

VISTA CHEMICAL COMPANY

ABERDEEN, MISSISSIPPI

HAZARD AND OPERABILITY STUDY

FOR THE

NEW MODULE

January 25, 1995

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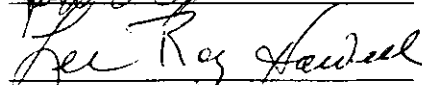
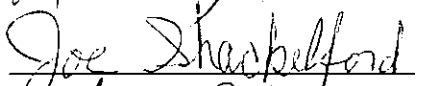





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1.0 Hazop Study Summary

As a result of the New Module Hazop study, 13 hazards were identified that had a risk ranking of 4. No hazards were identified having a risk ranking of 1, 2, or 3. The thirteen hazards requiring mitigation are listed in section 5.2. Documentation of all hazards identified is in Appendix D. In section 5.3, the team reviewed past incidents and near misses that were considered in the Old Module Hazop but had no additional recommendations based on the review. The team recommends a siting study for the New Module. Also recommended are four VCM release modeling scenarios listed in section 5.5. In section 6.1, the team lists six recommendations which came as a result of human factors considered. A listing of all team recommendations is in Appendix A.

2.0 Purpose

The New Module HAZOP was conducted for the following purposes:

- Provide Management and Operations personnel with the knowledge of where potential hazards exist in the New Module.
- 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 personnel.
- Make recommendations which the team feels should reduce the risks identified.

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

2.1 Rational For Selecting HAZOP As The Preferred PHA

HAZOP studies were chosen to fulfill OSHA's 29 CFR 1910.119 PHA requirement because of the size and complexity of the processes being studied, as well as the volume of acutely hazardous materials stored at the Aberdeen Plant.

3.0 Scope

Vista Chemical Company operates a nominal capacity 540 million pound per year PVC plant located in Aberdeen, MS. The plant polymerizes VCM in batch reactors to produce PVC. The New Module is the subject of this HAZOP study. The New Module HAZOP covers all equipment and piping shown on the New Module P&ID's. A P&ID list is given in section 7.3.

The hazard identification study focused on the following potential hazards:

- Personal injury/death resulting from:
 - Fire
 - Explosion
 - Toxic exposure
 - Chemical Contact
 - Thermal Burns
 - Asphyxiation
 - Impact injury
- Equipment/Property damage resulting from:
 - Fire
 - Explosion
 - Corrosion
 - Misoperation
 - Overpressure
 - Overheating
- Production loss resulting from:
 - Equipment Damage
 - Power failure
 - Maintenance
 - Turnarounds
 - Equipment failure
- Environmental excursions resulting from:
 - Spills
 - Vapor Releases
 - Emissions
 - Waste Water Excursions
- Human Factors
- Past Incidents
- Facility Siting

4.0 Risk Ranking Procedure

The risk of each hazard identified during the HAZOP analysis was quantified by the following risk ranking procedure:

Consequence Ranking

Consequence EXPECTED RESULTS OR IMPACT			
Level	Employee Safety	Equipment and/or Production	Community and/or Environment
I. Major	* Loss of Life * Severe Injury * Health Effects * Permanent, total, or partial disability. * Hospitalization of 2 more people.	Damage or Losses in excess of \$1MM	* Damage or Injuries, * Widespread evacuation. * Lasting effect on community.
II. High	* Moderate Injury or Health affect * Temporary Disability * Restricted Duty * Medical Treatment of 5 or more people * Hospitalization of 2 or more people	Damage or Losses of \$100M - \$1MM	* Minor damage or health effects on community. * Media coverage or large reportable release.
III. Medium	* Minor injury or health effects * First Aid, Minor Medical Treatment * Exposure above OSHA limits	* Damages or Losses of \$10M - \$100M * Significant operating problem or nuisance	* Irritant/ Nuisance * Small reportable release
IV. Low/None	No Impact	Less than \$10M	No Impact

Probability Rating

- A. Frequent - Expected to occur at least once per year.
- B. Probable - Expected to occur a number of times during the life of a facility. (Once every 2 years to once every 100 years).
- C. Possible - Expected to occur no more than once during the life of a facility, (once every 100 years to 10,000 years).
- D. Remote - Very unlikely to occur during the life of the facility or is physically impossible.

RISK RANKING MATRIX.

Probability					
c o n s e q u e n c e		A	B	C	D
	I	1	2	3	4/5
	II	2	3	4	5
	III	3	4	5	5
	IV	4/5	5	5	5

1. Extreme - Immediate mitigation of shutdown is required.
2. Excessive Risk - Mitigation planning should begin immediately. Corrective action should be completed within 3 months.
3. Undesirable - Corrective action to mitigate risk should be implemented within 12 months.
4. Marginal - Review existing safety controls and/or procedures to ensure their proper use and adequacy. Complete review and take necessary corrective action within 24 months.
5. Low Risk - No mitigation required.

- Notes:
- 1) For items I-D and IV - A, team should select the appropriate risk level depending upon the circumstances.
 - 2) The timing guidelines for mitigation apply only to existing facilities. Design HAZOP's items should be addressed prior to AFE.
 - 3) Mitigation can include a more detailed hazard review that results in lowering the risk ranking. It may also include temporary administrative or procedural revisions to lessen the risk until permanent physical change can be implemented.
 - 4) A risk ranking of 1 must be brought to the immediate attention of the appropriate plant management personnel, It should not be left until the final HAZOP report is issued.

5.0 Summary of Hazards and Recommendations

5.1 Preliminary Hazard Identification

During the initial stage of the HAZOP, the team prepared a preliminary list of potential hazards likely to be encountered during the study. This served to establish the team's mind-set in hazard identification and focus attention during the study.

The preliminary hazard identification yielded the following four hazards:

- * **Fire** - resulting from the ignition of a flammable material potentially causing physiological injury and or equipment damage.
- * **Explosion** - resulting from equipment overpressurization causing physiological injury due to missile fragment projectiles.
- * **Toxic exposure** - resulting from personnel exposure to an acutely hazardous material potentially causing physiological injury and or death. VCM was identified to a be potentially exposed material.
- * **Bumps/Falls** - resulting from misplaced equipment and/or tight operating spaces.

5.2 List of Hazards Identified From P&ID Review

The hazards appearing in this list are those that have a risk ranking of 4 or higher. These hazards require some sort of review or mitigation within the next two years. All hazards found in the study, including those with a risk ranking of 5, can be found in Appendix D.

No hazards were identified having a risk ranking of 1, 2, or 3. Thirteen hazards were identified having a risk ranking of 4.

New Module HAZOP		NM-95001
Critical Rank:	4 ,	Marginal Risk
	IV	= Medium Consequence
	A	= Frequent Occurrence
Deviation: Low Temperature		
Equipment Number: DM-131		
Equipment Description: Decal Tank		
Cause: 1) Process water valve left open 2) Charge water tank too cold 3) Decal tank not used for extended period 4) Charge water too cold		
Consequence: 1) Cold Reactor charge 2) Production loss 3) Hurts resin quality		
Suggested Mitigation: Install alarm or message on DCS to alert the lead operator that the decal tank is too cold to charge.		
Resolution:		
Comments:		

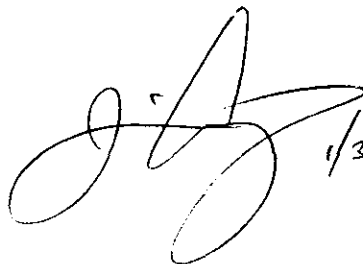
New Module HAZOP		NM-95002
Critical Rank:	4 ,	Marginal Risk
	II =	High Consequence
	C =	Possible Occurrence
Deviation: High Pressure		
Equipment Number: DM-741,742,743,744,& 745		
Equipment Description: NM PVC Reactors		
Cause:		
1. Loss of cooling water		
2. Loss of agitation		
3. Too much catalyst		
4. Reactor full - over charge		
5. Reactor vent failure		
6. Condenser dirty		
7. Power failure		
8. DCS failure		
9. Cooling water too warm		
10. Multiple kill systems failure		
11. Temp. indicator/controller failure		
Consequence:		
1. VCM release		
2. Personnel exposure/injury		
3. Fire/explosion - death		
4. Safety disk blows/Relief valve lift		
5. Early kill		
6. Reactor overpressure /damage		
7. Loss of production/reactor downtime		
8. Bad quality product		
Suggested Mitigation: Team recommends that existing procedures and safety controls are reviewed for adequacy and proper use.		
Resolution:		
Comments:		

New Module HAZOP		NM-95003
Critical Rank:	4 ,	Marginal Risk
	III	= Medium Consequence
	B	= Probable Occurrence
Deviation: Condenser Tube Leak		
Equipment Number: DM-741,742,743,744,& 745		
Equipment Description: NM PVC Reactors		
Cause:		
1. Corrosion/Erosion		
2. High Pressure		
3. Improper tube cleaning/drilling		
Consequence:		
1. VCM release into cooling water system		
2. Minor VCM overexposure to personnel		
Suggested Mitigation: Weekly sampling of cooling water for VCM		
Resolution:		
Comments:		

New Module HAZOP		NM-95004
Critical Rank:	4 ,	Marginal Risk
	III =	Medium Consequence
	B =	Probable Occurrence
Deviation: Agitator Failure		
Equipment Number: DM-741,742,743,744,& 745		
Equipment Description: NM PVC Reactors		
Cause:		
1. Power failure 2. DCS failure 3. Agitator shaft breaks (stress/fatigue failure) 4. Motor failure 5. Coupling failure 6. Gearbox failure 7. Misoperation 8. Circuit breaker tripped 9. Agitator seal failure		
Consequence:		
1. High reactor pressure 2. Production loss 3. Quality problems 4. Aborted batch (harder to kill) 5. Harder to dump and strip reactor		
Suggested Mitigation: Team recommends that a review be done on existing procedures and safety controls. The team also recommends that a review be done on existing preventative maintenance and inspection practices.		
Resolution:		
Comments:		

New Module HAZOP		NM-95004
Critical Rank:	4 , Marginal Risk III = Medium Consequence B = Probable Occurrence	
Deviation: Agitator Failure		
Equipment Number: DM-741,742,743,744,& 745		
Equipment Description: NM PVC Reactors		
Cause:		
1. Power failure 2. DCS failure 3. Agitator shaft breaks (stress/fatigue failure) 4. Motor failure 5. Coupling failure 6. Gearbox failure 7. Misoperation 8. Circuit breaker tripped 9. Agitator seal failure		
Consequence:		
1. High reactor pressure 2. Production loss 3. Quality problems 4. Aborted batch (harder to kill) 5. Harder to dump and strip reactor		
Suggested Mitigation: Team recommends that a review be done on existing procedures and safety controls. The team also recommends that a review be done on existing preventive maintenance and inspection practices.		
Resolution:		
Comments:		

1. Subs 121 & 102 have regularly scheduled PM's set up in VMS. All switchgear is IR checked annually.
2. PM's are coordinated thru ABG. Rep is onsite two days each month.
3. DRU disassembles shafts at least annually.
4. Regularly scheduled vibration analysis is performed on this equipment.
5. Same as 4.
6. Same as 4.
7. OPS responsibility.
8. OPS contacts us when this occurs.
9. Same as 8.

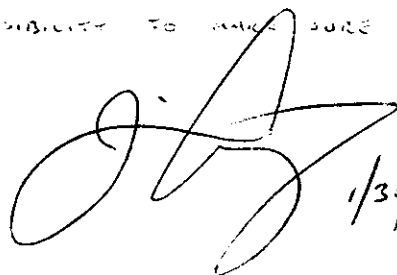


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New Module HAZOP		NM-95005
Critical Rank:	4, Marginal Risk III = Medium Consequence B = Probable Occurrence	
Deviation: Cooling Water No/Low Flow		
Equipment Number: DM-741, 742, 743, 744, & 745		
Equipment Description: NM PVC Reactors		
Cause:		
1. Manual valve closed 2. Cooling tower pump failure 3. Low cooling tower basin level 4. Control valve failure 5. Temperature controller failure 6. Plugged line 7. Cooling tower backpressure line control valve failure		
Consequence:		
1. High reactor pressure 2. High reactor temperature 3. Bad resin quality 4. Early reactor kill 5. Production loss		
Suggested Mitigation: Team recommends review of existing procedures, training, and safety controls.		
Resolution:		
Comments:		

New Module HAZOP		NM-95006
Critical Rank:	4 , Marginal Risk III = Medium Consequence B = Probable Occurrence	
Deviation: Reactor Vent No/Low Flow		
Equipment Number: DM-741,742,743,744, & 745		
Equipment Description: NM PVC Reactors		
Cause: 1. Plugged line 2. Valve failure 3. High pressure on recovery line - another reactor in recovery at higher pressure 4. Manual valve closed on inert vent line		
Consequence: 1. Can't vent/recover/evacuate reactor 2. Early kill 3. High reactor pressure and temperature 4. Production loss		
Suggested Mitigation: Review existing safety controls, operating & PM procedures, and training.		
Resolution:		
Comments:		

ONE OF THE MAIN RESPONSIBILITIES OF THE W/E SHIFTMAN FOR MAINTENANCE IS TO CLEAN EACH OF THESE VENTS. IT IS OPS RESPONSIBILITY TO CONTACT HIM WHEN EACH REACTOR IS READY AND THEIR RESPONSIBILITY TO MAKE SURE EACH ONE IS COMPLETED.


1/30/96

New Module HAZOP		NM-95007
Critical Rank:	4 , Marginal Risk III = Medium Consequence B = Probable Occurrence	
Deviation:	Reverse flow on Normal Kill and Catalysts Charge Lines	
Equipment Number:	DM-741,742,743,744,& 745	
Equipment Description:	NM PVC Reactors	
Cause:	1. Check valve failure with HPSW off and reactor valves open. 2. Charge Pot depressurized before catalyst valves closed. 3. Winterization circulation valve left open during catalyst charge/normal kill.	
Consequence:	1. VCM Release/Overexposure 2. Fire/Explosion	
Suggested Mitigation:	Review of existing recirculation line be conducted along with a review of existing safety controls, procedures, and training.	
Resolution:		
Comments:		

New Module HAZOP		NM-95008
Critical Rank:	4 ,	Marginal Risk
	IV	= Low/None Consequence
	A	= Frequent Occurrence
Deviation: Low Level		
Equipment Number: DM-760/761		
Equipment Description: Recovery Knock Out Drums		
Cause:		
1. Drain valve stuck open		
2. Low level switch failure		
Consequence:		
1. Resin carryover into recovery system		
2. Cavitate pumps		
3. Recovery system downtime - production loss		
4. High pressure in Blowdown Tank		
5. Bad resin quality (HP & contamination)		
Suggested Mitigation: Installation of a low level alarm on KO Drums		
Resolution:		
Comments:		

New Module HAZOP		NM-95009
Critical Rank:	4 , Marginal Risk III = Medium Consequence B = Probable Occurrence	
Deviation: High Pressure and High Temperature		
Equipment Number: EX-335		
Equipment Description: Water Recirculation Cooler		
Cause: 1. External Heat 2. Inlet and Outlet valves closed - thermal buildup in cooling water		
Consequence: 1. High Pressure on EX-335 shell side		
Suggested Mitigation: Install Pressure relief on shell side of EX-335		
Resolution:		
Comments:		

New Module HAZOP		NM-95010
Critical Rank:	4 , Marginal Risk IV = Low/None Consequence A = Frequent Occurrence	
Deviation: No/Low Flow and Low Pressure		
Equipment Number: VP-901/902, CP-903/904/905		
Equipment Description: NM Recovery Vacuum Pumps & Recovery Compressors Ring Seal Water		
Cause: 1. Seal Water Pump failure 2. Flow controller failure 3. Plugged/Blocked line 4. Valve closed 5. Filter Plugged 6. Flow Transmitter plugged		
Consequence: 1. Slow/No recovery 2. Production Loss		
Suggested Mitigation: Replace existing flow meters with orifice plates and flow transmitters.		
Resolution:		
Comments:		

COMPLETED AS PROJECT
 BY KELLY WOOD IN 12/95.
 WSC
 4/4/96

New Module HAZOP		NM-95010
Critical Rank:	4 ,	Marginal Risk
	IV	= Low/None Consequence
	A	= Frequent Occurrence
Deviation: No/Low Flow and Low Pressure		
Equipment Number: VP-901/902, CP-903/904/905		
Equipment Description: NM Recovery Vacuum Pumps & Recovery Compressors Ring Seal Water		
Cause:		
1. Seal Water Pump failure		
2. Flow controller failure		
3. Plugged/Blocked line		
4. Valve closed		
5. Filter Plugged		
6. Flow Transmitter plugged		
Consequence:		
1. Slow/No recovery		
2. Production Loss		
Suggested Mitigation: Replace existing flow meters with orifice plates and flow transmitters.		
Resolution:		
Comments:		

New Module HAZOP		NM-95011
Critical Rank:	4 ,	Marginal Risk
	III =	Medium Consequence
	B =	Probable Occurrence
Deviation: High Pressure and High Temperature		
Equipment Number: EX-334/36		
Equipment Description: Seal Water Coolers		
Cause:		
1. Blocked discharge or inlet		
2. External Heat		
Consequence:		
1. High Pressure in Seal Water Cooler shell		
2. Rupture Seal Water Cooler shell		
Suggested Mitigation: Thermal relief on both Seal Water Coolers shell side.		
Resolution:		
Comments:		

New Module HAZOP		NM-9501Z
Critical Rank:	4 ,	Marginal Risk
	IV	= Low/None Consequence
	A	= Frequent Occurrence
Deviation: Condenser Tube Leak		
Equipment Number: DM-317E & DM-317W		
Equipment Description: NM RVCM Receivers		
Cause:		
1. Corrosion		
Consequence:		
1. VCM in chilled water tank		
2. VCM release		
Suggested Mitigation: Periodic sampling of chilled water for VCM.		
Resolution:		
Comments:		

New Module HAZOP		NM-95013
Critical Rank:	4 , Marginal Risk III = Low/None Consequence B = Frequent Occurrence	
Deviation: No/Low Flow and Low Pressure		
Equipment Number: PP-877/878		
Equipment Description: HPSW to RVCM Transfer Pumps		
Cause:		
1. Valve closed 2. Line Plugged 3. No HPSW Pressure 4. Regulator failure		
Consequence:		
1. Damage Pump 2. Burn-up pump seal 3. VCM release		
Suggested Mitigation: None		
Resolution:		
Comments:		

*Current system is adequate. No
action required. Issue closed.*

WSC
4/4/96

New Module HAZOP		NM-95013
Critical Rank:	4 ,	Marginal Risk
	III	= Low/None Consequence
	B	= Frequent Occurrence
Deviation: No/Low Flow and Low Pressure		
Equipment Number: PP-877/878		
Equipment Description: HPSW to RVCM Transfer Pumps		
Cause:		
1. Valve closed		
2. Line Plugged		
3. No HPSW Pressure		
4. Regulator failure		
Consequence:		
1. Damage Pump		
2. Burn-up pump seal		
3. VCM release		
Suggested Mitigation: None		
Resolution:		
Comments:		

5.3 Past Incidents

All past incidents were reviewed. This included those that had the potential for catastrophic results and those that involved injuries. Information was obtained by researching all accident reports available and by meeting with vinyl operations personnel to recall accidents and near misses. The following list is the result of that study.

1. **Incident:** Worker got something in his eye while opening bottom reactor manway.

Time: February 6, 1987.

Cause: Insufficient eye protection.

Injuries: One, eye irritation.

Mitigation: Eye goggles must be worn while opening reactor bottom manways.

Reference: Herbert Jackson Eye Injury.
 March 23, 1987.

2. **Incident:** Near miss crane accident on 501 blend tank.

Time: 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

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Time: 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 RX-745.
- Time:** 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 RX-700 and RX-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.
- Time:** July 24, 1984.
- Cause:** Improper freezer upkeep, freezer location in direct sunlight, and freezer abuse.
- Injuries:** None
- Mitigation:** Freezers where put underneath open-side awnings to get the freezers out of direct sunlight. New freezer maintenance procedure.

5. **Incident:** An air hose connected to a jackhammer came loose, and as it whipped around uncontrollably, hit a bystander in the knee.
- Time:** 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 11, 1983.
April 22, 1983
6. **Incident:** Worker cut finger on rupture disk tag while opening a valve.
- Time:** July 6, 1991
- Cause:** Employee was not wearing gloves and all rupture disk 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 up before disposal, the worker was throwing several unfolded boxes in at a time. While doing so, a box knocked his glasses off. In his attempt to catch the glasses a box flap hit him in the eye cutting the lens.
- Time:** March 2, 1991
- Cause:** The worker was in a hurry to beat the rain. In addition, he didn't want his glasses to hit the ground.
- Injuries:** One, eye.
- Mitigation:** 1) Fold boxes before disposal, 2) don't 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.
- Time:** 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 coupling 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:** RX-700 evacuation valve failed to close resulting in a VCM release.
- Time:** 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 a reactor. 3) Add pressure switches and interlocks on evacuation header to look for leaking valves.
- Reference:** Investigation of RX-700 evacuation valve malfunction. March 23, 1992.

Recommendations Based on a Past Incidents Review

No recommendations were made after reviewing past incidents in the New Module.

5.4 Facility Siting

The Hazop team recommends that a separate siting study be performed on the New Module at the Aberdeen Plant.

5.5 EPA Release List

The Hazop team identified the following pieces of equipment as possible sites for significant VCM releases.

1. VCM Receiver: DM-745, DM-317E, and DM-317W.
2. Reactor: RX-741, RX-742, RX-743, RX-744, and RX-745.
3. Compressor: CP-903, CP-904, and CP-905.
4. Vacuum Pump: VP-901 and VP-902.

6.0 HUMAN FACTORS

Policy Issues

1. a. Is upper management's commitment to employee health and safety clear?

Yes. Plant management is involved in the development, implementation, and posting of safety and health policies. We have a representative on the Corporate Safety, Health and Environmental Council. We have a policy that addresses having adequate plant safety professionals.

- b. What policy statements communicate this commitment to employees?

Policies related to safety and health are compiled in the Plant Safety and Health Manual. Policies are also posted on bulletin boards and the company has a Corporate Safety and Health Policy.

- c. Do workers understand these policies and are they convinced of upper management's sincerity?

Yes, people are aware of these policies and manuals. Recently, new policies have come out and have been well publicized. As examples, new jewelry and Fire Retardant Clothing policies are aimed at improving plant safety.

2. a. Do supervisors and workers believe that safety has higher status with other business objectives in the organization?

Yes, safety is mentioned first when setting goals.

- b. How does the company promote a "safety first" approach?

All new hires and new contractors go through orientation and safety training. The Vista Aberdeen Safety Tours (VAST) program is a new way to measure safety practices. Safety is the first item on department and supervisor goals. The plant holds monthly employee safety meetings. Employees are involved in incident investigations.

- c. Have supervisors and workers been specifically told to err on the safe side whenever they perceive a conflict between safety and production?

Always.

3. a. Will such decisions be supported throughout the management chain?

Yes.

- b. Is management of worker health and safety an essential part of a manager's daily activities?

Yes.

4. a. How are managers held accountable for their health and safety record, and how do the rewards and penalties compare to those for production performance?

Safety is part of supervisor and department goals. Employees receive written recognition for safe performances as well as production performances.

- b. Is health and safety regularly discussed in management meetings at all levels?

Yes, Plant safety is discussed in weekly staff meetings, central safety meetings, group safety meetings, and at the corporate management levels.

5. a. Do such discussions involve more than a review of injury statistics?

Yes. These meetings discuss the causes, prevention techniques, and include specific incident reviews.

- b. What actions are taken if an injury occurs?

This is covered in our incident investigation policy.

- c. Are near misses discussed, and is any action taken to prevent recurrence?

Our incident investigation policy includes near misses.

6. a. Have human factors engineering policies been established by upper management?

No, we do not have a human factors policy, but human factors are considered during the different levels of project reviews.

- b. How are human factors engineering standards monitored to ensure implementation throughout the organization?

Our engineering standards are based on industry standards which were developed with human factors in mind. Examples of this include equipment locations, types of equipment in different services, personal protective insulation, and platform standards.

- c. Do these standards apply to vendors and subcontractors?

These standards apply all the way through projects. Standards are included in contracts. We use a contractor qualification checklist. We review contractors OSHA 200 Log and their Experience Modification Rate record for the past three years. Contractors must submit their written safety and health program for approval by the plant.

- d. How is noncompliance identified and resolved?

Same answer as 10.a.

- e. Who has the authority to remedy human factors engineering deficiencies?

Normal employee and supervisory authority limits and responsibility limits apply.

7. a. In the areas of research, design, construction, procurement, operations, maintenance, management, and so forth, are there clearly defined procedures for evaluating the human factors engineering aspects of:
- New and modified processes?
 - New and modified equipment?
 - New and modified procedures?
 - Special, abnormal, and one-of-a-kind procedures?

Aspects of human factors engineering are considered during the process design review meeting, the mechanical design review meeting, the MOCA approval process, the PHA, and the PSSR. Many of these processes have clearly designed procedures.

8. a. Are human factors engineering resources available in the organization, and are they readily available to help resolve design standards for human factors engineering?

Vista's General Engineering Dept. develops and reviews standards. They are also available for questions and consultation.

- b. Do they periodically review the adequacy of the standards in conjunction with other groups (engineering, operations, maintenance, etc.)?

Standards are updated on an as-needed basis.

9. a. Are adequate time and resources allocated to human factors engineering?

Human factors engineering is part of the engineering review process. It is also covered when considering job task analysis and incident investigations.

- b. How is human factors engineering integrated with the design process and the procedure-writing process?

It is covered in all stages of the review process and is part of the process hazard analysis. It is also covered in PreStart-up Safety Reviews (PSSRs). Experienced employees from operations and maintenance departments review designs and procedures for human factor issues.

- c. Is human factors engineering different for new designs procedures and modified designs procedures?

No, there are no distinctions.

- d. If so, are the differences justified?

N/A

10. a. Do workers help identify error-likely situations in existing designs/procedures? Are they also involved in the review of new designs/procedures?

Yes. We have several methods for identifying and evaluating health and safety concerns. The management of change policy and PSSR policy require a safety analysis of work orders and new projects. The VAST program and Employee Safety Action Request (ESAR) program are systems for encouraging employees to identify unsafe conditions in the work place. The plant is doing Hazop studies for existing units.

Employees from different disciplines are involved in the different design review stages.

Several employee meetings were held to explain and ask for employee input on the VAST program. Employee input was also used in developing the plant jewelry policy. Employees are involved in the Joint Safety Committee.

- b. How is worker input used?

Worker involvement is an important part of each of the above mentioned systems.

- c. Are worker suggestions implemented?

Yes.

11. a. Are workers encouraged to discuss potential human errors and near misses with their supervisors?

Yes.

- b. Are such worker disclosures treated as evidence of worker incompetence, as unwarranted criticism of management, or as valuable lessons to be shared and acted upon?

As valuable lessons to be shared and acted upon. We have a good history of acting on worker safety suggestions.

- c. What criteria and procedures exist for reporting and investigating accidents and near misses?

Our incident investigation policy is addressed in the Safety and Health Manual. This program is monitored by the Central Safety Committee, which also evaluates follow-up and effectiveness of the corrective actions.

All incident investigations are reviewed and approved by the plant manager.

ESARs also help report unsafe conditions or behavior.

- d. Are they followed consistently?

Yes.

- e. Do the investigations go into enough depth to identify the root causes of worker errors?

The goal of the investigations is to find the root causes.

- f. How are the human factors engineering deficiencies identified during the investigation of an incident corrected at (1) the site of the original incident, (2) similar sites at the same facility, and (3) similar sites at other facilities?

The incident investigation team makes recommendations for the plant that the incident occurs in. When appropriate these reports are shared internally and with other company sites.

12. a. Are supervisors trained and encouraged to identify error likely situations, unsafe behaviors, and personal problems that may adversely affect a worker's performance?

Yes. This is covered in supervisor training and is a critical part of all our supervisor's job.

- b. What actions are taken if a problem is identified?

Depending on the problem the proper policy is followed.

13. a. Are data on human errors collected and made available to managers?

We have several systems for analyzing safety and health data. We monitor trends and identify areas for improvement. Safety data and trends are reviewed at Central Safety Committee meetings.

The VAST program specifically collects human factors kind of data. Our policy encourages collecting data on the number and kind of safe behaviors observed.

- b. Have the data been used as the basis for any management decisions?

Data collected from incident investigations have often been used as the basis for management decisions. Examples include: the plant's truck unloading policy and its jewelry policy.

- c. Are the data collected routinely or are they only collected after an accident.

VAST data is collected weekly and summarized monthly. Injury data is regularly reviewed by type and area.

14. a. How are the problems associated with excessive or inadequate work loads handled?

The plant uses contract workers and employee overtime to balance work load requirements.

- b. How is worker performance monitored and measured?

Supervisors are trained in monitoring worker performance. There is also an employee appraisal system, which includes appropriate personnel counseling. The VAST program helps determine how well employees are practicing safe behaviors.

- c. Is there adequate supervision of the workers?

Yes.

- d. What is the supervisor's role in detecting and correcting human errors?

One of the supervisor's primary responsibilities is the personal safety of his/her group and the correcting of unsafe conditions and behaviors in his/her area(s).

