/E	4	C	5		
	5. VCM release	S/E	3	D	5		
						2. Fire Protection System	
						3. Fixed point monitor	
						4. general monitor	
						5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	
						8. Triple valves for isolating flame arrester from incinerator	

Node: 424. Flame arrester vent to atmosphere

Type: Line

Drawing: DY-090133-PID-D

Design Conditions/Parameters: Pipe spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
424.1 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Line blocked in with external heat (thermal expansion)
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	
	3. Line rupture	S/E	4	C	5	3. general monitor	
	4. Personal exposure	S	4	C	5	4. Operating procedures	
						5. Personal Protective Equipment	
424.2 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Line blocked in with external heat (thermal expansion)
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Operator error
	4. Personal exposure	S/E	4	C	5	4. Operating procedures	4. Valve failure
	5. VCM Leak	S/E	4	C	5	5. Personal Protective Equipment	

Node: 425. Eythelene Glycol supply to flame arrester.

Type: Line

Drawing: DY-090133-PID-D

Design Conditions/Parameters: Pipe spec A2-22

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
425.1 High Pressure							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Nitrogen pressure regulator failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Instrument failure
	3. Line rupture	S/E	4	C	5	3. general monitor	3. Line blocked in with external heat (thermal expansion)
	4. Personal exposure	S	4	C	5	4. Operating procedures	4. Operator error
	5. Valve leaking	S/E	4	C	5	5. Personal Protective Equipment	
	6. VCM Leak	S/E	4	C	5	6. Pressure Gauge	
						7. Pressure indicator - 84P105	
425.2 Reverse/Misdirected Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Check valve failure
	2. Gasket failure	S/E	4	C	5	2. Fixed point monitor	2. Operator error
	3. Lift relief valve	S/E	4	C	5	3. general monitor	3. Nitrogen pressure regulator failure
	4. VCM Leak	S/E	4	C	5	4. Level Transmitter 28, Low level switch 28	4. Valve failure
	5. VCM release	S/E	3	D	5	5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	
						8. sight glass	
						9. Check valve	
						10. relief valve	

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 426. Steam supply to incinerator combustion chamber

Type: Line

Drawing: DY-090135-PID-D

Design Conditions/Parameters: Pipe spec A2-3

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
426.1 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Safety Interlock - Incinerator will not run without sufficient steam pressure, and incinerator has high temperature alarm.	1. Instrument failure
	2. Personal exposure	S/E	4	C	5		2. Line plugged
	3. VCM release	S/E	4	C	5		3. Low steam pressure
	4. Melt down incinerator	S/E	4	C	5	2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operator training 6. Personal Protective Equipment	4. Operator error 5. Valve closed

Node: 427. Inert line to incinerator from flame arrester.	
Type: Line	Drawings: DY-090133-PID-D, DY-090135-PID-D
Design Conditions/Parameters: Pipe spec A2-22	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
427.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure 5. VCM Leak	S/E S/E S/E S S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge	1. Control Valve failure 2. Instrument failure 3. Line blocked in with external heat (thermal expansion) 4. Line plugged 5. Operator error 6. Valve failure
427.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Temperature gauge	1. External heat
427.3 Reverse/Misdirected Flow							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak 5. VCM release	S/E S/E S S/E S/E	3 4 4 4 3	D C C C D	5 5 5 5 5	1. DCS interlock - valves to incinerator will open if incinerator is selected, incinerator has run permissive, incinerator temperature is > 1800 F, pressure on flame arrester tank is < 15 psig, and fuel gas hi fire permissive is met. 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Triple valves for isolating flame arrester from incinerator	1. Incinerator not in operation 2. Instrument failure 3. Operator error

Node: 428. Fuel supply to incinerator combustion chamber

Type: Line

Drawing: DY-090135-PID-D

Design Conditions/Parameters: Pipe spec A2-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
428.1 Low/No Flow							
	1. Fire and explosion 2. Personal exposure 3. VCM Leak 4. Shutdown incinerator	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Flow indication - FIT 4B 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Valve indication 9. Safety Interlock - Low pressure switch	1. Instrument failure 2. Line plugged 3. Operator error 4. Valve closed
428.2 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge 7. Pressure regulator	1. Control Valve failure 2. Instrument failure 3. Line blocked in with external heat (thermal expansion) 4. Line plugged 5. Operator error 6. Valve failure
428.3 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Temperature gauge 7. Flame arrestors	1. External heat

Node: 429. Fuel line to incinerator pilot	
Type: Line	Drawing: DY-090135-PID-D
Design Conditions/Parameters: Pipe spec A2-1	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
429.1 High Pressure							
	1. Fire and explosion 2. Gasket failure 3. Line rupture 4. Personal exposure	S/E S/E S/E S	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Personal Protective Equipment 6. Pressure Gauge 7. Pressure regulator	1. Control Valve failure 2. Instrument failure 3. Line blocked in with external heat (thermal expansion) 4. Line plugged 5. Operator error 6. Valve failure
429.2 High Temperature							
	1. Fire and explosion 2. Line rupture 3. Personal exposure 4. VCM Leak	S/E S/E S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flame arrestors 4. general monitor 5. Operating procedures 6. Personal Protective Equipment 7. Temperature gauge	1. External heat
429.3 Low/No Flow							
	1. Fire and explosion 2. Personal exposure 3. Shutdown incinerator 4. VCM Leak	S/E S S/E S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Flow indication - FIT 4B 4. general monitor 5. Operating procedures 6. Operator training 7. Personal Protective Equipment 8. Safety Interlock - Low pressure switch 9. Valve indication	1. Instrument failure 2. Line plugged 3. Operator error 4. Valve closed

Node: 430. Combustion air to incinerator	
Type: Line	Drawing: DY-090135-PID-D
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
430.1 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Safety interlock - Fuel & inerts supply is cut off if blower is not running.	1. Instrument failure
	2. Personal exposure	S	4	C	5		2. Line plugged
	3. Shutdown incinerator	S/E	4	C	5	2. Fire Protection System	3. Operator error
	4. VCM Leak	S/E	4	C	5	3. Fixed point monitor	4. Valve closed
	5. Melt down incinerator	S/E	4	C	5	4. general monitor	
						5. Operating procedures	
						6. Operator training	
						7. Personal Protective Equipment	

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 431. Combustion air to incinerator pilot	
Type: Line	Drawing: DY-090135-PID-D
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
431.1 Low/No Flow							
	1. No consequence						

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 432. Purge air to incinerator combustion chamber.

Type: Line

Drawing: DY-090135-PID-D

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
432.1 Low/No Flow							
	1. No consequences						

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 433. Process "Quench" water to incinerator Quench Chamber.

Type: Line

Drawing: DY-090135-PID-D

Design Conditions/Parameters: Pipe spec A13-1

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
433.1 Low/No Flow							
	1. Fire and explosion	S/E	3	D	5	1. Fire Protection System	1. Instrument failure
	2. Personal exposure	S	4	C	5	2. Fixed point monitor	2. Line plugged
	3. Shutdown incinerator	S/E	4	C	5	3. general monitor	3. Operator error
	4. VCM Leak	S/E	4	C	5	4. Heat tracing	4. Valve closed
	5. Melt down incinerator	S/E	4	C	5	5. Line insulation	5. Cold weather
						6. Pressure Gauge	
						7. Flow indication - FIT 6B	
						8. Safety interlock - shuts incinerator down on loss of water flow	

Node: 434. Inerts incinerator	
Type: Furnace Heater	Drawing: DY-090135-PID-D
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
434.1 High Temperature							
	1. Fire and explosion 2. Melt down incinerator 3. Personal exposure 4. Shutdown incinerator 5. VCM Leak	S/E S/E S S/E S/E	3 4 4 4 4	D C C C C	5 5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Operating procedures 5. Operator training 6. Personal Protective Equipment 7. Safety interlock - Fuel & inerts supply is cut off if blower is not running, no steam flow, no water flow, or operator run permissive been given. 8. Temperature indication - 84T143, 84T144 9. High temperature alarm - TAH 5/6B 10. Temperature indication - 84T145	1. Instrument failure 2. Operator error 3. Blower failure 4. No water flow 5. No steam flow
434.2 High Residual VCM							
	1. Fire and explosion 2. Personal exposure	S/E S	3 4	D C	5 5	1. Gas chromatograph 2. Fuel gas pressure switch- PSL 3 3. Steam pressure switch - PSL 5 4. Inerts flow indicator controller - 84F102 5. Redundant temperature indicators - 84T143, 84T144 6. Fire Protection System 7. Fixed point monitor 8. general monitor 9. Operating procedures 10. Operator training 11. Personal Protective Equipment	1. High inerts flow 2. Improper air mixture 3. Inaccurate temperature indication

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 435. 1. Notify lead operator tank will be taken out of service.

Type: Procedural Step

Drawing: proc. VINYL-RM-SD003

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
435.1 No execution of step							
	1. No consequences						

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 436. 2. Isolate hot water make-ups to tank.

Type: Procedural Step

Drawing: proc. VINYL-RM-SD003

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
436.1 No execution of step							
	1. Personal injury	S	4	C	5	1. Operating procedures 2. Operator training 3. Level indication - 81LI006 4. Drain valve	1. Operator error 2. Valve leaking through

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 437. 3. Empty charge water tank

Type: Procedural Step

Drawing: proc. VINYL-RM-SD003

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
437.1 No execution of step							
	1. Personal injury	S	4	C	5	1. Drain valve 2. Level indication - 81LI006 3. Operating procedures 4. Operator training	1. Operator error 2. Valve leaking through

Node: 438. 4. Totally isolate tank.

Type: Procedural Step

Drawing: proc. VINYL-RM-SD003

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
438.1 No execution of step							
	1. Personal injury	S	4	C	5	1. Drain valve 2. Level indication - 81LI006 3. Operating procedures 4. Operator training	1. Operator error 2. Valve leaking through

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 439. Steps 5 thru 12	
Type: Procedural Step	Drawing: proc. VINYL-RM-SD003
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
439.1 No execution of step							
	1. Personal injury 2. Personal exposure	S S	4 4	C C	5 5	1. Direct reading portable instruments 2. Maintenance & operating procedures 3. Personal Protective Equipment 4. Safety control permits	1. Operator error

Node: 440. 13. Prepare tank for service

Type: Procedural Step

Drawing: proc. VINYL-RM-SD003

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
440.1 No execution of step							
	1. Personal exposure 2. Personal injury	S/E S/E	4 4	C C	5 5	1. Maintenance & operating procedures 2. Personal Protective Equipment 3. Safety control permits	1. Operator error 2. Valve leaking through

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 441. 14-15. Put tank in service/check for leaks.

Type: Procedural Step

Drawing: proc. VINYL-RM-SD003

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
441.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Maintenance & operating procedures 2. Safety control permits 3. Radio communication	1. Operator error 2. Gasket failure 3. Equipment failure

Node: 442. 1. Cold water flush using back flush method.

Type: Procedural Step

Drawing: proc. VINYL-RM-SD004

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
442.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S/E	4 4	C C	5 5	1. Maintenance & operating procedures 2. Radio communication 3. Safety control permits 4. Temperature indication 81T027 / 82T027	1. Equipment failure 2. Gasket failure 3. Operator error

Node: 443. 2. Cold water flush using fast rinse cycle method	
Type: Procedural Step	Drawing: proc. VINYL-RM-SD004
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
443.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Maintenance & operating procedures 2. Radio communication 3. Safety control permits 4. Temperature indication 81T027 / 82T027	1. Equipment failure 2. Gasket failure 3. Operator error

Node: 444. 3. Isolate Decal Tank	
Type: Procedural Step	Drawing: proc. VINYL-RM-SD004
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
444.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Maintenance & operating procedures 2. Radio communication 3. Safety control permits	1. Equipment failure 2. Gasket failure 3. Operator error

Node: 445. 4. Drain Decal Tank	
Type: Procedural Step	Drawing: proc. VINYL-RM-SD004
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
445.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Maintenance & operating procedures 2. Radio communication 3. Safety control permits	1. Equipment failure 2. Gasket failure 3. Operator error

Node: 446. steps 5 thru 8	
Type: Positive Displacement Pump	Drawing: proc. VINYL-RM-SD004
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
446.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Maintenance & operating procedures 2. Radio communication 3. Safety control permits	1. Equipment failure 2. Gasket failure 3. Operator error

Node: 447. 9. Fill decal tank for pressure check

Type: Procedural Step

Drawing: proc. VINYL-RM-SD004

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
447.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Maintenance & operating procedures 2. Radio communication 3. Safety control permits	1. Equipment failure 2. Gasket failure 3. Operator error

Node: 448. 10. Pressure check decal tank

Type: Procedural Step

Drawing: proc. VINYL-RM-SD004

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
448.1 No execution of step							
	1. Personal exposure 2. Personal injury 3. Lift relief valve	S S S/E	4 4 4	C C C	5 5 5	1. Maintenance & operating procedures 2. Radio communication 3. Safety control permits 4. Pressure Gauge 5. relief valve	1. Equipment failure 2. Gasket failure 3. Operator error 4. Instrument failure

Node: 449. Operation of Module Emergency Shutdown Switch	
Type: Procedural Step	Drawing: proc. VINYL-RM-ESD006
Design Conditions/Parameters: Review of procedure as a whole	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
449.1 No execution of step							
	1. Personal exposure 2. Personal injury 3. Fire and explosion 4. VCM release	S S S/E S/E	4 4 3 3	C C D D	5 5 5 5	1. Maintenance & operating procedures 2. Radio communication 3. Safety control permits 4. Fire Protection System 5. Fixed point monitor 6. general monitor	1. Equipment failure 2. Gasket failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 450. 1-2. Notification

Type: Procedural Step

Drawing: proc. VINYL-OM-E001

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
450.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Maintenance & operating procedures 2. Plant alarm system	1. Equipment failure 2. Operator error

Node: 451. 3-4. Activate Fire Suppression (deluge)	
Type: Procedural Step	Drawing: proc. VINYL-OM-E001
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
451.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Maintenance & operating procedures 2. Plant alarm system 3. Fire Protection System 4. Fixed point monitor 5. general monitor	1. Equipment failure 2. Operator error

Node: 452. 5. Lead operator will choose empty reactor and evacuate.

Type: Procedural Step

Drawing: proc. VINYL-OM-E001

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
452.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

Node: 453. 6. The lead operator will put pressure on charge water header.

Type: Procedural Step

Drawing: proc. VINYL-OM-E001

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
453.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S/E	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

Node: 454. 7. Put leaking reactor and evacuated reactor in "manual".	
Type: Procedural Step	Drawing: proc. VINYL-OM-E001
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
454.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

Node: 455. 8-9. Open charge dump valve on involved reactors.

Type: Procedural Step

Drawing: proc. VINYL-OM-E001

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
455.1 No execution of step							
	1. Personal exposure 2. Personal injury 3. Line rupture	S S S	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

Node: 456. 10. Lead operator put cooling water on evacuated reactor.

Type: Procedural Step

Drawing: proc. VINYL-OM-E001

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
456.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 457. 11. Close charge/dump valves.	
Type: Procedural Step	Drawing: proc. VINYL-OM-E001
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
457.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

Node: 458. 12. The lead operator will flush the charge water lines.	
Type: Procedural Step	Drawing: proc. VINYL-OM-E001
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
458.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S/E	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

Node: 459. 13-14. Put leaking reactor into auto recovery/ sound all clear

Type: Procedural Step

Drawing: proc. VINYL-OM-E001

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
459.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

Node: 460. Hazards/Discussion	
Type: Procedural Step	Drawing: proc. VINYL-OM-E002
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
460.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 461. 1-2. Plant notification	
Type: Procedural Step	Drawing: proc. VINYL-OM-E002
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
461.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 462. 3-4. Activate Deluge/Fire Monitor

Type: Procedural Step

Drawing: proc. VINYL-OM-E002

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
462.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

Node: 463. 5. Stop agitator and recover (if applicable).	
Type: Procedural Step	Drawing: proc. VINYL-OM-E002
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
463.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

Node: 464. 6-8. Prepare to split reactor	
Type: Procedural Step	Drawing: proc. VINYL-OM-E002
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
464.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

Node: 465. 9. Split reactor

Type: Procedural Step

Drawing: proc. VINYL-OM-E002

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
465.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

Node: 466. 10. Recover split batch reactors	
Type: Procedural Step	Drawing: proc. VINYL-OM-E002
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
466.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S/E	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

Node: 467. 11. Sound all clear	
Type: Procedural Step	Drawing: proc. VINYL-OM-E002
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
467.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. Equipment failure 2. Operator error

Node: 468. Discussion/Hazards	
Type: Procedural Step	Drawing: proc. VINYL-RM-E003
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
468.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system 6. Emergency Power System (UPS & Generator)	1. Equipment failure 2. Operator error

Node: 469. 1. Bump reactor.	
Type: Procedural Step	Drawing: proc. VINYL-RM-E003
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
469.1 No execution of step							
	1. Personal exposure	S	4	C	5	1. Fire Protection System	1. Equipment failure
	2. Personal injury	S	4	C	5	2. Fixed point monitor	2. Operator error
	3. Fire and explosion	S/E	3	D	5	3. general monitor	3. Line plugged
						4. Maintenance & operating procedures	
						5. Plant alarm system	
						6. Reactor emergency & manual kill system	
						7. AMS common header	

Node: 470. 2. Emergency cooling water	
Type: Procedural Step	Drawing: proc. VINYL-RM-E003
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
470.1 No execution of step							
	1. Personal exposure 2. Personal injury 3. Fire and explosion	S S S/E	4 4 3	C C D	5 5 5	1. AMS common header 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Maintenance & operating procedures 6. Plant alarm system 7. Reactor emergency & manual kill system 8. Emergency cooling water system	1. Equipment failure 2. Operator error

Node: 471. 3. Control reactor pressure.