Job and Task Issues

1. a. Have critical jobs and tasks been identified?

Yes. The team feels that all critical jobs and tasks are addressed in the operating procedures.

- b. Have the mental and physical aspects of such jobs been analyzed for both routine and emergency activities?

Yes, those aspects were considered while writing operating procedures.

- c. What has been done to reduce the likelihood and/or consequences of potential human errors in the performance of these jobs?

Installation and/or use of:

- 1) Distributed Control System interlocks.**
- 2) Alarms for process deviations.**
- 3) Fire protection.**
- 4) Breathing Apparatuses.**
- 5) Air Monitors.**

2. a. Have jobs and tasks been designed to maintain worker interest and involvement?

No. Jobs and tasks were designed to operate equipment efficiently, safely, and consistently. The team recommends no action in this area.

- b. Are assignments rotated to even out workloads and increase worker experience?

Yes. The "A" operator's position is rotated.

- c. How have activities with safety implications been emphasized?

By safety meetings, special training, warning signs around equipment, and emphasis on critical steps in written procedures.

3. a. Are tasks requiring either intense activity or uneventful monitoring minimized?

Yes. Automation is implemented wherever possible.

- b. How are the problems associated with excessive or inadequate work loads handled?

Contract labor or re-assignment.

- c. Is support from other personnel available when needed?

No, not at all times. The team has no recommendations on this issue.

Human-Machine Interface Issues

1. a. Has the human-machine interface ever undergone a human factors engineering review?

Yes. This was part of the VCSM project review.

- b. Is the whole workplace arranged so the workers can maintain a good working posture and perform a variety of movements?

No. There are several highly congested areas. The team has no recommendations for this issue.

2. a. Is adequate information about normal and upset process conditions displayed in the control room?

Yes.

- b. Is the information displayed in ways the workers understand?

Yes, for a properly trained worker.

- c. Do separate displays present information in a consistent manner?

Yes.

- d. What kinds of calculations must workers perform, and how are they checked?

No calculations are required.

3. a. Are workers provided with enough information to diagnose an upset when an alarm sounds?

Yes.

- b. Are the displays adequately visible from all relevant working positions?

Yes.

- c. Does the display provide adequate feedback on worker actions?

Yes.

4. a. Do control panel layouts reflect the functional aspects of the process or equipment?

Yes.

- b. Are related displays and controls grouped together?

Yes.

- c. Does the control arrangement logically follow the normal sequence of operation?

Yes.

- d. What are the consequences of worker intervention in computer-controlled processes?

Intervention could cause severe consequences, but in these cases operators cannot gain access to control systems. They are locked out by computer pass-word access and control systems interlocks. The team recommends no action on this issue.

5. a. Are all controls accessible and easy to distinguish?

Yes.

- b. Are the controls easy to use?

Yes.

- c. Do any controls violate strong populational stereotypes (color, direction of movement, etc.)?

No.

- d. Are any process variables difficult to control with the existing equipment?

There have been no problems with control using existing equipment.

- e. How many manual adjustments must a worker perform during normal and emergency operations?

The team feels that although there are several adjustments to be made, they can be made safely and efficiently in all cases. The team recommends no action on this issue.

6. a. Is there a formal mechanism for correcting human engineering deficiencies identified by the workers?

PSSR's, VAST's, and ESAR's.

- b. Have workers made any modifications to the displays, controls, or equipment to better suit their needs?

Yes.

- c. How are designers made aware of the problems so they can improve future designs?

Design reviews, PSSR's.

7. a. Are automatic safety features provided when either a rapid response or complex information processing is required to cope with a process upset?

Yes. Deluge can be automatically tripped or manually tripped by a single switch. There is also DCS and field interlocks.

8. a. Are instruments, displays, and controls promptly repaired after a malfunction?

Yes, by work orders. Promptness depends upon priority.

- b. Are any instruments, displays, or controls deliberately disabled during any phase of operation?

Yes. These cases have been reviewed as safe and are part of normal operating procedures. The team recommends no action on this issue.

- c. How are alarm setpoints and computer software protected from unauthorized changes?

Password protection and non-authorized persons are restricted from areas where changes of the such can be made.

9. a. Is the work environment (temperature, noise, lighting, general cleanliness, etc.) maintained within comfortable bounds?

There are several areas of poor lighting. The team recommends a lighting survey be conducted on the New Module.

10. a. Are the right tools available and used when needed?

No. There are some "home-made" tools that are used. The team recommends that home-made tools be replaced whenever possible with purchased tools designed for that particular need. "Home-made" tools should be used only when purchased tools are not available and only with prior approval from the employee's supervisor.

- b. Are special tools required to perform any tasks safely or efficiently?

Yes.

- c. What steps are taken to identify and provide special tools?

Operator feedback to supervision. However, there is no formal procedure. When a special tool can be justified it is supplied.

11. a. Is there adequate access for routine operation and maintenance of all equipment?

No, there are some highly congested areas. The team has no recommendations for this issue.

12. a. If protective clothing and equipment is required for the performance of some tasks, have the worker performance limitations imposed by the protective gear been evaluated for both routine and emergency tasks?

Yes.

- b. Are adequate supplies of the protective gear readily available for routine and emergency use?

Yes.

13. a. Is all important equipment (vessels, pipes, valves, instruments, controls, etc.) clearly and unambiguously labeled?

No. More and better labeling would be helpful. The team recommends a program be initiated to address labeling needs and to assign responsibility for keeping labels updated. The team recommends a color coding system for hazardous materials piping and equipment (i.e. VCM, Propane, Natural Gas).

- b. Does your labeling program include components (e.g., small valves) that are mentioned in the procedures even if they are not assigned an equipment number?

No. See above recommendation.

- c. Are the labels accurate?

Yes, existing labels are accurate.

d. Who is responsible for maintaining and updating the labels?

No one. See recommendation for question 13a.

14. a. Were the needs for communication and teamwork considered the workplace design?

Yes.

- b. How do different shifts communicate the process status (batch conditions, process abnormalities, equipment out of service, active work permits, etc.) to each other?

Verbal and logbook, as required by written procedures.

- c. What is the procedure for communication between departments?

Meetings and memos.

- d. Is it followed?

Yes.

15. a. Are there clear procedures during emergencies for communications between workers and emergency response personnel, plant management, corporate management, and public authorities?

Yes, procedure is in the Plant Safety and Health Manual for each operating department.

- b. Are they regularly practiced?

Yes, regular emergency drills are conducted under the auspices of the Emergency Drill Planning Team made up of representatives from each plant department.

16. a. Are workers encouraged to ask supervisors for assistance?

Yes, if they are in doubt or have a question.

- b. Do workers know when to seek assistance?

Yes.

- c. Are workers penalized for "unnecessary" shutdowns when they truly believe there is an emergency?

No.

17. a. Is there adequate supervision of the workers?

Yes, a supervisor is always available.

- b. How do supervisors interact with the workers?

Verbally and/or in writing.

- c. What is the supervisor's role in detecting and correcting human errors?

It is the supervisor's job to make sure each employee is fully capable and knowledgeable of a job task before he is allowed to perform it.

18. a. Are shift rotation schedules set to minimize the disruption of workers' circadian rhythms?

No, However a 6-day long break is given every two weeks to compensate for the disruption. The team recommends no action on this issue.

- b. How are problems with worker fatigue resolved?

Limits on how long a person can work (except emergencies) are established. "Long break" schedule.

- c. Is there a plan for rotating workers during extended emergencies?

No. There is no written plan. Extra coverage would come from off-shift personnel. The team recommends no action on this issue.

Procedural Issues

1. a. Is a complete, current set of procedures available for workers to use?

Yes.

- b. How are specific, up-to-date procedures maintained?

Management Of Change Authorization (MOCA).

- c. Do the workers themselves help review/revise the procedures?

Yes, procedures are written by operators and reviewed by engineering and management.

- d. How often?

As needed.

- e. Are known errors allowed to remain uncorrected?

No.

2. a. Are procedures written for the right level of knowledge and understanding by the workers, considering their education, background, experience, native language, etc?

Yes, procedures are written for simplicity.

- b. Is a step-by-step format used?

Yes, in almost all instances.

- c. Are diagrams, photographs, drawings, etc. used to clarify the written text?

Yes, Piping and Instrumentation Diagrams.

- d. Are cautions and warnings clearly stated in prominent locations?

Yes. Warnings are on all VCM containing equipment.

- e. Does procedure nomenclature match equipment labels?

Yes.

- f. Are there too many abbreviations and references to other procedures?

No.

3. a. Do worker practices always comply with written procedures?

Yes.

- b. How are differences detected and resolved?

Operator discussions, training sessions, and visual observation.

- c. Who can authorize changes and deviations from the written procedures?

Department heads, but only with a completed MOCA.

- d. Does such authorization include a review of the safety implications of the change or deviation?

Yes.

- e. Do cautions always precede action steps in the procedures?

Yes, when appropriate.

4. a. Are work permit systems correctly used?

Yes.

- b. How are contractors included in such systems?

Identical to employee work permits.

5. a. Are the emergency procedures clearly written?

Yes, they are written in the same format as normal procedures.

- b. Are they practiced regularly?

Yes. They are planned by the Emergency Drill Planning Team.

- c. How many "immediate" actions are required?

The team feels that although there are several actions to be made, they can be made safely and efficiently in all cases. The team recommends no action on this issue.

- d. Are the procedures designed so workers can cross-check each other's performance of the necessary tasks?

Yes, when necessary.

6. a. Are checklists used for critical procedures?

Yes, included with written procedures.

- b. Is only one action specified per numbered step?

Typically yes.

- c. Are any instructions embedded in explanatory notes?

No, but explanatory notes are included in procedures.

- d. Are the steps in the correct sequence?

Yes.

- e. Do steps requiring control actions also specify the correct system response?

Yes, when appropriate.

6.1 Human Factors Recommendations

1. Support personnel are not available at all times. The team has no recommendations for this issue.
2. There are several highly congested areas in the New Module. The team has no recommendations for this issue.
3. There are several areas of poor lighting. The team recommends a lighting survey be conducted on the New Module.
4. There are some "home-made" tools that are used for maintenance in the New Module. The team recommends that these tools be identified and replaced with purchased tools designed for that particular need whenever possible. "Home-made" tools should only be used whenever purchased tools are not available and only with prior approval by the employee's supervisor.
5. The team recommends a program be initiated to address labeling needs. The program also assign responsibility for keeping labels updated. The team also recommends a color coding system for hazardous materials piping and equipment.

7.0 Methodology

7.1 Introduction

A hazard and operability (HAZOP) study is a simple, yet structured methodology for hazard identification. A HAZOP study involves a systematic examination of design documents that describe a process. The study is performed by a team consisting of persons from various parts of the plant to identify potential hazards or operability problems that could result in an accident. Deviations from the design value of key parameters are studied using guide words to control the direction of the evaluation. This presumes that the design values of flow, temperature, pressure, and other process variables are inherently safe and operable. The study team consists of trained personnel, and has the necessary technical expertise to answer most questions raised during the review without outside assistance.

To begin, we will define the following terms:

Hazard: Anything (chemical reaction, equipment malfunction, or operator error) that can lead an unwanted event.

Operability: Anything that causes the operator to improvise in his actions.

These definitions are an important part of the basic HAZOP premise that if there are no deviations from the expected, by definition there are no hazard or operability problems.

The agenda followed to complete the HAZOP analysis is as follows:

- * **HAZOP methodology:** A presentation is made by the team leader of the methodology to be used in the study.
- * **Process review:** Team leader discusses the design with the team, answers any questions the team may have about the design, and in short to ensure the team understands the process being reviewed.

- * **Identify Hazards:** A preliminary identification by team members of hazards present within the process. This serves to focus the HAZOP study.
- * **Goal of the HAZOP:** This serves to direct the HAZOP study.
- * **Establish criticality and frequency ratings:** Review risk matrix, and how to determine consequence and frequency ratings.
- * **Line by Line Analysis of process nodes.** This considers process hazards from human error, maintenance, failure of engineering and administrative controls, and emergency response systems.
- * **HAZOP Report:** Teams findings as a result of the study.
- * **Human Error Analysis:** Analysis of potential sources of human errors that could cause those items listed in the Hazop's scope.
- * **Facility Siting:** Recommend a facility siting study.
- * **Past Incidents:** Review of past incidents and near misses the process has experienced as well as past incidents of similar processes in industry.
- * **Release Scenarios:** Determine what pieces of equipment should be modeled for a major VCM release.

7.2 Team members

HAZOP team meetings were held at the Vista Aberdeen Plant on Mondays beginning October 24, 1994 and ending January 23, 1995. Meetings were typically 6 to 7 hours long. The HAZOP study team included members with different areas of expertise, in order to have the broadest possible view of potential hazards. The team members conducting the HAZOP study on the New Module are as follows:

Jerald Uptain	Safety Engineer
Terry Barnes	Vinyl Lead Operator
Joe Shackelford	Instrument Technician
Lee Roy Howell	Maintenance-Mechanic
Danny Flipppo	Vinyl Chief Lead Operator
Allen Bodron	Process Engineer

Jerald Uptain, Safety Engineer - Jerald has been with Vista for 24 years and the nearly last 20 as Safety Engineer.

Terry Barnes, Vinyl Lead Operator - Terry has been with Vista for 9 years and the last 8 as a vinyl operator. Vinyl Lead Operators are primarily responsible for running the DCS.

Joe Shackelford, Instrument Technician - Joe has been with Vista for 26 years and the last 22 as an instrument technician. Instrument technicians are responsible for the maintenance of all process instrumentation and control systems.

Lee Roy Howell, Mechanic - Lee Roy has been with Vista for almost 27 years. He has been in maintenance for the last 10 years. Mechanics are responsible for the maintenance of all mechanical equipment in the plant.

Danny Flipppo, Vinyl Lead Operator - Danny has been with Vista for 14 years with 10 of those years as a vinyl operator.

Allen Bodron, Process Engineer and Team Leader - Allen has been with Vista for 2 years as a process engineer. Process engineers are primarily responsible for process designs of capital projects. Allen has had formal Hazop team leader training and previous Hazop experience (Appendix A).

7.3 Documents Referenced

Prior to the start of the HAZOP, the necessary reference material was assembled and made available for reference during the HAZOP study. A meaningful HAZOP study cannot be conducted without the required documentation to review. Assembly of the documentation optimizes the chance for a successful HAZOP. The documents used in this study were:

- * **New Module P&ID's:** # NM-090100-PID-D through
NM-090129-PID-D
- * **New Module Equipment Spec. Sheets** - Located in the equipment files in the maintenance conference room.
- * **Safety Systems Design Basis:** including relief valve settings and sizing basis, deluge system, fire water system, VCM detecting fixed point monitors and general monitors, and system shutdown. Located in the equipment files in the maintenance conference room.
- * **MSDS** for acutely hazardous material (VCM) - Located in the Safety Dept.
- * **Electrical Classification Drawing:** # GP-003000-EL-D
- * **New Module operating procedures** - Located in the vinyl control room. Procedures also contain: 1) Process Chemistry. 2) Maximum Inventories of raw materials. 3) Safe upper and lower control limits. 4) Consequences of deviation from control limits.
- * **Vista engineering standards** based on industrial codes.
- * **List of DCS control system safety interlocks.**
- * **Plot Plan Diagram.**
- * **Process Description.**
- * **Written description of process control interlocks.**

APPENDIX A. SUMMARY OF ALL TEAM RECOMMENDATIONSRecommendations based on P&ID review

1. Install low temperature alarm or message on decal tank (DM-131). Risk ranking: 4.
2. Review existing safety procedures and controls for Reactor high pressure. Risk ranking: 4.
3. Install high level probe or level indication on reactors. Risk ranking: 5.
4. Perform weekly sampling of cooling tower water for VCM. Risk ranking: 4.
5. Review existing operating procedures, safety controls, preventative maintenance practices, and inspection practices on reactor agitators. Risk ranking: 4.
6. Review existing procedures, training, and safety controls on reactor cooling water supply/return. Risk ranking: 4.
7. Review existing procedures, training, safety controls, and preventative maintenance practices on reactor vent lines. Risk ranking: 4.
8. Review winterization recirculation line on Normal Kill and Catalyst charge lines. Also review existing safety controls, procedures, and training. Risk ranking: 4.
9. Install low level alarm on K.O. Drums (DM-760/761). Risk ranking: 4.
10. Install pressure relief on shell side of water recirculation cooler (EX-335). Risk ranking: 4.
11. Replace ring seal water flow meters to recovery compressors and vacuum pumps with orifice plates and flow transmitters. Risk ranking: 4.
12. Install thermal relief valves on shell side of water coolers (EX-334/336). Risk ranking: 4.

13. Perform periodic VCM sampling of chilled water to RVCM receivers. Risk ranking: 4.
14. Review HPSW system to RVCM pumps. Risk ranking: 4.

Recommendations Based on a Past Incidents Review

No recommendations were made after reviewing past incidents in the New Module.

Facility Siting Recommendations

The Hazop team recommends that a separate siting study be performed on the New Module Facility at the Aberdeen Plant.

EPA Release List

The Hazop team identified the following pieces of equipment as possible sites for significant VCM releases.

1. VCM Receiver: DM-011, DM-012, and DM-013.
2. Reactor: RX-300, RX-400, RX-500, RX-600, and RX-700.
3. Compressor: CP-503 and CP-504.
4. Vacuum Pump: VP-107 and VP-108.

Human Factors Recommendations

1. Support personnel are not available at all times. The team has no recommendations for this issue.
2. There are several highly congested areas in the New Module. The team has no recommendations for this issue.
3. There are several areas of poor lighting. The team recommends a lighting survey be conducted on the New Module.
4. There are some "home-made" tools that are used for maintenance in the New Module. The team recommends that these tools be identified and replaced with purchased tools designed for that particular need whenever possible. "Home-made" tools should only be used whenever purchased tools are not available and only with prior approval by the employee's supervisor.
5. The team recommends a program be initiated to address labeling needs. The program also assign responsibility for keeping labels updated. The team also recommends a color coding system for hazardous materials piping and equipment.

APPENDIX B

TEAM LEADER TRAINING DOCUMENTATION

CERTIFICATE OF EDUCATIONAL ACHIEVEMENT

This is to acknowledge that

Allen Bodron

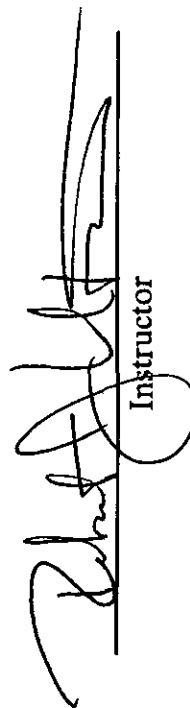
Has completed the course entitled

HAZOP Study Team Training

October 27 & 28, 1993

Presented by

NUS TRAINING CORPORATION


Instructor


Manager



APPENDIX C

EMPLOYEE PARTICIPATION DOCUMENTATION

To: New Module Hazop Team Members

From: J. A. Bodron
Date: October 13, 1994

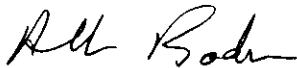
VISTA

**Interoffice
Communication**

Subject: **Meeting Notice**

The New Module Hazop Team will hold a kickoff meeting on Monday, October 17th at 8 a.m. in the Vinyl Conference Room.

The team will discuss the HAZOP procedure and the methodology used.



Allen Bodron
Team Leader

cc: Team Members, RAC, MLC, JEN, RHS

To: All Employees

From: Allen Bodron
Date: October 18, 1994

Interoffice
Communication

Subject: OSHA Employee Participation - New Module HAZOP

VISTA

As part of OSHA's PSM regulations, Vista will perform a Hazard Operability Study on all its existing processes. The regulation emphasizes employee participation. To comply with the regulation a team representing operations, maintenance, safety, and engineering has been formed to complete the HAZOP. The team began analysis of the New Module this week. Team members include:

1. Danny Flippo
2. Terry Barnes
3. Lee Roy Howell
4. Joe Shackelford
5. Jerald Uptain
6. Michael Harvey
7. Allen Bodron

To promote employee participation and to perform the best HAZOP analysis possible, the team is asking your assistance. If you have any comments or suggestions regarding the team's assignment please contact me or anyone on the team.

Thanks,



Allen Bodron
Team Leader

Posting Date 10-19-94
Removal Date 11-02-94

To: Distribution

From: J. A. Bodron

Date: January 12, 1995

VISTA

**Interoffice
Communication**

Subject: **Hazop Team Meeting Notice**

The New Module/SA Module Hazop team will resume meeting on Monday, January 23 at 8:00 in the conference room over the lab. The team will continue to meet every Monday until mid-March.

It is necessary that the same team members meet on the 23rd to complete the NM Hazop, but they can be replaced after that for the SA Module.

Please inform me of who will be on the team from your area by Jan. 22.



J. A. Bodron
Hazop Team Leader

cc: RAC, JBA, CMM, JEN, RHS

APPENDIX D

HAZOP ANALYSIS DATA FORMS

Node 01

Aberdeen New Module HAZOP		
Equipment/Line Description: DM-745 FVCM Receiver Drawing No. NM-090100-PID-D		
Deviation: High Level		
Cause: 1. PUMPING FROM TANKFARM 2. LEVEL XMITTER FAILURE 3. BLEEDOVER FROM RVCM RECEIVERS		
Consequences: 1. VCM RELEASE 2. OVERPRESSURE RECEIVER 3. BLOW RUPTURE DISK/LIFT RELIEF VALVE 4. VCM EXPOSURE TO PERSONNEL 5. FIRE/EXPLOSION/MINOR BURNS		
Safeguards: 1. HIGH LEVEL PROBE/SHUTOFF 2. HIGH LEVEL ALARM 3. VCM ISOLATION VALVES & DCS TARGET 4. LEVEL DISPLAYED ON DCS 5. SIGHT GLASSES ON RECEIVER 6. DCS INTERLOCKS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 01

Aberdeen New Module HAZOP		
Equipment/Line Description: DM-745 FVCM Receiver Drawing No. NM-090100-PID-D		
Deviation: High Pressure		
Cause: 1. HIGH LEVEL 2. EXTERNAL HEAT 3. HIGH LEVEL IN RVCM RECEIVERS 4. INERTS FROM RVCM RECEIVERS		
Consequences: 1. ALL FROM HIGH LEVEL 2. SHUT VCM TRANSFER PUMP OFF		
Safeguards: 1. RV/RD 2. PRESSURE XMITTERS/FIELD MOUNTED PRESSURE GAUGES 3. DCS INTERLOCKS/ALARMS 4. ALL FROM HIGH LEVEL		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 01

Aberdeen New Module HAZOP		
Equipment/Line Description: DM-745 FVCM Receiver Drawing No. NM-090100-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. FIRE MONITORS/DELUGE SYSTEM 2. SAME AS HIGH PRESSURE		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 01

Aberdeen New Module HAZOP		
Equipment/Line Description: DM-745 FVCM Receiver Drawing No. NM-090100-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: N/A		
Safeguards: N/A		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 01

Aberdeen New Module HAZOP		
Equipment/Line Description: DM-745 FVCM Receiver Drawing No. NM-090100-PID-D		
Deviation: No/Low Flow		
Cause: 1. PLUGGED BLOCKED LINE 2. EMPTY RECEIVER 3. VALVE MALFUNCTION		
Consequences: 1. HIGH PRESSURE 2. LOST PRODUCTION		
Safeguards: 1. SAME AS HIGH PRESSURE 2. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 02

Aberdeen New Module HAZOP		
Equipment/Line Description: FVCM Line from Sphere Drawing No. NM-090100-PID-D		
Deviation: No/Low Flow		
Cause: 1. TRANSFER PUMP FAILURE 2. PLUGGED / BLOCKED LINE 3. SPHERE EMPTY 4. RUPTURED LINE 5. INTERLOCKS		
Consequences: 1. PRODUCTION LOSS		
Safeguards: 1. 2 TRANSFER PUMPS 2. LEVEL INDICATOR ON SPHERE AND RECEIVER		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 02

Aberdeen New Module HAZOP		
Equipment/Line Description: FVCM Line from Sphere Drawing No. NM-090100-PID-D		
Deviation: Reverse Flow		
Cause: 1. RUPTURED LINE 2. OPEN BLEEDER 3. HIGHER PRESSURE IN RECEIVER		
Consequences: 1. VCM RELEASE 2. PRODUCTION LOSS		
Safeguards: 1. VCM ISOLATION VALVES 2. INTERLOCKS 3. OPERATING PROCEDURES 4. GC'S 5. CHECK VALVE		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 02

Aberdeen New Module HAZOP		
Equipment/Line Description: FVCM Line from Sphere Drawing No. NM-090100-PID-D		
Deviation: High Pressure		
Cause: 1. HIGH TEMPERATURE 2. NO FLOW 3. HIGH PRESSURE IN RECEIVER		
Consequences: 1. LINE RUPTURE 2. VCM RELEASE		
Safeguards: 1. OPERATING PROCEDURES 2. INTERLOCKS 3. SAME AS HIGH PRESSURE/HIGH TEMPERATURE		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 02

Aberdeen New Module HAZOP		
Equipment/Line Description: FVCM Line from Sphere Drawing No. NM-090100-PID-D		
Deviation: Low Pressure		
Cause: 1. PUMP FAILURE 2. LINE RUPTURE DUE TO OTHER MEANS 3. NO FLOW		
Consequences: 1. PRODUCTION LOSS		
Safeguards: 1. OPERATING PROCEDURES 2. INTERLOCKS 3. 2 TRANSFER PUMPS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 02

Aberdeen New Module HAZOP		
Equipment/Line Description: FVCM Line from Sphere Drawing No. NM-090100-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. FIRE PROTECTION SYSTEM		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 02

Aberdeen New Module HAZOP		
Equipment/Line Description: FVCM Line from Sphere Drawing No. NM-090100-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: N/A		
Safeguards: N/A		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 03

Aberdeen New Module HAZOP		
Equipment/Line Description: FVCM Charge Line Drawing Nos. NM-090100-PID-D, NM-090103-PID-D, NM-090104, PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D.		
Deviation: No/Low Flow		
Cause: 1. PLUGGED/BLOCKED LINE INCLUDING FILTER 2. VALVE MALFUNCTION 3. PUMP FAILURE 4. RUPTURED LINE OR BLEEDER OPEN 5. LOW LEVEL IN RECEIVER 6. HIGH REACTOR PRESSURE		
Consequences: 1. PRODUCTION LOSS		
Safeguards: 1. DUAL FLOW INDICATORS 2. OPERATING PROCEDURES 3. INTERLOCKS 4. DP GAUGE ON FILTER PACKS 5. SPARE CHARGE PUMP 6. SPARE FILTER PACK		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations: Note: RX-745 VCM Charge Line enters reactor, not charge/dump manifold.		