Type: Procedural Step

Drawing: proc. VINYL-RM-E003

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
471.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. AMS common header 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Maintenance & operating procedures 6. Plant alarm system 7. Reactor emergency & manual kill system	1. Equipment failure 2. Operator error 3. High Pressure in Reactor 4. Power failure

Node: 472. 4. Seal oil units and reactor seals	
Type: Procedural Step	Drawing: proc. VINYL-RM-E003
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
472.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system 6. Pressure gauge and transmitter	1. Equipment failure 2. Operator error 3. Power failure

Node: 473. 5. Close manual steam stripping valve.

Type: Procedural Step

Drawing: proc. VINYL-RM-E003

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
473.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury 4. Reverse flow	S/E S S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system 6. Check valve	1. Equipment failure 2. Operator error 3. Low steam pressure 4. Power failure

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 474. 6. Close lip seal water valve on each reactor.	
Type: Procedural Step	Drawing: proc. VINYL-RM-E003
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
474.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system 6. Check valve	1. High Pressure in Reactor 2. Power failure

Node: 475. 7. Close spray head flush water valve to each reactor.

Type: Procedural Step

Drawing: proc. VINYL-RM-E003

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
475.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Check valve 2. Fire Protection System 3. Fixed point monitor 4. general monitor 5. Maintenance & operating procedures 6. Plant alarm system	1. High Pressure in Reactor 2. Power failure

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 476. 8. Isolate catalyst pot on each reactor.	
Type: Procedural Step	Drawing: proc. VINYL-RM-E003
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
476.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system 6. Check valve	1. High Pressure in Reactor 2. Power failure

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 477. 9-18. Isolate mechanical seals on VCM containing equipment

Type: Procedural Step

Drawing: proc. VINYL-RM-E003

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
477.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system	1. High Pressure in Reactor 2. No high pressure service water available.

Node: 479. Operation of automatic shutdown/isolation system

Type: Procedural Step

Drawing: proc. VINYL-RM-E004

Design Conditions/Parameters: 1-3. Description of valve/equipment affected, no operator involvement except for operator activation of the system.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
479.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Plant alarm system 6. Spring return fail close valves	1. Fire in unit 2. Major VCM Leak or Release 3. Loss of instrument air

Node: 480. Operation of the Halos System in the Vinyl Control Room

Type: Procedural Step

Drawing: proc. VINYL-OM-E006

Design Conditions/Parameters: Description of valve/equipment affected, no operator involvement except for operator activation of the system.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
480.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury 4. DCS equipment damage	S/E S S S/E	3 4 4 4	D C C C	5 5 5 5	1. Maintenance & operating procedures 2. Personal Protective Equipment 3. Plant alarm system	1. Fire in control room

Node: 481. Operation of the Emergency Generator for the Vinyl Control Room.

Type: Procedural Step

Drawing: proc. VINYL-OM-E007

Design Conditions/Parameters: Discussion of Operation.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
481.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury 4. VCM release	S/E S S S/E	3 4 4 4	D C C C	5 5 5 5	1. Fire Protection System 2. Operating procedures 3. Operator training 4. Personal Protective Equipment 5. Plant alarm system 6. Back-up emergency power	1. Operator error 2. Power failure

Node: 482. Discussion/Hazards	
Type: Procedural Step	Drawing: proc. VINYL-OM-E008
Design Conditions/Parameters:	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
482.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. AMS common header 2. Emergency cooling water system 3. Fire Protection System 4. Fixed point monitor 5. general monitor 6. Maintenance & operating procedures 7. Plant alarm system 8. Reactor emergency & manual kill system 9. Bypass valve for emergency cooling water 10. Deluge water can be used for back-up cooling water 11. DCS interlock - Deluge water is diverted to reactors during a power failure	1. Equipment failure 2. Operator error

Node: 483. 1-3. Opening emergency cooling water valve.

Type: Procedural Step

Drawing: proc. VINYL-OM-E008

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
483.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. AMS common header 2. Bypass valve for emergency cooling water 3. DCS interlock - Deluge water is diverted to reactors during a power failure 4. Deluge water can be used for back-up cooling water 5. Emergency cooling water system 6. Fire Protection System 7. Fixed point monitor 8. general monitor 9. Maintenance & operating procedures 10. Plant alarm system 11. Reactor emergency & manual kill system	1. Equipment failure 2. Operator error

Node: 484. 4. Lead operator will determine whether or not a reactor needs more cooling water.

Type: Procedural Step

Drawing: proc. VINYL-OM-E008

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
484.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. AMS common header 2. Bypass valve for emergency cooling water 3. DCS interlock - Deluge water is diverted to reactors during a power failure 4. Deluge water can be used for back-up cooling water 5. Emergency cooling water system 6. Fire Protection System 7. Fixed point monitor 8. general monitor 9. Maintenance & operating procedures 10. Plant alarm system 11. Reactor emergency & manual kill system	1. Equipment failure 2. Operator error

Node: 485. 5. Put emergency cooling water on a bumped/killed reactor.

Type: Procedural Step

Drawing: proc. VINYL-OM-E008

Design Conditions/Parameters:

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
485.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. AMS common header 2. Bypass valve for emergency cooling water 3. DCS interlock - Deluge water is diverted to reactors during a power failure 4. Deluge water can be used for back-up cooling water 5. Emergency cooling water system 6. Fire Protection System 7. Fixed point monitor 8. general monitor 9. Maintenance & operating procedures 10. Plant alarm system 11. Reactor emergency & manual kill system	1. Equipment failure 2. Operator error

Node: 486. Discussion and steps 1 & 2.	
Type: Procedural Step	Drawing: proc. VINYL-RM-E009
Design Conditions/Parameters: Operation of Reactor Agitator On/Off/Auto Switch	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
486.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. AMS common header 2. Bypass valve for emergency cooling water 3. DCS interlock - Deluge water is diverted to reactors during a power failure 4. Deluge water can be used for back-up cooling water 5. Emergency cooling water system 6. Fire Protection System 7. Fixed point monitor 8. general monitor 9. Maintenance & operating procedures 10. Plant alarm system 11. Reactor emergency & manual kill system 12. Manual agitator switch	1. Equipment failure 2. Operator error 3. Power failure

Node: 487. Discussion and step 1 (notification of entry)

Type: Procedural Step

Drawing: proc. VINYL-OM-SD001

Design Conditions/Parameters: Prepare a batch water stripper for entry

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
487.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Operator error 3. Instrument failure

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 488. 2. Flush process water into BWS & strip

Type: Procedural Step

Drawing: proc. VINYL-OM-SD001

Design Conditions/Parameters: Prepare a batch water stripper for entry

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
488.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Operating procedures 3. Operator training 4. Personal Protective Equipment 5. Plant alarm system 6. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Operator error

Node: 489. 3. Isolate batch water stripper

Type: Procedural Step

Drawing: proc. VINYL-OM-SD001

Design Conditions/Parameters: Prepare a batch water stripper for entry

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
489.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 490. 4. Close the following manual valves.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD001
Design Conditions/Parameters: Prepare a batch water stripper for entry	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
490.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 491. 5. analyze BWS water sample.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD001
Design Conditions/Parameters: Prepare a batch water stripper for entry	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
491.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 492. 6-8. Notify maintenance and follow permit and lockout/tag out procedures.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD001

Design Conditions/Parameters: Prepare a batch water stripper for entry

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
492.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 493. 9. Blind/disconnect following lines.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD001

Design Conditions/Parameters: Prepare a batch water stripper for entry

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
493.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 494. 10-11. Remove manway and purge BWS.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD001

Design Conditions/Parameters: Prepare a batch water stripper for entry

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
494.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 495. 12. Check for leaks

Type: Procedural Step

Drawing: proc. VINYL-OM-SD001

Design Conditions/Parameters: Prepare a batch water stripper for entry

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
495.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 496. 13-14. Set up BWS for Service & place in Auto-fill.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD001

Design Conditions/Parameters: Prepare a batch water stripper for entry

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
496.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 497. Discussion/Hazards

Type: Procedural Step

Drawing: proc. VINYL-OM-SD002

Design Conditions/Parameters: Prepare VCM Condenser for Cleaning Tubes/Acid Treating Jacket.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
497.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 498. 1-2. Notify lead operator and shutdown ERS.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD002
Design Conditions/Parameters: Prepare VCM Condenser for Cleaning Tubes/Acid Treating Jacket.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
498.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 499. 3. Isolate pumps and compressors	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD002
Design Conditions/Parameters: Prepare VCM Condenser for Cleaning Tubes/Acid Treating Jacket.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
499.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 500. 4. Isolate and recover pressure from ERS.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD002

Design Conditions/Parameters: Prepare VCM Condenser for Cleaning Tubes/Acid Treating Jacket.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
500.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 501. 5. Isolate and drain cooling water.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD002

Design Conditions/Parameters: Prepare VCM Condenser for Cleaning Tubes/Acid Treating Jacket.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
501.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 502. 6. Steam condenser	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD002
Design Conditions/Parameters: Prepare VCM Condenser for Cleaning Tubes/Acid Treating Jacket.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
502.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 503. 7-8. Follow permitting and lockout/tag out procedures.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD002

Design Conditions/Parameters: Prepare VCM Condenser for Cleaning Tubes/Acid Treating Jacket.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
503.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 504. 9. Setup for tube cleaning	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD002
Design Conditions/Parameters: Prepare VCM Condenser for Cleaning Tubes/Acid Treating Jacket.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
504.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 505. 10. Setup for jacket acid cleaning.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD002
Design Conditions/Parameters: Prepare VCM Condenser for Cleaning Tubes/Acid Treating Jacket.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
505.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 506. 11. After maintenance, Setup cooling water lines and check for leaks.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD002

Design Conditions/Parameters: Prepare VCM Condenser for Cleaning Tubes/Acid Treating Jacket.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
506.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 507. 12. Setup condenser lines and check for leaks.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD002

Design Conditions/Parameters: Prepare VCM Condenser for Cleaning Tubes/Acid Treating Jacket.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
507.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 508. 13-14. Start-up ERS and notify lead operator that the ERS is back in service.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD002

Design Conditions/Parameters: Prepare VCM Condenser for Cleaning Tubes/Acid Treating Jacket.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
508.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 509. Hazards/Discussion

Type: Procedural Step

Drawing: proc. VINYL-OM-NSU002

Design Conditions/Parameters: How to Pressure Check Entire Recovery System and Put Back In Service.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
509.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 510. 1. Setting up recovery system for pressure checking

Type: Procedural Step

Drawing: proc. VINYL-OM-NSU002

Design Conditions/Parameters: How to Pressure Check Entire Recovery System and Put Back In Service.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
510.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 511. 2. Add water to recovery system for pressure check.	
Type: Procedural Step	Drawing: proc. VINYL-OM-NSU002
Design Conditions/Parameters: How to Pressure Check Entire Recovery System and Put Back In Service.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
511.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 512. 3. Pressure check recovery system.

Type: Procedural Step

Drawing: proc. VINYL-OM-NSU002

Design Conditions/Parameters: How to Pressure Check Entire Recovery System and Put Back In Service.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
512.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 513. 4. Isolate vacuum pumps.	
Type: Procedural Step	Drawing: proc. VINYL-OM-NSU002
Design Conditions/Parameters: How to Pressure Check Entire Recovery System and Put Back In Service.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
513.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 514. 5. Start water addition to seal water separators.	
Type: Procedural Step	Drawing: proc. VINYL-OM-NSU002
Design Conditions/Parameters: How to Pressure Check Entire Recovery System and Put Back In Service.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
514.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 515. 6. Draining water from recovery system	
Type: Procedural Step	Drawing: proc. VINYL-OM-NSU002
Design Conditions/Parameters: How to Pressure Check Entire Recovery System and Put Back In Service.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
515.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 516. 7. Putting recovery system in service.	
Type: Procedural Step	Drawing: proc. VINYL-OM-NSU002
Design Conditions/Parameters: How to Pressure Check Entire Recovery System and Put Back In Service.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
516.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 517. Hazards/Discussion	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
517.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S/E S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 518. 1-6. Clear and recovery one recovered receiver and all five reactors	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: .Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
518.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 519. 7. Evacuate and charge last reactor with one extra gallon of catalyst.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
519.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 520. 8. Isolating hot water make-up system	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
520.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	C C C	4 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 521. 9. Flush FVCM receiver fill line with HPSW.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
521.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 522. 10. Fill, isolate, recover, and steam strip receiver to meet receiver opening requirements.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
522.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 523. 11. Cleaning vcm charge header.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD005

Design Conditions/Parameters: Schedule Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
523.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 524. 12. Kill and recover final reactor.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
524.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 525. 13. Flushing R-300/400/500/600 VCM valves and header into R-700.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD005

Design Conditions/Parameters: Schedule Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
525.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 526. 14. When recovering fresh receiver and vcm charge header the following equipment will be recovered.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD005

Design Conditions/Parameters: Schedule Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
526.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 527. 15. Recovering VCM charge header, pumps, filter packs, fresh receiver, fresh receiver fill line, and vcm charge valve on R-700.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD005

Design Conditions/Parameters: Schedule Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
527.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 528. 16. Evacuate and add 5000 gal of hot water to R-300/400/500/600 and then recover.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD005

Design Conditions/Parameters: Schedule Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
528.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 529. 17. Recover between VCM valves on R-300.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
529.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 530. 18. Recover and steam strip R-300, R-400, R-500, R-600 reactors.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
530.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 531. 19-20. Dump reactors and notify "A" that reactors are dumping.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
531.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S/E	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 532. 21. Evacuate and steam R-300/400/500/600/700 reactor.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
532.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 533. 22. Switch east incinerator to process water.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD005

Design Conditions/Parameters: Schedule Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
533.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 534. 23. Set up walk-in catalyst freezers on process water.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
534.1 No execution of step							
	1. No consequence						

Node: 535. 24. Shutdown 4a - 4b cooling tower fans and pumps.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
535.1 No execution of step							
	1. Shutdown emission system	S/E	4	C	5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 536. 25. Flooding, recovering, and steaming the fresh VCM receiver.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD005

Design Conditions/Parameters: Schedule Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
536.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 537. 26. Recover and steam FVCM receiver fill line.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
537.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 538. 27. Recover FVCM filter packs and remove elements.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
538.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 539. 28. Recover RVCM filter pack and remove elements.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD005

Design Conditions/Parameters: Schedule Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
539.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 540. 29. Switching inerts venting from old module to new.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD005

Design Conditions/Parameters: Schedule Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
540.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 541. 30. Clearing old module recovery system of VCM.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
541.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 542. 31. Blinding old module recovery system.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
542.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 543. 32. Drain the hot water charge tank.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
543.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 544. 33. Blind the hot water tank for entry.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
544.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 545. 34. Verify all reactor agitators are off.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
545.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 546. 35-36. Open reactor lenape lids and move all drummed raw materials to the new module drum storage area.

Type: Procedural Step

Drawing: proc. VINYL-OM-SD005

Design Conditions/Parameters: Schedule Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
546.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 547. 37. Open the following filter packs and remove the used filters and put in the dumpster.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SD005
Design Conditions/Parameters: Schedule Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
547.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 548. Hazards/Discussion	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
548.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 549. 1. Put hot water charge system in service.

Type: Procedural Step

Drawing: proc. VINYL-OM-SU001

Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
549.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 550. 2. Install filters, button up, and put the following filters packs in service.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
550.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 551. 3. Hydo test and dump reactors.

Type: Procedural Step

Drawing: proc. VINYL-OM-SU001

Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
551.1 No execution of step							
	1. Personal exposure	S	4	C	5	1. Fire Protection System	1. Equipment failure
	2. Personal injury	S	4	C	5	2. Fixed point monitor	2. Instrument failure
						3. general monitor	3. Operator error
						4. Maintenance & operating procedures	
						5. Pressure, temperature, and level instrumentation	

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 552. 4. Put RVCM receivers in service.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
552.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 553. 5. Put fresh vcm receiver in service.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
553.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 554. 6. Put recovery system in service.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
554.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 555. 7. Put normal kill system in service.

Type: Procedural Step

Drawing: proc. VINYL-OM-SU001

Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
555.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 556. 8. Put emergency AMS pots in service.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
556.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 557. 9. Start-up 4a and 4b cooling tower pumps and fans.