Node 03

Aberdeen New Module HAZOP		
Equipment/Line Description: FVCM Charge Line Drawing Nos. NM-090100-PID-D, NM-090103-PID-D, NM-090104, PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D.		
Deviation: High Pressure		
Cause: 1. DEAD HEAD PUMP 2. EXTERNAL HEAT		
Consequences: 1. RUPTURED LINE 2. VCM RELEASE 3. FIRE 4. VCM EXPOSURE 5. PRODUCTION LOSS		
Safeguards: 1. INTERLOCKS 2. VCM ISOLATION VALVES 3. FIRE PROTECTION SYSTEM 4. OPERATING PROCEDURES 5. LOCAL PRESSURE GAUGE ON FILTER PACKS 6. RD/RV ON FILTER PACKS AND LINES		
Consequence Rating: II	Probability Rating: D	Risk Ranking: 5
Action/Other Considerations:		

Node 03

Aberdeen New Module HAZOP		
Equipment/Line Description: FVCM Charge Line Drawing Nos. NM-090100-PID-D, NM-090103-PID-D, NM-090104, PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D.		
Deviation: Low Pressure		
Cause: 1. PUMP FAILURE 2. RUPTURED LINE/BLEEDER OPEN 3. VALVE CLOSED ON SUCTION OF PUMP 4. BLOCKED/PLUGGED LINE 5. EMPTY RECEIVER		
Consequences: 1. PRODUCTION LOSS 2. NO/LOW VCM CHARGE FLOW 3. CAN'T CHARGE		
Safeguards: 1. FLOW INDICATION 2. DCS INTERLOCKS 3. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 03

Aberdeen New Module HAZOP		
Equipment/Line Description: FVCM Charge Line		
Drawing Nos. NM-090100-PID-D, NM-090103-PID-D, NM-090104, PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D.		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. FIRE PROTECTION SYSTEMS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 03

Aberdeen New Module HAZOP		
Equipment/Line Description: FVCM Charge Line		
Drawing Nos. NM-090100-PID-D, NM-090103-PID-D, NM-090104, PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D.		
Deviation: Low Temperature		
Cause:		
1. WEATHER		
Consequences:		
1. RUPTURED LINE FROM WATER IN LINE FROM RVCM RECEIVERS		
Safeguards:		
1. TEMP INDICATION ON LINE		
2. DRAIN WATER FROM RVCM RECEIVERS		
3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 04

Aberdeen New Module HAZOP		
Equipment/Line Description: Recovery Lines to Blowdown Tank Drawing No. NM-090100-PID-D		
Deviation: No/Low Flow		
Cause: 1. PLUGGED/BLOCKED LINE 2. VALVE CLOSED		
Consequences: 1. CAN'T RELIEVE EQUIPMENT 2. CAN'T RECOVER EQUIPMENT FOR MAINTENANCE		
Safeguards: 1. NONE 2. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 04

Aberdeen New Module HAZOP		
Equipment/Line Description: Recovery Lines to Blowdown Tank Drawing No. NM-090100-PID-D		
Deviation: Reverse Flow		
Cause: 1. HIGH PRESSURE ON RECEIVER AND 82X709 VALVE IS OPEN		
Consequences: 1. N/A		
Safeguards: 1. OPERATING PROCEDURES 2. INTERLOCKS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 04

Aberdeen New Module HAZOP		
Equipment/Line Description: Recovery Lines to Blowdown Tank Drawing No. NM-090100-PID-D		
Deviation: High Pressure		
Cause: 1. RELIEF VALVE LIFT 2. EXTERNAL HEAT 3. HIGH PRESSURE ON PUMP 4. HIGH PRESSURE IN RECOVERY SYSTEM		
Consequences: 1. VCM RELEASE 2. LINE RUPTURE		
Safeguards: 1. OPERATING PROCEDURES 2. FIRE PROTECTION SYSTEM 3. INTERLOCKS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 04

Aberdeen New Module HAZOP		
Equipment/Line Description: Recovery Lines to Blowdown Tank Drawing No. NM-090100-PID-D		
Deviation: Low Pressure		
Cause: N/A		
Consequences: N/A		
Safeguards: N/A		
Consequence Rating: N/A	Probability Rating: N/A	Risk Ranking: N/A
Action/Other Considerations:		

Node 04

Aberdeen New Module HAZOP		
Equipment/Line Description: Recovery Lines to Blowdown Tank Drawing No. NM-090100-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. SAME AS HIGH PRESSURE 2. FIRE PROTECTION SYSTEM		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 04

Aberdeen New Module HAZOP		
Equipment/Line Description: Recovery Lines to Blowdown Tank Drawing No. NM-090100-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: NONE		
Safeguards: NONE		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 05

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to FVCM Pumps Drawing No. NM-090100-PID-D		
Deviation: No/Low Flow		
Cause: 1. BLOCKED/PLUGGED FLOW 2. PRESSURE REGULATOR FAILURE 3. HPSW PUMP FAILURE		
Consequences: 1. SEAL FAILURE ON VCM CHARGE PUMPS 2. VCM RELEASE 3. PRODUCTION LOSS 4. DAMAGE VCM CHARGE PUMP		
Safeguards: 1. FLOW METER IN FIELD 2. OPERATOR CHECK OF FLOW METER ONCE PER DAY 3. HPSW PUMP DISCHARGE LOW PRESSURE ALARM ON DCS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 05

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to FVCM Pumps Drawing No. NM-090100-PID-D		
Deviation: High Pressure		
Cause: 1. NONE		
Consequences: N/A		
Safeguards: N/A		
Consequence Rating:	Probability Rating:	Risk Ranking: N/A
Action/Other Considerations:		

Node 05

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to FVCM Pumps Drawing No. NM-090100-PID-D		
Deviation: Low Pressure		
Cause: 1. NO/LOW FLOW		
Consequences: 1. SAME AS NO/LOW FLOW		
Safeguards: 1. SAME AS NO/LOW FLOW 2. PRESSURE GAUGES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 05

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to FVCM Pumps Drawing No. NM-090100-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. RUPTURE LINE -- NO/LOW FLOW RESULTING		
Safeguards: 1. INSULATED LINE		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 05

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to FVCM Pumps Drawing No. NM-090100-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. NO/LOW FLOW		
Safeguards: 1. INSULATED LINE 2. FLOWING MOST OF THE TIME		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 06

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water Charge Tank Drawing No. NM-090101-PID-D		
Deviation: High Level		
Cause: 1. INLET VALVE MALFUNCTION 2. HIGH LEVEL SWITCH MALFUNCTION		
Consequences: 1. OVER FILL TANK WASTE WATER & HEAT 2. ALGAE GROWTH ON WALKING SURFACES IF OVER FLOWS FOR EXTENDED PERIODS.		
Safeguards: 1. LEVEL INDICATOR 2. OVER FLOW PIPE 3. HIGH LEVEL ALARM 4. SIGHTGLASS		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations: 1. P&ID WRONG ADD LEVEL XMITTER TO BOTTOM OF TANK. LT SHOWN AT TOP OF TANK IS ACTUALLY LS.		

Node 06

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water Charge Tank Drawing No. NM-090101-PID-D		
Deviation: Low Level		
Cause: 1. LEVEL CONTROLLER FAILURE 2. INLET VALVE FAILURE 3. COLD HOT WATER MAKE-UP 4. DRAIN VALVE OPEN		
Consequences: 1. CAN'T CHARGE PRODUCTION LOSS		
Safeguards: 1. LEVEL INDICATION & ALARM 2. SIGHTGLASS ON TANK		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 06

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water Charge Tank Drawing No. NM-090101-PID-D		
Deviation: High Pressure		
Cause: 1. ATMOSPHERIC VENT & OVERFLOW PLUGGED 2. BACKFLOW VCM INTO TANK DURING RXR CHARGE		
Consequences: 1. OVERPRESSURE TANK		
Safeguards: 1. 2 ATMOSPHERIC VENTS 2. LOW FLOW SHUTDOWN ON WATER CHARGE LINE		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 06

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water Charge Tank Drawing No. NM-090101-PID-D		
Deviation: Low Pressure		
Cause: 1. BOTH VENTS PLUGGED, PULL VAC ON TANK WITH CHARGE WATER PUMPS		
Consequences: 1. SUCK IN TANK WALLS --- LOST PRODUCTION		
Safeguards: 1. 2 ATMOSPHERIC VENTS		
Consequence Rating: III	Probability Rating: D	Risk Ranking: 5
Action/Other Considerations:		

Node 06

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water Charge Tank Drawing No. NM-090101-PID-D		
Deviation: High Temperature		
Cause: 1. TEMP CONTROLLER MALFUNCTION 2. STEAM SUPPLY VALVE MALFUNCTION		
Consequences: 1. DAMAGE CHARGE WATER PUMPS		
Safeguards: 1. TEMP INDICATION ON TANK		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 06

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water Charge Tank Drawing No. NM-090101-PID-D		
Deviation: Low Temperature		
Cause: 1. TEMP CONTROLLER MALFUNCTION 2. STEAM SUPPLY VALVE MALFUNCTION 3. CENTRATE HEAT RECOVERY SYSTEM FAILURE		
Consequences: 1. COLD CHARGE 2. BAD QUALITY 3. PRODUCTION LOSS		
Safeguards: 1. TEMP INDICATION ON TANK 2. BACKUP HOT WATER SUPPLY SYSTEM		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 07

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water from Centrate Exchanger Drawing No. NM-090101-PID-D		
Deviation: No/Low Flow		
Cause: 1. PLUGGED FILTER 2. PLUGGED/BLOCKED LINE 3. RUPTURED LINE, BLEEDER OPEN 4. CONTROLLER FAILURE 5. VALVE CLOSED/MALFUNCTION		
Consequences: 1. LOW TANK LEVEL		
Safeguards: 1. BACKUP HOT WATER SUPPLY SYSTEM		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 07

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water from Centrate Exchanger Drawing No. NM-090101-PID-D		
Deviation: Reverse Flow		
Cause: 1. RUPTURED LINE 2. BLEEDER OPEN		
Consequences: NONE		
Safeguards: NONE		
Consequence Rating: IV	Probability Rating: D	Risk Ranking: 5
Action/Other Considerations:		

Node 07

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water from Centrate Exchanger Drawing No. NM-090101-PID-D		
Deviation: High Pressure		
Cause: 1. EXTERNAL HEAT 2. PLUGGED/BLOCKED LINE OR FILTER		
Consequences: 1. LINE RUPTURE		
Safeguards: 1. INSULATION ON LINE 2. RV ON FILTER PACK		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 07

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water from Centrate Exchanger Drawing No. NM-090101-PID-D		
Deviation: Low Pressure		
Cause: 1. PLUGGED/BLOCKED LINE 2. PUMP FAILURE		
Consequences: 1. LOW/NO FLOW		
Safeguards: SEE NO/LOW FLOW		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 07

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water from Centrate Exchanger Drawing No. NM-090101-PID-D		
Deviation: High Temperature		
Cause: 1. TEMP CONTROLLER MALFUNCTION 2. EXTERNAL HEAT		
Consequences: 1. HOT WATER TANK ABOVE SETPOINT 2. HIGH PRESSURE		
Safeguards: 1. RV ON FILTER PACK		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 07

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water from Centrate Exchanger Drawing No. NM-090101-PID-D		
Deviation: Low Temperature		
Cause: 1. TEMP CONTROLLER MALFUNCTION 2. WEATHER WHEN LINE NOT IN USE		
Consequences: 1. LOW CHARGE WATER TANK TEMP		
Safeguards: 1. INSULATED LINE 2. BACKUP HOT WATER SUPPLY SYSTEM 3. TEMP INDICATION		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 08

Aberdeen New Module HAZOP		
Equipment/Line Description: Process Water To Pic-Heater Drawing No. NM-090101-PID-D		
Deviation: No/Low Flow		
Cause: SAME AS NODE 07		
Consequences:		
Safeguards:		
Consequence Rating:	Probability Rating:	Risk Ranking:
Action/Other Considerations:		

Node 08

Aberdeen New Module HAZOP		
Equipment/Line Description: Process Water To Pic-Heater Drawing No. NM-090101-PID-D		
Deviation: Reverse Flow		
Cause: SAME AS NODE 7		
Consequences:		
Safeguards:		
Consequence Rating:	Probability Rating:	Risk Ranking:
Action/Other Considerations:		

Node 08

Aberdeen New Module HAZOP		
Equipment/Line Description: Process Water To Pic-Heater Drawing No. NM-090101-PID-D		
Deviation: High Pressure		
Cause: SAME AS NODE 7		
Consequences:		
Safeguards:		
Consequence Rating:	Probability Rating:	Risk Ranking:
Action/Other Considerations:		

Node 08

Aberdeen New Module HAZOP		
Equipment/Line Description: Process Water To Pic-Heater Drawing No. NM-090101-PID-D		
Deviation: Low Pressure		
Cause: SAME AS NODE 7		
Consequences:		
Safeguards:		
Consequence Rating:	Probability Rating:	Risk Ranking:
Action/Other Considerations:		

Node 08

Aberdeen New Module HAZOP		
Equipment/Line Description: Process Water To Pic-Heater Drawing No. NM-090101-PID-D		
Deviation: High Temperature		
Cause: SAME AS NODE 7		
Consequences:		
Safeguards:		
Consequence Rating:	Probability Rating:	Risk Ranking:
Action/Other Considerations:		

Node 08

Aberdeen New Module HAZOP		
Equipment/Line Description: Process Water To Pic-Heater Drawing No. NM-090101-PID-D		
Deviation: Low Temperature		
Cause: SAME AS NODE 7		
Consequences:		
Safeguards:		
Consequence Rating:	Probability Rating:	Risk Ranking:
Action/Other Considerations:		

Node 09

Aberdeen New Module HAZOP		
Equipment/Line Description: Misc. Process Water Lines Drawing No. NM-090101-PID-D		
Deviation: No/Low Flow		
Cause: 1. BLOCKED/PLUGGED LINE		
Consequences: NONE		
Safeguards: NONE		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 09

Aberdeen New Module HAZOP		
Equipment/Line Description: Misc. Process Water Lines Drawing No. NM-090101-PID-D		
Deviation: Reverse Flow		
Cause: NONE		
Consequences: NONE		
Safeguards: NONE		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 09

Aberdeen New Module HAZOP		
Equipment/Line Description: Misc. Process Water Lines Drawing No. NM-090101-PID-D		
Deviation: High Pressure		
Cause: 1. HIGH TEMP		
Consequences: 1. LINE RUPTURE		
Safeguards: 1. INSULATED LINE		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 09

Aberdeen New Module HAZOP		
Equipment/Line Description: Misc. Process Water Lines Drawing No. NM-090101-PID-D		
Deviation: Low Pressure		
Cause: 1. EMPTY WATER TOWER		
Consequences: NONE		
Safeguards: WATER TOWER LEVEL CONTROL AND ALARM		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 09

Aberdeen New Module HAZOP		
Equipment/Line Description: Misc. Process Water Lines Drawing No. NM-090101-PID-D		
Deviation: High Temperature		
Cause: EXTERNAL HEAT		
Consequences: LINE RUPTURE		
Safeguards: 1. FIRE PROTECTION SYSTEM 2. INSULATED LINE		
Consequence Rating: III	Probability Rating: D	Risk Ranking: 5
Action/Other Considerations:		

Node 09

Aberdeen New Module HAZOP		
Equipment/Line Description: Misc. Process Water Lines Drawing No. NM-090101-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. LINE RUPTURE 2. NO FLOW		
Safeguards: INSULATED LINE		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 10

Aberdeen New Module HAZOP		
Equipment/Line Description: Cold Charge Water Drawing No. NM-090101-PID-D		
Deviation: No/Low Flow		
Cause: 1. PLUGGED/BLOCKED LINE 2. RUPTURED LINE 3. VALVE MALFUNCTION 4. TEMP. CONTROLLER MALFUNCTION 5. LOSS OF INSTRUMENT AIR		
Consequences: 1. HOT CHARGE 2. BAD PRODUCT QUALITY		
Safeguards: 1. TEMP INDICATION ON CHARGE LINE 2. INTERLOCKS 3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 10

Aberdeen New Module HAZOP		
Equipment/Line Description: Cold Charge Water Drawing No. NM-090101-PID-D		
Deviation: High Pressure		
Cause: 1. HIGH TEMP.		
Consequences: 1. LINE RUPTURE		
Safeguards: 1. RV ON FILTER PACK		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 10

Aberdeen New Module HAZOP		
Equipment/Line Description: Cold Charge Water Drawing No. NM-090101-PID-D		
Deviation: Low Pressure		
Cause: 1. EMPTY WATER TOWER 2. RUPTURED LINE/BLEEDER OPEN 3. PLUGGED/BLOCKED LINE		
Consequences: 1. NO/LOW FLOW		
Safeguards: SAME AS NO/LOW FLOW		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 10

Aberdeen New Module HAZOP		
Equipment/Line Description: Cold Charge Water Drawing No. NM-090101-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT 2. RINSE REACTOR WITH HOT WATER		
Consequences: 1. HIGH PRESSURE 2. HOT CHARGE - BAD QUALITY		
Safeguards: 1. FIRE PROTECTION SYSTEM 2. INSULATED LINE 3. TEMP INDICATION ON CHARGE LINE		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 10

Aberdeen New Module HAZOP		
Equipment/Line Description: Cold Charge Water Drawing No. NM-090101-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED LINE 2. RUPTURED LINE		
Safeguards: 1. INSULATED LINE 2. USED FREQUENTLY		
Consequence Rating: III	Probability Rating: D	Risk Ranking: 5
Action/Other Considerations:		

Node 11

Aberdeen New Module HAZOP		
Equipment/Line Description: Steam To Pic-Heater Drawing No. NM-090101-PID-D		
Deviation: No/Low Flow		
Cause: 1. VALVE CLOSED/MALFUNCTION 2. BOILERS DOWN 3. LINE RUPTURE 4. TEMP CONTROLLER MALFUNCTION		
Consequences: 1. COLD MAKE-UP TANK 2. COLD CHARGE - BAD QUALITY, LOST PRODUCTION		
Safeguards: 1. TEMP INDICATION ON HOT WATER LINE 2. BACK-UP HOT WATER SUPPLY SYSTEM		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 11

Aberdeen New Module HAZOP		
Equipment/Line Description: Steam To Pic-Heater Drawing No. NM-090101-PID-D		
Deviation: High Pressure		
Cause: NONE		
Consequences: N/A		
Safeguards: N/A		
Consequence Rating: N/A	Probability Rating: N/A	Risk Ranking: N/A
Action/Other Considerations:		

Node 11

Aberdeen New Module HAZOP		
Equipment/Line Description: Steam To Pic-Heater Drawing No. NM-090101-PID-D		
Deviation: Low Pressure		
Cause: 1. BOILERS DOWN 2. NO FLOW		
Consequences: SAME AS NO FLOW		
Safeguards: SAME AS NO FLOW		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 11

Aberdeen New Module HAZOP		
Equipment/Line Description: Steam To Pic-Heater Drawing No. NM-090101-PID-D		
Deviation: Low Temperature		
Cause: 1. LOW PRESSURE		
Consequences: SAME AS LOW PRESSURE/NO FLOW		
Safeguards: SAME AS NO FLOW		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 12

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water Charge Line Drawing No. NM-090101-PID-D, NM-090102-PID-D, NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D & NM-090107-PID-D		
Deviation: No/Low Flow		
Cause: 1. CHARGE PUMP FAILURE 2. VALVE MALFUNCTION 3. RUPTURED LINE/ BLEEDER OPEN 4. EMPTY HOT WATER TANK 5. PLUGGED/BLOCKED LINE 6. PLUGGED FILTER 7. INTERLOCKS		
Consequences: 1. PRODUCTION LOSS 2. BAD PRODUCT QUALITY 3. DAMAGE CHARGE WATER PUMP		
Safeguards: 1. DUAL FLOW METERS 2. INTERLOCKS & ALARMS 3. 2 CHARGE PUMPS 4. OPERATING PROCEDURES 5. HOT WATER TANK LEVEL INDICATION		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations: PID NM-090102-PID-D Wrong - ARROW #36 SHOULD GO TO MN-090105-PID-D		

Node 12

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water Charge Line		
Drawing No. NM-090101-PID-D, NM-090102-PID-D, NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, & NM-090107-PID-D		
Deviation: Reverse Flow		
Cause: 1. NO CHARGE WATER FLOW, BACKFLOW VCM DURING RXR CHARGE		
Consequences: 1. VCM RELEASE 2. OVERPRESSURE HOT WATER TANK 3. PERSONNEL EXPOSURE		
Safeguards: 1. LOW FLOW SHUTDOWN & OTHER INTERLOCKS 2. CHECK VALVES 3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 12

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water Charge Line Drawing No. NM-090101-PID-D, NM-090102-PID-D, NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, & NM-090107-PID-D		
Deviation: High Pressure		
Cause: 1. BLOCKED/PLUGGED LINE WITH PUMP RUNNING		
Consequences: 1. RUPTURE LINE 2. LIFT RELIEF VALVE 3. EQUIPMENT DAMAGE		
Safeguards: 1. RV FILTER PACK 2. PUMP DEAD HEAD PRESSURE UNDER MAX PIPE PRESSURE RATING		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 12

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water Charge Line Drawing No. NM-090101-PID-D, NM-090102-PID-D NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, & NM-090107-PID-D		
Deviation: Low Pressure		
Cause: SAME AS NO/LOW FLOW		
Consequences:		
Safeguards:		
Consequence Rating:	Probability Rating:	Risk Ranking:
Action/Other Considerations:		

Node 12

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water Charge Line Drawing No. NM-090101-PID-D, NM-090102-PID-D, NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D NM-090106-PID-D, & NM-090107-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT 2. HIGH TEMP IN HOT WATER TANK 3. TEMPERATURE CONTROLLER FAILURE		
Consequences: 1. DAMAGE PUMPS 2. HOT CHARGE - BAD QUALITY, PRODUCTION LOSS		
Safeguards: 1. FIRE PROTECTION SYSTEM 2. REACTOR TEMP INDICATION 3. OPERATING PROCEDURES 4. INTERLOCKS 5. INSULATED LINE		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 12

Aberdeen New Module HAZOP		
Equipment/Line Description: Hot Water Charge Line		
Drawing No. NM-090101-PID-D, NM-090102-PID-D, NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, & NM-090107-PID-D		
Deviation: Low Temperature		
Cause:		
1. WEATHER		
2. TEMP CONTROLLER MALFUNCTION		
Consequences:		
1. COLD CHARGE - BAD QUALITY, LOST PRODUCTION		
Safeguards:		
1. INSULATED LINE		
2. TEMP INDICATION ON REACTOR		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 13

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank DM-131 Drawing No. NM-090102-PID-D		
Deviation: High Pressure		
Cause: 1. DISCHARGE VALVE CLOSED 2. DISCHARGE PLUGGED/BLOCKED 3. EXTERNAL HEAT		
Consequences: 1. LIFT RELIEF VALVE 2. OVERPRESSURE VESSEL 3. LOW MOL PRODUCTION LOSS		
Safeguards: 1. RELIEF VALVE ON VESSEL		
Consequence Rating: III	Probability Rating: D	Risk Ranking: 5
Action/Other Considerations:		

Node 13

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank DM-131 Drawing No. NM-090102-PID-D		
Deviation: Low Pressure		
Cause: 1. INLET LINE CLOSED 2. VENT OPEN 3. VESSEL EMPTY 4. BYPASS VALVE OPEN		
Consequences: 1. CAN'T CHARGE REACTOR WITH DECAL WATER 2. PRODUCTION LOSS		
Safeguards: 1. OPERATING PROCEDURES 2. CHARGE WATER FLOW METER		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 13

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank DM-131 Drawing No. NM-090102-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT 2. HOT WATER CHARGE TANK TOO HOT		
Consequences: 1. HIGH PRESSURE 2. HOT CHARGE - COURSE BATCH		
Safeguards: 1. RELIEF VALVE 2. TEMPERATURE TRANSMITTER ON TANK		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 13

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank DM-131 Drawing No. NM-090102-PID-D		
Deviation: Low Temperature		
Cause: 1. PROCESS WATER VALVE LEFT OPEN 2. CHARGE WATER TANK TOO COLD 3. DECAL TANK NOT USED FOR EXTENDED PERIOD 4. CHARGE WATER TOO COLD		
Consequences: 1. COLD CHARGE 2. PRODUCTION LOSS 3. RESIN QUALITY		
Safeguards: 1. TEMPERATURE TRANSMITTER 2. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: A	Risk Ranking: 4
Action/Other Considerations: TEAM RECOMMENDS THAT AN ALARM OR MESSAGE BE PUT ON THE DCS TO ALERT THE LEAD OPERATOR THAT THE DECAL TANK IS TOO COLD TO BE CHARGED.		

Node 014 DELETED Combined with Node 12

Node 15

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Inlet Line & Filter Drawing No. NM-090102-PID-D		
Deviation: No/Low Flow		
Cause: 1. VALVE CLOSED 2. PLUGGED/BLOCKED LINE 3. FILTER PLUGGED 4. CHARGE WATER PUMP FAILURE 5. BACK FLUSH VALVE LEFT OPEN		
Consequences: 1. CAN'T CHARGE 2. PRODUCTION LOSS		
Safeguards: 1. CHARGE WATER FLOW METERS 2. OPERATING PROCEDURES 3. DP CELL ON FILTER PACK		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 15

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Inlet Line & Filter Drawing No. NM-090102-PID-D		
Deviation: High Pressure		
Cause: 1. PLUGGED/BLOCKED LINE 2. VALVE CLOSED 3. EXTERNAL HEAT W/ NO FLOW (ELEC. TRACE ON) 4. FILTER PLUGGED		
Consequences: 1. RUPTURE LINE/BLOW GASKET 2. OVER PRESSURE FILTER PACK		
Safeguards: 1. RELIEF VALVES ON FILTER PACK/DECAL TANK 2. PRESSURE GAUGES IN FIELD 3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 15

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Inlet Line & Filter Drawing No. NM-090102-PID-D		
Deviation: Low Pressure		
Cause: 1. CHARGE WATER PUMP FAILURE 2. RUPTURED LINE 3. BLEEDER OPEN 4. FILTER PACK OPEN 5. PLUGGED/BLOCKED LINE		
Consequences: 1. CAN'T CHARGE WITH DECAL WATER 2. QUALITY ISSUE ON LOW MOLE		
Safeguards: 1. PRESSURE GAUGES IN FIELD 2. OPERATING PROCEDURES 3. FLOW METERS & LOW FLOW ALARMS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 15

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Inlet Line & Filter Drawing No. NM-090102-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT 2. ELEC. TRACE STAYS ON WHEN NOT NEEDED 3. CHARGE WATER TOO HOT		
Consequences: 1. HIGH PRESSURE 2. HOT CHARGE -- COURSE BATCH		
Safeguards: 1. FIRE PROTECTION SYSTEMS 2. CHARGE WATER TEMP. INDICATION & CONTROL 3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 15

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Inlet Line & Filter Drawing No. NM-090102-PID-D		
Deviation: Low Temperature		
Cause:		
1. WEATHER 2. CHARGE WATER TOO COLD 3. HAVEN'T USED DECAL TANK FOR A WHILE		
Consequences:		
1. COLD CHARGE 2. PRODUCTION LOSS 3. RESIN QUALITY 4. FROZEN LINE -- LINE RUPTURE		
Safeguards:		
1. ELECTRIC TRACED LINE 2. TEMP. INDICATION		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 16

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Outlet Line & Filter Drawing No. NM-090102-PID-D, NM-090125-PID-D		
Deviation: No/Low Flow		
Cause: 1. VALVE CLOSED 2. PLUGGED/BLOCKED LINE 3. FILTER PLUGGED 4. CHARGE WATER PUMP FAILURE 5. BACK FLUSH VALVE LEFT OPEN		
Consequences: 1. CAN'T CHARGE 2. PRODUCTION LOSS 3. CAN'T MAKE-UP BRINE FOR REGENERATION		
Safeguards: 1. CHARGE WATER FLOW METERS 2. OPERATING PROCEDURES 3. DP CELL ON FILTER PACK		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 16

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Outlet Line & Filter Drawing No. NM-090102-PID-D, NM-090125-PID-D		
Deviation: High Pressure		
Cause: SAME AS NODE 15		
Consequences: SAME AS NODE 15		
Safeguards: SAME AS NODE 15		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 16

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Outlet Line & Filter Drawing No. NM-090102-PID-D, NM-090125-PID-D		
Deviation: Low Pressure		
Cause: SAME AS NODE 13		
Consequences: SAME AS NODE 13		
Safeguards: SAME AS NODE 13		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 16

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Outlet Line & Filter Drawing No. NM-090102-PID-D, NM-090125-PID-D		
Deviation: High Temperature		
Cause: SAME AS NODE 15		
Consequences: SAME AS NODE 15		
Safeguards: SAME AS NODE 15		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 16

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Outlet Line & Filter Drawing No. NM-090102-PID-D, NM-090125-PID-D		
Deviation: Low Temperature		
Cause: SAME AS NODE 15		
Consequences: SAME AS NODE 15		
Safeguards: SAME AS NODE 15		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 17

Aberdeen New Module HAZOP		
Equipment/Line Description: Brine to Decal Tank Drawing No. NM-090102-PID-D, NM-090125-PID-D		
Deviation: No/Low Flow		
Cause: 1. PUMP FAILURE 2. VALVE CLOSED 3. PLUGGED/BLOCKED LINE 4. TK-702 BRINE CHARGE TANK EMPTY		
Consequences: 1. CAN'T REGENERATE DECAL TANK		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 17

Aberdeen New Module HAZOP		
Equipment/Line Description: Brine to Decal Tank Drawing No. NM-090102-PID-D, NM-090125-PID-D		
Deviation: High Pressure		
Cause: 1. DEAD HEAD PUMP 2. EXTERNAL HEAT 3. ELECTRIC TRACE FAILURE		
Consequences: 1. LINE RUPTURE/BLOW GASKET 2. DAMAGE PUMP		
Safeguards: 1. PRESSURE GAUGE IN FIELD 2. OPERATING PROCEDURES 3. PRESSURE RELIEF ON PUMP DISCHARGE		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 17

Aberdeen New Module HAZOP		
Equipment/Line Description: Brine to Decal Tank Drawing No. NM-090102-PID-D, NM-090125-PID-D		
Deviation: Low Pressure		
Cause: 1. EMPTY TANK 2. PUMP FAILURE 3. PLUGGED/BLOCKED LINE 4. BLEEDER OPEN		
Consequences: 1. CAN'T REGENERATE SOFTENER 2. DAMAGE PUMP		
Safeguards: 1. PRESSURE GAUGES 2. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 17

Aberdeen New Module HAZOP		
Equipment/Line Description: Brine to Decal Tank Drawing No. NM-090102-PID-D, NM-090125-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT 2. ELECTRIC TRACE FAILURE		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. PRESSURE RELIEF ON PUMP DISCHARGE 2. FIRE PROTECTION SYSTEM 3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 17

Aberdeen New Module HAZOP		
Equipment/Line Description: Brine to Decal Tank Drawing No. NM-090102-PID-D, NM-090125-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. FROZE LINE/RUPTURE LINE 2. CAN'T REGENERATE SOFTENER		
Safeguards: 1. ELECTRIC TRACED 2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 18

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Regen. Lines & Water Supply Drawing No. NM-090102-PID-D		
Deviation: No/Low Flow		
Cause: 1. PLUGGED/BLOCKED LINE 2. VALVE CLOSED 3. EMPTY WATER TOWER		
Consequences: 1. CAN'T REGENERATE DECAL TANK		
Safeguards: 1. OPERATING PROCEDURES 2. PRESSURE GAUGES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 18