Type: Procedural Step

Drawing: proc. VINYL-OM-SU001

Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
557.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 558. 10. Setup walk-in catalyst storage freezers on cooling tower water.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
558.1 No execution of step							
	1. No consequence, step no longer valid						

Node: 559. 11. Switch east incinerator to cooling water.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
559.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 560. 12. Check cooling water flow on each reactor.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
560.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 561. 13. False charge reactors to check following equipment.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
561.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 562. 14. Verify reactor setup.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
562.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 563. 15. Fill and flush additive lines.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
563.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 564. 16. False charge reactor.

Type: Procedural Step

Drawing: proc. VINYL-OM-SU001

Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
564.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 565. 17. Add 5000 gal hot water to each reactor.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
565.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 566. 18. Recovery and steam stripping false charges.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
566.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 567. 19. Dumping false charges.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
567.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 568. 20. Sampling dumping of false charge for residual vcm.

Type: Procedural Step

Drawing: proc. VINYL-OM-SU001

Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
568.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 569. 21. Rinsing reactor after false charge.

Type: Procedural Step

Drawing: proc. VINYL-OM-SU001

Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
569.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 570. 22. Clean wall reactor after dump/rinse is complete.

Type: Procedural Step

Drawing: proc. VINYL-OM-SU001

Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
570.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 571. 23. Evacuating a reactor before charging.

Type: Procedural Step

Drawing: proc. VINYL-OM-SU001

Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
571.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 572. 24. Charging reactor.	
Type: Procedural Step	Drawing: proc. VINYL-OM-SU001
Design Conditions/Parameters: How to Start-up after Scheduled Shutdown/Turnaround	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
572.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 573. Discussion/Hazards	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
573.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 574. 1.-3. Set up HPSW/MSPW pumps.	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
574.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 575. 4. Lead Operator will close emergency cooling water valves.

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
575.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fixed point monitor 2. Maintenance & operating procedures 3. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 576. 5. Start cooling water pumps	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
576.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fixed point monitor 2. Maintenance & operating procedures 3. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 577. 6. Start cooling tower fans.

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
577.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 578. 7. Check duraseal units and reactor seals.

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
578.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 579. 8. Put lip seal flush to reactor seals

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
579.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 580. 9. Start reactor agitators	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
580.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 581. 10. Set up seal water on ERS and LRS vacuum pumps and compressors.

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
581.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 582. 11. Set up seal water to LRS recirculation pumps	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
582.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 583. 12. Set up seal water to LRS ring seal water pumps	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
583.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 584. 13. Set up seal water to return (collect) pumps.

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
584.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 585. 14. Lead operator will start LRS when notified by field operators.	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
585.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 586. 15. Set up seal water to ERS ring seal water pumps.	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
586.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 587. 16. Start-up ERS	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
587.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 588. 17. Set up seal water to fresh vcm charge pumps.	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
588.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 589. 18. Set up seal water to RVCM charge pumps	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
589.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 590. 19. Line up steam stripping valve to reactors

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
590.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fixed point monitor 2. Maintenance & operating procedures 3. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 591. 20. Set up steam supply to BWS	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
591.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fixed point monitor 2. Maintenance & operating procedures 3. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 592. 21. Refill AMS pot.	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
592.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 593. 22. Check Nitrogen bottles pressure.

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
593.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 594. 23. Check catalyst day freezers	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
594.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 595. 24. Start normal kill agent pump	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
595.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Maintenance & operating procedures 2. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 596. 25. Check calcium stearate tank agitator.

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
596.1 No execution of step							
	1. No consequence, wet stearate not used.						

Node: 597. 26. Check frick unit	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
597.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 598. 27. Check general monitors

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
598.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. Maintenance & operating procedures 4. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 599. 28. Check deluge system.	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
599.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 600. 29. Check fixed point monitors

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
600.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 601. 30. Check centrate system	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
601.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 602. 31. Check emergency cooling water valve bottled air pressure.

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
602.1 No execution of step							
	1. Personal exposure 2. Personal injury	S S	4 4	C C	5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 603. 32. Reset fire water pumps	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
603.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 604. 33. Check pressurization blowers

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
604.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 605. 34. Inject isonox into "normal batch" reactors.	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
605.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 606. 35. Recover reactor as normal batch

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
606.1 No execution of step							
	1. Condenser plugged 2. High pressure 3. High temperature	S/E S S/E	4 4 4	C C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 607. 36. Split the reactor batch	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
607.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 608. 37. Cold recover reactor.

Type: Procedural Step

Drawing: proc. VINYL-OM-ESU001

Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
608.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 609. 38. Re-initiate reactors	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
609.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

Node: 610. 39. Recover re-initiated reactors	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
610.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

VIII.D. Hazards Identified - P&ID/Operating
Procedures Review

Old Module Hazop

Georgia Gulf Corp

Node: 611. 40. Dump power failure batches	
Type: Procedural Step	Drawing: proc. VINYL-OM-ESU001
Design Conditions/Parameters: Start-up of Old Module After an Emergency Shutdown.	

Dev	Consequences	CAT	S	L	RR	Safeguards	Causes
611.1 No execution of step							
	1. Fire and explosion 2. Personal exposure 3. Personal injury	S/E S S	3 4 4	D C C	5 5 5	1. Fire Protection System 2. Fixed point monitor 3. general monitor 4. Maintenance & operating procedures 5. Pressure, temperature, and level instrumentation	1. Equipment failure 2. Instrument failure 3. Operator error

**LIST OF
RECOMMENDATIONS**

**PROCESS SAFETY MANAGEMENT
GEORGIA GULF CORPORATION, ABERDEEN PLANT
OLD MODULE HAZOP**

IX. LIST OF RECOMMENDATIONS

A. Preliminary Hazard Review

1. PM the deluge system and fixed point monitors more frequently.
2. Identify crane outrigger placement points to avoid sewers.
3. Investigate centralizing deluge valves for unit in one building.
4. Perform a survey to determine if all equipment needing individual fire protection has individual fire protection.

B. Human Factors Review

1. Add sections on operator checklists to report piping/conduit needing to be demoed, poor lighting conditions, and poorly labeled pipe/instruments/equipment.
2. Survey local controls to determine if they can and/or should to put on the DCS.
3. Recover dump polishing strainers using ERS system.

C. Past Incidents Review

No recommendations

Recommendations	Related Drawings
1. Investigate whether emergency isolation switch gives charge system adequate protection if valve in this line is open. (See: 9.4)	OM-090100-PID-D
2. Investigate whether recirculation valve, 81xv709, should be interlocked with RVCM & FVCM charge pumps. Valve may need to open before pumps start. (See: 16.1)	OM-090100-PID-D
3. Investigate need to interlock valve, 81hv020, closed on low steam header pressure. (See: 19.2)	OM-090101-PID-D
4. Investigate the need for check valve in rinse header flush line. (See: 47.1)	OM-090102-PID-D, OM-090103-PID-D, OM-090104-PID-D, OM-090105-PID-D, OM-090106-PID-D
5. Investigate whether BME charge pot drain valve, 81H443 & 81H543, should be interlocked not to open if BME charge valves are open. (See: 69.4)	OM-090107-PID-D
6. Investigate possible KO tank DM-027 overpressure if runaway reactor (@ pressure > 150 psig) is vented to knockout tank. (See: 84.1)	OM-090108-PID-D
7. Investigate need to house actuated valve solenoids in protected boxes. (See: 84.1)	OM-090108-PID-D
8. Investigate poly flow tubing use for air line service in hazardous locations (See: 84.1)	OM-090108-PID-D
9. Investigate relief valve setting and rupture disk rating on vacuum pump VP-501, 502- settings don't match (See: 103.1)	OM-090109-PID-D
10. Investigate the need for relief valves on shell and tube sides of exchanger (See: 124.1)	OM-090110-PID-D
11. Investigate feasibility of relocating RVCM condensers to improve maintenance access ability. (See: 147A.4)	OM-090111-PID-D
12. Investigate need for system modifications due to the cooler MAWP of 75 psig and normal seal water pressure of > 100 psig, and coolers have no relief valve. (See: 222.1)	OM-090114-PID-D
13. Evaluate need for relief valves for thermal expansion on flush line to stripper outlet between valve 91H642 and valves, 91H942, 91H858, 91H664, and 91H631. (See: 350.1)	OM-090132-PID-D
14. Evaluate need for interlock to prevent valves 91H645 and 91H657 from opening without rinse pump running. (See: 355.1)	OM-090132-PID-D
15. Evaluate need for relief valve for thermal expansion between valves 91H630, 91H657, and 91H645. (See: 354.2)	OM-090132-PID-D
16. Evaluate need for interlock to prevent valves 91H630 and 91H657 from opening without rinse pump running. (See: 354.1)	OM-090132-PID-D
17. Evaluate need for relief valve for thermal expansion between valves 91H641, and 91H652. (See: 356.1)	OM-090132-PID-D
18. Evaluate need for relief valve for thermal expansion between double block valves on rinse line to dump strainers (See: 375.2)	OM-090134-PID-D
19. Review and update, if necessary, procedure Vinyl-RM-ESD006 and verify that procedure write-up matches DCS programming. (See: 449.1)	proc. VINYL-RM-ESD006
20. Review and update, if necessary, the portion of procedure Vinyl-RM-ESD006 pertaining to what rinse valves close on reactor. (No Linked Items)	
21. Review and update step #4 of procedure Vinyl-OM-E001 to include Old Module fire monitor locations. (See: 451.1)	proc. VINYL-OM-E001
22. Evaluate the need to developed procedure to dump leaking reactor to dump tank if empty reactor is not available. (See: 452.1)	proc. VINYL-OM-E001

Recommendations	Related Drawings
23. Review and update step #6 of procedure Vinyl-OM-E001 to include old module valve references and pump references that now have new module references only. (See: 453.1)	proc. VINYL-OM-E001
24. Evaluate need to include capability to split reactors using closed dump line to split reactors instead of charge water header in procedure Vinyl-OM-E001/Vinyl-OM-ESU001. (See: 453.1, 607.1)	proc. VINYL-OM-E001, proc. VINYL-OM-ESU001
25. Update step #12 of procedure Vinyl-OM-E001 to include references to Old Module Equipment where as now only new module equipment is referenced. (See: 458.1)	proc. VINYL-OM-E001
26. Evaluate the need for fixed point monitors to be on emergency power so leak monitoring can continue during power failure. (See: 468.1)	proc. VINYL-RM-E003
27. Review step #2 of procedure Vinyl-OM-SD001. Batch water stripper fill and equalization valves may need to be isolated to prevent having to restart procedure if opened. (See: 488.1)	proc. VINYL-OM-SD001
28. Review step#11 of procedure Vinyl-OM-SD001. Should batch water stripper be purged and pressure checked with steam at 20 psig. (See: 494.1)	proc. VINYL-OM-SD001
29. Review step #12 of procedure Vinyl-OM-SD001. Verify accuracy of described step. (See: 495.1)	proc. VINYL-OM-SD001
30. Review step #2 of procedure Vinyl-OM-SD002. If exchanger can be or should be bypassed to keep ERS running while cleaning exchanger, then steps to do so should be added to procedure. (No Linked Items)	
31. Review procedure Vinyl-OM-SD002 for proper shutdown and start-up of ERS. (See: 508.1)	proc. VINYL-OM-SD002
32. Review and update procedure Vinyl-OM-SD005 for accuracy. Procedure does not cover EXPRESS installed equipment. Include procedure # for all reference procedures. (See: 517.1)	proc. VINYL-OM-SD005
33. Evaluate revising all normal, shutdown, and start-up procedures (where applicable) to permit using hot water for clearing equipment instead of steam. (See: 517.1)	proc. VINYL-OM-SD005
34. Review and update procedure, Vinyl-OM-SU001 for accuracy. Include procedure # for referenced normal procedures and include start-up of any applicable EXPRESS installed equipment. (See: 548.1)	proc. VINYL-OM-SU001
35. Review and update procedure Vinyl-OM-ESU001 for accuracy. Include start-up procedures for all applicable EXPRESS installed equipment. (See: 573.1)	proc. VINYL-OM-ESU001

**PROCESS SAFETY MANAGEMENT
GEORGIA GULF CORPORATION, ABERDEEN PLANT
OLD MODULE HAZOP**

X. List of Items Needing Further Review

No items were identified requiring further review.

APPENDIX B

To: All Employees

From: Kelly Wood

Date: March 6, 2000

Interoffice
Communication

Subject: **Employee Participation in the Old Module Hazop Study**

To comply with OSHA regulations, Georgia Gulf Corporation must perform a hazard analysis on all its existing processes covered under OSHA's PSM standard. Due to the size and complexity of the process unit being considered, Hazop has been chosen to fulfill the process hazard analysis requirement. Soon a Hazop team will begin analysis of the plant's Old Module. Hazop methodology also requires employee participation. To comply with the employee participation portion, the following team has been assembled to conduct the Old Module Hazop.

- Shea Sargent
- Craig English
- A vinyl operations member
- An instrument technician
- A maintenance member
- Kelly Wood

To further promote employee participation and to hopefully perform the most thorough Hazop analysis possible, the team is asking you to contact one of the team members if you know of any operability, safety, or environmental issues regarding the project or area you feel needs addressing.

Meetings will be held in the plant's Training Conference Room. Meeting times will be 7:45 AM - 11:30 AM and 12:30 PM - 4:00 PM daily beginning Wednesday, March 15, 2000. The meetings will continue until the Hazop is completed on or about Wednesday, March 29, 2000.

Posting Date 3-6-2000

Removal Date 3-20-2000

APPENDIX C

**PROCESS SAFETY MANAGEMENT
GEORGIA GULF CORPORATION, ABERDEEN PLANT
OLD MODULE HAZOP**

Appendix C. HAZOP Pre-Work Material List

Process Safety Information Per OSHA CFR 1910.199 (d)

I. Hazards Of The Highly Hazardous Chemicals In The Process

Item	Where Found
Toxicity	DMS-ABER-Safety-MSDS/Vendor
Permissible Exposure Limits	DMS-ABER-Safety-MSDS/Vendor
Physical Data	DMS-ABER-Safety-MSDS/Vendor
Reactivity Data	DMS-ABER-Safety-MSDS/Vendor
Corrosivity Data	DMS-ABER-Safety-MSDS/Vendor
Thermal & Chemical stability Data	DMS-ABER-Safety-MSDS/Vendor
Hazardous Effects of Inadvertent Mixing	DMS-ABER-Process-Unit Information

II. Information On Technology of Process

Item	Where Found
PFDs	DMS-ABER-Process-Flow Diagrams
Maximum Intended Inventory	DMS-ABER-Process-Unit Information
Process Chemistry	DMS-ABER-Process-Unit Information
Safe Upper/Lower Limits For Critical Parameters	DMS-ABER-OM-Procedures/Process Operation/Normal
Evaluation of Consequence of Deviation	DMS-ABER-OM-Procedures/Process Operation/Normal

III. Information on Equipment In Process

Item	Where Found
Materials of Construction	Equipment Files/DMS
P&IDs	DMS-ABER-OM-Engineering Drawings
Electrical Classification	DMS-ABER-OM-Engineering Drawings
Relief System Design & Design Basis	DMS-ABER-Safety/Environmental/Relief Devices.
Ventilation System Design	Not Applicable
Design Codes/Standards	K: Eng_Std
Material & Energy Balances	DMS-ABER-Process-Unit Information
Safety Systems	DMS-ABER-Eng.Dwgs-Piping-Firewater Plans/Details

**PROCESS SAFETY MANAGEMENT
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OLD MODULE HAZOP**

Other Information Used

	Where Found
Chemical Interaction Matrix for VCM	DMS-ABER-Process-Unit Information
Documentation of previous incidents that had a likely potential for catastrophic consequences in the Utilities area.	Safety Dept. Files
Documentation of previous relevant safety audits that addressed the potential for catastrophic consequences in the Utilities area.	PSM File Room
Facility Siting Information. Dow Fire & Explosion Index	DMS-ABER-PSM Compliance/Facility Siting
Operating Procedures	DMS-ABER-OM-Procedures/Process Operations/Normal
P&IDs	DMS-ABER-Engineering Drawings
List of Miscellaneous Alarm Points	DMS-ABER-Engineering Drawings
List of DCS Safety Interlocks	DCS Control System
Condea Vista Company Corporate Safety & Health Standards, Process Hazard Analysis, PSM-004	DMS-Procedures-PSM Compliance-PHA-PSM-004
Plant Plot Plan, GP-F005-42-2-1, DTD. 8/18/82	DMS-ABER-Engineering Drawings

PSM Covered Equipment

Where Found: DMS-ABER-(Use Folder Search Equipment/Equipment No.) or Project File

Equipment Number	Equipment Description
721151	PP-020 PUMP: AMS KILL OM
721146	PP-107 PUMP: N BWS TRANSFER OM
701319	PP-107 MOTOR: 20 HP 3515 RPM FR 256T
721147	PP-108 PUMP: S BWS TRANSFER OM
701320	PP-108 MOTOR: 20 HP 3515 RPM FR 256-T
722521	CP-108 COMPRESSOR: E ERS OM
781153	PSV-CP-108 RV: E ERS COMPRESSOR OM
701503	CP-108 MOTOR: 100 HP 1780 RPM FR 405-T
722532	VP-703 VAC PUMP: W ERS OM

**PROCESS SAFETY MANAGEMENT
GEORGIA GULF CORPORATION, ABERDEEN PLANT
OLD MODULE HAZOP**

PSM Covered Equipment

Where Found: DMS-ABER-(Use Folder Search Equipment/Equipment No.) or Project File

Equipment Number	Equipment Description
700933	VP-703 MOTOR: 40 HP 1180 RPM FR 364-TS
781166	PSV-VP-703 RV: WEST ERS VAC PMP OM
722533	VP-704 VAC PUMP: E ERS OM
700932	VP-704 MOTOR: 40 HP 1180 RPM FR 364-TS
781182	PSV-VP-704 RV: E ERS VACUUM PUMP
720993	CP-107 COMPRESSOR: W ERS OM
722549	CP-109 COMPRESSOR: ERS OM
720567	PP-708 PUMP: N SEAL WATER ERS OM
700567	PP-708 MOTOR: 40 HP 3540 RPM FR 324-TS
720568	PP-707 PUMP: S SEAL WATER ERS OM
700568	PP-707 MOTOR: 40 HP 3540 RPM FR 324-TS
720209	PP-112 PUMP: ERS KO DRUM WATER
700421	PP-112 MOTOR: 7.5 HP 3500 RPM FR 215
510002	TK-313 AGITATOR: BRINE MAKE-UP OM
720038	PP-481 PUMP: BRINE SOLUTION TRANSFER OM
701005	PP-481 MOTOR: 2 HP 1730 RPM FR 145T
721009	PP-483 PUMP: BRINE TANK TRANSFER OM
701645	PP-483 MOTOR: 50 HP 3540 RPM FR326TP 212
721149	PP-014 PUMP: E CAUSTIC STORAGE TANK
701350	PP-014 MOTOR: 3 HP
721150	PP-015 PUMP: W CAUSTIC STORAGE TANK
701351	PP-015 MOTOR: 3 HP
721298	PP-547 PUMP: OM CENTRATE RECYCLE
702145	PP-547 MOTOR: 75 HP 1780 RPM FR 365T
721087	PP-230 PUMP: S HOT WATER CHARGE OM
700676	PP-230 MOTOR: 75 HP 3560 RPM FR 365-TS
721088	PP-231 PUMP: N HOT WATER CHARGE OM
700036	PP-231 MOTOR: 75 HP 3560 RPM FR 365TS
721086	PP-229 PUMP: RX RINSE WATER OM
700047	PP-229 MOTOR: 125 HP 3560 RPM FR 444TS
491026	FN-026 FAN: LM SWECO EXHAUST OM
701054	FN-026 MOTOR:
720874	PP-496 PUMP: E SLURRY DUMP OM
700042	PP-496 MOTOR: 30 HP 1770 RPM FR 286TS
721152	PP-801A PUMP: E LM SLURRY DUMP OM
701186	PP-801A MOTOR: 25 HP 885 RPM FR 326T
721153	801B PUMP W LM SLURRY DUMP OM

**PROCESS SAFETY MANAGEMENT
GEORGIA GULF CORPORATION, ABERDEEN PLANT
OLD MODULE HAZOP**

PSM Covered Equipment

Where Found: DMS-ABER-(Use Folder Search Equipment/Equipment No.) or Project File

Equipment Number	Equipment Description
701187	PP-801B MOTOR: 25 HP 885 RPM FR 326T
720033	PP-601 PUMP: RX-700 S SLURRY DUMP OM
701098	PP-601 MOTOR: 40 HP 1775 RPM FR 324T
720034	PP-602 PUMP: RX-700 N SLURRY DUMP OM
700958	PP-602 MOTOR: 40 HP 1775 RPM FR 324T
721021	PP-497 PUMP: W SLURRY DUMP OM
701019	PP-497 MOTOR: 30 HP 1760 RPM FR 286TS
721239	PP-500 PUMP: OM HM DUMP
700034	PP-500 MOTOR: 150 HP 1785 RPM FR B445T
721243	PP-504 PUMP: OM HM DUMP
701238	PP-504 MOTOR: 150 HP 1785 RPM FR B445T
481000	GR-601 SCREENER: SWECO VIBRATOR RX-700
701633	GR-601 MOTOR:
480001	GR-001 SCREENER: DUMP SWECO OM
720044	PP-475W PUMP: W VCM CHARGE OM
700044	PP-475W MOTOR: 150 HP 3560 RPM FR 445TS
781306	PSV-PP-475 RV: E/W FVCM CHG PMP DISCHG
720800	PP-475E PUMP: E VCM CHARGE OM
700800	PP-475E MOTOR: 150 HP 3560 RPM FR 445TS
720011	PP-011 PUMP: W HPSW OM
700268	PP-011 MOTOR: 20 HP 3530 RPM FR 286U
720010	PP-010 PUMP: E HPSW OM
720891	PP-874 PUMP: S HPSW OM
700041	PP-874 MOTOR: 25 HP 3530 RPM FR 284TS
721014	PP-134 PUMP: N HPSW OM
701341	PP-134 MOTOR: 25 HP 3535 RPM FR 284-TS
720953	PP-953 PUMP: N MECH SEAL WATER OM
700953	PP-953 MOTOR: 15 HP 3540 RPM FR 254TDZ
781406	PSV-PP-953W RV: OU MECH.SEAL OIL
720954	PP-954 PUMP: S MECH SEAL WATER OM
700954	PP-954 MOTOR: 15 HP 3540 RPM FR 254TDZ
721089	PP-276 PUMP: NORMAL KILL SOL OLD MOD
780009	PSV-PP-276 RV: NORMAL KILL SOL PUMP OM
861021	PP-276 GBOX: NORMAL KILL PUMP OM
701104	PP-276 MOTOR: 5 HP 1160 RPM FR 215-T
511137	RX-300 AGITATOR: REACTOR OM
861012	RX-300 GBOX: SMALL RX AGITATOR

**PROCESS SAFETY MANAGEMENT
GEORGIA GULF CORPORATION, ABERDEEN PLANT
OLD MODULE HAZOP**

PSM Covered Equipment

Where Found: DMS-ABER-(Use Folder Search Equipment/Equipment No.) or Project File

Equipment Number	Equipment Description
700331	RX-300 MOTOR: 200 HP 1780 RPM FR 447TS
510073	RX-400 AGITATOR: REACTOR OM
860074	RX-400 GBOX: RX AGITATOR
700822	RX-400 MOTOR: 200 HP 1800 RPM FR 447TS
510075	RX-500 AGITATOR: REACTOR OM
861016	RX-500 GBOX: SMALL RX AGITATOR
700185	RX-500 MOTOR: 200 HP 1760 RPM FR 449TS
510716	RX-600 AGITATOR: REACTOR OM
861022	RX-600 GBOX: SMALL RX AGITATOR
700227	RX-600 MOTOR: 200 HP 1785 RPM FR 449TS
511000	RX-700 AGITATOR: REACTOR OM
860004	RX-700 GBOX: RX AGITATOR
701007	RX-700 MOTOR: 350 HP 1786 RPM FR 5809-S
722531	VP-501 VAC PUMP: A OM
701010	VP-501 MOTOR: 75 HP 1175 RPM FR 405T
781408	PSV-VP-501 RV: RV ON OM "A" VACC.PUMP
721200	VP-502 VAC PUMP: B OM
700901	VP-502 MOTOR: 75 HP 1175 RPM 405T
781407	PSV-VP-502 RV: VP-502 OM "B" VAC PUMP
720018	CP-503 COMPRESSOR: A RECOVERY OM
780301	PSV-CP-503 RV: "A" RECOVERY COMPRESSOR
700910	CP-503 MOTOR: 150 HP 1780 RPM FR 445TS
722527	CP-504 COMPRESSOR: B RECOVERY OM
780119	PSV-CP-504 RV: "B" RECOVERY COMPRESSOR
722517	CP-506 COMPRESSOR: C RECOVERY OM
700117	CP-506 MOTOR: 150 HP 1785 RPM FR 445TS
781258	PSV-CP-506 RV: OM RECOVERY "C" COMP
722522	CP-111 COMPRESSOR: D RECOVERY OM
781299	PSV-CP-111 RV: CP-111 REC COMP OM
700138	CP-506 MOTOR: 150 HP 1785 RPM FR 445TS
720430	PP-489 PUMP: S KO TANK OM
700031	PP-489 MOTOR: 7.5 HP 1740 RPM FR 213T
721007	PP-490 PUMP: N KO TANK OM
701300	PP-490 MOTOR: 20 HP
720268	PP-492 PUMP: N SEAL WTR OM
701034	PP-492 MOTOR: 7.5 HP 1745 RPM FR 213T
721160	PP-491 PUMP: S SEAL WATER OM

**PROCESS SAFETY MANAGEMENT
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OLD MODULE HAZOP**

PSM Covered Equipment

Where Found: DMS-ABER-(Use Folder Search Equipment/Equipment No.) or Project File

Equipment Number	Equipment Description
700028	PP-491 MOTOR: 7.5 HP 1740 RPM FR 213T
721083	PP-237 PUMP: HYDROQUINONE METERING OM
701638	PP-237 MOTOR: 0.25 HP 1725 RPM FR 56C
721029	PP-271 PUMP: RVCM CHILLED H2O OM
701642	PP-271 MOTOR: 5 HP 1745 RPM FR 184-T
800001	RF-002 CHILLER: OM INERTS REMOVAL
720001	PP-110 PUMP: E RVCM RETURN OM
700003	PP-110 MOTOR: 7.5 HP 3480 RPM FR 215
720003	PP-111 PUMP: W RVCM RETURN OM
700232	PP-111 MOTOR: 7.5 HP 3480 RPM FR 213-T
720878	PP-477 PUMP: RVCM CHARGE OM
780326	PSV-PP-477 RV: RVCM CHARGE PUMP AT 45012
722504	PP-058 PUMP: RECOVERED VCM CHARGE
781327	PSV-PP-058 RV: OM RVCM EAST PUMP ANDY H
700237	PP-058 MOTOR: 25 HP 1775 RPM FR 284T
720136	PP-279 PUMP: W OM SEAL OIL
781251	PSV-PP-279 RV: W OM SEAL OIL DISCHARGE
720137	PP-283 PUMP: E OM SEAL OIL
781252	PSV-PP-283 RV: E OM SEAL OIL PUMP
512000	DM-313 AGITATOR: CALC STEARATE
700000	DM-313 MOTOR:
511126	DM-075 AGITATOR: OM HM DUMP TK
701257	DM-075 MOTOR: 20 HP 1800 RPM FR 256T
511130	DM-079 AGITATOR: OM HM STRIPPER FEED TK
701258	DM-079 MOTOR: 3 HP 1200 RPM FR 213T
721250	PP-511 PUMP: OM HM STRIPPER FEED
701284	PP-511 MOTOR: 50 HP 1770 RPM FR 326T
721254	PP-515 PUMP: OM HM STRIPPER BOTTOMS
701294	PP-515 MOTOR: 50 HP 1770 RPM 326T
722541	STRIPPER PUMP
702182	MOTOR: 125 HP 1800 RPM FR 444T
722544	STRIPPER PUMP
702185	MOTOR: 125 HP 1800 RPM FR 444T
450806	DM-806 POT: EMERG AMS KILL RX-300 OM
780295	PSV-DM-806: RX- 300 KILL POT
450811	DM-811 POT: EMERG AMS KILL RX 400 OM
780296	PSV-DM-811: RX-400 EMERGENCY KILL POT

**PROCESS SAFETY MANAGEMENT
GEORGIA GULF CORPORATION, ABERDEEN PLANT
OLD MODULE HAZOP**

PSM Covered Equipment

Where Found: DMS-ABER-(Use Folder Search Equipment/Equipment No.) or Project File

Equipment Number	Equipment Description
450808	DM-808 POT: EMERG AMS KILL RX-500 OM
780297	PSV-DM-808: RX-500 KILL POT
450809	DM-809 POT: EMERG AMS KILL RX 600 OM
780298	PSV-DM-809: RX-600 EMERGENCY KILL POT
450780	DM-780 POT: EMERG AMS KILL RX 700 OM
780281	PSV-DM-780 RV: D-700 EMERGENCY KILL POT
450310	DM-310 POT: BME CHARGE RX-600 OM
781046	PSV-DM-310 RV: RX-600 BME CHARGE POT
451030	DM-311 POT: BME METERING RX-600
450200	DM-200 POT: BME CHARGE RX-700 OM
781049	PSV-DM-200 RV: RX-700 BME CHARGE POT
450201	DM-201 POT: BME METERING RX-700
450801	DM-801 DRUM: S BATCH WATER STRIPPER OM
780235	PSV-DM-801 RV: S BATCH WATER STRIPPER
450802	DM-802 DRUM: N BATCH WATER STRIPPER OM
780951	PSV-DM-802 RV: N BATCH WATER STRIPPER
550002	EX-002 SUBCOOLER: N SEAL WTR ERS OM
550004	EX-004 SUBCOOLER: CNTR SEAL WTR OM
550311	EX-311 SUBCOOLER: S SEAL WTR ERS OM
550351	EX-351 SUBCOOLER: ERS
781011	PSV-EX-351 RV: ERS SUBCOOLER ON ROOF
550376	EX-376 EXCHANGER: OM ROOF REC SYS
781283	PSV-EX-376 RV: OM ERS CONDENSOR ON ROOF
640050	FL-050 FILTER: S ERS SEAL WATER PAK
781109	PSV-FL-050 RV: S. ERS SEAL WTR FL OM
640051	FL-051 FILTER: N ERS SEAL WATER PAK
781108	PSV-FL-051 RV: N. ERS SEAL WTR FL OM
641057	PP-112 STRAINER: E AT SUCTION PP-112
641058	PP-112 STRAINER: W AT SUCTION PP-112
450026	DM-701 DRUM: ERS KO OM
781290	PSV-DM-701 RV: 701 SEAL WATER TANK ERS
450308	DM-702 DRUM: N SEAL WATER HOLD ERS OM
780269	PSV-DM-702 RV: S. SEAL WTR HLD TK ERS OM
450309	DM-703 DRUM: S SEAL WATER HOLD ERS OM
780255	PSV-DM-703 RV: S. SEAL WATER TANK ERS
890004	TK-004 TANK: S BRINE SOLUTION TK OM
891104	TK-114 TANK: CAUSTIC SYS HOLD OM

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PSM Covered Equipment

Where Found: DMS-ABER-(Use Folder Search Equipment/Equipment No.) or Project File

Equipment Number	Equipment Description
890005	TK-471 TANK: OM CHILLED WATER -VCM RCVRS
551008	EX-114 HEATER: CHARGE WATER PIK OM
640714	FL-714 FILTER: PIK HTR CHARGE WATER OM
641005	FL-002 FILTER: DECAL TANK OUTLET OM
781136	PSV-FL-002 RV: DECALF RESIN POLISH FL OM
641053	FL-101 FILTER: HOT WATER CHARGE OM
781066	SPARE RV: OM MAIN CHARGE WATER FL-101
781418	PSV-FL-101 RV: FL-101 OM CHG. WATER
641054	FL-102 FILTER: HOT WATER MAKE UP OM
780306	PSV-FL-102 RV: CENTRATE WATER FL OM
641055	FL-103 FILTER: RINSE WATR OM NEAR TK-023
781242	PSV-FL-103 RV: OM RINSE WATER FL
641077	FL-379 FILTER: DECALCIFIED WATR INLET OM
781006	PSV-FL-379 RV: DECALCIFIED WATER FL OM
890319	TK-014 TANK: OM CENTRATE RECYCLE STORAGE
891023	TK-023 TANK: HOT WTR CHRG TK OM
451013	DM-130 DRUM: DECALCIFIED WATER OM
781014	PSV-DM-130 RV: DECALCIFIED WATER TANK OM
640810	FL-810 FILTER: LOW MOL SWCO PROCESS H2O
890601	TK-601 TANK: D-700 SLURRY DUMP
890007	TK-007 TANK: 001 SWECO DUMP OM
451097	DM-075 DRUM: OM HM DUMP TK
781332	PSV-DM-075 RV: RV ON DM-075 OM DUMP TK
640008	FL-008 FILTER: N FRESH VCM PAK OM
781410	PSV-FL-008 RV: RV ON OM VC FILTER
640009	FL-009 FILTER: S FRESH VCM PAK OM
780327	PSV-FL-009A RV: S FRESH VCM FILTER PAK
781102	PSV-FL-009B RV: S FRESH VCM FL PAK PIPE
450013	DM-013 RECEIVER: FRESH VCM OM
781285	PSV-DM-013 RV: OU FVCM REC
640811	FL-811 FILTER: HPSW PUMP DISCH OM
641063	FL-953 FILTER: MECH SEAL WATER OM
641064	FL-954 FILTER: MECH SEAL WATER OM
641065	FL-134 FILTER: HPSW PUMP SUCTION OM
781003	PSV-FL-004 RV: ERS HPSW FLTR UPSTAIRS OM
640004	FL-004 FILTER: ERS HPSW FILTER 2ND FL OM
450014	DM-014 DRUM: MECH SEAL WATER SURGE OM