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Regen. Lines & Water Supply Drawing No. NM-090102-PID-D		
Deviation: High Pressure		
Cause: 1. EXTERNAL HEAT 2. ELECTRIC TRACE FAILURE		
Consequences: 1. LINE RUPTURE/BLOW GASKET		
Safeguards: 1. OPERATING PROCEDURES 2. FIRE PROTECTION SYSTEMS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 18

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Regen. Lines & Water Supply Drawing No. NM-090102-PID-D		
Deviation: Low Pressure		
Cause: 1. EMPTY WATER TANK 2. RUPTURED LINE 3. VALVE CLOSED / BLOCKED OR PLUGGED LINE 4. BLEEDER OPEN		
Consequences: 1. CAN'T REGENERATE		
Safeguards: 1. PRESSURE GAUGES 2. WATER TOWER LEVEL INDICATION & LOW LEVEL ALARM		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 18

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Regen. Lines & Water Supply Drawing No. NM-090102-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT 2. ELECTRIC TRACE FAILURE		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. FIRE PROTECTION SYSTEM 2. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 18

Aberdeen New Module HAZOP		
Equipment/Line Description: Decal Tank Regen. Lines & Water Supply Drawing No. NM-090102-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED/RUPTURED LINE 2. CAN'T REGENERATE DECAL TANK		
Safeguards: 1. ELECTRIC TRACED 2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 19

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Rinse Supply Line Drawing No. NM-090102-PID-D, NM-090103-PID-D NM-090104-PID-D, NM-090105-PID-D NM-090106-PID-D, & NM-090107-PID-D		
Deviation: No/Low Flow		
Cause: 1. CLOSED VALVE 2. PUMP FAILURE 3. PLUGGED/BLOCKED LINE 4. SPRAY HEAD PLUGGED 5. REACTOR VALVE LEAKING THROUGH -- VCM FREEZES WATER IN LINE 6. WATER TOWER EMPTY 7. INTERLOCKED OUT (i.e. CHARGING ANOTHER REACTOR)		
Consequences: 1. CAN'T RINSE REACTOR -- CONTAMINATION/HP PROBLEMS 2. REACTOR DOWNTIME		
Safeguards: 1. LOW FLOW METERS 2. INTERLOCKS 3. HPSW TO SPRAY NOZZLE TO PREVENT PLUGGING 4. TWO PUMPS 5. LEVEL XMITTER ON WATER TOWER & LOW LEVEL ALARM 6. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 19

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Rinse Supply Line		
Drawing No. NM-090102-PID-D, NM-090103-PID-D NM-090104-PID-D, NM-090105-PID-D NM-090106-PID-D, & NM-090107-PID-D		
Deviation: High Pressure		
Cause:		
1. EXTERNAL HEAT W/ NO FLOW 2. DEAD HEAD PUMP DUE TO NO FLOW		
Consequences:		
1. LIFT FILTER PACK RELIEF VALVE 2. RUPTURE LINE/BLOW GASKET		
Safeguards:		
1. FIELD MOUNTED PRESSURE GAUGES 2. FILTER PACK RV 3. PUMP RECIRCULATION LINE		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 19

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Rinse Supply Line Drawing No. NM-090102-PID-D, NM-090103-PID-D NM-090104-PID-D, NM-090105-PID-D NM-090106-PID-D, & NM-090107-PID-D		
Deviation: Low Pressure		
Cause: 1. RINSE PUMP FAILURE 2. PLUGGED/BLOCKED LINE 3. WATER TOWER EMPTY 4. VALVE CLOSED 5. HPSW PUMP FAILURE 6. BLEEDER OPEN/RUPTURED LINE		
Consequences: 1. DIRTY REACTOR - QUALITY PROBLEMS 2. CONDENSER PLUGGING 3. REACTOR DOWNTIME 4. VCM RELEASE/BACK-UP VCM INTO HPSW LINE		
Safeguards: 1. FLOW METERS 2. PUMP RUN INDICATION 3. CHECK VALVE ON HPSW LINE 4. INTERLOCKS 5. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 19

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Rinse Supply Line		
Drawing No. NM-090102-PID-D, NM-090103-PID-D NM-090104-PID-D, NM-090105-PID-D NM-090106-PID-D, & NM-090107-PID-D		
Deviation: High Temperature		
Cause:		
1. EXTERNAL HEAT		
2. HOT CHARGE WATER VALVE OPEN TO RINSE WATER LINE		
Consequences:		
1. HIGH PRESSURE		
2. QUALITY PROBLEMS		
Safeguards:		
1. FIRE PROTECTION SYSTEM		
2. INTERLOCKS		
3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 19

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Rinse Supply Line		
Drawing No. NM-090102-PID-D, NM-090103-PID-D NM-090104-PID-D, NM-090105-PID-D NM-090106-PID-D, & NM-090107-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED/RUPTURED LINE 2. VCM RELEASE INTO LINE OR ATMOSPHERE DURING POLY		
Safeguards: 1. INSULATED LINE 2. RINSE WATER LINE USED FREQUENTLY 3. HPSW LINE ALWAYS FLOWING		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 20

Aberdeen New Module HAZOP

Equipment/Line Description: Reactor 741,742,743,744,745
 Drawing No. NM-090103-PID-D, NM-090104-PID-D,
 NM-090105-PID-D, NM-090106-PID-D,
 & NM-090107-PID-D

Deviation: High Pressure

Cause:

- | | |
|--|--------------------------------|
| 1. LOSS OF COOLING WATER | 2. LOSS OF AGITATION |
| 3. TOO MUCH CATALYST | 4. REACTOR FULL -- OVER CHARGE |
| 5. REACTOR VENT FAILURE | 6. CONDENSER DIRTY |
| 7. POWER FAILURE | 8. DCS FAILURE |
| 9. COOLING WATER TOO WARM | 10. KILL SYSTEMS FAILURE |
| 11. TEMPERATURE INDICATOR/CONTROLLER FAILURE | |

Consequences:

- | | |
|---------------------------|--|
| 1. VCM RELEASE | 2. PERSONNEL EXPOSURE/INJURY |
| 3. FIRE/EXPLOSION - DEATH | 4. SAFETY DISK BLOWS/RELIEF VALVE LIFT |
| 5. EARLY KILL | 6. REACTOR OVERPRESSURE/DAMAGE |
| 7. BAD QUALITY PRODUCT | 8. LOSS OF PRODUCTION/REACTOR DOWNTIME |

Safeguards:

1. INTERLOCKS & DCS ALARMS
2. AUTOMATIC EMERGENCY KILL
3. MANUAL EMERGENCY KILL
4. OPERATING PROCEDURES
5. DELUGE SYSTEM/FIRE PROTECTION SYSTEM/GAS CHROMOGRAPHS
6. EMERGENCY COOLING WATER & MANUAL BYPASSES
7. RELIEF VALVES/RUPTURE DISKS
8. ROUTINE VESSEL INSPECTION PROGRAM
9. EMERGENCY POWER TO DCS
10. INSTRUMENTATION CALIBRATION & CHECK ON PERIODIC BASIS
11. OPERATOR CHECK BEFORE CHARGING EACH BATCH
12. SLURRY TEMPERATURE CONTROL
13. DUAL FLOW METERS ON ALL INGREDIENT CHARGE LINES
14. CONSTANT MONITORING OF ALL REACTORS IN CONTROL ROOM
15. FIELD AND PANEL PRESSURE INDICATION
16. REACTOR VENTS TO RECOVERY SYSTEM AND ATMOSPHERE
17. FIELD BACK-UP EMERGENCY KILL SYSTEM

Consequence Rating:
II

Probability Rating:
C

Risk Ranking:
4

Action/Other Considerations:

Note: RX-745 same as others except larger, more relief valves.
TEAM RECOMMENDS THAT EXISTING PROCEDURES AND SAFETY CONTROLS ARE REVIEWED FOR ADEQUACY AND PROPER USE.

Node 20

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor 741,742,743,744,745 Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, & NM-090107-PID-D		
Deviation: Low Pressure		
Cause: 1. TOO MUCH COOLING WATER 2. AMS LEAK INTO REACTOR/AMS IN VCM RVCM RECEIVERS 3. NOT ENOUGH CATALYST 4. MISCHARGE - WRONG AMOUNT OF CHARGE INGREDIENTS 5. INCORRECT SLURRY TEMPERATURE READING 6. COLD CHARGE		
Consequences: 1. PRODUCTION LOSS 2. BAD QUALITY		
Safeguards: 1. OPERATING PROCEDURES 2. INSTRUMENTATION CALIBRATION 3. DUAL PRESSURE INDICATION & FIELD PRESSURE GAUGES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 20

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor 741,742,743,744,745 Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, & NM-090107-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT 2. COOLING WATER FAILURE 3. LOSS OF AGITATION 4. TOO MUCH CATALYST 5. UNABLE TO VENT REACTOR INERTS 6. DIRTY CONDENSER 7. INCORRECT SLURRY TEMPERATURE INDICATION 8. COOLING WATER TEMPERATURE TOO WARM 9. POWER FAILURE 10. DCS FAILURE		
Consequences: 1. HIGH PRESSURE 2. BAD QUALITY 3. REACTOR DOWNTIME/PRODUCTION LOSS		
Safeguards: 1. SAME AS HIGH PRESSURE		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations: NOTE: HIGH PRESSURE CONSEQUENCES AND PROBABILITY WERE ADDRESSED DURING HIGH PRESSURE DEVIATION STUDY		

Node 20

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor 741,742,743,744,745 Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, & NM-090107-PID-D		
Deviation: Low Temperature		
Cause: 1. TOO MUCH COOLING WATER 2. COLD CHARGE 3. STEAM FAILURE TO RX-745 OR HEAT-UP LOOP		
Consequences: 1. BAD QUALITY 2. PRODUCTION LOSS		
Safeguards: 1. OPERATING PROCEDURES 2. SLURRY TEMP INDICATION 3. COOLING WATER TEMP. AND FLOWRATE INDICATION		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 20

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor 741,742,743,744,745 Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, & NM-090107-PID-D		
Deviation: High Level		
Cause: 1. OVERCHARGE REACTOR 2. REACTOR NOT EMPTY 3. TOO MUCH SEAL WATER OR SPRAY HEAD WATER 4. REACTOR FOAMING OR SPLITTING DURING POLY OR RECOVERY		
Consequences: 1. BAD QUALITY 2. ABORTED BATCH 3. PRODUCTION LOSS 4. HIGH PRESSURE 5. CARRYOVER OF RESIN INTO RECOVERY SYSTEM		
Safeguards: 1. DUAL FLOWMETERS ON ALL CHARGE INGREDIENTS 2. DUAL PRESSURE INDICATORS IN CONTROL ROOM, PRESSURE GAUGE IN FIELD 3. DCS INTERLOCKS 4. OPERATING PROCEDURES 5. SEAL WATER AND SPRAY HEAD WATER FLOWRATES CHECKED EACH CHARGE 6. VCM AND WATER CHARGE METERS CHECKED PERIODICALLY 7. REACTOR IS VERIFIED EMPTY BY PANEL OPERATORS AFTER EACH DUMP		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations: TEAM RECOMMENDS THAT LEVEL INDICATION OR HIGH LEVEL PROBE BE INSTALLED ON EACH REACTOR		

Node 20

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor 741,742,743,744,745 Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, & NM-090107-PID-D		
Deviation: Condenser Tube Leak		
Cause: 1. CORROSION/EROSION 2. HIGH PRESSURE 3. IMPROPER TUBE CLEANING/DRILLING		
Consequences: 1. VCM RELEASE INTO COOLING WATER SYSTEM 2. MINOR VCM EXPOSURE TO PERSONNEL		
Safeguards: 1. GC'S IN REACTOR MODULES 2. CONDENSER INSPECTION 3. PERIODIC REACTOR PRESSURE CHECK		
Consequence Rating: III	Probability Rating: B	Risk Ranking: 4
Action/Other Considerations: TEAM RECOMMENDS PERIODIC (WEEKLY) SAMPLING OF COOLING WATER FOR VCM		

Node 20

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor 741,742,743,744,745 Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, & NM-090107-PID-D		
Deviation: Agitator Failure		
Cause: 1. POWER FAILURE 2. DCS FAILURE 3. AGITATOR SHAFT BREAKS (STRESS/FATIGUE FAILURE) 4. MOTOR FAILURE 5. COUPLING FAILURE 6. GEARBOX FAILURE 7. MISOPERATION 8. CIRCUIT BREAKER TRIPPED 9. AGITATOR SEAL FAILURE		
Consequences: 1. HIGH PRESSURE 2. PRODUCTION LOSS 3. QUALITY PROBLEMS 4. ABORTED BATCH (HARDER TO KILL) 5. HARDER TO DUMP AND STRIP REACTOR		
Safeguards: 1. LOW AND HIGH AGITATOR AMP ALARMS 2. BACK-UP DCS CARD 3. OPERATING PROCEDURES 4. AGITATOR START/STOP BUTTONS ON HARD PANEL 5. GEARBOX PM 6. SEAL OIL AND SEAL WATER FLOW AND PRESSURE CHECKED BEFORE EACH CHARGE 7. DCS INTERLOCKS		
Consequence Rating: III	Probability Rating: B	Risk Ranking: 4
Action/Other Considerations: TEAM RECOMMENDS THAT A REVIEW BE DONE ON EXISTING PROCEDURES AND SAFETY CONTROLS. THE TEAM ALSO RECOMMENDS THAT A REVIEW BE DONE ON EXISTING PREVENTATIVE MAINTENANCE AND INSPECTION PRACTICES.		

Node 21

Aberdeen New Module HAZOP		
Equipment/Line Description: Slurry Dump Header		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090116-PID-D		
Deviation: No/Low Flow		
Cause:		
1. PLUGGED LINE		
2. EMPTY REACTOR		
3. DUMP VALVE CLOSED		
4. SLURRY DUMP TANK LEVEL CONTROLLER FAILURE		
5. INTERLOCKED OUT		
Consequences:		
1. PRODUCTION LOSS		
2. OVERFILL REACTOR		
Safeguards:		
1. OPERATING PROCEDURES		
2. FLOW INSTRUMENT ON BULLS EYE - NO FLOW ALARM ON DCS		
3. BULLS EYE AND TV CAMERA ON DUMP LINE		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 21

Aberdeen New Module HAZOP		
Equipment/Line Description: Slurry Dump Header		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090116-PID-D		
Deviation: High Pressure		
Cause:		
1. FLUSHING DUMP HEADER WITH CHARGE WATER PUMPS		
Consequences:		
1. BLOW BULLS-EYE OUT		
2. RUPTURE LINE/BLOW GASKET		
Safeguards:		
1. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 21

Aberdeen New Module HAZOP		
Equipment/Line Description: Slurry Dump Header Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090116-PID-D		
Deviation: High Temperature		
Cause:		
Consequences: NONE		
Safeguards:		
Consequence Rating:	Probability Rating:	Risk Ranking:
Action/Other Considerations:		

Node 21

Aberdeen New Module HAZOP		
Equipment/Line Description: Slurry Dump Header Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090116-PID-D		
Deviation: Low Temperature		
Cause:		
Consequences: NONE		
Safeguards:		
Consequence Rating:	Probability Rating:	Risk Ranking:
Action/Other Considerations:		

Node 22

Aberdeen New Module HAZOP		
Equipment/Line Description: S.A. Charge Lines Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: No/Low Flow		
Cause: 1. SA CHARGE PUMP FAILURE 2. SA CHARGE TANK EMPTY 3. BLOCKED/PLUGGED LINE 4. VALVE CLOSED 5. RAM VALVE FAILURE/HUNG 6. 745 F-50 FILTER PLUGGED 7. LINE BROKEN/BLEEDER OPEN 8. DCS INTERLOCKS		
Consequences: 1. COURSE/ABORTED BATCH 2. BAD QUALITY 3. PRODUCTION LOSS		
Safeguards: 1. DUAL FLOW METERS & LOW FLOW ALARMS 2. OPERATING PROCEDURES 3. SPARE CHARGE PUMP		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations: Note: RX-744 & RX-745 same as other except more SA charge lines (same interlocks, valve/piping configuration).		

Node 22

Aberdeen New Module HAZOP		
Equipment/Line Description: S.A. Charge Lines Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: High Pressure		
Cause: 1. DEAD HEAD PUMP 2. EXTERNAL HEAT		
Consequences: 1. LINE RUPTURE/BLOW GASKET 2. DAMAGE CHARGE PUMP 3. PRODUCTION LOSS		
Safeguards: 1. FIRE PROTECTION SYSTEM 2. DCS SEQUENCING ON PUMP START-UP/SHUT-DOWN AND VALVE OPENING/CLOSING 3. LOW FLOW SHUTDOWN		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 22

Aberdeen New Module HAZOP		
Equipment/Line Description: S.A. Charge Lines Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: Low Pressure		
Cause: 1. PUMP FAILURE 2. PLUGGED/BLOCKED LINE 3. VALVE CLOSED 4. CHARGE TANK EMPTY 5. BLEEDER OPEN/LINE RUPTURE 6. 745 F-50 FILTER PLUGGED		
Consequences: 1. SAME AS NO/LOW FLOW		
Safeguards: 1. SAME AS NO/LOW FLOW		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 22

Aberdeen New Module HAZOP		
Equipment/Line Description: S.A. Charge Lines Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT 2. ELECTRIC TRACE FAILURE		
Consequences: 1. HIGH PRESSURE 2. BURN SA - COURSE BATCH, QUALITY PROBLEMS		
Safeguards: 1. FIRE PROTECTION SYSTEMS 2. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 22

Aberdeen New Module HAZOP		
Equipment/Line Description: S.A. Charge Lines Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED LINE 2. PRODUCTION LOSS		
Safeguards: 1. ELECTRIC TRACED 2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 23

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Dump/Charge Manifold Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: No/Low Flow		
Cause: 1. PLUGGED DURING DUMP 2. VALVE MALFUNCTION 3. VALVES INTERLOCKED OUT		
Consequences: 1. CAN'T DUMP/RINSE 2. CAN'T CHARGE 3. PRODUCTION LOSS		
Safeguards: 1. BULLSEYE ON DUMP LINE 2. FLOW INDICATOR ON DUMP LINE 3. OPERATING PROCEDURES 4. VALVE POSITION INDICATION		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations: Note: RX-745 same as others except no VCM charge line, additional dump line.		

Node 23

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Dump/Charge Manifold Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: High Pressure		
Cause: 1. VALVES LEAKING THROUGH 2. MAIN CHARGE/DUMP VALVE CLOSED DEAD HEAD CHARGE PUMPS 3. EXTERNAL HEAT		
Consequences: 1. RUPTURE LINE/BLOW GASKET 2. VCM OVER EXPOSURE 3. VCM RELEASE - FIRE 4. DAMAGE PUMPS		
Safeguards: 1. LOW FLOW SHUTDOWN ON CHARGE PUMPS 2. DCS INTERLOCKS 3. FIRE PROTECTION SYSTEM & GC'S 4. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 23

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Dump/Charge Manifold Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. FIRE PROTECTION SYSTEMS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 24

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Cooling Water Supply/Return Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: No/Low Flow		
Cause: 1. MANUAL VALVE CLOSED 2. COOLING TOWER PUMPS FAILURE 3. LOW COOLING TOWER BASIN LEVEL 4. CONTROL VALVE FAILURE 5. TEMPERATURE CONTROLLER FAILURE 6. PLUGGED LINE 7. COOLING TOWER BACKPRESSURE LINE CONTROL VALVE FAILURE		
Consequences: 1. HIGH REACTOR TEMPERATURE - SEE NODE 20 2. HIGH REACTOR PRESSURE - SEE NODE 20 3. BAD RESIN QUALITY 4. EARLY REACTOR KILL 5. PRODUCTION LOSS		
Safeguards: 1. FLOW INDICATORS 2. HIGH TEMP/PRESS. INDICATORS/ALARMS ON RXRS 3. COOLING WATER RETURN TEMP. INDICATION 4. COOLING TOWER LOW LEVEL ALARM 5. OPERATING PROCEDURES 6. THREE PUMPS ON COOLING TOWER 7. EMERGENCY COOLING WATER 8. CONTROL VALVE BYPASSES		
Consequence Rating: III	Probability Rating: B	Risk Ranking: 4
Action/Other Considerations: TEAM RECOMMENDS REVIEW OF EXISTING PROCEDURES, TRAINING, AND SAFETY CONTROLS.		

Node 24

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Cooling Water Supply/Return Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: High Pressure		
Cause: 1. MANUAL VALVE CLOSED ON RETURN LINE 2. PLUGGED/BLOCKED LINE ON RETURN LINE 3. EXTERNAL HEAT WITH NO FLOW		
Consequences: 1. LIFT RELIEF VALVE 2. OVERPRESSURE RXR JACKET 3. RUPTURE LINE/BLOW GASKET		
Safeguards: 1. RELIEF VALVE 2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 24

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Cooling Water Supply/Return Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: Low Pressure		
Cause: 1. COOLING WATER PUMP FAILURE 2. BACK PRESSURE CONTROLLER FAILS OPEN. 3. LOW COOLING TOWER LEVEL 4. PLUGGED/BLOCKED LINE		
Consequences: 1. LOW/NO FLOW		
Safeguards: 1. FLOW INDICATOR 2. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 24

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Cooling Water Supply/Return Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: High Temperature		
Cause: 1. COOLING TOWER FAN FAILURE 2. EXTERNAL HEAT		
Consequences: 1. POOR RXR COOLING - HIGH TEMP/HIGH PRESSURE - SEE NODE 20		
Safeguards: 1. COOLING WATER TEMP INDICATION 2. COOLING TOWER FAN FAILURE ALARM		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 25

Aberdeen New Module HAZOP		
Equipment/Line Description: Heat-up Loop Supply/Return Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D NM-090122-PID-D		
Deviation: No Flow		
Cause: 1. PUMP/VALVE FAILURE 2. BLOCKED/PLUGGED LINE 3. CONTROLLER FAILURE		
Consequences: 1. LONGER RXR HEAT-UP 2. LOST PRODUCTION		
Safeguards: 1. PUMP FAILURE ALARM 2. TEMP. INDICATION 3. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 25

Aberdeen New Module HAZOP		
Equipment/Line Description: Heat-up Loop Supply/Return Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D NM-090122-PID-D		
Deviation: High Pressure		
Cause: 1. VALVE FAILURE - DEAD HEAD PUMP 2. NO FLOW - INJECT RAW STEAM INTO LINE		
Consequences: 1. RUPTURE LINE/BLOW GASKET		
Safeguards: 1. RELIEF VALVE 2. TEMPERATURE CONTROLLER/INDICATION 3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 25

Aberdeen New Module HAZOP		
Equipment/Line Description: Heat-up Loop Supply/Return Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D NM-090122-PID-D		
Deviation: Low Pressure		
Cause: 1. PUMP/VALVE FAILURE 2. NO WATER IN HEAT-UP LOOP 3. BLEEDER OPEN/RUPTURED LINE		
Consequences: 1. LOW/NO FLOW		
Safeguards: 1. OPERATING PROCEDURES 2. PUMP RUN INDICATION		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 25

Aberdeen New Module HAZOP		
Equipment/Line Description: Heat-up Loop Supply/Return Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D NM-090122-PID-D		
Deviation: High Temperature		
Cause: 1. NO/LOW WATER FLOW 2. TEMP CONTROLLER FAILURE 3. EXTERNAL HEAT 4. SET POINT TOO HIGH		
Consequences: 1. HIGH PRESSURE 2. REACTOR TOO HOT - OVERSHOOT POLY TEMP		
Safeguards: 1. TEMP INDICATION 2. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 25

Aberdeen New Module HAZOP		
Equipment/Line Description: Heat-up Loop Supply/Return Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D NM-090122-PID-D		
Deviation: Low Temperature		
Cause: 1. NO STEAM 2. CONTROLLER FAILURE 3. SYSTEM DOWN FOR EXTENDED PERIOD		
Consequences: 1. LONG RXR HEAT-UP 2. PRODUCTION LOSS		
Safeguards: 1. TEMP. INDICATION 2. STEAM PRESSURE INDICATION 3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 26

Aberdeen New Module HAZOP		
Equipment/Line Description: Clean Wall Supply Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090128-PID-D		
Deviation: No/Low Flow		
Cause: 1. PLUGGED NOZZLE 2. VALVE FAILURE 3. STEAM FAILURE 4. PLUGGED/BLOCKED LINE		
Consequences: 1. CAN'T CW REACTOR 2. BAD QUALITY 3. RXR DOWNTIME 4. PLUGGED CONDENSER		
Safeguards: 1. OPERATING PROCEDURES 2. FLOW TRANSMITTER		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations: Note: RX-745 same as others except additional line to condenser.		

Node 26

Aberdeen New Module HAZOP		
Equipment/Line Description: Clean Wall Supply		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090128-PID-D		
Deviation: Low Pressure		
Cause:		
1. VALVE FAILURE		
2. PLUGGED LINE		
3. LOW STEAM PRESSURE		
4. NO CLEAN WALL SUPPLY		
5. RUPTURED LINE/ BLEEDER OPEN		
Consequences:		
1. CAN'T CLEANWALL -- SEE NO/LOW FLOW		
Safeguards:		
1. FLOW INDICATION		
2. FIELD MOUNTED PRESSURE GAUGE		
3. VALVE POSITION INDICATION		
4. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 26

Aberdeen New Module HAZOP		
Equipment/Line Description: Clean Wall Supply Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090128-PID-D		
Deviation: High Temperature/Pressure		
Cause: 1. EXTERNAL HEAT 2. ELEC. TRACE FAILURE		
Consequences: 1. HIGH PRESSURE - RUPTURED LINE/BLOW GASKET		
Safeguards: 1. OPERATING PROCEDURES 2. FIRE PROTECTION SYSTEM 3. RELIEF VALVE ON SUPPLY PUMP DISCHARGE		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 26

Aberdeen New Module HAZOP		
Equipment/Line Description: Clean Wall Supply Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090128-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED/BLOCKED LINE - SEE NO FLOW		
Safeguards: 1. ELECTRIC TRACED LINE		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 27

Aberdeen New Module HAZOP		
Equipment/Line Description: Auto Kill (Isonox)		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: No/Low Flow		
Cause:		
1. PLUGGED LINE		
2. VALVE FAILURE		
3. NO ISONOX SUPPLY (TANK EMPTY, NO NITROGEN)		
4. RUPTURED LINE/BLEEDER OPEN		
Consequences:		
1. CAN'T AUTO KILL RXR WITH ISONOX		
Safeguards:		
1. BACK-UP KILL SYSTEMS		
2. VALVE ALARMS		
3. OPERATING PROCEDURES		
4. DUAL FLOW INDICATION		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		
Note: RX-745 same as others except separate header & Emergency Kill line enters Isonox line.		

Node 27

Aberdeen New Module HAZOP		
Equipment/Line Description: Auto Kill (Isonox)		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: High Pressure		
Cause:		
1. EXTERNAL HEAT		
Consequences:		
1. RUPTURE LINE/BLOW GASKET		
2. CAN'T USE AUTO KILL		
Safeguards:		
1. FIRE PROTECTION SYSTEM		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 27

Aberdeen New Module HAZOP		
Equipment/Line Description: Auto Kill (Isonox)		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: Low Pressure		
Cause:		
1. PLUGGED/BLOCKED LINE		
2. LOW N2 PRESSURE		
3. VALVE FAILURE		
4. RUPTURED LINE/BLEEDER OPEN		
5. STORAGE TANK EMPTY		
Consequences:		
1. NO/LOW FLOW		
2. CAN'T AUTO KILL		
Safeguards:		
1. FLOW INDICATOR		
2. BACK-UP KILL SYSTEMS		
3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 27

Aberdeen New Module HAZOP		
Equipment/Line Description: Auto Kill (Isonox)		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: High Temperature		
Cause:		
1. EXTERNAL HEAT		
2. ELECTRIC TRACE FAILURE		
Consequences:		
1. HIGH PRESSURE		
Safeguards:		
1. OPERATING PROCEDURES		
2. FIRE PROTECTION SYSTEM		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 27

Aberdeen New Module HAZOP		
Equipment/Line Description: Auto Kill (Isonox)		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: Low Temperature		
Cause:		
1. WEATHER		
Consequences:		
1. PLUGGED/BLOCKED LINE - NO/LOW		
Safeguards:		
1. ELECTRIC TRACED LINES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 28

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Vent Lines Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090122-PID-D		
Deviation: No/Low Flow		
Cause: 1. PLUGGED LINE 2. VALVE FAILURE 3. HIGH PRESSURE ON RECOVERY LINE - ANOTHER RXR IN RECOV. @ HIGHER PRES. 4. MANUAL VALVE CLOSED ON INERT VENT LINE		
Consequences: 1. CAN'T VENT/RECOVER/EVACUATE REACTOR 2. EARLY KILL 3. HIGH REACTOR PRESSURE & TEMPERATURE 4. PRODUCTION LOSS		
Safeguards: 1. CONDENSER TEMP INDICATION - IF NO RISE, INDICATION RXR NOT VENTING 2. WEEKLY PM ON VENT LINES 3. VALVE POSITION INDICATION LIGHTS ON DCS 4. OPERATING PROCEDURES 5. PRESSURE INDICATOR ON RECOVERY LINE 6. EMERGENCY/AUTO KILL		
Consequence Rating: III	Probability Rating: B	Risk Ranking: 4
Action/Other Considerations: TEAM RECOMMENDS REVIEW OF EXISTING SAFETY CONTROLS, OPERATING AND PM PROCEDURES, & TRAINING		

Node 28

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Vent Lines Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090122-PID-D		
Deviation: High Pressure		
Cause: 1. HIGH PRESSURE ON RECOVERY LINE - ANOTHER RXR IN RECOV. @ HIGHER PRES.		
Consequences: 1. CAN'T VENT REACTOR 2. EARLY KILL		
Safeguards: 1. OPERATING PROCEDURES 2. KILL SYSTEMS 3. PRESSURE INDICATION ON RXRS 4. CONDENSER TEMP INDICATOR		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 28

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Vent Lines Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. FIRE PROTECTION SYSTEM		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 29

Aberdeen New Module HAZOP		
Equipment/Line Description: AMS Emergency Kill Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090120-PID-D		
Deviation: No/Low Flow and Charge Pot Low Level		
Cause: 1. VALVE FAILURE 2. CLOSED MANUAL VALVE 3. PLUGGED LINE 4. NO/LOW NITROGEN PRESSURE 5. NO AMS IN AMS CHARGE POT 6. RUPTURED LINE/BLEEDER OPEN 7. RXRS BEING BUMPED FREQUENTLY		
Consequences: 1. UNABLE TO BUMP/KILL REACTOR 2. HIGH TEMP./PRESSURE IN RXR		
Safeguards: 1. PRE-CHARGE CHECKS BEFORE EACH CHARGE 2. AMS VALVE FAILURE ALARM 3. HARD PANEL AMS KILL BACKUP BUTTONS 4. AMS AUTO KILL IN DCS PROGRAMMING 5. WEEKLY CHECKS OF AMS SYSTEM 6. OPERATING PROCEDURES 7. AUTO & NORMAL KILL SYSTEMS AS BACKUP 8. LOW PRESSURE AND LOW LEVEL ALARMS ON CHARGE POTS 9. SIGHT GLASS ON CHARGE POT		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations: Note: RX-745 same as others except enters Isonox line.		