PROCESS SAFETY MANAGEMENT
GEORGIA GULF CORPORATION, ABERDEEN PLANT
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PSM Covered Equipment

Where Found: DMS-ABER-(Use Folder Search Equipment/Equipment No.) or Project File

Equipment Number	Equipment Description
640795	FL-395 FILTER: NORMAL KILL SOL OM
781063	PSV-FL-395 RV: NORMAL KILL FILTER
640040	FL-040 FILTER: POLIVIC CHARGE OM
550321	RX-500 CONDENSER: RX500 OM
551019	RX-600 CONDENSER: RX600 OM
550356	RX-700 CONDENSER: RX700 OM
550330	RX-300 CONDENSER: RX300 OM
550329	RX-400 CONDENSER: RX400 OM
641131	FL-130 FILTER: F50 TO RX600/ RX700
781243	PSV-FL-130 RV: F50 FL-W OF RX-700 OM
450300	RX-300 REACTOR: VINYL OM
780095	PSV-RX-300C RV:RX-300 E RV: 8T10 @ 199
780096	PSV-RX-300A RV: N SHELL RV 8T10 @ 199
780312	PSV-RX-300D RV: RX-300 CONDENSER
780318	PSV-RX-300B RV: RX-300 SHELL RV
781133	PSV-RX-300J RV: RX-300 JACKET
450400	RX-400 REACTOR: VINYL OM
780089	PSV-RX-400B RV: W SHELL RV: 8 X 10
780090	PSV-RX-400A RV: N SHELL RV: 8 X 10
780230	PSV-RX-400C RV: E SHELL RV: 6 X 8
780314	PSV-RX-400D RV: RELIEF VALVE: 6 X 8
781039	PSV-RX-400J RV: D-400 REACTOR JCKT (OM)
450500	RX-500 REACTOR: VINYL OM
780001	PSV-RX-500C RV: SHELL OU SMALL RX'S
780091	PSV-RX-500B RV: OU RX SHELL 8T10-199
780094	PSV-RX-500A RV: OU SMALL RX SHELL
780325	PSV-RX-500D RV: OU RX COND RV 6Q8 @ 185
781171	PSV-RX-500J RV: 6Q8 RX JCKT RV
450600	RX-600 REACTOR: VINYL OM
780087	PSV-RX-600A RV: N RV: 8 X 10
780088	PSV-RX-600B RV: W RV
780225	PSV-RX-600D RV: SM RX RV CONDENS
780313	PSV-RX-600 RV: E RELIEF VALVE: 6 X 8
781040	PSV-RX-600J JCKT RV6 Q 8 : 45 PSIG
450700	RX-700 REACTOR: VINYL OM
780282	PSV-RX-700J RV: JACKET RELIEF VALVE: 3X4
780288	PSV-RX-700F RV: N CONDENSER RELIEF VALVE

**PROCESS SAFETY MANAGEMENT
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PSM Covered Equipment

Where Found: DMS-ABER-(Use Folder Search Equipment/Equipment No.) or Project File

Equipment Number	Equipment Description
780289	PSV-RX-700D RV: shell
780290	PSV-RX-700B RV: #2 NOZZLE RELIEF VALVE
780291	PSV-RX-700E RV: #5 NOZZLE RELIEF VALVE
780292	PSV-RX-700A RV: #1 NOZZLE RELIEF VALVE
780293	PSV-RX-700G RV: SW CONDENSER RV
780294	PSV-RX-700C RV: #3 NOZZLE RV
450065	DM-065 POT: CATALYST CHARGE -RX 300
450067	DM-067 POT: CATLYST CHARGE - RX 400
450066	DM-066 POT: CATLYST CHARGE - RX 500
450068	DM-068 POT: CATALYST CHARGE -RX 600
450778	DM-778 POT: CATALYST CHARGE -RX 700
550005	EX-005 COOLER: TOP SEAL WATER OM
550006	EX-006 COOLER: BOTTOM SEAL WATER OM
550340	EX-340 COOLER: KO RECIRCULATION
781411	PSV-EX-340 RV: OM VC KO RECIRC COOLER
641061	FL-020E FILTER: E RING SEAL WTR :OM RECV
641062	FL-020W FILTER: W RING SEAL WTR FLTR OM
781298	PSV-FL-020W RV: SEAL WATER FL OM
781301	PSV-FL-020E RV: OM RING SEAL WATER
780120	PSV-PR-021 RV: REC PUMP RVCM RCVR EQUAL
891008	TK-127 TANK: HYDROQ MAKE UP TK OM
890003	TK-003 TANK: PVA CHARGE OM
451100	DM-017 DRUM: N SEAL H2O SEPARATOR OM
781255	PSV-DM-017 RV: S OM SEAL WTR SEPERATOR
451101	DM-018 DRUM: S SEAL H2O SEPARATOR OM
781256	PSV-DM-018 RV: N OM SEAL WTR SEPERATOR
450027	DM-027 DRUM: N KNOCK OUT OM
781416	PSV-DM-027 RV: OM NORTH KO POT
450028	DM-028 DRUM: S KNOCK OUT OM
450129	DM-129 DRUM: HYDROQUINONE STORAGE OM
781041	PSV-DM-129 RV: O.U. HYDROQUINONE DM
451010	TANK: OLD BPA CHARGE POT E OF RX700
780133	PSV-DM-T2 RV: OLD BPA CHG POT E OF 700
550008	EX-008 CONDENSER: S RVCM OM
781284	PSV-EX-008 RV: S RVCM CONDENSER OM
550009	EX-009 CONDENSER: N RVCM OM
780329	PSV-EX-009 RV: N RVCM CONDENSER OM

**PROCESS SAFETY MANAGEMENT
GEORGIA GULF CORPORATION, ABERDEEN PLANT
OLD MODULE HAZOP**

PSM Covered Equipment

Where Found: DMS-ABER-(Use Folder Search Equipment/Equipment No.) or Project File

Equipment Number	Equipment Description
550040	EX-124 CONDENSER: S RVCM RECEIVER OM
550041	EX-123 CONDENSER: N RVCM RECEIVER OM
550045	EX-129 SUBCOOLER: RVCM OM
781211	PSV-EX-128T RV: SUBCOOLER TUBE SIDE NM
781213	PSV-EX-129S RV: OM GSN RVCM SUBCOOLER
781291	PSV-EX-129T RV: RVCM O.M. SUBCOOLER
640691	FL-691 FILTER: RVCM PAK OM
781308	PSV-PR-007 RV: FRM FL691 TO PP475 OM
781409	PSV-FL-691 RV: FL-691 OM FVCM FILTER
781077	PSV-PR-020 RV: PIPING ABOVE FL-008&9 OM
450005	DM-005 RECEIVER: RVCM COLLECT OM
450011	DM-011 RECEIVER: N RVCM OM
780233	PSV-DM-011 RV: N RVCM RECEIVER OM
450012	DM-012 RECEIVER: S. RVCM OM
780232	PSV-DM-012 RV: OM S RVCM RECEIVER
641034	FL-113 FILTER: N RX SEAL OIL OM
641039	FL-116 FILTER: S RX SEAL OIL OM
891025	TK-472 TANK: OM EAST SEAL OIL RESERVOIR
890001	TK-473 TANK: OM W RX SEAL OIL RESERVOIR
450063	TK-063 DRUM: SEAL OIL OM
450313	DM-313 DRUM: CALCIUM STERATE HOLD OM
551086	EX-011 EXCHANGER: OM HM STRIPPER FEED
781341	PSV-EX-011 RV: OM HM SPIRAL FEED EX
551089	TW-002 CONDENSER: OM HM STRIPPING COLUMN
641111	FL-030 STRAINER: OM HIGH MOLE POLISH
641112	FL-031 STRAINER: OM HIGH MOLE POLISH
641117	FL-010 STRAINER: OM HIGH MOLE DUMP
641118	FL-011 STRAINER: OM HIGH MOLE DUMP
641121	FL-014 STRAINER: OM HIGH MOLE DUMP
641122	FL-015 STRAINER: OM HIGH MOLE DUMP
641129	FL-128 FILTER: OM HM STRIPPER FLUSH WTR
881000	TW-002 STRIPPER: OM HM STRIPPING COLUMN
781344	PSV-TW-002A RV: TW-002 OM HM STRIP COL
781345	PSV-TW-002B RV: TW-002 OM HM STRIPPER
452006	DM-084 POT: OM HM EMERG AMS KILL
781336	PSV-DM-084 RV: DM-084 OM HM Kill Pot
452001	DM-079 DRUM: OM HM STRIPPER FEED TK

**PROCESS SAFETY MANAGEMENT
GEORGIA GULF CORPORATION, ABERDEEN PLANT
OLD MODULE HAZOP**

PSM Covered Equipment

Where Found: DMS-ABER-(Use Folder Search Equipment/Equipment No.) or Project File

Equipment Number

781335

Equipment Description

PSV-DM-079 RV: DM-079 OM HM FEED TANK

APPENDIX D

INCIDENTS AT CONDEA VISTA'S ABERDEEN PLANT

1. Incident: Worker got something in his eye while opening bottom reactor manway.
Date: February 6, 1987
Cause: Insufficient eye protection
Injuries: One eye irritation
Mitigation: Eye goggles must be work while opening reactor bottom manways.
Reference: Herbert Jackson eye injury – March 23, 1987.

2. Incident: Near-miss crane accident on 501 blend tank.
Date: May 28, 1986.
Cause: Lack of communication and planning.
Injuries: None.
Mitigation: A Vista maintenance supervisor oversees all personnel lifting operations.
Reference: Near-miss accident, 501 blend tank cleaning – June 26, 1986.

3. Incident: Worker pinched the skin on his finger while repositioning the global drilling rig on Reactor 745.
Date: September 22, 1983.
Cause: Inadequate procedure for safely setting up the drilling rig.
Injuries: One pinched skin on finger.
Mitigation: 1) Install secondary lifting davit on reactor 700 and reactor 745;
2) Discuss incident with employees; and
3) Modify lighting for crane operator visibility.
Reference: Accident investigation, William Moore, October 14, 1983.

4. Incident: Catalyst bottles melted down while in a storage freezer.
Date: July 24, 1984.
Cause: Improper freezer unkeep, freezer location in direct sunlight, and freezer abuse.
Injuries: None.
Mitigation: Freezers were put underneath open-side awnings to get the freezers out of direct sunlight; new freezer maintenance procedure.
Reference:

5. Incident: An air hose connected to a jackhammer came loose and as it whipped around uncontrollably, hit a bystander in the knee.
Date: April 11, 1983.
Cause: Equipment failure.
Injuries: One bruised knee.
Mitigation: Ban all non-locking Thor air fittings from the plant.
Reference: Lander Keaton injury, April 22, 1983.
6. Incident: Worker cut finger on rupture disk tag while opening a valve.
Date: July 6, 1991
Cause: Employee was not wearing gloves and all rupture disks tags have sharp edges.
Injuries: One cut finger
Mitigation: 1) Check all safety disks to see if they can be arranged more safely; and 2) Wear gloves while working in the field.
Reference: Accident investigation report #91-3.
7. Incident: Worker was loading empty catalyst cardboard boxes in a dumpster. Instead of folding the empty boxes before disposal, the worker was throwing several unfolded boxes in at a time. While doing so, a box knocked his glasses off. In an attempt to catch the glasses, a box flap hit him in the eye cutting the lens.
Date: March 2, 1991
Cause: The worker was in a hurry to beat the rain. In addition, he did not want his glasses to hit the ground.
Injuries: One eye
Mitigation: 1) Fold boxes before disposal; 2) Do not hurry doing a job; and 3) Inform employees and discuss accident.
Reference: Accident investigation report #91-2.
8. Incident: Worker pinched a nerve in his back while working on a pump from a squatting position.
Date: July 3, 1989
Cause: Excessive pulling and straining while trying to loosen some bolts.
Injuries: One, pinched nerve in worker's back.
Mitigation: 1) Pump couplings halves are to be sprayed with an anti-seize solution at all subsequent similar maintenance; and 2) if more than normal effort is required to do a job of this nature, the pump is to be pulled and taken to the shop.
Reference: Herbert Jackson back injury – July 21, 1989.

9. Incident: Reactor 700 evacuation valve failed to close resulting in a VCM release.
- Date: February 20, 1992
- Cause: This particular type of actuator and valve stem connection was not properly assembled. The type in question has a recessed valve stem and a transition piece between the valve stem and actuator.
- Injuries: None
- Mitigation: 1) Identify, check all valves of this type, eventually replacing them with valves without recessed stems and transition pieces during shutdowns and downtime; 2) Added an interlock to shut the reactor evacuation valve if more than 8 psig is seen on the reactor; and 3) Add pressure switches and interlocks on evacuation header to look for leaking valves.
- Reference: Investigation of reactor 700 evacuation valve malfunction. March 23, 1992.

INCIDENTS AT OTHER CONDEA VISTA PLANTS:

1. Incident: A 695 lb. release occurred when a threaded pipe spool sheared off an unloading compressor head in the tank farm.
- Date: May 20, 1996
- Cause: Fatigue induced by compressor vibration.
- Injuries: None
- Mitigation: Replace Sch. 80 piping with Sch. 160. Include pipe spools in inspection program.
- Reference: C-102 VCM release.
2. Incident: A reactor was not fully drained after a test and was overfilled during charge. The safety pressure interlock shut down the charge and prevented a release.
- Date: May 15, 1996
- Cause: Too many activities in progress at the same time. Panel Operator was distracted and did not answer the DCS question to rerinse or continue.
- Injuries: None
- Mitigation: Evaluate need for low level switch and permissive to ensure the reactor is liquid empty.
- Reference: D-306 charge.

3. Incident: Near miss accident when operator steamed a line and a valve containing organic peroxide. The organic peroxide rapidly decomposed and split the piping.
Date: January 21, 1996
Cause: A valve started to open but closed immediately due to low pressure on the HPSW line. A small amount of organic peroxide was trapped between two valves.
Injuries: None
Mitigation: Various, such as modifying DCS graphic to show low pressure on the HPSW.
Reference: F-364 organic peroxide piping.

4. Incident: Electrical fire in the new control room mechanical room.
Date: June 28, 1995
Cause: A ground fault occurred at a motor. The surge suppressors were the wrong types for this application.
Injuries: None
Mitigation: Remove surge suppressors; follow-up with manufacturer regarding inspection and testing; ensure that the Management of Change System addresses electrical components for future installations and modifications.
Reference: New control room mechanical room electrical fire.

5. Incident: 46 lbs. of VCM were released to the atmosphere when the antifoam injection line failed and pulled away from the slurry feed line.
Date: January 7, 1996
Cause: Failure of the weld connecting the antifoam line and the slurry feed line.
Injuries: None
Mitigation: Various procedural, design and maintenance actions (see original report).
Reference: W-622 VCM release.

6. Incident: A small flash fire occurred while welding on a stripper feed line at the stripper area.
Date: July 29, 1996
Cause: The piping contained VCM vapor residue, which collected and created a flammable vapor/air mixture.
Injuries: None.
Mitigation: Operations personnel to check jobs closer to the actual performance of hot work, permit writers to be aware of long runs of piping which may allow residual vapors to build up, include requirements for accessible flanges and bleeders for long runs of piping.
Reference: Stripper feed line flash fire.

APPENDIX E

**PROCESS SAFETY MANAGEMENT
GEORGIA GULF CORPORATION, ABERDEEN PLANT
OLD MODULE HAZOP**

Appendix E. List of Updates and Revalidations

1. Old Module Hazop updated March 2000.

APPENDIX F

CERTIFICATE OF EDUCATIONAL ACHIEVEMENT

This is to acknowledge that

Kelly D. Wood

Has completed the course entitled

HAZOP Study Team Training

October 27 & 28, 1993

Presented by

NUS TRAINING CORPORATION

[Signature]
Instructor

[Signature]
Manager



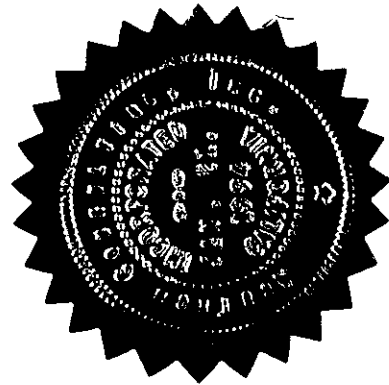


Kelly Wood

Having satisfactorily completed the prescribed course of study and having been recommended by the AcuTech Training Institute, is awarded this certificate in

Using PHA-Pro™ for PHA Studies

Conducted on
December 16, 1997
Lake Charles, Louisiana



In witness whereof, the faculty grants this certificate under the seal of the AcuTech Training Institute this 17th day of December, 1997.

A handwritten signature in cursive script, appearing to read 'Christian R. Youngerman'.

Christian R. Youngerman – Instructor
Engineering Western Consulting Group

APPENDIX G

CONDEA VISTA COMPANY CORPORATE SAFETY & HEALTH STANDARDS

Subject: Process Hazard Analysis
Issue Date: July 30, 1998
Approved By: Harry D. Garrison
Manager Safety, Health & Environment

1. SCOPE

This standard applies to all existing CONDEA Vista processes covered by the PSM regulation [Reference: CONDEA Vista Corporate Standard PSM-001]. It includes provisions that address some anticipated requirements of the EPA Risk Management Programs for Accidental Release Prevention [40 CFR Part 68].

The procedure does not include all potential requirements that may be included in State or EPA regulations. Nor does it include requirements for hazard reviews that may be required or implied by other paragraphs of the OSHA PSM Standard such as Management of Change or Pre-Startup Safety Reviews.

2. PURPOSE

This standard defines the minimum requirements for complying with the Process Hazard Analysis requirements, paragraph (e), of the OSHA Process Safety Management of Highly Hazardous Chemicals (PSM) regulation, 29 CFR 1910.119.

3. DEFINITIONS

- 3.1 Catastrophic Release or Incident - means a major uncontrolled emission, fire, or explosion, involving one or more highly hazardous chemicals (HHC), that presents a serious danger to employees in the workplace.
- 3.2 Covered Process - This is the group(s) of equipment and systems to which all PSM elements except for the Mechanical Integrity element (which is a subset of the Covered Process) apply. It is possible to have one or more covered process equipment groups.

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- 3.3 Process - refers to any activity involving a highly hazardous chemical (HHC) including any use, storage, manufacturing, handling, or the on-site movement of chemicals, or combination of these activities. For purposes of this definition, any group of vessels which are interconnected and separate vessels which are located such that a highly hazardous chemical could be involved in a potential release shall be considered a single process.
- 3.4 Process Hazards - for purposes of clarification for this standard only, the term "process hazards" means findings resulting from a Process Hazard Analysis that have safety (on-site or offsite), environmental, or community consequences having a scenario ranking requiring mitigation as determined by this standard.
- 3.5 Flammable Gas - means (a) a gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of thirteen (13) percent by volume or less; or (b) a gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than twelve (12) percent by volume, regardless of the lower limit. (29 CFR 1910.1200, Hazard Communication)
- 3.6 Flammable Liquid - means any liquid having a flashpoint below 100°F, except any mixture having components with flashpoints of 100°F or higher, the total of which makes up 99 percent or more of the total volume of the mixture. (29 CFR 1910.1200, Hazard Communication) Refer to 1910.1200 for definitions of flashpoint.
- 3.7 HAZOP - A Hazards and Operability (HAZOP) study is a systematic method to identify hazards and operability problems. A HAZOP study involves a systematic, methodical examination of design documents that describe a process. The study is performed by a multi-discipline team. Deviations from the design value of key parameters are studied using guide words to control the examination evaluation. This presumes that the design values of flows, temperatures, and other process variables are inherently safe and operable.
- 3.8 Highly Hazardous Chemical (HHC) - A Highly Hazardous Chemical (HHC) means a substance possessing toxic, reactive, flammable, or explosive properties and specified in Appendix A of the OSHA PSM Standard or a flammable liquid or gas on site in one location, in a quantity of 10,000

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pounds or more. See 1910.119 (a)(1)(A), (a)(1)(B) and (a)(2) of the OSHA PSM standard for exceptions.

3.9 PHA - Process Hazard Analysis (PHA) is a thorough, orderly, systematic approach for identifying, evaluating and controlling the hazards of processes involving highly hazardous chemicals.

3.10 Threshold Quantity (TQ) - Quantity at or above which the OSHA PSM Standard applies. The threshold quantities listed in Appendix A of the standard apply only to pure (or "commercial grade") chemicals unless otherwise specified.

4. PROCESS HAZARD ANALYSIS (PHA) METHODOLOGY

Each covered facility shall conduct Process Hazard Analyses (PHA's) on each of its existing covered processes. PHA methods used will depend on the nature and complexity of the process under consideration.

4.1 Each covered facility shall perform an initial process hazard analysis (hazard evaluation) on each of its existing covered processes as soon as possible but not later than the following schedule:

4.1.1 No less than 50 percent of the initial PHA's will be completed by May 26, 1995.

4.1.2 No less than 75 percent of the initial PHA's will be completed by May 26, 1996.

4.1.3 No less than 100 percent of the initial PHA's will be completed by May 26, 1997.

A PHA on a process or part of a process should not be delayed even if it is of a lower priority than one where records and documentation are still being generated.

4.2 The initial process hazards analyses will be conducted using the Hazard and Operability Study (HAZOP) methodology and reviews of human factors, facility siting and other hazards common or specific to the location.

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Except as limited by Section 9 (PHA Revalidation), subsequent process hazard analyses may utilize any of the hazard evaluation techniques accepted by OSHA.

- 4.3 Each facility shall determine and document the priority order for conducting the initial process hazard analyses based on a rationale which includes as a minimum such considerations as:
 - a. The extent of the process hazards,
 - b. The number of potentially affected employees,
 - c. The age of the process, and
 - d. The operating history of the process.
- 4.4 The documentation shall include a priority order listing of each covered process and a narrative explanation of the rationale for the priority order. A matrix similar to the one presented in Appendix A may be useful in documentation of the rationale.
- 4.5 If the facility contains large processes with different risk factors within the process, the large processes can be broken down into sub-processes for the priority determination.
- 4.6 In addition to the considerations listed above in Section 4.3, it may be appropriate for the facility to consider other items when setting the priority for completing PHA's. Some examples are:
 - a. Previous safety studies.
 - b. Potential for off-site impacts.
 - c. Volume of highly hazardous chemicals on site.
 - d. Operating conditions of process containing HHC's.

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4.7 Process Hazard Analysis Requirements

Except as provided in and 4.8 of this standard, all Process Hazard Analyses of existing covered processes in CONDEA Vista require:

4.7.1 Specifically including and addressing each of the following elements:

- a. The hazards of the process.
- b. Previous incidents which had a likely potential for catastrophic consequences in the workplace.
- c. Engineering and administrative controls applicable to the hazards and their interrelationships such as appropriate application of detection methodologies (acceptable examples include process monitoring and control instrumentation with alarms and hydrocarbon or inorganic vapor detection systems) to provide early warning of releases. Other controls include inventory reduction, substitution of less hazardous materials, protective systems (deluges, monitors, foams, etc.), increased separation distances, modification of process temperatures or pressures, redundancy in instrumentation, etc.
- d. Consequences of failure of engineering and administrative controls.
- e. Facility siting. An example includes taking into consideration safe distances for locating control rooms based on evaluations of the individual characteristics of equipment involved such as types of construction of the room, types and quantities of materials, types of reactions and processes, operating pressures and temperatures, presence of ignition sources, fire protection facilities, capabilities to respond to explosions, drainage facilities, location of fresh air intakes, etc. Other relevant siting factors such as equipment spacing, equipment spacing from potential ignition sources, and the potential of an incident spreading from one unit to another should also be considered.

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- f. Human factors (the interaction between the process and the employees on the scenarios being evaluated). Examples may include review of operator-process and operator-equipment interfaces, the number and frequency of tasks operators must perform, the evaluation of extended or unusual work schedules, the clarity and simplicity of control displays, operator feedback and communications, clarity of signs and codes, etc.
 - g. A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace.
- 4.7.2 The PHA must be conducted by a team of at least two individuals. The team members must have the following expertise:
- a. Engineering - An engineer must have a minimum of four (4) years of engineering experience.
 - b. Process Operations - The individual filling this requirement shall have at least four (4) years of plant experience.
 - c. Knowledge specific to the process being evaluated. It is recommended that the individual with this expertise be from the unit Operations group. The individual should have at least four (4) years of experience with the unit's operation.
 - d. The team leader must have formal classroom training in the PHA methodology being used. On-the-job training or participation in PHA's is not considered formal training.
 - e. The scope and type of process being studied will determine the make-up and number of the remainder of the team. Typically, representatives from the Mechanical Maintenance group will participate in evaluating processes involving mechanical equipment or piping and those from the Instrument Maintenance group will help evaluate processes involving instrumentation or electrical equipment. Safety Department representation is also typical. Members may be full-time or may participate only on a part-time, as-

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needed basis as determined by the full-time members of the team.

4.8 PHA's Conducted Prior to Issuance of the Final Corporate Standard

If PHA's completed after May 26, 1987 and prior to the issuance of this FINAL corporate standard do not meet the requirements of this standard, facilities must evaluate the PHA's and take appropriate actions to ensure the safety of the facility and compliance with the OSHA PSM standard. Such evaluations shall be conducted by a team satisfying the requirements of 4.7.2 of this standard. The results of the evaluation(s) shall be documented, addressed as required by Section 7 of this standard (if applicable), communicated as required by Section 8 and retained with the original PHA.

4.9 Process Hazard Analysis Pre-work Requirements

The following information must be available to the PHA team when they conduct the PHA:

- 4.9.1 The information requirements contained in 1910.199 (d) - Process Safety Information.
- 4.9.2 A chemical interaction matrix.
- 4.9.3 Documentation of any previous incidents that had a likely potential for catastrophic consequences in the work place being evaluated.
- 4.9.4 Documentation of relevant safety audits or studies in the facility's files that addressed the potential for catastrophic consequences in the work place.
- 4.9.5 Facility siting information. At a minimum, this will include calculations for occupied plant buildings using the Dow Fire and Explosion Index.
- 4.9.6 Shutdown, startup, and emergency operating procedures.
- 4.9.7 Plant Safety & Health Manual.

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4.10 Process Hazard Analysis Team Orientation

The orientation of the PHA team is a critical step in obtaining a good quality PHA. This is used to set the tone for the PHA and to meet some of the OSHA requirements that are not a direct result of some PHA methods. Attendance records must be kept.

All full-time (or core) team members must attend an orientation that includes the following elements:

- 4.10.1 A review of the purpose and scope of the PHA.
- 4.10.2 A review of why the PHA method chosen is appropriate for the PHA. Currently, only the HAZOP method is approved for CONDEA Vista's initial PHA's. Unlike most of the other methods, the HAZOP method was developed specifically for chemical plants and processes. In particular, it is an appropriate method for complex processes and when operating conditions are important.
- 4.10.3 A review of the PHA methodology that the team will use.
- 4.10.4 A review of all pre-work information. This is not intended to be an detailed review. The intent is to make the team members aware of the resources available to the team.
- 4.10.5 A review of the process description.
- 4.10.6 Process or Unit tour (if necessary to ensure all team members are physically oriented and familiarized with the process or unit being evaluated).
- 4.10.7 A review of the process chemistry description, chemical interaction matrix, and the hazards of the process. The review of the hazards of the process consists of identifying the process chemicals or streams and reviewing the chemical hazards, physical hazards, and corrosion potential for each. This review may result in recommendations to reduce the hazards of the process. These should be listed but no scenario ranking should be assigned.

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- 4.10.8 A review of previous incidents that had a likely potential for catastrophic consequences in the work place.
- 4.10.9 A review of human factors. If a separate human factors study has not been conducted, the human factors list in Appendix B will be used as a checklist of items that the team should discuss. This review may result in recommendations to reduce the risks associated with the operation of the process. These should be listed but no scenario ranking should be assigned.
- 4.10.10 A facility siting review. The primary intent is to determine if there are process hazards (as defined by this standard) associated with the facility location/layout that should be examined in detail. If a separate facility siting study has not been conducted, an evaluation of occupied plant buildings utilizing the Dow Fire and Explosion Index as required by 4.9.5 and the facility siting checklist contained in Appendix C will be used to conduct the facility siting study. This review may result in recommendations to reduce the risks associated with the operation of the process. These should be listed but no scenario ranking should be assigned.
- 4.10.11 A review of the site-specific hazards. This review may result in recommendations to reduce the risks associated with the operation of the process. These should be listed but no scenario ranking should be assigned. This review may also highlight specific areas of focus for the PHA.

5. HAZOP METHODOLOGY FOR PROCESS OR UNIT PHA's.

5.1 Scenario Ranking

The team will use the Consequence Rating Table, Likelihood of Occurrence Rating Table, and the Scenario Ranking Matrix included in Appendix D to rate each scenario. Each scenario can receive three (3) separate ratings - Safety (on-site), Economic, and Environmental/Community (including off-site safety). Each scenario must receive a safety and environmental/community rating.

The information in Appendix D can not be modified without the approval of the corporate Manager of Safety, Health and Environment.

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5.2 Team Responsibility

The team's responsibility is to define deviations from normal operating conditions that may represent an unacceptable risk level and to identify the problems. The team does not have the responsibility to engineer the solutions; however, it may recommend actions or solutions for consideration in remedying the hazard/risk identified for correction.

5.3 Process Parameters

Common process parameters are listed below. The team should review the list and select those appropriate for the process being evaluated. Other deviations may be added by the team if necessary.

Flow	Pressure	Temperature
Level	Time	Composition
Reaction	pH	Speed
Frequency	Viscosity	Voltage
Information	Mixing	Addition
Separation	Startup	Shutdown
Corrosion	Fouling	Atmospheric Temperature
Tube Leak	Tube Rupture	Leak
Utilities	Electricity	Steam
	Fuel Gas	Instrument Air
	Nitrogen	Cooling Water

5.4 Guide Words and Phrases

5.4.1 Common guide words and phrases for process design and operations are given below:

<u>Guide Word/Phrase</u>	<u>Meaning</u>
No	Negative of the design intent
Less or Lower	Quantitative decrease
More or Higher	Quantitative increase
Part Of	Qualitative decrease
As Well As	Qualitative Increase
Reverse	Logical opposite of intent

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Subject: Process Hazard Analysis

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Other Than or Sooner/Later Complete Substitution

- 5.4.2 Common guide words and phrases for procedures are given below:

Guide Word/Phrase

Meaning

Missing

A step is missing from the written procedure at, or just before, the step being examined.

Skip/Part of

The operator skips this step (or some part of it) and performs the rest of the procedure correctly.

More

The operator does too much of the specified action or does it too quickly.

Less

The operator does too little of the specified action or does it too slowly.

Out of Sequence / As well as

The operator performs the steps in a different order than specified by the procedure, possibly as a short cut.

Other Than/Reverse

The operator performs some action other than the one specified in the procedure, usually because of confusion or haste.

5.5 Study Nodes - P&I Diagrams

Each P&I Diagram is divided into study nodes. The study nodes should be as large as possible without the team having to apply the guide words to the parameters for parts of the study node.

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Most utility connections are handled as one part of the study node if the utility is selected as a process parameter. The exception is process-generated fuel gas which may involve multiple nodes.

These nodes are reviewed as part of the HAZOP.

5.6 Study Nodes - Operating Procedures

Emergency, startup (initial introduction of HHC into the unit), and shutdown operating procedures are divided into nodes which are normally defined as the group of sequential steps with one intent. These nodes are reviewed as part of the HAZOP.

Other operating procedures are covered as part of the P&I Diagram node. These operating procedures are reviewed when the team believes that it is appropriate.

5.7 Team Process

The team will use the following process:

- 5.7.1 The team selects a study node and reviews the design intent of the study node. If the design intent is not documented, the team can develop it.
- 5.7.2 The team applies the first guide word to the first process parameter to form a deviation. Guide words and process parameters that have no meaning (such as reverse temperature) are ignored.
- 5.7.3 The team defines the consequences associated with the deviation assuming that all equipment and procedural protection systems fail.
- 5.7.4 The team lists all possible causes of the deviation.
- 5.7.5 The team identifies all safeguards that prevent the deviation.
- 5.7.6 The team uses the tables found in the Appendix D to define the consequence rating, likelihood of occurrence rating, process hazards scenario ranking.

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- a. Economic scenario rankings can also be generated using the same process.
 - b. If information necessary to define scenario ranking is missing, then the scenario can not be ranked. The team will define an action step to obtain the missing information. If the information can not be found during the HAZOP, then the team will recommend an action step to obtain the information and for the scenario to be ranked at that time.
 - c. The team should not over-state or under-state the risk of the scenario. Making scenarios greater than reality as a method to get faster action or being conservative and playing it "safe" is unacceptable. Down playing the scenario because the solution may be perceived to be politically unacceptable is equally unacceptable.
 - d. To highlight the risk reduction afforded by existing safeguards and/or to evaluate the impact of any additional safeguards, teams may choose to first identify the scenario ranking without (or "before") considering the effects of safeguards and then arrive at a final (or "after") ranking considering all existing safeguards. If teams choose to do this, the final (or "after") ranking will be the ranking reported for mitigation as appropriate.
 - e. In each scenario where various combinations of consequences and probability are possible, only the consequence and corresponding probability yielding the maximum scenario ranking will be reported for mitigation.
- 5.7.7 If there are scenarios that result in catastrophic consequences even though some of the safeguards work properly, these scenarios should be risk ranked.
- 5.7.8 If the team has a recommendation to mitigate the risks, the team should recommend that the person or team responsible for mitigation evaluate that option. Since the team does not take the time to evaluate all options, the team should phrase

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recommendations as "consider" or "evaluate" rather than "do" or "install".

- 5.7.9 Repeat the process for each deviation until all deviations have been applied to the node. Then repeat the process for each node.