Node 29

Aberdeen New Module HAZOP		
Equipment/Line Description: AMS Emergency Kill		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090120-PID-D		
Deviation: High Pressure		
Cause:		
1. NITROGEN BOTTLE PRESSURE REGULATOR MALFUNCTION		
2. HIGH TEMPERATURE/EXTERNAL HEAT		
Consequences:		
1. BLOWN SAFETY DISK/RELIEF VALVE LIFT ON CHARGE POT		
2. LINE RUPTURE/POT RUPTURE		
3. AMS OVEREXPOSURE TO EMPLOYEE(S)		
4. UNABLE TO EMERGENCY KILL RXR WITH AMS SYSTEM		
5. PRODUCTION LOSS/DOWNTIME		
Safeguards:		
1. PRESSURE ALARM		
2. OPERATOR CHECK BEFORE EACH CHARGE		
3. RELIEF VALVE/SAFETY DISK		
4. OPERATING PROCEDURES		
5. FIRE PROTECTION SYSTEMS		
6. FIELD MOUNTED PRESSURE GAUGES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 29

Aberdeen New Module HAZOP		
Equipment/Line Description: AMS Emergency Kill Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090120-PID-D		
Deviation: Low Pressure		
Cause: 1. LOW NITROGEN PRESSURE 2. PRESSURE REGULATOR MALFUNCTION 3. RUPTURED LINE/BLEEDER OPEN 4. CHARGE POT RV/RD OPEN		
Consequences: 1. CAN'T BUMP/KILL RXR WITH AMS SYSTEM		
Safeguards: 1. OPERATOR CHECK BEFORE EACH CHARGE 2. LOW PRESSURE ALARM ON CHARGE POT 3. WEEKLY CHECK BY OPERATIONS 4. OPERATING PROCEDURES 5. PRESSURE GAUGE IN FIELD		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 29

Aberdeen New Module HAZOP		
Equipment/Line Description: AMS Emergency Kill Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090120-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. FIRE PROTECTION SYSTEMS 2. RV/RD ON CHARGE POT 3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 29

Aberdeen New Module HAZOP		
Equipment/Line Description: AMS Emergency Kill Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090120-PID-D		
Deviation: Low Temperature		
Cause:		
Consequences: NONE		
Safeguards:		
Consequence Rating:	Probability Rating:	Risk Ranking:
Action/Other Considerations:		

Node 30

Aberdeen New Module HAZOP		
Equipment/Line Description: Jacket Steam Supply		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090121-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause:		
1. SUPPLY VALVE FAILURE/MANUAL VALVE CLOSED		
2. LOW/NO STEAM PRESSURE		
3. PLUGGED/BLOCKED LINE OR EDUCTOR		
4. RUPTURED LINE/BLEEDER OPEN		
Consequences:		
1. SLOW RXR HEAT-UP		
2. PRODUCTION LOSS		
3. QUALITY PROBLEM		
Safeguards:		
1. VALVE POSITION INDICATION		
2. STEAM PRESSURE INDICATOR		
3. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		
Note: RX-745 same except 3 eductors instead of 1.		

Node 30

Aberdeen New Module HAZOP		
Equipment/Line Description: Jacket Steam Supply		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090121-PID-D		
Deviation: Low Temperature		
Cause:		
1. NO STEAM		
2. WEATHER		
Consequences:		
1. SLOW RXR HEAT-UP		
2. PRODUCTION LOSS		
3. RUPTURED/PLUGGED LINE		
4. QUALITY PROBLEMS		
Safeguards:		
1. INSULATED LINE		
2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 31

Aberdeen New Module HAZOP		
Equipment/Line Description: Stripping Steam Supply Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090121-PID-D		
Deviation: No/Low Flow or Low Pressure		
Cause: 1. VALVE MALFUNCTION 2. MANUAL VALVE CLOSED 3. LOW/NO STEAM PRESSURE 4. STRIPPING STEAM CONTROL VALVE/CONTROLLER MALFUNCTION 5. PLUGGED/RUPTURED LINE 6. STRIPPING STEAM TEMP. XMITTER MALFUNCTION		
Consequences: 1. UNABLE TO STRIP/RECOVER RXR 2. PRODUCTION LOSS 3. HIGH RESIDUAL VCM IN RESIN - POSSIBLE OVEREXPOSURE - QUALITY PROBLEM		
Safeguards: 1. STEAM FLOW INDICATOR 2. STEAM PRESSURE INDICATOR 3. LOW STEAM PRESSURE ALARM 4. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 31

Aberdeen New Module HAZOP		
Equipment/Line Description: Stripping Steam Supply		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090121-PID-D		
Deviation: Reverse Flow		
Cause:		
1. STEAM PRESSURE LOSS DURING STRIPPING		
Consequences:		
1. BACK REACTOR CONTENTS INTO STEAM HEADER		
Safeguards:		
1. FAIL CLOSED STEAM SUPPLY VALVES		
2. INTERLOCKS ON LOW STEAM PRESSURE - VALVES CLOSE		
3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 31

Aberdeen New Module HAZOP		
Equipment/Line Description: Stripping Steam Supply		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090121-PID-D		
Deviation: Low Temperature		
Cause:		
1. WEATHER		
2. NO STEAM PRESSURE/FLOW		
Consequences:		
1. RUPTURED LINE		
2. CAN'T STRIP/RECOVER RXR		
3. PRODUCTION LOSS		
4. QUALITY PROBLEM		
Safeguards:		
1. INSULATED LINE		
2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 32

Aberdeen New Module HAZOP		
Equipment/Line Description: Normal Kill and Catalyst Charge Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090127-PID-D		
Deviation: No Flow		
Cause: 1. VALVE FAILURE 2. PLUGGED/BLOCKED/RUPTURED LINE 3. NO POT PRESSURE 4. BLEEDER OPEN 5. INTERLOCKED 6. MANUAL VALVE CLOSED		
Consequences: 1. CAN'T CHARGE CATALYST OR NORMAL KILL RXR 2. DOWNTIME/PRODUCTION LOSS		
Safeguards: 1. BACK-UP KILL SYSTEMS 2. OPERATING PROCEDURES 3. PRESSURE GAUGES ON POT 4. DCS ALARMS 5. HPSW METER		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 32

Aberdeen New Module HAZOP		
Equipment/Line Description: Normal Kill and Catalyst Charge Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090127-PID-D		
Deviation: Reverse Flow		
Cause: 1. CHECK VALVE FAILURE WITH HPSW OFF AND RXR VALVES OPEN 2. POT DEPRESSURIZED BEFORE CATALYST VALVE CLOSED 3. WINTERIZATION CIRCULATION VALVE LEFT OPEN DURING CATALYST CHARGE/NORMAL KILL CHARGE		
Consequences: 1. VCM RELEASE/OVEREXPOSURE 2. FIRE/EXPLOSION		
Safeguards: 1. OPERATING PROCEDURES 2. GC'S 3. FIRE PROTECTION SYSTEMS 4. DCS MESSAGE ABOUT RXR VALVES OPEN TOO LONG 5. PRESSURE GAUGE ON CHARGE POT		
Consequence Rating: III	Probability Rating: B	Risk Ranking: 4
Action/Other Considerations: TEAM RECOMMENDS THAT A REVIEW OF THE EXISTING RECIRCULATION LINE BE CONDUCTED. EXISTING SAFETY CONTROLS, PROCEDURES, AND TRAINING SHOULD ALSO BE REVIEWED.		

Node 32

Aberdeen New Module HAZOP		
Equipment/Line Description: Normal Kill and Catalyst Charge Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090127-PID-D		
Deviation: High Pressure		
Cause: 1. RXR CHARGE VALVE FAILURE OR SLOW TO OPEN (1 OF 2 VALVES) 2. EXTERNAL HEAT 3. CATALYST DECOMPOSITION IN CHARGE POT 4. HPSW LEFT ON AND CATALYST VALVES CLOSED		
Consequences: 1. RUPTURE DISK BLOWN 2. RUPTURE LINE OR CATALYST POT 3. PRODUCTION LOSS 4. CAN'T CHARGE/NORMAL KILL RXR		
Safeguards: 1. RUPTURE DISK ON CHARGE POT 2. PRESSURE GAUGE ON POT 3. OPERATING PROCEDURES 4. CHARGE POT HIGH PRESSURE ALARM ON DCS 5. FIRE PROTECTION SYSTEMS		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 32

Aberdeen New Module HAZOP		
Equipment/Line Description: Normal Kill and Catalyst Charge Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090127-PID-D		
Deviation: Low Pressure		
Cause: 1. HPSW FAILURE 2. RUPTURED LINE/BLEEDER OPEN 3. RUPTURE DISK BLOWN 4. LINE PLUGGED 5. VALVE CLOSED 6. FUNNEL VALVE LEFT OPEN		
Consequences: 1. CAN'T CHARGE CATALYST/CAN'T NORMAL KILL 2. PRODUCTION LOSS		
Safeguards: 1. PRESSURE GAUGE 2. OPERATING PROCEDURES 3. HPSW LOW PRESSURE INDICATOR 4. HPSW FLOW INDICATOR		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 32

Aberdeen New Module HAZOP		
Equipment/Line Description: Normal Kill and Catalyst Charge Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090127-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT 2. CATALYST DECOMPOSITION 3. STEAM/ELECTRIC TRACING ON		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. FIRE PROTECTION SYSTEMS 2. OPERATING PROCEDURES 3. PRESSURE GAUGES AND HIGH PRESSURE ALARM		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 32

Aberdeen New Module HAZOP		
Equipment/Line Description: Normal Kill and Catalyst Charge Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090127-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED/RUPTURED LINE		
Safeguards: 1. RECIRCULATION LINE 2. STEAM/ELECTRIC TRACING 3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 33

Aberdeen New Module HAZOP		
Equipment/Line Description: Seal Oil Supply/Return		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090126-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause:		
1. PUMP FAILURE 2. SEAL OIL RESERVOIR LEVEL LOW 3. RUPTURED LINE/BLEEDER OPEN 4. PLUGGED/BLOCKED LINE 5. PLUGGED FILTER 6. REGULATOR FAILURE 7. RXR SEAL BLOWN 8. VALVE CLOSED		
Consequences:		
1. RUIN AGITATOR SEAL AT RXR. 2. PRODUCTION LOSS 3. GET OIL IN RXR. BAD QUALITY		
Safeguards:		
1. PRESSURE XMITTERS ON EACH RXR - LOW PRESSURE ALARM 2. PRE-CHARGE CHECKS TO CHECK LEVEL AND PRESSURE 3. LOW LEVEL ALARM ON RESERVOIR 4. PRESSURE GAUGE ON INLET AND OUTLET OF AGITATOR SEAL 5. OPERATING PROCEDURES 6. FLOW INDICATION		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 33

Aberdeen New Module HAZOP		
Equipment/Line Description: Seal Oil Supply/Return		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090126-PID-D		
Deviation: High Pressure		
Cause:		
1. REGULATOR FAILURE		
2. CLOSED VALVE		
3. PLUGGED/BLOCKED LINE		
4. PLUGGED FILTER		
Consequences:		
1. BLOW RXR SEAL OUT - OIL IN RXR		
2. LIFT RELIEF VALVE		
Safeguards:		
1. RELIEF VALVE		
2. HIGH PRESSURE ALARM		
3. PRESSURE REGULATOR		
4. PRESSURE GAUGE		
5. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 34

Aberdeen New Module HAZOP		
Equipment/Line Description: Lip Seal Flush		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090119-PID-D		
Deviation: No/Low Flow		
Cause:		
1. PUMP FAILURE		
2. PLUGGED LINE		
3. VALVE CLOSED		
4. LINE RUPTURE/BLEEDER OPEN		
Consequences:		
1. DAMAGE SEAL		
2. PRODUCTION LOSS		
Safeguards:		
1. OPERATING PROCEDURES		
2. PRESSURE GAUGES		
3. LOW FLOW ALARM ON DCS		
4. FIELD MOUNTED FLOW METER		
5. PRE-CHARGE CHECKS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 34

Aberdeen New Module HAZOP		
Equipment/Line Description: Lip Seal Flush		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090119-PID-D		
Deviation: More Flow		
Cause:		
1. WRONG FLOWMETER IN LINE		
2. MANUAL VALVES OPEN TOO MUCH		
3. FLOWMETER BYPASS VALVE OPEN		
Consequences:		
1. HIGH REACTOR LEVEL - SEE NODE 20		
Safeguards:		
1. OPERATING PROCEDURES		
2. REACTOR FOAMING AN INDICATION OF HIGH LEVEL		
3. REACTOR PRESSURE GAUGES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 34

Aberdeen New Module HAZOP		
Equipment/Line Description: Lip Seal Flush		
Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090119-PID-D		
Deviation: High Pressure		
Cause:		
1. PLUGGED/BLOCKED LINE		
2. VALVE CLOSED		
3. PRESSURE REGULATOR FAILURE		
Consequences:		
1. RUPTURE LINE		
2. OVERFILL REACTOR		
3. PRODUCTION LOSS		
Safeguards:		
1. PRESSURE GAUGES IN FIELD		
2. OPERATING PROCEDURES - PRE-CHARGE CHECKS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 34

Aberdeen New Module HAZOP		
Equipment/Line Description: Lip Seal Flush Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090119-PID-D		
Deviation: Low Pressure		
Cause: 1. PUMP FAILURE 2. PLUGGED/BLOCKED LINE 3. REGULATOR FAILURE 4. VALVE CLOSED 5. BLEEDER OPEN/LINE RUPTURE		
Consequences: 1. NO/LOW FLOW		
Safeguards: 1. PRESSURE GAUGES 2. FLOW METERS 3. SPARE PUMP 4. LOW PRESSURE ALARM ON DCS 5. OPERATING PROCEDURES - PRE-CHARGE CHECKS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 34

Aberdeen New Module HAZOP		
Equipment/Line Description: Lip Seal Flush Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090119-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. NONE		
Safeguards: 1. CONTINUOUS FLOW IN ALL LINES 2. FIRE PROTECTION SYSTEM		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 34

Aberdeen New Module HAZOP		
Equipment/Line Description: Lip Seal Flush Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D, NM-090119-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED/BLOCKED LINE 2. RUPTURE LINE		
Safeguards: 1. STEAM TRACED LINES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 35

Aberdeen New Module HAZOP		
Equipment/Line Description: Reactor Atmospheric Vent Drawing No. NM-090103-PID-D, NM-090104-PID-D, NM-090105-PID-D, NM-090106-PID-D, NM-090107-PID-D		
Deviation: No/Low Flow		
Cause: 1. PLUGGED/BLOCKED LINE 2. VALVE FAILURE 3. DCS INTERLOCKED		
Consequences: 1. CAN'T DUMP REACTOR 2. REACTOR WON'T RINSE WELL		
Safeguards: 1. OPERATING PROCEDURES 2. VALVE POSITION INDICATORS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 36

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 Low Mol Dump Header Drawing No. NM-090107-PID-D, NM-090117-PID-D		
Deviation: No/Low Flow		
Cause: 1. PLUGGED BLOCKED LINE 2. REACTOR ATMOSPHERIC VENT NOT OPEN 3. RUPTURED LINE 4. VALVE CLOSED 5. LEVEL CONTROL VALVE MALFUNCTION 6. DCS INTERLOCK 7. REACTOR EMPTY		
Consequences: 1. CAN'T DUMP REACTOR 2. PRODUCTION LOSS/DOWNTIME		
Safeguards: 1. SIGHTGLASS 2. FLOW SWITCH 3. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 36

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 Low Mol Dump Header Drawing No. NM-090107-PID-D, NM-090117-PID-D		
Deviation: High Pressure		
Cause: 1. VALVE LEAKING THROUGH FROM REACTOR 2. EXTERNAL HEAT		
Consequences: 1. VCM RELEASE THROUGH DUMP HEADER 2. RUPTURE LINE		
Safeguards: 1. DOUBLE BLOCK VALVES ON REACTOR 2. GC'S 3. FIRE PROTECTION SYSTEMS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 36

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 Low Mol Dump Header Drawing No. NM-090107-PID-D, NM-090117-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. FIRE PROTECTION SYSTEMS		
Consequence Rating: III	Probability Rating: D	Risk Ranking: 5
Action/Other Considerations:		

Node 36

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 Low Mol Dump Header Drawing No. NM-090107-PID-D, NM-090117-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. NONE		
Safeguards: 1. DUMP HEADER USUALLY EMPTY		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 37

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 BME Charge Line Drawing No. NM-090107-PID-D, NM-090108-PID-D		
Deviation: No/Low Flow		
Cause: 1. LOW HPSW PRESSURE 2. CLOSED VALVE 3. BLEEDER OPEN/RUPTURED LINE 4. PLUGGED/BLOCKED LINE 5. DCS INTERLOCK		
Consequences: 1. CAN'T CHARGE BME 2. QUALITY PROBLEMS 3. REACTOR HIGH PRESSURE 4. PRODUCTION LOSS		
Safeguards: 1. OPERATING PROCEDURES 2. DCS CHARGE SEQUENCE 3. ELECTRIC TRACING 4. PRESSURE SWITCHES -- DCS INTERLOCKS		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 37

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 BME Charge Line Drawing No. NM-090107-PID-D, NM-090108-PID-D		
Deviation: Reverse Flow		
Cause: 1. BLEEDER OPEN DURING CHARGE		
Consequences: 1. VCM RELEASE TO SEWER		
Safeguards: 1. OPERATING PROCEDURES 2. DCS INTERLOCKS & VALVE SEQUENCING		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 37

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 BME Charge Line Drawing No. NM-090107-PID-D, NM-090108-PID-D		
Deviation: High Pressure		
Cause: 1. CHARGE VALVES SLOW TO OPEN 2. VALVE FAILURE 3. EXTERNAL HEAT 4. PRESSURE SWITCH FAILURE		
Consequences: 1. BLOW RUPTURE DISK ON CHARGE POT 2. LINE RUPTURE/BLOW GASKET 3. CAN'T CHARGE BME		
Safeguards: 1. HIGH PRESSURE SWITCHES ON CHARGE POT 2. VALVE SEQUENCING BY DCS 3. PRESSURE GAUGES 4. OPERATING PROCEDURES 5. SAFETY DISK/RELIEF VALVE ON CHARGE POT		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 37

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 BME Charge Line Drawing No. NM-090107-PID-D, NM-090108-PID-D		
Deviation: Low Pressure		
Cause: 1. NO HPSW 2. LOW HPSW PRESSURE 3. VALVE FAILURE 4. BLEEDER OPEN/LINE RUPTURE 5. SAFETY DISK BLOWN/RV OPEN		
Consequences: 1. CAN'T CHARGE BME 2. REVERSE FLOW 3. QUALITY PROBLEMS 4. NO FLOW		
Safeguards: 1. DCS INTERLOCKS 2. PRESSURE GAUGE 3. PRESSURE SWITCH 4. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 37

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 BME Charge Line Drawing No. NM-090107-PID-D, NM-090108-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. RV/RD 2. FIRE PROTECTION SYSTEM 3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 37

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 BME Charge Line Drawing No. NM-090107-PID-D, NM-090108-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED LINE 2. RUPTURED LINE 3. CAN'T CHARGE BME		
Safeguards: 1. STEAM TRACING & INSULATION 2. WINTERIZATION PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 38

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 Polyvic Charge Line Drawing No. NM-090107-PID-D		
Deviation: No/Low Flow		
Cause: 1. VALVE CLOSED 2. LOW PRESSURE 3. RUPTURED LINE/GASKET BLOWN 4. BLEEDER OPEN 5. LINE PLUGGED 6. RAM VALVE MALFUNCTION 7. DCS INTERLOCK		
Consequences: 1. CAN'T CHARGE POLYVIC 2. QUALITY PROBLEMS		
Safeguards: 1. LOW FLOW ALARM -- DUAL FLOW METERS 2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 38

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 Polyvic Charge Line Drawing No. NM-090107-PID-D		
Deviation: High Pressure		
Cause: 1. VALVE CLOSED -- DEAD HEAD PUMP 2. HIGH TEMPERATURE - EXTERNAL HEAT 3. PLUGGED/BLOCKED LINE		
Consequences: 1. RUPTURE LINE/BLOW GASKET 2. NO/LOW FLOW		
Safeguards: 1. RELIEF VALVE ON DISCHARGE OF CHARGE PUMP 2. FLOW METERS -- LOW FLOW SHUTDOWN 3. VALVE POSITION INDICATION 4. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 38

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 Polyvic Charge Line Drawing No. NM-090107-PID-D		
Deviation: Low Pressure		
Cause: 1. BLEEDER OPEN/RUPTURED LINE 2. PLUGGED/BLOCKED LINE 3. VALVE CLOSED 4. LOW INLET PRESSURE		
Consequences: 1. CAN'T CHARGE POLYVIC 2. QUALITY PROBLEMS		
Safeguards: 1. LOW FLOW ALARM & SHUTDOWN - DUAL FLOW METERS 2. OPERATING PROCEDURES 3. VALVE POSITION INDICATION		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 38

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 Polyvic Charge Line Drawing No. NM-090107-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT 2. ELECTRIC TRACE THERMOSTAT MALFUNCTION		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. RV ON PUMP DISCHARGE 2. OPERATING PROCEDURES 3. FIRE PROTECTION SYSTEM		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 38

Aberdeen New Module HAZOP		
Equipment/Line Description: RX-745 Polyvic Charge Line Drawing No. NM-090107-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER 2. ELECTRIC TRACE FAILURE		
Consequences: 1. TOO VISCOUS TO PUMP 2. LINE RUPTURE 3. PLUGGED LINE 4. CAN'T CHARGE POLYVIC		
Safeguards: 1. ELECTRIC TRACE 2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 39

Aberdeen New Module HAZOP		
Equipment/Line Description: BME Metering Line Drawing No. NM-090108-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. PUMP FAILURE 2. CLOSED VALVE 3. RUPTURED LINE/BLEEDER OPEN 4. TOTE EMPTY 5. NO AIR PRESSURE TO PUMP 6. PLUGGED/BLOCKED LINE 7. PRESSURE ON CHARGE POT/CHARGE POT FULL 8. DCS INTERLOCKED		
Consequences: 1. CAN'T CHARGE BME 2. CAN'T PUMP BME TO METERING POT		
Safeguards: 1. SIGHTGLASSES 2. OPERATING PROCEDURES 3. PRESSURE GAUGES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 39

Aberdeen New Module HAZOP		
Equipment/Line Description: BME Metering Line Drawing No. NM-090108-PID-D		
Deviation: High Pressure		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. RUPTURE LINE/BLOW GASKET 2. FIRE - BME IS FLAMMABLE		
Safeguards: 1. RELIEF VALVE/RUPTURE DISK ON CHARGE POT 2. POP-OFF VALVE ON BME STORAGE TOTE 3. FIRE PROTECTION SYSTEMS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 39

Aberdeen New Module HAZOP		
Equipment/Line Description: BME Metering Line Drawing No. NM-090108-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE 2. FIRE		
Safeguards: 1. RELIEF VALVES 2. FIRE PROTECTION SYSTEMS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 40

Aberdeen New Module HAZOP		
Equipment/Line Description: BME/Nitrogen Purge Line Drawing No. NM-090108-PID-D		
Deviation: No/Low Flow		
Cause: 1. NO NITROGEN PRESSURE 2. PLUGGED/BLOCKED LINE 3. REGULATOR FAILURE		
Consequences: 1. CAN'T PURGE BME TRANSFER LINES		
Safeguards: 1. OPERATING PROCEDURES 2. PRESSURE GAUGES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 40

Aberdeen New Module HAZOP		
Equipment/Line Description: BME/Nitrogen Purge Line Drawing No. NM-090108-PID-D		
Deviation: High Pressure		
Cause: 1. EXTERNAL HEAT 2. N2 REGULATOR MALFUNCTION		
Consequences: 1. RUPTURE LINE/BLOW GASKET		
Safeguards: 1. PRESSURE GAUGES 2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 40

Aberdeen New Module HAZOP		
Equipment/Line Description: BME/Nitrogen Purge Line Drawing No. NM-090108-PID-D		
Deviation: Low Pressure		
Cause: 1. RUPTURED LINE 2. LOW N2 BOTTLE PRESSURE 3. REGULATOR MALFUNCTION		
Consequences: 1. CAN'T PURGE BME LINES		
Safeguards: 1. PRESSURE GAUGES 2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 40

Aberdeen New Module HAZOP		
Equipment/Line Description: BME/Nitrogen Purge Line Drawing No. NM-090108-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. FIRE PROTECTION SYSTEMS 2. PRESSURE GAUGES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 41

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to BME Charge Pot Drawing No. NM-090108-PID-D, NM-090127-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. PLUGGED BLOCKED LINE 2. VALVE MALFUNCTION/CLOSED 3. HPSW PUMP NOT RUNNING - NO HPSW 4. BLEEDER OPEN/RUPTURED LINE 5. DCS INTERLOCK		
Consequences: 1. CAN'T CHARGE BME		
Safeguards: 1. FLOW METER - LOW FLOW ALARM/SHUTDOWN 2. LOW PRESSURE XMITTER ON HPSW SYSTEM 3. PRESSURE SWITCH ON BME CHARGE POT 4. PRESSURE GAUGE/SWITCHES ON BME CHARGE POT 5. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 41

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to BME Charge Pot Drawing No. NM-090108-PID-D, NM-090127-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. NONE		
Safeguards: 1. FIRE PROTECTION SYSTEM		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 41

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to BME Charge Pot Drawing No. NM-090108-PID-D, NM-090127-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUG LINE 2. RUPTURE LINE		
Safeguards: 1. INSULATED LINE 2. WINTERIZATION PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 42

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to BME Charge Line Drawing No. NM-090108-PID-D, NM-090127-PID-D		
Deviation: No/Low Flow		
Cause: 1. RUPTURED LINE 2. PLUGGED LINE 3. VALVE CLOSED		
Consequences: NONE		
Safeguards:		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 42

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to BME Charge Line Drawing No. NM-090108-PID-D, NM-090127-PID-D		
Deviation: High Pressure		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. LINE RUPTURE		
Safeguards: 1. FIRE PROTECTION SYSTEMS		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 42

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to BME Charge Line Drawing No. NM-090108-PID-D, NM-090127-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. FIRE PROTECTION SYSTEM		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 42

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to BME Charge Line Drawing No. NM-090108-PID-D, NM-090127-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. LINE RUPTURE		
Safeguards: 1. INSULATED LINE 2. WINTERIZATION PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 43

Aberdeen New Module HAZOP		
Equipment/Line Description: Rxr. Recovery Lines to K.O. Drums & Compressors		
Drawing No. NM-090109-PID-D		
Deviation: No/Low Flow		
Cause:		
1. VALVE CLOSED 2. LINE RUPTURED 3. PLUGGED LINE 4. CONTROL VALVE FAILURE 5. DCS INTERLOCKED 6. HIGH K.O. DRUM PRESSURE 7. RECOVERY SYSTEM NOT RUNNING W/ RECOVERY VALVE ON RXR OPEN		
Consequences:		
1. PRODUCTION LOSS 2. UNABLE TO VENT REACTORS 3. UNABLE TO RECOVER REACTORS		
Safeguards:		
1. PRESSURE INDICATOR/XMITTER ON RECOVERY LINE 2. VALVE POSITION INDICATORS 3. OPERATING PROCEDURES 4. AMP INDICATORS ON COMPRESSORS & VAC. PUMPS 5. SEAL WATER CONTROLLERS TO VAC. PUMPS & COMPRESSORS 6. DISPLAY OF CONTROLLER OUTPUT & SET POINT TO PRESSURE CONTROL VALVE		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 43

Aberdeen New Module HAZOP		
Equipment/Line Description: Rxr. Recovery Lines to K.O. Drums & Compressors		
Drawing No. NM-090109-PID-D		
Deviation: More Flow & High Pressure		
Cause:		
1. PRESSURE CONTROL VALVE FAILURE 2. LINE RUPTURE 3. PRESSURE CONTROLLER SET POINT TOO HIGH 4. PRESSURE CONTROLLER IN MANUAL OPEN 5. EXTERNAL HEAT		
Consequences:		
1. FOAM REACTOR - CARRYOVER RESIN INTO RECOVERY SYSTEM 2. BLOW SAFETY DISK/LIFT RELIEF VALVE ON K.O. DRUMS 3. VCM RELEASE 4. PRODUCTION LOSS 5. MUST CLEAN RECOVERY SYSTEM 6. RUPTURE LINE/BLOW GASKET		
Safeguards:		
1. PRESSURE XMITTER 2. PRESSURE GAUGES ON SYSTEM 3. SAFETY DISK/RELIEF VALVES 4. OPERATING PROCEDURES 5. DCS INTERLOCKS 6. AMP INDICATION ON COMPRESSORS & VAC. PUMPS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 43

Aberdeen New Module HAZOP		
Equipment/Line Description: Rxr. Recovery Lines to K.O. Drums & Compressors		
Drawing No. NM-090109-PID-D		
Deviation: High Level in K.O. Drum		
Cause:		
1. HPSW LEFT ON 2. DRAIN CONTROL NOT WORKING 3. DRAIN LINE PLUGGED 4. PUMP NOT RUNNING 5. BLOWDOWN TANK HIGH PRESSURE		
Consequences:		
1. CAN'T RECOVER RXR 2. PRODUCTION LOSS 3. HIGH AMPS ON REC. COMPRESSORS & VAC. PUMPS 4. POSSIBLE DAMAGE TO REC. COMPRESSORS & VAC. PUMPS 5. BLOW SAFETY DISK/LIFT RELIEF VALVE		
Safeguards:		
1. HIGH LEVEL SWITCH CONTROLS FLOW TO BLOWDOWN TANK 2. SIGHTGLASS 3. OPERATING PROCEDURES 4. PRESSURE XMITTERS 5. AMP INDICATION ON REC. COMPRESSORS & VAC. PUMPS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 43

Aberdeen New Module HAZOP		
Equipment/Line Description: Rxr. Recovery Lines to K.O. Drums & Compressors		
Drawing No. NM-090109-PID-D		
Deviation: Low Level in K.O. Drum		
Cause:		
1. DRAIN VALVE STUCK OPEN 2. LOW LEVEL SWITCH FAILURE		
Consequences:		
1. RESIN CARRYOVER INTO RECOVERY SYSTEM 2. CAVITATE PUMPS 3. RECOVERY SYSTEM DOWNTIME - PRODUCTION LOSS 4. HIGH PRESSURE IN BLOWDOWN TANK 5. BAD RESIN QUALITY (HP & CONTAMINATION)		
Safeguards:		
1. SIGHTGLASSES 2. LEVEL CONTROL SWITCHES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 4
Action/Other Considerations:		
TEAM RECOMMENDS THAT A LOW LEVEL ALARM ON THE K.O. DRUMS IS INSTALLED ON THE DCS.		