5.8 Scenarios with a Ranking of 1 or 2.

Any scenarios with a ranking of 1 or 2 shall be reported to the managers having engineering and operations responsibility for the process being evaluated as soon as possible but not greater than 24 hours of the determination.

6. PROCESS HAZARD ANALYSIS REPORT

The report shall contain sufficient detail such that a second PHA team can understand the findings and conclusions of the first team. At a minimum the report shall contain the following items:

- 6.1 A table of contents.
- 6.2 Start and end date of the PHA team work covered by the report.
- 6.3 Issue date.
- 6.4 The distribution of the report. Please note that either a paper copy or electronic copy must be available to employees affected by the findings and conclusions of the PHA.
- 6.5 The signatures of the team members and/or the team leader.
- 6.6 PHA methodology used. This shall include a rationale for the selection of the PHA method.
- 6.7 Description of the process evaluated.
- 6.8 The scope of the PHA. This will include a listing of the P&I Diagram(s) and operating procedures that were reviewed. The listing shall include the diagram or procedure number and issue date.

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- 6.9 A listing of the team members and their qualifications. The documentation shall specify those individuals meeting the expertise requirements of Section 4.7.3 of this standard.
- 6.10 Attendance records.
- 6.11 Team orientation. This documentation should identify the steps covered in the PHA orientation and copies of any completed checklists.
- 6.12 Listing of updates and revalidations to the PHA report.
- 6.13 Copies of the P&I Diagrams with the study nodes marked and identified.
- 6.14 Work sheets from the team meetings.
- 6.15 A listing or index of resources utilized that were not included in the process safety information such as a list of previous incidents considered, technical experts who may have been consulted, research and engineering reports, etc.
- 6.16 A listing of actions steps requiring further evaluation including identifying nodes which require further evaluation due to missing process safety information.
- 6.17 Separate listings of the team's process hazards (as defined by this standard) findings and recommendations. This should include any recommendations or findings resulting from the review of human factors, facility siting, previous incidents, or hazards of the process. If economic or operability findings or recommendations are made, then these should be listed separately from the process hazards findings.

7. SYSTEM FOR ADDRESSING PHA TEAM'S FINDINGS

Utilizing the clarifications provided in Appendix E, each covered facility shall develop written procedures for the facility's management to address the PHA Team's process hazards (as defined by this standard) findings and recommendations. These procedures shall include the following elements:

7.1 Mitigation Requirements

7.1.1 1 Ranked Scenarios

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A written schedule for responding to a scenario ranked 1 must be completed within five (5) working days of the managers having engineering and operations responsibility for the process being evaluated being made aware of the finding. If the unit is shut down at the time, the schedule must be completed prior to the unit resuming operations. The written schedule must include a plan for sufficient mitigation to drop the scenario ranking to at least a 3 level. The schedule shall include major milestones and responsibilities. This schedule will be updated monthly.

Within ten (10) working days of the managers having engineering and operations responsibility for the process being evaluated being made aware of a 1 ranked scenario, the ranking level must be reduced to a 2 level or that portion of the process must be shut down.

Items can not be deleted from the schedule until all appropriate paperwork has been placed in the PHA file. A copy of each schedule shall be placed in the PHA file.

7.1.2 2 Ranked Scenarios

A written schedule for scenarios ranked 2 must be completed within ten (10) working days of the managers having engineering and operations responsibility for the process being evaluated being made aware of the team's findings. The written schedule must include a plan for sufficient mitigation to drop the scenario ranking to at least a 3 level. The schedule shall include major milestones and responsibilities. This schedule will be updated monthly.

A 2 ranked scenario shall be mitigated sufficiently to obtain a 3 ranking within sixty (60) working days of the managers having engineering and operations responsibility for the process being evaluated being made aware of the item. Exceptions must be approved by the facility S.H.E. Manager and the managers having engineering and operations responsibility for the process being evaluated.

Items can not be deleted from the schedule until all appropriate paperwork has been placed in the PHA file. A copy of each schedule shall be placed in the PHA file.

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7.1.3 3 Ranked Scenarios

A written schedule for all 3 ranked scenarios must be completed within two (2) months of the issuance of the PHA report. Scenarios initially ranked 1 and 2 that have been mitigated to a 3 level should be incorporated into this schedule. The schedule shall include major milestones and responsibilities. This schedule shall be updated each quarter.

Scenarios ranked 3 should normally be mitigated to at least a 4 ranking within twelve (12) months unless significant engineering design work or a turnaround is required to make revisions.

Items can not be deleted from the schedule until all appropriate paperwork has been placed in the PHA file. A copy of each schedule shall be placed in the PHA file.

7.1.4 4 Ranked Scenarios

Within two (2) months of the issuance of the PHA report, all 4 ranked scenarios must be evaluated to determine whether mitigation is required, and a written schedule for all 4 ranked items requiring mitigation must be completed. Scenarios initially ranked 1 and 2 that have been mitigated to a 4 level should be incorporated into this schedule. The schedule shall include major milestones and responsibilities. This schedule shall be updated each quarter.

Mitigation action steps shall be completed within two years of issuance of the report. Extensions to the next scheduled shutdown are permissible if a shutdown is required to implement.

Items can not be deleted from the schedule until all appropriate paperwork has been put in the PHA file. A copy of each schedule shall be placed in the PHA file.

7.1.5 5 Ranked Scenarios

Scenarios ranked 5 do not require mitigation.

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7.2 Documentation of Resolution of Team Findings

The PHA file will include documentation of the resolution of each team's findings or recommendations. At minimum, there will be a typed page (or electronic equivalent) summarizing the corrective action taken in sufficient detail that the next PHA team can understand the corrective action that was taken and how the corrective action impacted the scenario ranking. This document can refer to other attached papers such as a Process Design. However, the design alone is not acceptable documentation.

7.3 Tracking System

Each facility must have a documented system to track the status of each team's findings.

8. PROCESS HAZARD ANALYSIS COMMUNICATIONS

8.1 Determination of Affected Employees

An affected employee is any operator, maintenance employee, contractor, or other employee whose:

8.1.1 Normal work assignment can significantly affect the likelihood of occurrence or consequences of the 1, 2, and 3 ranked scenarios;

or

8.1.2 Normal work assignment in occupied buildings takes them within a Dow Fire and Explosion Index radius for more than 2 hours per week.

Note: The immediate Supervisor of those individuals defined by items 8.1.1 and 8.1.2 above are also affected employees.

8.2 Pre-Process Hazard Analysis Communications

Prior to each process or unit PHA, affected employees and their representatives shall be provided notice of the scheduled PHA. The notice

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shall indicate the unit or process being analyzed, the team leader and other team members who will be conducting the PHA, the scheduled meeting place/dates/times, etc. The notice shall also solicit input from affected employees who have concerns or knowledge of issues that the team should consider in its analysis.

8.3 Post-Process Hazard Analysis Communications

- 8.3.1 Process or Unit PHA findings and mitigation plans shall be reviewed with affected employees within one month of the issuance of the PHA report. Meetings for this purpose are required if scenarios ranked 1 or 2 were identified; otherwise, written communications to affected employees are acceptable.
- 8.3.2 The affected employees shall have access to a copy of the PHA and the latest mitigation plan.
- 8.3.3 Documentation including lists of affected employees, date(s) of reviews, meeting attendance records, etc. shall be prepared and placed in the PHA file.
- 8.3.4 Updates on the status of the mitigation plans for scenarios with rankings of 1, 2 or 3 can be handled through meetings or written communications as deemed appropriate by the facility management. Updates on scenarios ranked 4 or 5 are not required.
- 8.3.5 Where written communications are used or PHA's are provided to employees, management shall take measures if necessary to make sure recipients understand the information being communicated.

9. PROCESS HAZARD ANALYSIS REVALIDATION

- 9.1. Initial PHA's performed prior to the issuance of this FINAL standard and not meeting the requirements of this standard shall be evaluated on an accelerated timetable and actions shall be taken to remedy deficiencies as prescribed in 4.8.

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- 9.2. At least every five (5) years after the completion of the initial process hazard analysis, the process hazard analysis shall be updated and revalidated by a team meeting the requirements of Section 4.7.2 to assure that the process hazard analysis is consistent with the current process.
- 9.3. PHA Revalidation Team Leaders shall have formal PHA Revalidation training.
- 9.4. Facilities shall conduct a PHA each time the initial (or subsequent) PHA is revalidated. Generally, the HAZOP methodology is recommended for the first PHA revalidation of a process to ensure a quality baseline PHA has been conducted. If facilities are satisfied with the quality of the initial PHA using the HAZOP methodology, the What If/Checklist methodology is recommended for the PHA revalidation. Any of the methodologies listed in 29 CFR 1910.119 (e) (2) may be used if deemed appropriate for the process or sub-process being evaluated,
- 9.5. In addition, PHA revalidations shall, as a minimum, include a review of :
 - 9.5.1. Prior determinations of PSM coverage and a re-evaluation of the current PSM coverage.
 - 9.5.2. Previous PHA recommendations and status of actions.
 - 9.5.3. MOCAs and PSI/Procedures to identify any changes since the last PHA.
 - 9.5.4. Any process safety incidents since the last PHA and the investigation recommendations and status of actions to be taken. (Other incidents and their findings known to have occurred at other CONDEA Vista Company locations or in the industry having relevance or applicability to the process being evaluated should also be considered.)
 - 9.5.5. Facility Siting and Human Factors changes since the last PHA.
 - 9.5.6. Applicability of EPA's Risk Management Program (RMP) regulations.
- 9.6. PHA Revalidation Report shall contain sufficient detail that a future PHA Revalidation Team can understand the findings and conclusions of the current team. At a minimum the PHA Revalidation Report shall contain

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updated information required for initial PHAs (see Section 6 of this standard). In addition, the following are recommended:

- 9.6.1. Discussion of differences in conclusions to identified hazards by the PHA Revalidation Team.
- 9.6.2. Documentation of the status of corrective actions to the recommendations/action items of the initial PHA.
- 9.6.3. Description of the changes in the process or to equipment since the initial PHA.
- 9.7. PHA Revalidation Team Findings shall be addressed and managed in accordance with Section 7 of this standard.
- 9.8. Communications before and after the Revalidation shall occur in accordance with Section 8 of this standard.

10. RECORDS RETENTION

Process Hazard Analyses (report and other documentation generated by the team) and updates or revalidations for each covered process and documentation of the resolution of process hazards identified by each shall be retained for the life of the process.

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Appendix A PHA ORDER ANALYSIS MATRIX

Each facility shall determine and document the priority order for conducting the initial process hazard analyses based on a rationale which includes as a minimum such considerations as:

- A - the extent of the process hazards,
- B - the number of potentially affected employees,
- C - the age of the process, and
- D - the operating history of the process.
- E - other as determined by facility

A matrix similar to the one presented below may be useful in documentation of the rationale. The documentation of this chart alone does not satisfy the narrative documentation required by Section 4.4 of this standard.

By force ranking the criteria above (and others the facility feel are appropriate) for each of the Processes (or Sub-Processes) for the Unit or Facility and comparing the composite scores, a PHA order may be established. Criteria are ranked from Highest Risk (1) to Lowest Risk (# of Processes being ranked).

E X A M P L E

Unit/Facility	Criteria	Rank	Total	Order	Comments/Remarks
Process A	A B C D E	1 2 2 1 2	8	1	
Process B	A B C D E	3 3 1 2 1	10	2	
Process C	A B C D E	2 1 3 3 3	12	3	

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Appendix B HUMAN FACTORS CHECKLIST

EQUIPMENT	+	-	OBSERVED PRACTICE
Labeling	equipment clearly labeled, uniform coding	mislabeled or not Labeled	
Access	immediately at hand	hard to reach or access	
Operability	power-assisted operation	difficult t to operate/change position	
Layout	well-planned, logical arrangement	confusing/inconsistent arrangement	
Uniqueness	only component of its kin in area	several components look similar	

CONTROLS	+	-	OBSERVED PRACTICE
Labeling	controls clearly labeled; uniform coding	mislabeled or not labeled	
Mode	fully automatic; well-tuned	manual operation; many manual steps	
Involvement	operator continually involved	operator detached from process	
Displays	clear, simple, representational	unclear, complex, non-representational	
	immediate, unambiguous	none or potentially misleading	

DEVIATIONS	+	-	OBSERVED PRACTICE
Alarms	first-out; safety-critical alarms	many simultaneous or false alarms	
Coverage	dual operator coverage at all times	operator not always present	
Time	no time pressure for response	inadequate time to respond	
Preparedness	periodic simulation exercises	no drills or simulation of scenarios	
Last-Resort	shutdown not discouraged; fast access	shutdown discouraged or unsafe	

TRANSIENT	+	-	OBSERVED PRACTICE
Procedures	complete, accurate, current, verified	incomplete/too general/out of date	
Identifying	ID, location of devices/actions given	ambiguous device/action identification	
Format	graphical identification aids	confusing/inconsistent; difficult to read	
Aids	checklist or supervisory check	task sequence done by memory	

"+" = FACTORS BEYOND STANDARD PRACTICE; MAY REDUCE HUMAN ERROR OR INADEQUATE RESPONSE LIKELIHOOD.
 "-" = FACTORS THAT MAY TEND TO INCREASE THE LIKELIHOOD OF HUMAN ERROR OR INADEQUATE RESPONSE

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Appendix B (continued) HUMAN FACTORS CHECKLIST

SCHEDULING	+	-	OBSERVED PRACTICE
Overtime		extreme enough to affect performance	
Consistency	permanent shift assignments	inconsistent shift rotations/schedules	
# of Tasks	tasks, work force, and skills matched	tasks required exceed time available	
Task Frequency	routine task	very infrequent; no expertise base	
Intensity	regular task at normal pace	differing tasks in rapid succession	

COMMUNICATE	+	-	OBSERVED PRACTICE
Shift Changes	status communicated verbally, plus turnover sheet used	inadequate communication of plant status between shifts	
Field/Control	constant communication with field	no communication with field operator	
Supervision	frequent supervisory communication	little or no supervisory checks	
Emergency	rapid, unambiguous plant alarm system	no distinction between area, type	

ENVIRONMENT	+	-	OBSERVED PRACTICE
Noise Level	office environment noise level	area where hearing protection required	
Climate	indoors, climate controlled	temperature/humidity/precipitation/wind extremes	
Visibility	visibility enhancement of some kind	often foggy or other visibility limitation	
Lighting		inadequate lighting for task	

"+" = FACTORS BEYOND STANDARD PRACTICE; MAY REDUCE HUMAN ERROR OR INADEQUATE RESPONSE LIKELIHOOD.

"-" = FACTORS THAT MAY TEND TO INCREASE THE LIKELIHOOD OF HUMAN ERROR OR INADEQUATE RESPONSE

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Appendix C (Pages 25 - 32) FACILITY SITING CHECKLISTS AND MITIGATION GUIDANCE

Instructions:

The team will review each item on the checklist. After evaluation, each item is marked to indicate that the item has been reviewed. Comments and findings are attached on a separate sheet. No scenario rankings are given to the findings.

REVIEWED YES NO		DISCUSSION TOPIC
		1. Location of on-site populations relative to the unit.
		2. Location of off-site populations relative to the unit. Location of environmentally sensitive areas.
		3. Location of critical and safety systems.
		4. Dominant Wind Direction.
		5. Climate and water extremes; earthquake; flooding; hurricanes; tornadoes; windstorms.
		6. Site topography
		7. External hazards and threats (fire, explosion, toxic release from nearby process or facilities; aircraft, subsidence, sabotage).
		8. On-site traffic flow patterns and clearances.
		9. Security and reliability of all critical feeds, utilities, and safety systems.
		10. Evacuation routes, emergency exits, safe rally spots.
		11. Passive mitigation systems such as dikes, berms, (control spills and fires) and blast walls (protect against explosions).
		12. Crane lifts over operating equipment and piping.
		13. Barricades between traffic and equipment and piping.
		14. Adequate lighting for normal operation, routine maintenance, power failure procedures, evacuation.
		15. Communication systems.
		16. House keeping - walkways, aisles, operating areas, evacuation routes.
		17. Location of railroads to process equipment (derailment, access).

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REVIEWED YES NO		DISCUSSION TOPIC
		18. Open ditches, sumps, low points (collect toxic and flammable vapors).
		19. Entry into confined spaces during emergencies- Trapped Gases, Hazards, Permit.
		Buildings
		20. Location of occupied building near process units. (Please note that the Dow Chemical Fire and Explosion Index will be used as a screening tool to determine if the building is located sufficiently remote from the process. If the building is not located sufficiently remote from the process, the team should suggest that a more detailed study be conducted.)
		Control Rooms
		21. Minimum occupancy; only essential functions during emergencies.
		22. Control Room Construction.
		23. Fresh air intake locations/isolation; Temporary safe havens; Access during an emergency.
		24. Control room location relative to unit, columns, and pipe bridges.
		25. Supply of breathing air in control room. Sufficient for emergency shutdown.
		26. Instrument labels up-to-date.
		Process Facilities
		27. Area electrical classification.
		28. Accessibility for mechanical integrity inspection and testing.
		29. Protection of piping and vessels from vehicles and forklifts.
		30. Protection of small bore lines, fittings, from external impact, personnel.
		31. Routing of process piping, critical controls cable trays, critical utilities.
		32. Vent, drain, and relief valve discharge locations.
		33. Remote shutoff valves for feed lines to the unit, accessible, functional in emergency.
		Loading, unloading, and storage facilities
		34. Incompatible materials segregated; storage, dikes, sumps, drains, and waste.