Node 43

Aberdeen New Module HAZOP		
Equipment/Line Description: Rxr. Recovery Lines to K.O. Drums & Compressors		
Drawing No. NM-090109-PID-D		
Deviation: High Temperature		
Cause:		
1. EXTERNAL HEAT		
Consequences:		
1. HIGH PRESSURE		
Safeguards:		
1. FIRE PROTECTION SYSTEMS		
2. OPERATING PROCEDURES		
3. PRESSURE XMITTER		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 44

Aberdeen New Module HAZOP		
Equipment/Line Description: Water/VCM from KO Tank, Recirc. Line & to Blowdown Tank		
Drawing No. NM-090109-PID-D, NM-090115-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause:		
1. PUMP FAILURE 2. RUPTURED LINE/BLEEDER OPEN 3. PLUGGED/BLOCKED LINE 4. K.O. DRUMS UNDER VACUUM 5. VALVE CLOSED/MALFUNCTION 6. HIGH PRESSURE ON BLOWDOWN TANK 7. SPRAY HEAD PLUGGED IN K.O. DRUM 8. K.O. TANK EMPTY		
Consequences:		
1. HIGH K.O. TANK LEVEL 2. RESIN CARRYOVER - QUALITY PROBLEMS/PRODUCTION LOSS 3. DAMAGE RECIRC. PUMPS		
Safeguards:		
1. TWO RECIRCULATION PUMPS 2. LEVEL CONTROL ON K.O. DRUMS 3. SIGHTGLASS ON KO DRUMS 4. PRESSURE GAUGES 5. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 44

Aberdeen New Module HAZOP		
Equipment/Line Description: Water/VCM from KO Tank, Recirc. Line & to Blowdown Tank		
Drawing No. NM-090109-PID-D, NM-090115-PID-D		
Deviation: High Pressure		
Cause:		
1. KO TANK EMPTY		
2. NO FLOW - DEAD HEAD PUMPS		
3. EXTERNAL HEAT		
Consequences:		
1. RUPTURE LINE - VCM RELEASE		
2. HIGH PRESSURE IN BLOWDOWN TANK		
3. DAMAGE PUMPS		
Safeguards:		
1. FIRE PROTECTION SYSTEMS		
2. OPERATING PROCEDURES		
3. RELIEF VALVE ON BLOWDOWN TANK		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 44

Aberdeen New Module HAZOP		
Equipment/Line Description: Water/VCM from KO Tank, Recirc. Line & to Blowdown Tank		
Drawing No. NM-090109-PID-D, NM-090115-PID-D		
Deviation: High Temperature		
Cause:		
1. EXTERNAL HEAT		
Consequences:		
1. HIGH PRESSURE		
Safeguards:		
1. FIRE PROTECTION SYSTEMS		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 44

Aberdeen New Module HAZOP		
Equipment/Line Description: Water/VCM from KO Tank, Recirc. Line & to Blowdown Tank		
Drawing No. NM-090109-PID-D, NM-090115-PID-D		
Deviation: Low Temperature		
Cause:		
1. WEATHER		
Consequences:		
1. PLUG LINE		
2. RUPTURE LINE		
Safeguards:		
1. INSULATED LINE		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 45

Aberdeen New Module HAZOP		
Equipment/Line Description: Cooling Water to EX-335 Drawing No. NM-090109-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. COOLING TOWER PUMP NOT RUNNING 2. VALVE CLOSED 3. LINE RUPTURED/BLEEDER OPEN 4. LINE BLOCKED/PLUGGED 5. TEMPERATURE CONTROLLER FAILURE 6. INSTRUMENT AIR LOW/NO PRESSURE		
Consequences: 1. HIGH KO DRUM TEMPERATURE		
Safeguards: 1. PRESSURE GAUGES 2. TEMPERATURE GAUGE ON DISCHARGE 3. BYPASS AROUND CONTROL VALVE 4. COOLING TOWER PUMP FAILURE ALARM		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 45

Aberdeen New Module HAZOP		
Equipment/Line Description: Cooling Water to EX-335 Drawing No. NM-090109-PID-D		
Deviation: High Pressure and High Temperature		
Cause: 1. EXTERNAL HEAT 2. INLET AND OUTLET VALVES CLOSED - THERMAL BUILDUP IN COOLING WATER		
Consequences: 1. HIGH PRESSURE ON WATER RECIRC. COOLER SHELL SIDE		
Safeguards: 1. FIRE PROTECTION SYSTEM		
Consequence Rating: III	Probability Rating: B	Risk Ranking: 4
Action/Other Considerations: TEAM RECOMMENDS PRESSURE RELIEF ON SHELL SIDE OF WATER RECIRC. COOLER		

Node 45

Aberdeen New Module HAZOP		
Equipment/Line Description: Cooling Water to EX-335 Drawing No. NM-090109-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUG LINE 2. RUPTURE LINE		
Safeguards: 1. INSULATED LINE		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 46

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to KO Drum LG/Level Switches Drawing No. NM-090109-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. VALVE CLOSED 2. LINE RUPTURED 3. LINE PLUGGED/BLOCKED 4. HPSW PUMPS NOT RUNNING		
Consequences: 1. CAN'T RINSE OFF SIGHTGLASS OR LEVEL SWITCHES 2. SIGHTGLASS OR LEVEL SWITCH PLUGGED WITH RESIN		
Safeguards: 1. FLOW METER TO EACH K.O. DRUM 2. HPSW PUMP FAILURE ALARM 3. PRESSURE GAUGES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 46

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to KO Drum LG/Level Switches Drawing No. NM-090109-PID-D		
Deviation: High Temperature and High Pressure		
Cause: 1. EXTERNAL HEAT W/ NO FLOW		
Consequences: 1. HIGH PRESSURE 2. LINE OR SIGHTGLASS RUPTURE 3. VCM RELEASE		
Safeguards: 1. FIRE PROTECTION SYSTEMS 2. CONTINUOUS FLOW OF HPSW THROUGH LEVEL WELL		
Consequence Rating: III	Probability Rating: D	Risk Ranking: 5
Action/Other Considerations:		

Node 47

Aberdeen New Module HAZOP		
Equipment/Line Description: VCM Vapor Lines Drawing No. NM-090109-PID-D		
Deviation: No/Low Flow		
Cause: 1. VALVES CLOSED 2. PLUGGED/BLOCKED LINE 3. RUPTURED LINE 4. HIGH PRESSURE IN KO DRUMS		
Consequences: 1. CAN'T EQUALIZE PRESSURE IN RECOVERY SYSTEM 2. CAN'T RECOVER RVCN/VCM RECEIVER FOR MAINTENANCE/INSPECTION 3. CAN'T VENT BLOWDOWN TANK VAPORS TO KO DRUMS		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 47

Aberdeen New Module HAZOP		
Equipment/Line Description: VCM Vapor Lines Drawing No. NM-090109-PID-D		
Deviation: High Pressure and High Temperature		
Cause: 1. EXTERNAL HEAT 2. HIGH KO DRUM PRESSURE		
Consequences: 1. DIFFICULTY RECOVERING EQUIPMENT IN RECOVERY SYSTEM 2. LINE RUPTURE/BLOW GASKET		
Safeguards: 1. FIRE PROTECTION EQUIPMENT 2. KO DRUM PRESSURE CONTROL		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 48

Aberdeen New Module HAZOP		
Equipment/Line Description: VCM Vapors to Vac. Pumps, Rec. Compressors, & Seal Water Separators		
Drawing No. NM-090110-PID-D, NM-090111-PID-D		
Deviation: No/Low Flow		
Cause:		
1. VALVE CLOSED 2. PLUGGED/BLOCKED LINE 3. RUPTURED LINE/BLEEDER OPEN 4. COMPRESSOR OR VACUUM PUMP FAILURE 5. HIGH RECOVERY SYSTEM BACKPRESSURE 6. DCS FAILURE		
Consequences:		
1. CAN'T RECOVER REACTOR 2. PRODUCTION LOSS		
Safeguards:		
1. OPERATING PROCEDURES 2. DCS ALARMS 3. VALVE POSITION INDICATION 4. COMPRESSOR / VAC. PUMP RUN INDICATION		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 48

Aberdeen New Module HAZOP		
Equipment/Line Description: VCM Vapors to Vac. Pumps, Rec. Compressors, & Seal Water Separators Drawing No. NM-090110-PID-D, NM-090111-PID-D		
Deviation: High Pressure and High Temperature		
Cause: 1. BLOCKED FLOW ON DISCHARGE OF COMPRESSORS 2. EXTERNAL HEAT		
Consequences: 1. BLOW SAFETY DISK /LIFT RV ON COMPRESSOR DISCHARGE 2. VCM RELEASE		
Safeguards: 1. PRESSURE XMITTER ON COMPRESSOR DISCHARGE 2. RELIEF VALVE/ SAFETY DISK 3. FIRE PROTECTION SYSTEM 4. VALVE POSITION INDICATORS 5. DCS INTERLOCKS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 48

Aberdeen New Module HAZOP		
Equipment/Line Description: VCM Vapors to Vac. Pumps, Rec. Compressors, & Seal Water Separators Drawing No. NM-090110-PID-D, NM-090111-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED LINE		
Safeguards: 1. WINTERIZATION PROCEDURES 2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 48

Aberdeen New Module HAZOP		
Equipment/Line Description: VCM Vapors to Vac. Pumps, Rec. Compressors, & Seal Water Separators		
Drawing No. NM-090110-PID-D, NM-090111-PID-D		
Deviation: Seal Water Separator High Level		
Cause:		
1. HPSW LEFT ON 2. LEVEL CONTROLLER MALFUNCTION 3. PLUGGED DRAIN LINE 4. PUMP FAILURE		
Consequences:		
1. SLOW RECOVERY 2. HIGH RECOVERY SYSTEM PRESSURE 3. LIFT RV/BLOW RD		
Safeguards:		
1. SIGHTGLASS 2. LEVEL CONTROLLER 3. HIGH LEVEL ALARM 4. PUMP RUM INDICATION 5. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 48

Aberdeen New Module HAZOP		
Equipment/Line Description: VCM Vapors to Vac. Pumps, Rec. Compressors, & Seal Water Separators		
Drawing No. NM-090110-PID-D, NM-090111-PID-D		
Deviation: Seal Water Separator Low Level		
Cause:		
1. LEVEL CONTROLLER FAILURE		
2. NO HPSW		
3. DRAIN VALVE STUCK OPEN		
4. RUPTURE LINE/BLEEDER OPEN		
Consequences:		
1. SLOW RECOVERY		
2. VCM RELEASE		
3. NO RING SEAL WATER TO COMPRESSORS & VAC. PUMPS		
Safeguards:		
1. SIGHTGLASS		
2. LOW LEVEL ALARM		
3. OPERATING PROCEDURES		
4. AMP INDICATION ON COMPRESSORS AND VAC. PUMPS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 49

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to Vac. Pumps & Recovery Compressors Drawing No. NM-090110-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. HPSW PUMP FAILURE 2. VALVE CLOSED 3. BLOCKED/PLUGGED LINE		
Consequences: 1. SEAL FAILURE 2. SLOW/NO RECOVERY 3. DAMAGE VAC. PUMPS/RECOVERY COMPRESSORS		
Safeguards: 1. FLOW METER IN FIELD 2. PRESSURE XMITTER ON HPSW PUMP AND LOW PRESSURE ALARM ON DCS 3. OPERATING PROCEDURES, DAILY CHECK OF HPSW PUMPS		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 49

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to Vac. Pumps & Recovery Compressors Drawing No. NM-090110-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED LINE 2. RUPTURED LINE 3. NO/LOW FLOW		
Safeguards: 1. INSULATED LINE		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 50

Aberdeen New Module HAZOP		
Equipment/Line Description: Ring Seal Water Drawing No. NM-090110-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. SEAL WATER PUMP FAILURE 2. FLOW CONTROLLER FAILURE 3. PLUGGED/BLOCKED LINE 4. VALVE CLOSED 5. FILTER PLUGGED 6. FLOW XMITTER PLUGGED		
Consequences: 1. SLOW/NO RECOVERY 2. LOST PRODUCTION		
Safeguards: 1. FLOW METERS 2. VALVE POSITION INDICATION 3. MOTOR AMP INDICATION ON COMPRESSORS AND VAC. PUMPS 4. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 4
Action/Other Considerations: TEAM RECOMMENDS THAT EXISTING FLOW METERS BE REPLACED WITH ORIFICE PLATES AND FLOW XMITTERS. THIS WOULD REDUCE MAINTENANCE WORK AND VINYL DOWNTIME.		

Node 50

Aberdeen New Module HAZOP		
Equipment/Line Description: Ring Seal Water Drawing No. NM-090110-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED LINE 2. RUPTURED LINE 3. NO/LOW FLOW 4. SEAL WATER TOO COOL TO VAPORIZE VCM - COMPRESSORS WON'T PULL		
Safeguards: 1. RUNS ALL THE TIME IN COLD WEATHER 2. STEAM TRACED 3. WINTERIZATION PROCEDURES 4. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 51

Aberdeen New Module HAZOP		
Equipment/Line Description: Relief Valve Header to Blowdown Tank Drawing No. NM-090110-PID-D, NM-090115-PID-D		
Deviation: No/Low Flow		
Cause: 1. VALVE CLOSED ON INLET OR OUTLET OF RV 2. PLUGGED LINE 3. NORMAL OPERATION		
Consequences: 1. HIGH HIGH PRESSURE IN INLET TO VAC. PUMP OR DISCHARGE OF COMPRESSORS IF RELIEF SYSTEM IS PLUGGED		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 52

Aberdeen New Module HAZOP		
Equipment/Line Description: Seal Water Separator Pressure Equalization Bypass Header		
Drawing No. NM-090110-PID-D, NM-090111-PID-D		
Deviation: No/Low Flow		
Cause: 1. COMPRESSORS RUNNING 2. VALVE CLOSED 3. LINE PLUGGED		
Consequences: 1. PRESSURE STAYS ON RVCM RECEIVERS AND SEAL WATER SEPARATORS		
Safeguards: 1. VALVE POSITION INDICATION		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 53

Aberdeen New Module HAZOP		
Equipment/Line Description: Water/VCM Recirculation Line Drawing No. NM-090111-PID-D, NM-090112-PID-D, NM-090113-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. SEAL WATER SEPARATORS EMPTY 2. PLUGGED FILTERS 3. PUMP FAILURE 4. VALVE CLOSED 5. PLUGGED/BLOCKED LINE 5. RUPTURED LINE/BLEEDER OPEN 6. CONTROLLER FAILURE ON SEAL WATER COOLERS		
Consequences: 1. NO/SLOW RECOVERY 2. NO RING SEAL WATER 3. HIGH SEAL WATER SEP. LEVEL		
Safeguards: 1. LOW LEVEL ALARM ON SEAL WATER SEPS. 2. RUN INDICATION ON PUMPS 3. PRESSURE GAUGES ON FILTERS 4. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 53

Aberdeen New Module HAZOP		
Equipment/Line Description: Water/VCM Recirculation Line Drawing No. NM-090111-PID-D, NM-090112-PID-D, NM-090113-PID-D		
Deviation: High Pressure		
Cause: 1. EXTERNAL HEAT 2. HPSW LEFT ON SEAL WATER SEP. TO MAKE-UP LEVEL		
Consequences: 1. RUPTURE LINE 2. LIFT RELIEF VALVE 3. SMALL VCM RELEASE CONTAINED IN WATER		
Safeguards: 1. RELIEF VALVES 2. OPERATING PROCEDURES 3. FIRE PROTECTION SYSTEMS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 53

Aberdeen New Module HAZOP		
Equipment/Line Description: Water/VCM Recirculation Line Drawing No. NM-090111-PID-D, NM-090112-PID-D, NM-090113-PID-D		
Deviation: High Temperature		
Cause: 1. TEMP. CONTROLLER FAILURE ON SEAL WATER COOLERS 2. NO COOLING WATER TO SEAL WATER COOLERS 3. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE 2. RAISE DISCHARGE PRESSURE OF RECOVERY COMPRESSORS - SLOW RECOVERY		
Safeguards: 1. FIRE PROTECTION SYSTEM 2. RECOVERY COMPRESSOR DISCHARGE HIGH TEMP. ALARM 3. SEAL WATER COOLERS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 53

Aberdeen New Module HAZOP		
Equipment/Line Description: Water/VCM Recirculation Line Drawing No. NM-090111-PID-D, NM-090112-PID-D, NM-090113-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED/RUPTURED LINE 2. SEAL WATER TOO COOL TO VAPORIZE VCM - COMPRESSORS WON'T PULL 3. LOW COMPRESSOR DISCHARGE PRESSURE		
Safeguards: 1. TEMP. CONTROLLER ON OUTLET OF SEAL WATER COOLERS 2. WINTERIZATION PROCEDURES 3. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 54

Aberdeen New Module HAZOP		
Equipment/Line Description: Cooling Water to Seal Water Coolers Drawing No. NM-090111-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. VALVE CLOSED 2. TEMPERATURE CONTROLLER FAILURE 3. COOLING TOWER PUMP FAILURE 4. PLUGGED/BLOCKED LINE		
Consequences: 1. HIGH SEAL WATER TEMP TO REC. COMPRESSORS		
Safeguards: 1. OPERATING PROCEDURES 2. TEMP. GAUGES ON COOLING WATER SUPPLY		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 54

Aberdeen New Module HAZOP		
Equipment/Line Description: Cooling Water to Seal Water Coolers Drawing No. NM-090111-PID-D		
Deviation: High Pressure and High Temperature		
Cause: 1. BLOCKED DISCHARGE OR INLET 2. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE IN SEAL WATER COOLER SHELL 2. RUPTURE SEAL WATER COOLER SHELL		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: B	Risk Ranking: 4
Action/Other Considerations: TEAM RECOMMENDS THERMAL RELIEF ON SEAL WATER COOLER SHELL SIDE		

Node 55

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to Seal Water Pumps and Seal Water Seps. Drawing No. NM-090111-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. HSPW PUMP FAILURE 2. BLOCKED/PLUGGED LINE 3. VALVE CLOSED		
Consequences: 1. DAMAGE PUMP SEAL 2. CAN'T MAKE-UP LEVEL TO SEAL WATER SEPS.		
Safeguards: 1. FLOW INDICATION TO PUMPS 2. OPERATING PROCEDURES 3. LOW PRESSURE ALARM ON HPSW PUMPS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 55

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to Seal Water Pumps Drawing No. NM-090111-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. NO/LOW FLOW 2. RUPTURE LINE		
Safeguards: 1. INSULATED LINE 2. WINTERIZATION PROCEDURES 3. CONSTANT FLOW		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 56

Aberdeen New Module HAZOP		
Equipment/Line Description: Hydroquinone System Drawing No. NM-090111-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. INJECTION PUMP FAILURE 2. MIXING DRUM LEVEL EMPTY 3. VALVE CLOSED/ BLOCKED LINE 4. RECOVERY SYSTEM NOT RUNNING		
Consequences: 1. CAN'T FEED HYDROQUINONE		
Safeguards: 1. LOW LEVEL ALARM ON MIXING DRUM 2. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 56

Aberdeen New Module HAZOP		
Equipment/Line Description: Hydroquinone System Drawing No. NM-090111-PID-D		
Deviation: High Pressure and High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. LIFT RELIEF VALVE ON PUMP DISCHARGE OR MIXING DRUM		
Safeguards: 1. FIRE PROTECTION SYSTEM		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 57

Aberdeen New Module HAZOP		
Equipment/Line Description: VCM Vapors to RVCM Coolers to RVCM Receivers		
Drawing No. NM-090111-PID-D, NM-090112-PID-D, NM-090113-PID-D		
Deviation: No/Low Flow		
Cause:		
1. VALVE CLOSED		
2. PLUGGED LINE		
3. INTERLOCKED BY DCS		
Consequences:		
1. CAN'T RECOVER		
2. PRODUCTION LOSS		
Safeguards:		
1. OPERATING PROCEDURES		
2. VALVE INDICATION		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 57

Aberdeen New Module HAZOP		
Equipment/Line Description: VCM Vapors to RVCM Coolers to RVCM Receivers		
Drawing No. NM-090111-PID-D, NM-090112-PID-D NM-090113-PID-D		
Deviation: High Pressure and High Temperature		
Cause:		
1. FOULED CONDENSERS - REDUCED COOLING		
2. NO COOLING WATER TO CONDENSERS		
3. EXTERNAL HEAT		
Consequences:		
1. SLOW/STOP RECOVERY		
Safeguards:		
1. COOLING WATER BYPASS OPEN		
2. OPERATING PROCEDURES		
3. FIRE PROTECTION SYSTEMS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 58

Aberdeen New Module HAZOP		
Equipment/Line Description: Cooling Water to RVCM Condensers Drawing No. NM-090112-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. COOLING WATER PUMP FAILURE 2. VALVE CLOSED 3. BLOCKED/PLUGGED LINE 4. BLEEDER OPEN/RUPTURED LINE		
Consequences: 1. HIGH PRESSURE ON NODE 57		
Safeguards: 1. TEMP. GAUGES 2. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 58

Aberdeen New Module HAZOP		
Equipment/Line Description: Cooling Water to RVCM Condensers Drawing No. NM-090112-PID-D		
Deviation: High Temperature		
Cause: 1. SUMMERTIME OPERATION		
Consequences: 1. MORE BACKPRESSURE ON RECOVERY SYSTEM		
Safeguards: 1. NONE		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 59 COMBINED WITH NODE 57

Node 60

Aberdeen New Module HAZOP		
Equipment/Line Description: Inert Gas Vent Lines to Incinerators Drawing No. NM-090112-PID-D		
Deviation: No/Low Flow		
Cause: 1. LINE PLUGGED/BLOCKED 2. VALVE CLOSED		
Consequences: 1. HIGHER PRESSURE IN RVCM RECEIVERS		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 61

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to RVCM Condensers Drawing No. NM-090112-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. BLOCKED LINE 2. VALVE CLOSED 3. NORMAL OPERATION		
Consequences: 1. CAN'T FLUSH CONDENSERS		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 62

Aberdeen New Module HAZOP		
Equipment/Line Description: RVCN Condenser Recovery Line Drawing No. NM-090112-PID-D		
Deviation: No/Low Flow		
Cause: 1. VALVE CLOSED 2. PLUGGED LINE		
Consequences: 1. CAN'T RECOVER CONDENSERS		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 63

Aberdeen New Module HAZOP		
Equipment/Line Description: RVCN Condensers Cooling Water Drain Lines Drawing No. NM-090112-PID-D		
Deviation: No/Low Flow		
Cause: 1. VALVE CLOSED 2. PLUGGED LINE		
Consequences: 1. CAN'T DRAIN CONDENSERS		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 64

Aberdeen New Module HAZOP		
Equipment/Line Description: RVCN Receivers DM-317E, DM-317W Drawing No. NM-090113-PID-D		
Deviation: High Level		
Cause: 1. NOT CHARGING RVCN 2. LEAKING VALVES 3. PUMPING VCN FROM OLD MODULE 4. LEVEL XMITTER FAILURE 5. HIGH LEVEL PROBE & ALARM FAILURE		
Consequences: 1. HIGH PRESSURE 2. VCN RELEASE 3. BLOW RD/LIFT RV 4. PERSONNEL EXPOSURE 5. MINOR BURNS/FIRE/EXPLOSION		
Safeguards: 1. HIGH LEVEL PROBE/SHUTOFF 2. HIGH LEVEL ALARM 3. VCN ISOLATION VALVES & DCS TARGET 4. LEVEL DISPLAYED ON DCS 5. SIGHT GLASSES ON RECEIVER 6. DCS INTERLOCKS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 64

Aberdeen New Module HAZOP		
Equipment/Line Description: RVCM Receivers DM-317E, DM-317W Drawing No. NM-090113-PID-D		
Deviation: Low Level		
Cause: 1. NO RVCM TO CHARGE 2. LEVEL XMITTER FAILURE		
Consequences: 1. NO RVCM TO CHARGE - NO REAL CONSEQUENCE		
Safeguards: 1. SIGHTGLASS 2. LEVEL XMITTER		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 64

Aberdeen New Module HAZOP		
Equipment/Line Description: RVCN Receivers DM-317E, DM-317W Drawing No. NM-090113-PID-D		
Deviation: High Pressure		
Cause: 1. HIGH LEVEL 2. EXTERNAL HEAT 3. RECOVERING VAPOR INSTEAD OF LIQUID - NOT CONDENSING VAPOR 4. VENT TO INCINERATORS BLOCKED 5. TOO MANY INERTS 6. RVCN CHILLER FAILURE 7. EQUALIZATION VALVES CLOSED		
Consequences: 1. NO/SLOW RECOVERY 2. OVERPRESSURE RECEIVER 3. LIFT RV/BLOW RD 4. VCM RELEASE 5. FIRE/EXPLOSION 6. PERSONNEL EXPOSURE		
Safeguards: 1. PRESSURE EQUALIZATION LINE 2. INERTS VENT LINE 3. HIGH LEVEL SAFEGUARDS 4. RV/RD 5. PRESSURE XMITTERS/FIELD MOUNTED PRESSURE GAUGES 6. DCS INTERLOCKS/ALARMS 7. ALL FROM HIGH LEVEL		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 64

Aberdeen New Module HAZOP		
Equipment/Line Description: RVCN Receivers DM-317E, DM-317W Drawing No. NM-090113-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. SAME AS HIGH PRESSURE 2. FIRE PROTECTION SYSTEM		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 64

Aberdeen New Module HAZOP		
Equipment/Line Description: RVCN Receivers DM-317E, DM-317W Drawing No. NM-090113-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. FREEZE WATER IN BOTTOM OF RECEIVER 2. CAN'T PUMP FROM/TO BOTTOM OF RECEIVER 3. DOWNTIME		
Safeguards: 1. WINTERIZATION PROCEDURES 2. STEAM TRACING ON BOTTOM OF RECEIVER		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 64