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REVIEWED YES NO		DISCUSSION TOPIC
		35. Siting, labeling of unloading spots for incompatible materials.
		36. Spacing consideration for flammable, combustible, and unstable liquid storage (note use the checklist - "Hazardous Analysis Review for Spacing Considerations for flammable, combustible, and Unstable Liquid Storage")
		39. Storage of flammable solids such as wood, paper, rags.
		Fire Protection
		40. Access for fire fighting and other emergency services - trains, vehicle parking, construction.
		41. Ignition sources, continuous, intermittent, uncontrolled, hot surfaces.
		42. Access to hydrants, monitors, and deluge valves.
		43. Grading drains flammables away from storage.
		44. Equipment spaced to minimize potential fire explosion damage.
		45. Coverage of fire monitors/sprinkler systems.
		46. Fire proofing of structures.
		Accident Mitigation
		47. Detection of leaks and ruptures.
		48. Emergency shutdown switch locations.
		49. Accessibility of isolation valves, size.
		50. Potential for fire/explosion in units affecting other equipment.
		51. Critical control, mitigation, communication after initial explosion or release.
		Personnel Protection
		52. Passageways, pedestrian traffic patterns vs. hazardous locations.
		53. SCBA/respirators locations; accessibility on all shifts.
		54. Sufficient escape routes from operating areas, shops, labs, offices.

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HAZARDOUS ANALYSIS REVIEW FOR SPACING APPLICATIONS FOR FLAMMABLE, COMBUSTIBLE AND UNSTABLE LIQUID STORAGE

Instructions: This checklist represents item #36 on the CONDEA Vista Company Facility Siting Checklist. The hazard review team will review each item and mark to indicate a review was completed. Comments and findings are shown in a separate report. No scenario rankings are given to these findings.

REVIEWED YES NO		DISCUSSION TOPIC
		1. Tanks accessible for fire fighting purposes.
		2. Minimum distance between tank and property line or building as defined in paragraph 2-3 of NFPA 30, attached.
		3. Outside base tank dike at ground level at least ten (10) feet from property line.
		4. Minimum distance between any two storage tanks one third (1/3) of adjacent tank diameters, but at least three (3) feet. If unstable, flammable, or combustible liquids are stored, distance shall be minimum of one half (1/2) the sum of the diameters.
		5. Inside base of tank dike at ground level at least five (5) feet from storage tank.
		6. Minimum distance between liquefied petroleum gas (LPG) container and storage tank twenty (20) feet. If storage tank operates above 2.5 psig, or is equipped with emergency venting that will permit pressures to exceed 2.5 psig, then Item 4. above applies.
		7. Storage tanks not permitted inside buildings.
		8. When a storage tank is located in an area subject to flooding, the following shall be observed.
		a. The provisions of Item 8. shall apply only if the maximum flood stage exceeds the elevation of the dike wall.
		b. Provisions to prevent tank, either full or empty, from floating during rise in water level to established maximum flood stage.
		c. Independent water supply facilities available for loading partially empty tanks with water. If filling with water is impractical or hazardous due to tank contents, tank shall be protected by other means against movement or collapse.
		d. Top of vertical tank extends above maximum flood stage by at least thirty.

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REVIEWED YES NO		DISCUSSION TOPIC
		(30) percent of its allowable storage capacity.
		e. In addition to Items a., b., c., and d. above, if tank is located such that seventy (70) to one hundred (100) percent of its allowable liquid storage capacity will be submerged at the established maximum flood stage, then the following also applies.
		i. Is tank raised, or height increased, until it extends above the level obtainable at maximum flood stage a distance equivalent to at least thirty (30) percent of its allowable liquid storage capacity. Submerged part of tank shall not exceed two and one-half (2 ½) times its diameter.
		ii. As an alternate to Item i. above, adequate noncombustible structural guides, designed to permit tank to float vertically without loss of product may be provided.
		f. Horizontal tanks located such that more than seventy (70) percent of storage capacity will be submerged at the established flood stage attached to foundation of concrete, or of steel and concrete, of sufficient weight to provide adequate load for the tank when filled with flammable or combustible liquid and submerged by flood waters to the established flood stage.
		g. For tanks in Item f. above, are tank vents or other openings that are not liquid tight extended above the level obtainable by flood waters at maximum flood stage water level.
		h. Spherical or spheroid tanks protected by applicable methods specified for either vertical or horizontal tanks as described above.
Definitions: <u>Combustible Liquid.</u> A liquid having a flash point at or above 100°F (37.8°C). <u>Flammable Liquid.</u> A liquid having a flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 psia at 100°F (37.8°C). <u>Unstable Liquid.</u> A liquid that, in the pure state or as commercially produced or transported, will vigorously polymerize, decompose, undergo condensation reaction, or become self-reactive under conditions of shock, pressure or temperature. Reference Materials: NFPA (National Fire Protective Association) 30, Flammable and Combustible Liquids Code OSHA 1910.106		

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List of Short-term Mitigation Steps for Consideration for Normally Occupied Buildings Inside the Dow F&EI Radius

This list is intended to serve as a guide for measures to be considered as short-term mitigation steps for facility siting issues identified. It is not an all inclusive list.

MITIGATION STEP	APPLICATION
1. Provide a system on the buildings' fresh air intake to detect and alarm when hydrocarbons, smoke, or toxic chemicals are present above acceptable levels.	Fire Explosion Toxic
2. Provide the means to quickly shutdown the building's ventilation system to prevent entry of contaminated air. Locate this control inside the building at a readily accessible location and clearly mark its function.	Fire Explosion Toxic
3. All sewers, except sanitary sewers, leaving a building shall be sealed by installing a break tank or equivalent in the sewer system. The break tank shall be located outside the building, and must be between the building and any other inlet into the sewer line. There shall be no additional inlets into the sewer between the building and the break tank. Additional inlets into the break tank or into the sewer after the break tank are acceptable. Venting of the break tank shall be routed away from the building to an appropriate place.	Fire Explosion
4. The exterior surface of the building, at risk including its roof, shall be constructed of fire resistant materials, or a fire suppression system shall be provided to protect these exterior surfaces.	Fire
5. All office equipment, supplies, and other materials located within the building which could fall over or become mobile should be removed, relocated, or secured. This applies to all areas except for designated store rooms. Samples, office, janitorial supplies, and other liquids should be evaluated for potential hazards from spills.	Explosion
6. Interior fixtures, such as ceiling lighting fixtures, wall mounted video monitors, other wall mounted equipment, etc., shall be attached to a building structural member.	Explosion
7. Exterior windows shall not be permitted unless required for safety or regulatory compliance. If required, windows shall meet these criteria: a. Strength equivalent or better than the building wall, and safe construction that fails in a manner that minimizes risk to building occupants. Examples are 3/8" minimum thickness polycarbonate, toughened glass, laminated glass with internal catch bars. b. Window area is minimized.	Explosion
8. Provide clearly marked utility (gas, electric, steam, etc.) shut-offs inside the	Fire

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MITIGATION STEP building.	APPLICATION Explosion
9. Occupant assignments should be reviewed to determine if individuals can be relocated to buildings that do not fall within the radius defined by the Dow Fire and Explosion Index, unless the building is blast resistant design (BRD). Develop a policy to minimize the use of conference areas in non-BRD buildings located within the radius of concern defined by the Dow Fire and Explosion Index. Non-BRD buildings within the radius of concern defined by the Dow Fire and Explosion Index shall not be used as shelter-in-place facilities for non-operating personnel when there is a potential for fire or explosion impacting such buildings.	Explosion
10. The building should be equipped with sufficient exits to allow personnel to exit in a direction away from potential fire and explosion sources. Doors shall open to the outside and be capable of resisting at a minimum the same external pressure as the building. The door frame shall support the door on all four sides. The door shall be weather stripped, and have a door closer of sufficient strength such that the door will remain closed and sealed against any positive pressure system that may be present in the building.	Fire Explosion
11. Other openings in a building shall be sealed to prevent flammable or toxic gases and smoke from entering the building. An opening is defined as penetration of the walls, roof, or floor by a system component. Any system component penetrating the wall, roof, or floor, shall be capable of resisting the same external pressure as the building until the system component is inside the building. Examples of system components that require openings include, but are not limited to, the following: 1) Pipes 2) Conduits 3) Cable trays	Explosion Toxic
12. Each building shall have an emergency response plan for fire, explosion, and toxic release situations. The normal occupants shall be trained in the plan. A brief summary of actions to take in the event of an emergency (evacuation, shelter-in-place, etc.) shall be posted in common areas, such as hallways, and conference or training rooms, so visitors can quickly see what they need to do in the event of an emergency.	Fire Explosion Toxic
13. Occupied temporary buildings will not be located within the radius calculated by the Dow Fire and Explosion Index.	Fire Explosion

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DEFINITION: Normally occupied building

- The primary function is to house people on a routine basis.
- Examples of normally occupied buildings include:
 1. Control rooms that are staffed during emergencies
 2. Offices
 3. Laboratories
 4. Maintenance shops
 5. Buildings designated as gathering points for emergencies
- Examples of buildings that are not normally occupied buildings include:
 1. Motor control centers
 2. Electrical substations
 3. Temporary operator shelters
 4. Compressor sheds, etc.

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Appendix D

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CORPORATE MANAGER SAFETY, HEALTH & ENVIRONMENT.**

If information necessary to define scenario ranking is missing,
the scenario can not be ranked.

The team should not over-state or under-state the likelihood of occurrence or consequence of the scenario.

Making scenarios greater than reality as a method to get faster action or being conservative and playing it "safe" is unacceptable.

Down playing the scenario because the solution may be perceived to be politically unacceptable is equally unacceptable.

Note: The Environmental and Community column of the Consequence Rating Table was changed on May 19, 1997. PHAs done after May 19, 1997 should use the table as revised. PHAs done prior to May 19, 1997 do not need to be re-rated until the PHA is revalidated.

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Appendix D (continued)

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CONSEQUENCE RATING

CONSEQUENCE LEVEL	EXPECTED RESULT OR IMPACT		
	SAFETY (ON-SITE)	ECONOMIC	ENVIRONMENTAL AND COMMUNITY (OFF-SITE SAFETY)
I MAJOR	- LOSS OF LIFE - PERMANENT TOTAL DISABILITY OR PARTIAL DISABILITY. - HOSPITALIZATION OF 5 OR MORE PEOPLE.	- EQUIPMENT DAMAGE IN EXCESS OF \$1,00,000 - RAW MATERIAL OR PRODUCT LOSSES IN EXCESS OF \$1,000,000	- HOSPITALIZATION OF ONE COMMUNITY MEMBER - DAMAGE TO AN ENVIRONMENTALLY SENSITIVE AREA - SIGNIFICANT PROPERTY DAMAGE. - COMMUNITY EVACUATION - SHELTER IN PLACE THE COMMUNITY AND/OR AN OFF-SITE INDUSTRIAL FACILITY.
II HIGH	MEDICAL TREATMENT FOR FIVE OR MORE PEOPLE. HOSPITALIZATION OF TWO OR MORE PEOPLE.	- EQUIPMENT DAMAGE IN EXCESS OF \$100,000. - RAW MATERIAL OR PRODUCT LOSSES IN EXCESS OF \$500,000	- MINOR DAMAGE TO OFF-SITE STRUCTURES. - INJURY TO ONE OR MORE COMMUNITY MEMBERS. - OFF-SITE ENVIRONMENTAL DAMAGE.
III MEDIUM	- MINOR INJURY OR HEALTH EFFECTS. - MEDICAL TREATMENT OF ONE PERSON. - MULTIPLE EXPOSURES ABOVE OSHA LIMITS.	- EQUIPMENT DAMAGE IN EXCESS OF \$10,000. - RAW MATERIAL OR PRODUCT LOSSES IN EXCESS OF \$100,000	REGULATORY REPORTABLE EVENT.
IV LOW TO NONE	- FIRST AID TREATMENT ONLY - SINGLE EXPOSURE ABOVE THE OSHA LIMITS - NO IMPACT	- EQUIPMENT DAMAGE LESS THAN 10,000. - RAW MATERIAL OR PRODUCT LOSSES LESS THAN \$100,00.	NO IMPACT

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LIKELIHOOD OF OCCURRENCE RATINGS

RATING	DESCRIPTION	LIKELIHOOD OF OCCURRENCE
A	FREQUENT	EXPECTED TO OCCUR ONE OR MORE TIMES WITHIN THE NEXT YEAR
B	PROBABLE	EXPECTED TO OCCUR ONCE WITHIN THE NEXT TEN (10) YEARS
C	POSSIBLE	EXPECTED TO OCCUR ONCE WITHIN THE NEXT 100 YEARS
D	REMOTE	EXPECTED TO OCCUR LESS FREQUENTLY THAN ONCE EVERY 100 YEARS OR IS PHYSICALLY IMPOSSIBLE

SCENARIO RANKING MATRIX

	A	B	C	D
I	1	2	3	4
II	2	2	3	4
III	3	3	4	5
IV	5	5	5	5

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RESPONSE/MITIGATION REQUIREMENTS FOR SAFETY & ENVIRONMENTAL RANKED ITEMS (See Section 7.1 of this Standard for expanded detail)

SCENARIO RANK	WRITTEN SCHEDULE	MITIGATION REQUIREMENT
1	COMPLETE WITHIN 5 DAYS OF NOTIFICATION OF THE MANAGERS HAVING ENGINEERING AND OPERATIONS RESPONSIBILITY FOR THE UNIT BEING EVALUATED (SEE NOTE BELOW)	MITIGATE TO SCENARIO RANK 2 OR LOWER WITHIN 10 DAYS OF NOTIFICATION OF THE MANAGERS HAVING ENGINEERING AND OPERATIONS RESPONSIBILITY FOR THE UNIT BEING EVALUATED (SEE NOTE BELOW) OR SHUT DOWN UNIT
2	COMPLETE WITHIN 10 DAYS NOTIFICATION OF THE MANAGERS HAVING ENGINEERING AND OPERATIONS RESPONSIBILITY FOR THE UNIT BEING EVALUATED (SEE NOTE BELOW)	MITIGATE TO SCENARIO RANK 3 OR LOWER WITHIN 60 DAYS OF NOTIFICATION OF THE MANAGERS HAVING ENGINEERING AND OPERATIONS RESPONSIBILITY FOR THE UNIT BEING EVALUATED (SEE NOTE BELOW)
3	COMPLETE WITHIN 2 MONTHS OF ISSUANCE OF PHA REPORT	MITIGATE TO RISK RANK 4 OR LOWER WITHIN 12 MONTHS OF ISSUANCE OF PHA REPORT
4	COMPLETE WITHIN 2 MONTHS OF ISSUANCE OF PHA REPORT	MITIGATE (IF REQUIRED) WITHIN 2 YEARS OF ISSUANCE OF PHA REPORT
5	NOT REQUIRED	NO MITIGATION REQUIRED

NOTE: SCENARIOS RANKED "1" OR "2" REQUIRE NOTIFICATION OF THE MANAGERS HAVING ENGINEERING AND OPERATIONS RESPONSIBILITY FOR THE UNIT BEING EVALUATED WITHIN 24 HOURS OF DETERMINATION.

IF MITIGATION REQUIRES MORE TIME THAN DEFINED ABOVE, A MOCA EXTENSION IS REQUIRED.

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Appendix E

OSHA GUIDELINES ON ADDRESSING PHA TEAM FINDINGS AND RECOMMENDATIONS

Paragraph (e) of the OSHA PSM standard requires that a team with expertise in engineering and process operations conduct a process hazard analysis, containing specific findings and recommendations for each covered process. The employer is then required to promptly "address" and resolve[] the team's findings, document the actions taken, and communicate these actions to the affected employees. 29 CFR 1910.119(e)(5).

OSHA considers an employer to have "resolved" the team's findings and recommendations when the employer either has adopted the recommendations, or has justifiably declined to do so. Where a recommendation is rejected, the employer must communicate this to the team, and expeditiously resolve any subsequent recommendations of the team.

An employer can justifiably decline to adopt a recommendation where the employer can document, in writing and based upon adequate evidence, that one or more of the following conditions is true:

1. The analysis upon which the recommendation is based contains material factual errors;
2. The recommendation is not necessary to protect the health and safety of the employer's own employees, or the employees of contractors;
3. An alternative measure would provide a sufficient level of protection; or
4. The recommendation is infeasible.

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DOCUMENT REVISION HISTORY

Revision Date	Comments
06/03/96	Original Document.
02/18/97	5.7.6.d. Clarified that teams may choose to rank scenarios "before" consideration of safeguards as well as "after" but that doing so is not mandatory.
05/19/97	
07/30/98	Expanded and clarified requirements for PHA revalidations (Section 9). Added Document Revision History page.