Aberdeen New Module HAZOP		
Equipment/Line Description: RVCN Receivers DM-317E, DM-317W Drawing No. NM-090113-PID-D		
Deviation: Condenser Tube Leak		
Cause: 1. CORROSION		
Consequences: 1. VCM IN CHILLED WATER TANK 2. VCM RELEASE		
Safeguards: 1. CHILLED WATER LINE TIED TO BLOWDOWN TANK FOR RECOVERY		
Consequence Rating: III	Probability Rating: B	Risk Ranking: 4
Action/Other Considerations: TEAM RECOMMENDS PERIODIC SAMPLING OF CHILLED WATER FOR VCM CONTAMINATION		

Node 65

Aberdeen New Module HAZOP		
Equipment/Line Description: RVCM Charge Line Drawing No. NM-090113-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. PUMP FAILURE 2. RVCM RECEIVER EMPTY 3. FILTER PLUGGED 4. VALVE CLOSED 5. INTERLOCKED OUT		
Consequences: 1. CAN'T CHARGE RVCM		
Safeguards: 1. LOW FLOW SHUTDOWN 2. PRESSURE GAUGES ON FILTER 3. PUMP RUN INDICATION 4. VALVE POSITION INDICATION 5. OPERATING PROCEDURES 6. RECEIVER LEVEL INDICATION		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 65

Aberdeen New Module HAZOP		
Equipment/Line Description: RVCN Charge Line Drawing No. NM-090113-PID-D		
Deviation: High Pressure		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. RUPTURE LINE/BLOW GASKET 2. LIFT RELIEF VALVE TO RECOVERY SYSTEM		
Safeguards: 1. FIRE PROTECTION SYSTEMS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 65

Aberdeen New Module HAZOP		
Equipment/Line Description: RVCN Charge Line Drawing No. NM-090113-PID-D		
Deviation: High Temperature		
Cause: 1. EXTERNAL HEAT		
Consequences: 1. HIGH PRESSURE		
Safeguards: 1. SAME AS HIGH PRESSURE		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 65

Aberdeen New Module HAZOP		
Equipment/Line Description: RVCM Charge Line Drawing No. NM-090113-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER - WATER IN LINE		
Consequences: 1. PLUG LINE/RUPTURE LINE		
Safeguards: 1. WINTERIZATION PROCEDURES 2. ELECTRIC TRACED		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 66

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to RVCM Pumps Drawing No. NM-090113-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. VALVE CLOSED 2. LINE PLUGGED 3. NO HPSW PRESSURE 4. REGULATOR FAILURE		
Consequences: 1. DAMAGE PUMP 2. BURN-UP PUMP SEAL 3. VCM RELEASE		
Safeguards: 1. FLOW METER 2. HPSW LOW PRESSURE ALARM 3. OPERATING PROCEDURES - DAILY CHECK OF HPSW 4. FIELD MOUNTED PRESSURE GAUGES		
Consequence Rating: III	Probability Rating: B	Risk Ranking: 4
Action/Other Considerations: NO RECOMMENDATIONS FROM TEAM		

Node 66

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to RVCM Pumps Drawing No. NM-090113-PID-D		
Deviation: High Pressure		
Cause: 1. PRESSURE REGULATOR FAILURE 2. DISCHARGE VALVE CLOSED		
Consequences: 1. BLOW PUMP SEAL OUT		
Safeguards: 1. OPERATING PROCEDURES 2. FLOW METER		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 67

Aberdeen New Module HAZOP		
Equipment/Line Description: Recovery, Relief, and Drain Lines to Blowdown Tank		
Drawing No. NM-090113-PID-D		
Deviation: No/Low Flow		
Cause:		
1. VALVE CLOSED 2. RVCM RECEIVERS EMPTY 3. LINE PLUGGED 4. FILTER PLUGGED 5. RUPTURED LINE		
Consequences:		
1. CAN'T DRAIN WATER FROM RVCM RECEIVERS 2. CAN'T RECOVER FILTER PACK & PIPING 3. QUALITY PROBLEMS		
Safeguards:		
1. OPERATING PROCEDURES 2. STEAM TRACING ON SOME LINES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 67

Aberdeen New Module HAZOP		
Equipment/Line Description: Recovery, Relief, and Drain Lines to Blowdown Tank		
Drawing No. NM-090113-PID-D		
Deviation: Low Temperature		
Cause:		
1. WEATHER		
Consequences:		
1. NO/LOW FLOW		
2. RUPTURED LINE		
Safeguards:		
1. WINTERIZATION PROCEDURES		
2. STEAM TRACING		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 68

Aberdeen New Module HAZOP		
Equipment/Line Description: Chilled Water to RVCM Condensers Drawing No. NM-090113-PID-D, NM-090114-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. PUMP FAILURE 2. PLUGGED LINE 3. VALVE CLOSED 4. NO WATER IN STORAGE TANK 5. BLEEDER OPEN 6. RUPTURED LINE 7. LOW LEVEL SWITCH MALFUNCTION 8. POWER FAILURE 9. LOW FLOW SWITCH MALFUNCTION 10. HIGH TEMP SWITCH MALFUNCTION		
Consequences: 1. HIGH RECEIVER TEMP/PRESSURE 2. SLOW RECOVERY 3. PRODUCTION LOSS 4. HIGH VCM CONCENTRATION IN VENT TO INCINERATORS		
Safeguards: 1. FLOW METERS TO EACH CONDENSER 2. LOW FLOW SWITCH 3. LOW LEVEL ALARM 4. OPERATING PROCEDURES 5. TIE-IN TO OLD MODULE CHILLER SYSTEM		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 68

Aberdeen New Module HAZOP		
Equipment/Line Description: Chilled Water to RVCM Condensers Drawing No. NM-090113-PID-D, NM-090114-PID-D		
Deviation: High Pressure		
Cause: 1. VALVE CLOSED - THERMAL EXPANSION 2. DEAD HEAD PUMP		
Consequences: 1. LINE RUPTURE 2. DAMAGE CHILLER PACKAGE		
Safeguards: 1. LOW FLOW SWITCH 2. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 68

Aberdeen New Module HAZOP		
Equipment/Line Description: Chilled Water to RVCM Condensers Drawing No. NM-090113-PID-D, NM-090114-PID-D		
Deviation: High Temperature		
Cause: 1. CHILLER PACKAGE FAILURE 2. EXTERNAL HEAT		
Consequences: 1. CHILLED WATER SYSTEM SHUTDOWN 2. HIGH RVCM RECEIVER TEMP/PRESSURE 3. HIGH VCM CONCENTRATION TO INCINERATORS 4. PRODUCTION LOSS		
Safeguards: 1. HIGH TEMP SWITCH 2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 68

Aberdeen New Module HAZOP		
Equipment/Line Description: Chilled Water to RVCN Condensers Drawing No. NM-090113-PID-D, NM-090114-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER 2. CHILLER PACKAGE MALFUNCTION		
Consequences: 1. RUPTURED/PLUGGED LINE		
Safeguards: 1. ETHYLENE GLYCOL IN WATER 2. TEMPERATURE GAUGES IN FIELD 3. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 69

Aberdeen New Module HAZOP		
Equipment/Line Description: Inerts Vent Line Drawing No. NM-090113-PID-D		
Deviation: No/Low Flow		
Cause: 1. VALVE CLOSED 2. LINE PLUGGED 3. PRESSURE CONTROL VALVE MALFUNCTION 4. VCM ISOLATION VALVES CLOSED 5. INTERLOCKED		
Consequences: 1. HIGH RECEIVER PRESSURE 2. CAN'T VENT INERTS TO INCINERATOR 3. PRODUCTION LOSS		
Safeguards: 1. FLOW CONTROL & INDICATION TO INCINERATORS 2. PRESSURE GAUGES & INDICATION IN CONTROL ROOM 3. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 70

Aberdeen New Module HAZOP		
Equipment/Line Description: Line To Blowdown Tank Drawing No. NM-090113-PID-D, NM-090115-PID-D		
Deviation: No/Low Flow		
Cause: 1. LINE PLUGGED\BLOCKED 2. VALVE CLOSED 3. LINE RUPTURED		
Consequences: 1. CAN'T DRAIN RECEIVERS 2. CAN'T RECOVER FILTER PACK, PIPING 3. PRODUCTION LOSS		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 71

Aberdeen New Module HAZOP		
Equipment/Line Description: Chilled Water to Blowdown Tank Drawing No. NM-090113-PID-D, NM-090114-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. VALVE CLOSED 2. LINE PLUGGED 3. NORMAL OPERATING CONDITION		
Consequences: 1. CAN'T RECOVER CHILLED WATER SYSTEM IF CONTAMINATED W/ VCM		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 72

Aberdeen New Module HAZOP		
Equipment/Line Description: Make-up Water to Chilled Water Tank Drawing No. NM-090114-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. VALVE FAILURE/CLOSED VALVE 2. RUPTURED LINE 3. NO WATER PRESSURE 4. LINE PLUGGED		
Consequences: 1. CAN'T MAKE-UP WATER TO STORAGE TANK AUTOMATICALLY 2. LOW STORAGE TANK LEVEL		
Safeguards: 1. LOW LOW LEVEL ALARM & SHUTDOWN ON STORAGE TANK 2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 72

Aberdeen New Module HAZOP		
Equipment/Line Description: Make-up Water to Chilled Water Tank Drawing No. NM-090114-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED LINE 2. RUPTURED LINE		
Safeguards: 1. WINTERIZATION PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 73

Aberdeen New Module HAZOP		
Equipment/Line Description: Chilled Water Tank Drawing No. NM-090114-PID-D		
Deviation: High Level		
Cause: 1. MAKE-UP VALVE FAILURE 2. HIGH LEVEL SWITCH MALFUNCTION		
Consequences: 1. OVERFLOW TANK		
Safeguards: 1. OPERATING PROCEDURES 2. SIGHTGLASS 3. HIGH LEVEL SWITCH 4. OVERFLOW LINE		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 73

Aberdeen New Module HAZOP		
Equipment/Line Description: Chilled Water Tank Drawing No. NM-090114-PID-D		
Deviation: Low Level		
Cause: 1. MAKE-UP VALVE FAILURE 2. LOW LEVEL SWITCH FAILURE 3. MANUAL VALVE CLOSED		
Consequences: 1. NO WATER IN CHILLED WATER TANK		
Safeguards: 1. SIGHTGLASS 2. LOW LEVEL ALARM & SHUTDOWN		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 74

Aberdeen New Module HAZOP		
Equipment/Line Description: Blowdown Tank, DM-746 Drawing No. NM-090115-PID-D		
Deviation: High Level		
Cause: 1. DRAIN LINE PLUGGED 2. STRAINERS PLUGGED ON DRAIN 3. PUMP MALFUNCTION 4. VALVE CLOSED 5. BLOWDOWN TANK UNDER VACUUM 6. LEVEL XMITTER MALFUNCTION 7. BWS HIGH LEVEL OR PRESSURE		
Consequences: 1. OVERFILL BLOWDOWN TANK 2. CAN'T DRAIN KO TANKS, SEPARATORS, RVCN RECEIVERS 3. PRODUCTION LOSS 4. HIGH PRESSURE IN RECOVERY SYSTEM		
Safeguards: 1. 2 HIGH LEVEL ALARMS 2. DUAL STRAINERS 3. 2 PUMPS 4. SIGHTGLASS 5. LEVEL INDICATION ON DCS 6. OPERATING PROCEDURES 7. AUTO PUMP OVER PROGRAM ON DCS		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 74

Aberdeen New Module HAZOP		
Equipment/Line Description: Blowdown Tank, DM-746 Drawing No. NM-090115-PID-D		
Deviation: Low Level		
Cause: 1. MANUAL DRAIN VALVE OPEN 2. LEVEL XMITTER MALFUNCTION 3. PUMP CONTROL MALFUNCTION 4. RUPTURED DRAIN LINE		
Consequences: 1. CAVITATE PUMPS		
Safeguards: 1. LOW LEVEL ALARM 2. LEVEL INDICATION ON DCS 3. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 74

Aberdeen New Module HAZOP		
Equipment/Line Description: Blowdown Tank, DM-746 Drawing No. NM-090115-PID-D		
Deviation: High Pressure and High Temperature		
Cause: 1. RVCN RECEIVERS, KO TANKS DRAIN LINE STUCK OPEN 2. EXTERNAL HEAT 3. RECOVERY VALVE ON FILTER PACK LEFT OPEN OR LEAKING 4. STEAM FLOW / TEMP CONTROLLER MALFUNCTION 5. MANUAL STEAM SUPPLY BYPASS VALVE LEFT OPEN		
Consequences: 1. BLOW SAFETY DISK/LIFT RV 2. VCM RELEASE 3. RUPTURE VESSEL		
Safeguards: 1. HIGH PRESSURE ALARM 2. AUTO PRESSURE RECOVERY BY RECOVERY SYSTEM 3. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 75

Aberdeen New Module HAZOP		
Equipment/Line Description: Blowdown Tank Vapor Vent Lines Drawing No. NM-090115-PID-D		
Deviation: No/Low Flow		
Cause: 1. VALVE CLOSED 2. LINE PLUGGED		
Consequences: 1. CAN'T RECOVER/VENT BLOWDOWN TANK 2. CAN'T RECOVER OLD UNIT EMISSION SYSTEM		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 76

Aberdeen New Module HAZOP		
Equipment/Line Description: Blowdown Tank Steam Supply Drawing No. NM-090115-PID-D, NM-090121-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. NO STEAM PRESSURE 2. STEAM / TEMP CONTROLLER FAILURE 3. PRESSURE SWITCH MALFUNCTION 4. CLOSED VALVE 5. PLUGGED LINE		
Consequences: 1. CAN'T HEAT-UP BLOWDOWN TANK		
Safeguards: 1. OPERATING PROCEDURES 2. STEAM CONTROLLER BYPASS 3. LOW PRESSURE SWITCH		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 77

Aberdeen New Module HAZOP		
Equipment/Line Description: From RX-741 SA Charge Header Drawing No. NM-090115-PID-D, NM-090103-PID-D		
Deviation: No/Low Flow		
Cause:		
Consequences:		
Safeguards:		
Consequence Rating:	Probability Rating:	Risk Ranking:
Action/Other Considerations: LINE IS O.O.S.		

Node 78

Aberdeen New Module HAZOP		
Equipment/Line Description: Water to Batch Water Strippers Drawing No. NM-090115-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. STRAINER PLUGGED 2. PUMP FAILURE 3. VALVE CLOSED 4. BLOWDOWN TANK UNDER VACUUM 5. PLUGGED LINE 6. BLEEDER OPEN 7. BLOWDOWN TANK EMPTY		
Consequences: 1. CAN'T PUMP OVER TO BWS		
Safeguards: 1. PUMP RUN INDICATION 2. 2 PUMPS 3. 2 STRAINERS 4. HIGH LEVEL ALARM ON BD TANK 5. LEVEL INDIC. ON BD TANK 6. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 78

Aberdeen New Module HAZOP		
Equipment/Line Description: Water to Batch Water Strippers Drawing No. NM-090115-PID-D		
Deviation: High Pressure and High Temperature		
Cause: 1. EXTERNAL HEAT 2. ELEC./STEAM TRACING STUCK ON		
Consequences: 1. RUPTURE LINE/BLOW GASKET		
Safeguards: 1. OPERATING PROCEDURES 2. FIRE PROTECTION SYSTEM 3. PRESSURE GAUGES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 78

Aberdeen New Module HAZOP		
Equipment/Line Description: Water to Batch Water Strippers Drawing No. NM-090115-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUG/RUPTURE LINE		
Safeguards: 1. ELECTRIC/STEAM TRACED LINE		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 79

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW Drawing No. NM-090115-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. VALVE CLOSED 2. LINE PLUGGED 3. HPSW PUMP FAILURE		
Consequences: 1. NO SEAL WATER TO BD TANK TRANSFER PUMPS 2. DAMAGE PUMPS 3. NO FLUSH WATER TO BD LEVEL POT AND SIGHTGLASS		
Safeguards: 1. FLOW METER ON PUMPS 2. FLOW METER ON LINE TO LEVEL POT 3. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 79

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW Drawing No. NM-090115-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUG LINE 2. RUPTURE LINE		
Safeguards: 1. STEAM TRACED		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 80

Aberdeen New Module HAZOP		
Equipment/Line Description: Process Water Drawing No. NM-090115-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. VALVE CLOSED/FAILURE 2. LINE PLUGGED 3. NO/LOW WATER PRESSURE 4. RUPTURED LINE/BLEEDER OPEN 5. INTERLOCKED		
Consequences: 1. CAN'T FLUSH LINE TO BWS		
Safeguards: 1. OPERATING PROCEDURES 2. VALVE INDICATION		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 80

Aberdeen New Module HAZOP		
Equipment/Line Description: Process Water Drawing No. NM-090115-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED/RUPTURED LINE		
Safeguards: 1. INSULATED LINE 2. WINTERIZATION PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 81

Aberdeen New Module HAZOP		
Equipment/Line Description: Process Water to Dump Systems Drawing No. NM-090116-PID-D, NM-090117-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. VALVE CLOSED 2. LINE PLUGGED 3. NO/LOW WATER PRESSURE 4. PW FILTER PLUGGED		
Consequences: 1. NO WATER TO LEVEL CONTROLLER 2. CAN'T FLUSH SCREENER 3. CAN'T FILL DUMP TANK AFTER DUMP - CAVITATE PUMP ON NEXT DUMP		
Safeguards: 1. WATER TOWER LEVEL INDICATION 2. VALVE ALARMS & POSITION INDICATION 3. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 81

Aberdeen New Module HAZOP		
Equipment/Line Description: Process Water to Dump Systems Drawing No. NM-090116-PID-D, NM-090117-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUG/RUPTURE LINE		
Safeguards: 1. INSULATED LINE ON OLD SYSTEM, LOW MOLE SYSTEM IS ELECTRIC TRACED 2. WINTERIZATION PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 82

Aberdeen New Module HAZOP		
Equipment/Line Description: Slurry Screeners and Dump Tanks & Pumps Drawing No. NM-090116-PID-D, NM-090117-PID-D		
Deviation: No/Low Flow		
Cause: 1. PLUGGED SCREENER 2. PUMP FAILURE 3. NO DUMP TANK LEVEL 4. SCREENER DISCHARGE PLUGGED 5. SLURRY LEVEL CONTROL VALVE FAILURE 6. DUMP TANK DISCHARGE PLUGGED 7. SLURRY LINE PLUGGED 8. CLOSED VALVE 9. INTERLOCK 10. SCREENER MOTOR FAILURE		
Consequences: 1. CAN'T DUMP RXR 2. PRODUCTION LOSS		
Safeguards: 1. OPERATING PROCEDURES 2. BULLS EYE 3. FLOW SWITCH 4. VALVE POSITION INDICATOR 5. PUMP/SCREENER RUN INDICATOR 6. DUMP TANK HIGH LEVEL ALARM		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 82

Aberdeen New Module HAZOP		
Equipment/Line Description: Slurry Screeners and Dump Tanks & Pumps Drawing No. NM-090116-PID-D, NM-090117-PID-D		
Deviation: High Pressure		
Cause: 1. OPEN RXR UNDER PRESSURE TO DUMP TANK		
Consequences: 1. BLOW UP SCREENER		
Safeguards: 1. INTERLOCKS		
Consequence Rating: II	Probability Rating: D	Risk Ranking: 5
Action/Other Considerations:		

Node 83

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to Dump System Drawing No. NM-090116-PID-D, NM-090117-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. CLOSED VALVE/VALVE FAILURE 2. PLUGGED LINE 3. HPSW PUMP FAILURE 4. INTERLOCKS		
Consequences: 1. DAMAGE PUMP 2. CAN'T UNPLUG PUMP DISCHARGE TO BLEND TANKS OR RECIRCULATION LINE		
Safeguards: 1. VALVE POSITION INDICATION 2. OPERATING PROCEDURES 3. LOW HPSW PRESSURE ALARM		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 83

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to Dump System Drawing No. NM-090116-PID-D, NM-090117-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED/RUPTURED LINE		
Safeguards: 1. WINTERIZATION PROCEDURES 2. INSULATED LINE 3. USED OFTEN		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 84

Aberdeen New Module HAZOP		
Equipment/Line Description: Slurry Screener and Dump Tank Exhaust Drawing No. NM-090116-PID-D, NM-090117-PID-D		
Deviation: No/Low Flow		
Cause: 1. EXHAUST FAN FAILURE		
Consequences: 1. CAN'T EXHAUST VAPORS FROM SCREENER/DUMP TANK		
Safeguards: 1. FAN RUN INDICATION & ALARM		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 85

Aberdeen New Module HAZOP		
Equipment/Line Description: Wet Calcium Stearate Addition System Drawing No. NM-090116-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. NO/LOW AIR PRESSURE TO PUMP 2. DRUM EMPTY 3. PLUGGED LINE 4. PUMP FAILURE 5. VALVE CLOSED		
Consequences: 1. NO CALCIUM STEARATE ON SLURRY - QUALITY/TRANSFER PROBLEMS		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 85

Aberdeen New Module HAZOP		
Equipment/Line Description: Wet Calcium Stearate Addition System Drawing No. NM-090116-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED/RUPTURED LINE 2. FREEZE-UP DRUM		
Safeguards: 1. ELECTRIC TRACED LINE 2. WINTERIZATION PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 86

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW Pumps Drawing No. NM-090118-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. PUMP FAILURE 2. FILTER PLUGGED 3. VALVE CLOSED 4. NO WATER 5. RUPTURED LINE/BLEEDER OPEN 6. PLUGGED/BLOCKED LINE		
Consequences: 1. NO HPSW IN NEW MODULE		
Safeguards: 1. HPSW PUMP RUN INDICATION AND PUMP FAILURE ALARM 2. LOW PRESSURE ALARM 3. OPERATING PROCEDURES - PUMPS CHECKED 2 TIMES PER SHIFT 4. FILTERS CHANGED ONCE PER MONTH		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 86

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW Pumps Drawing No. NM-090118-PID-D		
Deviation: High Pressure		
Cause: 1. CLOSED VALVE 2. PLUGGED LINE 3. RECIRCULATION LINE ORIFICE PLUGGED		
Consequences: 1. RUPTURED LINE		
Safeguards: 1. RECIRCULATION LINE 2. PRESSURE GAUGES 3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 86

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW Pumps Drawing No. NM-090118-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED/RUPTURED LINE 2. RUPTURED PUMP HOUSING		
Safeguards: 1. CONSTANT FLOW 2. WINTERIZATION PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 87

Aberdeen New Module HAZOP		
Equipment/Line Description: Process Water Drawing No. NM-090118-PID-D, NM-090119-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. NO WATER 2. VALVE CLOSED 3. LINE PLUGGED 4. LINE RUPTURED 5. FILTER PLUGGED 6. LOW WATER TOWER LEVEL		
Consequences: 1. NO HPSW 2. NO PROCESS WATER IN NEW MODULE		
Safeguards: 1. OPERATING PROCEDURES 2. WATER TOWER LEVEL INDICATION 3. PRESSURE GAUGE ON FILTER		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 87

Aberdeen New Module HAZOP		
Equipment/Line Description: Process Water Drawing No. NM-090118-PID-D, NM-090119-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED/RUPTURED LINE		
Safeguards: 1. WINTERIZATION PROCEDURES 2. CONSTANT FLOW		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 88

Aberdeen New Module HAZOP		
Equipment/Line Description: Mechanical Seal Water Purge Drum Drawing No. NM-090119-PID-D		
Deviation: Low Level		
Cause: 1. NO PROCESS WATER 2. VALVE CLOSED 3. DRAIN VALVE OPEN		
Consequences: 1. NO MSPW DURING POWER OUTAGE OR PUMP FAILURE		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 88

Aberdeen New Module HAZOP		
Equipment/Line Description: Mechanical Seal Water Purge Drum Drawing No. NM-090119-PID-D		
Deviation: High Pressure and High Temperature		
Cause: 1. EXTERNAL HEAT 2. NITROGEN BOTTLE REGULATOR FAILURE		
Consequences: 1. LIFT RELIEF VALVE 2. RUPTURE TANK		
Safeguards: 1. OPERATING PROCEDURES 2. RELIEF VALVE ON TANK 3. REGULATOR ON N2 BOTTLE 4. FIRE PROTECTION SYSTEMS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 88

Aberdeen New Module HAZOP		
Equipment/Line Description: Mechanical Seal Water Purge Drum Drawing No. NM-090119-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 2. FREEZE WATER IN DRUM		
Safeguards: 1. WINTERIZATION PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 89

Aberdeen New Module HAZOP		
Equipment/Line Description: MSPW to Rxr Rinse Nozzles		
Drawing No. NM-090119-PID-D, NM-090103-PID-D NM-090104-PID-D, NM-090105-PID-D NM-090106-PID-D, NM-090107-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause:		
1. PUMP FAILURE		
2. VALVE CLOSED		
3. LINE PLUGGED/RUPTURED		
4. RXR RINSE NOZZLE PLUGGED		
Consequences:		
1. PLUG RXR RINSE NOZZLE		
2. NO MSPW TO RXR SEALS		
Safeguards:		
1. PUMP RUN INDICATION/FAILURE ALARM		
2. PRECHARGE CHECKS		
3. FLOW METER ON RINSE NOZZLE		
4. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 89

Aberdeen New Module HAZOP		
Equipment/Line Description: MSPW to Rxr Rinse Nozzles		
Drawing No. NM-090119-PID-D, NM-090103-PID-D NM-090104-PID-D, NM-090105-PID-D NM-090106-PID-D, NM-090107-PID-D		
Deviation: More Flow		
Cause:		
1. VALVES OPEN TOO MUCH		
2. FLOW METER FAILURE		
Consequences:		
1. OVER FILL RXR		
Safeguards:		
1. PRECHARGE CHECKS		
2. OPERATING PROCEDURES		
3. FLOW METERS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 89

Aberdeen New Module HAZOP		
Equipment/Line Description: MSPW to Rxr Rinse Nozzles		
Drawing No. NM-090119-PID-D, NM-090103-PID-D NM-090104-PID-D, NM-090105-PID-D NM-090106-PID-D, NM-090107-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED/RUPTURED LINE 2. NO/LOW FLOW		
Safeguards: 1. WINTERIZATION PROCEDURES 2. OPERATING PROCEDURES 3. STEAM TRACED LINE		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 90

Aberdeen New Module HAZOP		
Equipment/Line Description: AMS Transfer System Drawing No. NM-090120-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. PUMP FAILURE 2. NO/LOW INSTRUMENT AIR PRESSURE 3. DRUM EMPTY 4. VALVE CLOSED 5. LINE PLUGGED/RUPTURED 6. AMS POT PRESSURED UP 7. INSTRUMENT AIR REGULATOR FAILURE		
Consequences: 1. CAN'T FILL AMS POTS		
Safeguards: 1. OPERATING PROCEDURES 2. SIGHTGLASSES ON AMS POTS 3. PRESSURE GAUGES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 90

Aberdeen New Module HAZOP		
Equipment/Line Description: AMS Transfer System Drawing No. NM-090120-PID-D		
Deviation: High Pressure		
Cause: 1. DEADHEAD PUMP 2. EXTERNAL HEAT		
Consequences: 1. RUPTURE LINE 2. LIFT RELIEF VALVE		
Safeguards: 1. RELIEF VALVE 2. FIRE PROTECTION SYSTEMS		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 91

Aberdeen New Module HAZOP		
Equipment/Line Description: Clean Wall Steam Supply Drawing No. NM-090121-PID-D, NM-090128-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. VALVE CLOSED 2. NO STEAM PRESSURE 3. LINE PLUGGED		
Consequences: 1. CAN'T CLEAN WALL RXR 2. PRODUCTION LOSS		
Safeguards: 1. OPERATING PROCEDURES 2. STEAM PRESSURE INDICATION & LOW PRESSURE ALARM		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 92

Aberdeen New Module HAZOP		
Equipment/Line Description: New Module Steam Supply Drawing No. NM-090121-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. BOILERS DOWN 2. VALVE CLOSED 3. LINE RUPTURE/BLEEDER OPEN		
Consequences: 1. NO STEAM IN NEW MODULE 2. PRODUCTION LOSS		
Safeguards: 1. LOW PRESSURE ALARM & PRESSURE INDICATION 2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 93

Aberdeen New Module HAZOP		
Equipment/Line Description: RXR Steam Ejectors Supply Drawing No. NM-090122-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. BOILERS DOWN 2. VALVE CLOSED 3. BLEEDER OPEN/LINE RUPTURE		
Consequences: 1. CAN'T EVACUATE RXR		
Safeguards: 1. LOW PRESSURE ALARM & PRESSURE INDICATION 2. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 94

Aberdeen New Module HAZOP		
Equipment/Line Description: Process & Cooling Water to TK-751 & EX-800 Drawing No. NM-090123-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. VALVE CLOSED 2. CW PUMP FAILURE 3. LINE PLUGGED 4. LINE RUPTURED/BLEEDER OPEN		
Consequences: 1. CAN'T COOL DOWN TK-751/EX-800		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 94

Aberdeen New Module HAZOP		
Equipment/Line Description: Process & Cooling Water to TK-751 & EX-800 Drawing No. NM-090123-PID-D		
Deviation: High Pressure & High Temperature		
Cause: 1. EXTERNAL HEAT - THERMAL EXPANSION		
Consequences: 1. OVER PRESSURE TK-751 JACKET/EX-800 SHELL 2. LIFT RV ON EX-800		
Safeguards: 1. OPERATING PROCEDURES 2. RV ON EX-800		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 94

Aberdeen New Module HAZOP		
Equipment/Line Description: Process & Cooling Water to TK-751 & EX-800 Drawing No. NM-090123-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. RUPTURE LINE/EQUIPMENT 2. PLUG LINE		
Safeguards: 1. WINTERIZATION PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 95

Aberdeen New Module HAZOP		
Equipment/Line Description: Process & Hot Water to TK-751/752 Drawing No. NM-090123-PID-D, NM-090125-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. VALVE CLOSED 2. LINE PLUGGED 3. NO HOT WATER 4. PROCESS WATER TOWER EMPTY 5. BLEEDER OPEN/LINE RUPTURE		
Consequences: 1. CAN'T PUT WATER IN TK-751/752		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 95

Aberdeen New Module HAZOP		
Equipment/Line Description: Process & Hot Water to TK-751/752 Drawing No. NM-090123-PID-D, NM-090125-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUG/RUPTURE LINE		
Safeguards: 1. WINTERIZATION PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 96

Aberdeen New Module HAZOP		
Equipment/Line Description: Steam to TK-751/752 Drawing No. NM-090123-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. VALVE CLOSED 2. LINE PLUGGED 3. BLEEDER OPEN/RUPTURED LINE 4. LOW/NO STEAM PRESSURE		
Consequences: 1. CAN'T HEAT UP TANKS		
Safeguards: 1. OPERATING PROCEDURES 2. LOW STEAM PRESSURE ALARM IN CONTROL ROOM		
Consequence Rating: IV	Probability Rating: A	Risk Ranking: 5
Action/Other Considerations:		

Node 97

Aberdeen New Module HAZOP		
Equipment/Line Description: North/South Make-up Tanks and Transfer Sys.		
Drawing No. NM-090123-PID-D, NM-090124-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause:		
1. XFER PUMP FAILURE 2. PLUGGED LINE 3. VALVE CLOSED 4. TANK EMPTY 5. BLEEDER OPEN/RUPTURED LINE 6. FILTER PLUGGED		
Consequences:		
1. CAN'T XFER SA TO CHARGE TANKS		
Safeguards:		
1. OPERATING PROCEDURES 2. 2 PUMPS 3. 2 FILTERS		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 97

Aberdeen New Module HAZOP		
Equipment/Line Description: North/South Make-up Tanks and Transfer Sys.		
Drawing No. NM-090123-PID-D, NM-090124-PID-D		
Deviation: High Pressure and High Temperature		
Cause:		
1. EXTERNAL HEAT		
Consequences:		
1. RUPTURE LINE		
2. SPILL PVA		
Safeguards:		
1. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 98

Aberdeen New Module HAZOP		
Equipment/Line Description: South System and Old F-50 Charge Tanks & Piping		
Drawing No. NM-090124-PID-D, NM-090125-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause:		
1. PUMP FAILURE 2. VALVE CLOSED 3. PLUGGED/BLOCKED LINE 4. INTERLOCKED 5. BLEEDER OPEN/LINE RUPTURE		
Consequences:		
1. CAN'T CHARGE EXPERIMENTAL PVA 2. PVA SPILL		
Safeguards:		
1. OPERATING PROCEDURES 2. FLOW METER 3. VALVE POSITION INDICATION 4. PUMP RUN INDICATION		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 98

Aberdeen New Module HAZOP		
Equipment/Line Description: South System and Old F-50 Charge Tanks & Piping Drawing No. NM-090124-PID-D, NM-090125-PID-D		
Deviation: High Pressure and High Temperature		
Cause: 1. EXTERNAL HEAT 2. DEAD HEAD CHARGE PUMP		
Consequences: 1. RUPTURE LINE 2. SPILL PVA 3. DAMAGE CHARGE PUMP		
Safeguards: 1. OPERATING PROCEDURES 2. INTERLOCKS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 98

Aberdeen New Module HAZOP		
Equipment/Line Description: South System and Old F-50 Charge Tanks & Piping Drawing No. NM-090124-PID-D, NM-090125-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED LINE 2. RUPTURED LINE		
Safeguards: 1. ELECTRIC TRACED LINE 2. WINTERIZATION PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 99

Aberdeen New Module HAZOP		
Equipment/Line Description: Steam & Process Water to TK-701 Drawing No. NM-090125-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. VALVE CLOSED 2. LINE PLUGGED 3. BLEEDER OPEN		
Consequences: 1. NOT NORMALLY USED		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 100

Aberdeen New Module HAZOP		
Equipment/Line Description: East Additive Make-up and Charge Tanks Drawing No. NM-090125-PID-D		
Deviation: Low Level		
Cause: 1. CHARGE TANK DRAIN VALVE OPEN 2. LOW LEVEL SWITCH ON CHARGE TANK FAILURE		
Consequences: 1. CAN'T CHARGE BRINE TO DECAL TANKS		
Safeguards: 1. SIGHTGLASS 2. LOW LEVEL SWITCH 3. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 100

Aberdeen New Module HAZOP		
Equipment/Line Description: East Additive Make-up and Charge Tanks Drawing No. NM-090125-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. LOW TK-702/701 LEVEL 2. PUMP FAILURE 3. VALVE CLOSED 4. LINE PLUGGED		
Consequences: 1. CAN'T TRANSFER/CHARGE BRINE		
Safeguards: 1. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 101

Aberdeen New Module HAZOP		
Equipment/Line Description: Seal Oil Tank Drawing No. NM-090126-PID-D		
Deviation: DM-754 Low Level		
Cause: 1. DRAIN VALVE OPEN TO SEWER OR SEAL OIL RESERVOIRS		
Consequences: 1. NO MAKE-UP SEAL OIL TO RESERVOIRS 2. SEAL OIL SPILL		
Safeguards: 1. OPERATING PROCEDURES 2. SIGHTGLASS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 101

Aberdeen New Module HAZOP		
Equipment/Line Description: Seal Oil Tank Drawing No. NM-090126-PID-D		
Deviation: No/Low Flow		
Cause: 1. VALVE CLOSED 2. NO LEVEL IN SEAL OIL TANK 3. LINE PLUGGED		
Consequences: 1. CAN'T MAKE-UP OIL TO RESERVOIRS		
Safeguards: 1. OPERATING PROCEDURES 2. SIGHTGLASS		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 102

Aberdeen New Module HAZOP		
Equipment/Line Description: Steam to Seal Oil Units, ME-299/300 Drawing No. NM-090126-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. STEAM TRAP FAILURE 2. VALVE CLOSED 3. PLUGGED/BLOCKED LINE 4. LOW STEAM PRESSURE		
Consequences: 1. VICIOUS SEAL OIL IN WINTER - HARD TO PUMP		
Safeguards: 1. OPERATING PROCEDURES 2. PLANT STEAM PRESSURE INDICATION		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 102

Aberdeen New Module HAZOP		
Equipment/Line Description: Steam to Seal Oil Units, ME-299/300 Drawing No. NM-090126-PID-D		
Deviation: More Flow		
Cause: 1. STEAM TRAP FAILURE		
Consequences: 1. SEAL OIL TOO HOT - BREAK DOWN OIL		
Safeguards: 1. OPERATING PROCEDURES 2. HIGH TEMPERATURE ALARM		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 103

Aberdeen New Module HAZOP		
Equipment/Line Description: Cooling Water to Seal Oil Units, ME-299/300 Drawing No. NM-090126-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. VALVE CLOSED 2. PLUGGED/BLOCKED LINE 3. LOW COOLING WATER PRESSURE		
Consequences: 1. SEAL OIL TOO HOT IN SUMMER		
Safeguards: 1. OPERATING PROCEDURES 2. HIGH TEMPERATURE ALARM		
Consequence Rating: IV	Probability Rating: B	Risk Ranking: 5
Action/Other Considerations:		

Node 104

Aberdeen New Module HAZOP		
Equipment/Line Description: Emergency Seal Oil Drum Drawing No. NM-090126-PID-D		
Deviation: No/Low Flow and Low Level		
Cause: 1. VALVE CLOSED 2. PLUGGED/BLOCKED LINE 3. DRAIN OPEN		
Consequences: 1. NO EMERGENCY SEAL OIL 2. BURN UP RXR SEAL		
Safeguards: 1. OPERATING PROCEDURES 2. USED ONLY WHEN PUMPS ARE OUT		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 105

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to Kill/Charge Pots Drawing No. NM-090127-PID-D		
Deviation: No/Low Flow and Low Pressure		
Cause: 1. PLUGGED/BLOCKED LINE 2. VALVE CLOSED 3. HPSW PUMP FAILURE 4. DRAIN VALVE OPEN		
Consequences: 1. CAN'T CHARGE/KILL WITH POTS 2. PRODUCTION LOSS		
Safeguards: 1. OTHER KILL SYSTEMS 2. FLOW METERS 3. OPERATING PROCEDURES 4. PRESSURE GAUGES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 105

Aberdeen New Module HAZOP		
Equipment/Line Description: HPSW to Kill/Charge Pots Drawing No. NM-090127-PID-D		
Deviation: Low Temperature		
Cause: 1. WEATHER		
Consequences: 1. PLUGGED/RUPTURED LINE 2. CAN'T KILL/CHARGE RXR WITH POTS 3. PRODUCTION LOSS		
Safeguards: 1. STEAM TRACED LINE 2. WINTERIZATION PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

Node 106

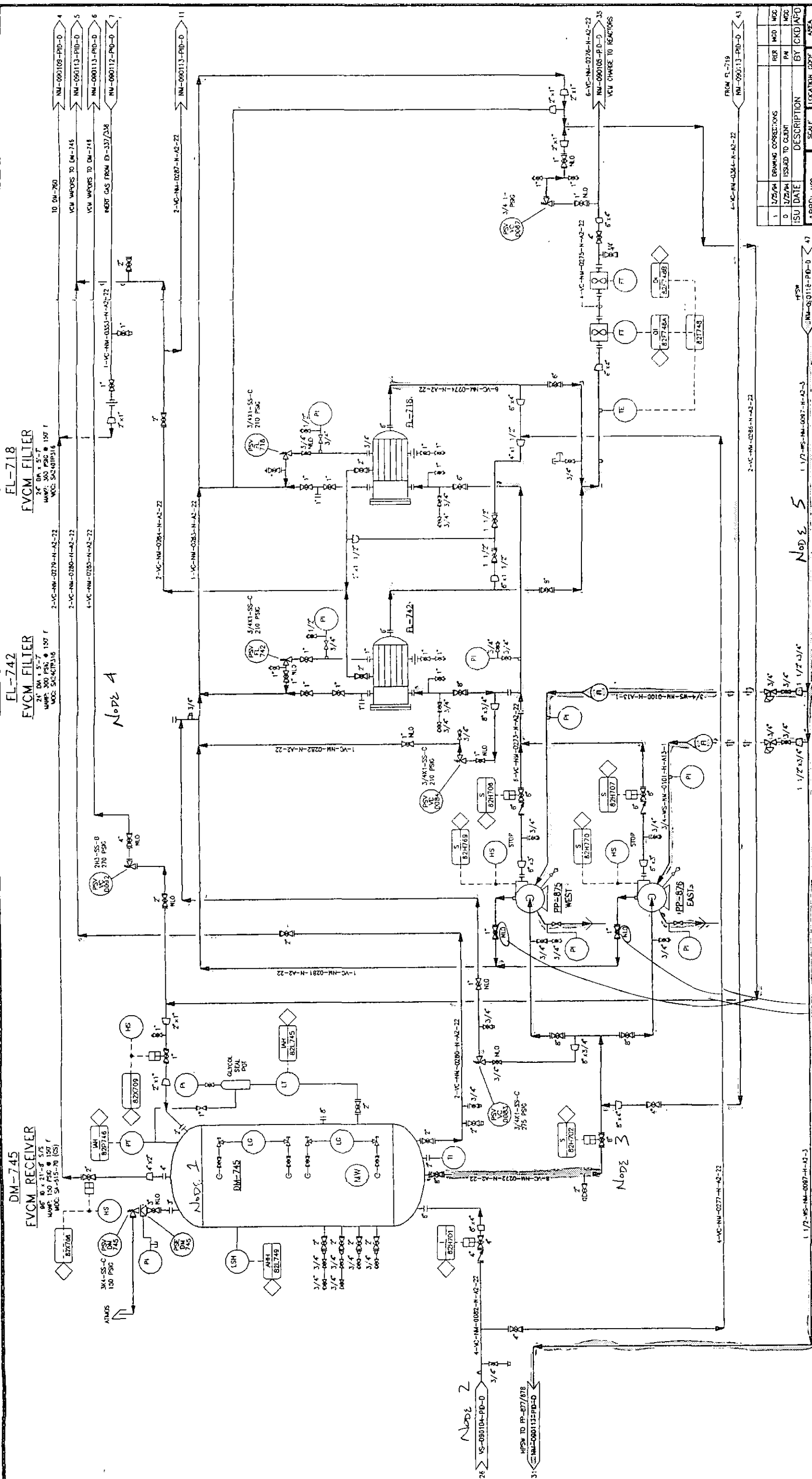
Aberdeen New Module HAZOP		
Equipment/Line Description: Kill Solution Transfer System Drawing No. NM-090127-PID-D		
Deviation: No/Low Flow, Low Pressure, and TK-600 Low Level		
Cause: 1. FILTER PLUGGED 2. VALVE CLOSED 3. PLUGGED/BLOCKED LINE 4. TRANSFER PUMP FAILURE 5. AIR PUMP FAILURE 6. DRAIN/BLEEDER OPEN		
Consequences: 1. CAN'T KILL FROM POTS 2. AMS/ISONOX SPILL IF DRAIN/BLEEDER OPEN		
Safeguards: 1. SIGHTGLASS ON STORAGE TANK 2. STORAGE TANK BYPASS 3. OPERATING PROCEDURES		
Consequence Rating:	Probability Rating:	Risk Ranking:
Action/Other Considerations:		

Node 106

Aberdeen New Module HAZOP		
Equipment/Line Description: Kill Solution Transfer System Drawing No. NM-090127-PID-D		
Deviation: High Pressure		
Cause: 1. EXTERNAL HEAT 2. DEADHEAD PUMP		
Consequences: 1. LIFT RV 2. AMS/ISONOX SPILL 3. RUPTURE LINE/BLOW GASKET		
Safeguards: 1. RELIEF VALVES 2. OPERATING PROCEDURES		
Consequence Rating: III	Probability Rating: C	Risk Ranking: 5
Action/Other Considerations:		

APPENDIX E

P&ID'S USED DURING NEW MODULE HAZOP

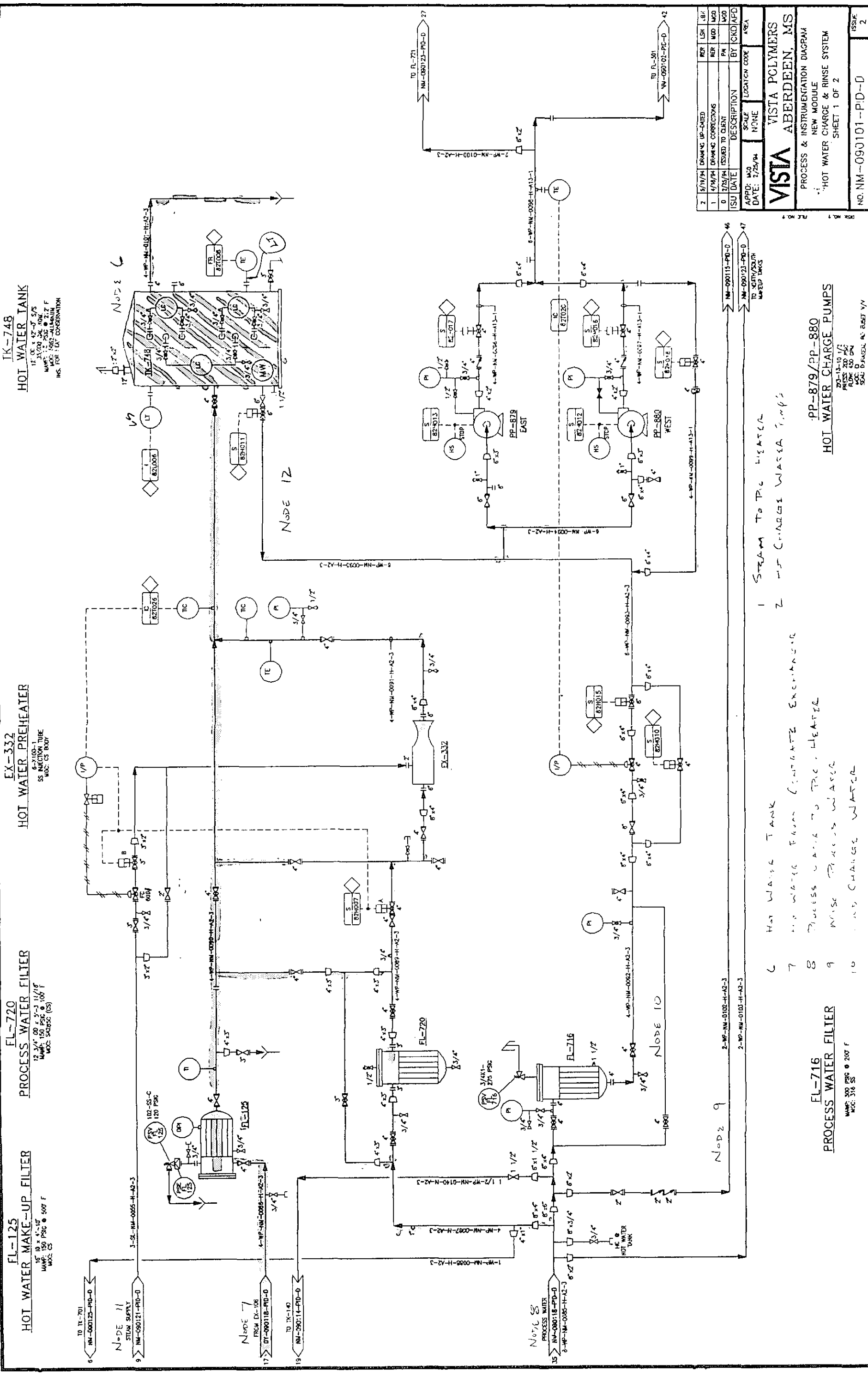


1	1/25/94	DRAWING CORRECTIONS	RET	WFO
0	1/25/94	ISSUED TO CLIENT	PA	WFO
ISU	DATE	DESCRIPTION	BY	CHKD/APPD
APPD: WFO	SCALE	LOCATION CODE	AREA	
DATE: 1/25/94	NONE			
VISTA				
VISTA POLYMERS ABERDEEN, MS				
PROCESS & INSTRUMENTATION DIAGRAM NEW MODULE FVCM RECEIVER				
NC. NM - 090100 - PID - D				ISSUE 1

Node 5

PP-875/PP-876
FVCM CHARGE PUMPS

- 1 FVM RECEIVED
- 2 FVM LINE FROM '10-1000
- 3 FVM CHARGE LINE
- 4 RECEIVED LINES TO FVM FROM TANK
- 5 TIPSW. TO FVM - MP'S



REV	DATE	DESCRIPTION	BY	CHKD	APPD
2	5/19/94	DRAWING UP-DATED	LSH	LSH	
1	4/19/94	DRAWING CORRECTING	REF	MOD	
0	2/25/94	ISSUED TO CLIENT	REF	MOD	
		ISSU DATE		BY	CHKD/APPD

SCALE	LOCATION	CODE	AREA
NONE			

APPD: MCB	DATE: 2/25/94
VISTA POLYMERS	
ABERDEEN, MS	
PROCESS & INSTRUMENTATION DIAGRAM	
NEW MODULE	
HOT WATER CHARGE & RINSE SYSTEM	
SHEET 1 OF 2	

NO. NM-090101-PID-D	ISSUE	2
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- 1 STEAM TO P.C. LINE
- 2 HOT WATER TANK
- 3 PROCESS WATER TO P.C. HEAT
- 4 PROCESS WATER TO P.C. HEAT
- 5 HOT WATER CHARGE
- 6 HOT WATER TANK
- 7 HOT WATER TANK
- 8 PROCESS WATER TO P.C. HEAT
- 9 PROCESS WATER TO P.C. HEAT
- 10 HOT WATER CHARGE

FL-716
PROCESS WATER FILTER
12" x 4" x 10"
WMP: 150 PSC @ 500 F
MOC: CS

FL-720
PROCESS WATER FILTER
12" x 4" x 10"
WMP: 150 PSC @ 500 F
MOC: CS

EX-332
HOT WATER PREHEATER
6" x 100"
SS INJECTION TUBE
MOC: CS BODY

TK-748
HOT WATER TANK
17' x 6' x 10"
WMP: 150 PSC @ 500 F
MOC: CS

FL-301
HOT WATER CHARGE FILTER

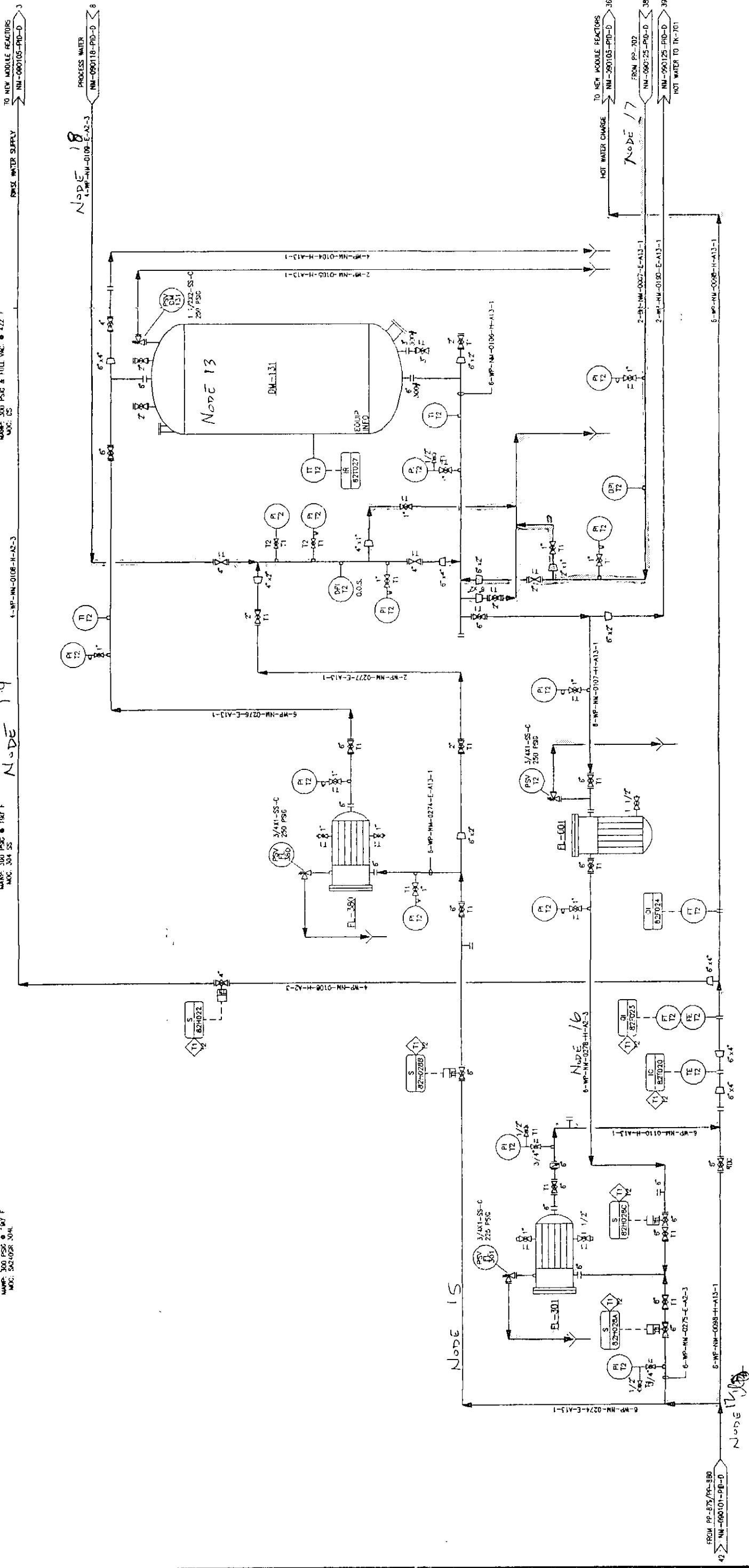
24" 1/16" ID x 3'-2" H
WMP: 300 PSIG @ 180° F
MOC: 304 SS

FL-380
DECALCIFIED WATER INLET FILTER

24" 1/16" ID x 3'-2" H
WMP: 300 PSIG @ 180° F
MOC: 304 SS

DM-131
DECALCIFIED WATER CHARGE TANK

106" ID x 5' H
WMP: 300 PSIG @ 180° F
MOC: CS

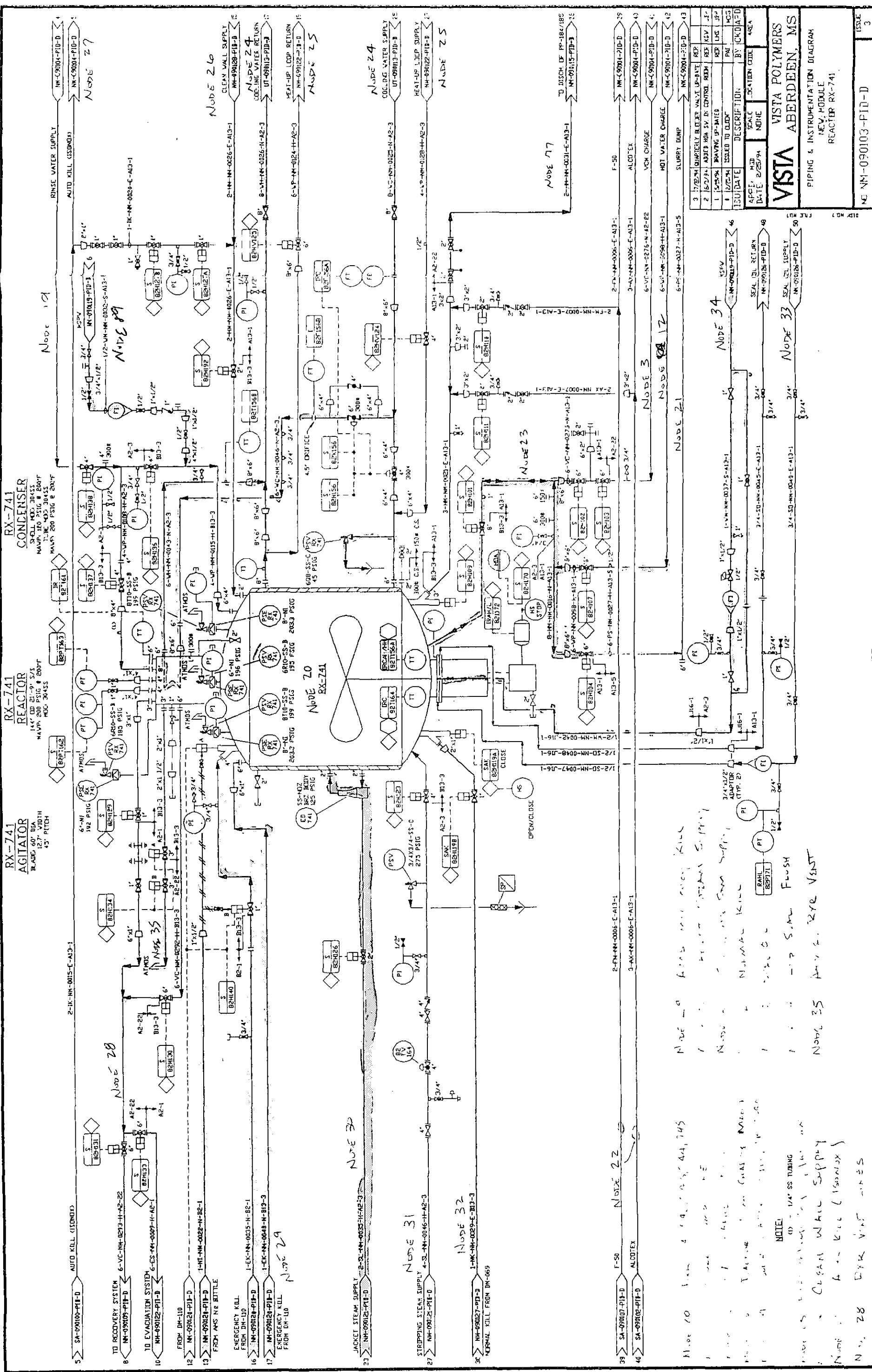


1	3/19/94	DRAWING UP-DATED	RDR	U8H	JBR	MOD	BY	CRD	AF	AREA
0	3/25/94	ISSUED TO CLIENT	PA							
ISU	DATE	DESCRIPTION								
APPD:	MOD	SCALE	LOCATION	CODE						
DATE:	2/75/94	NONE								

VISTA
VISTA POLYMERS
ABERDEEN, MS

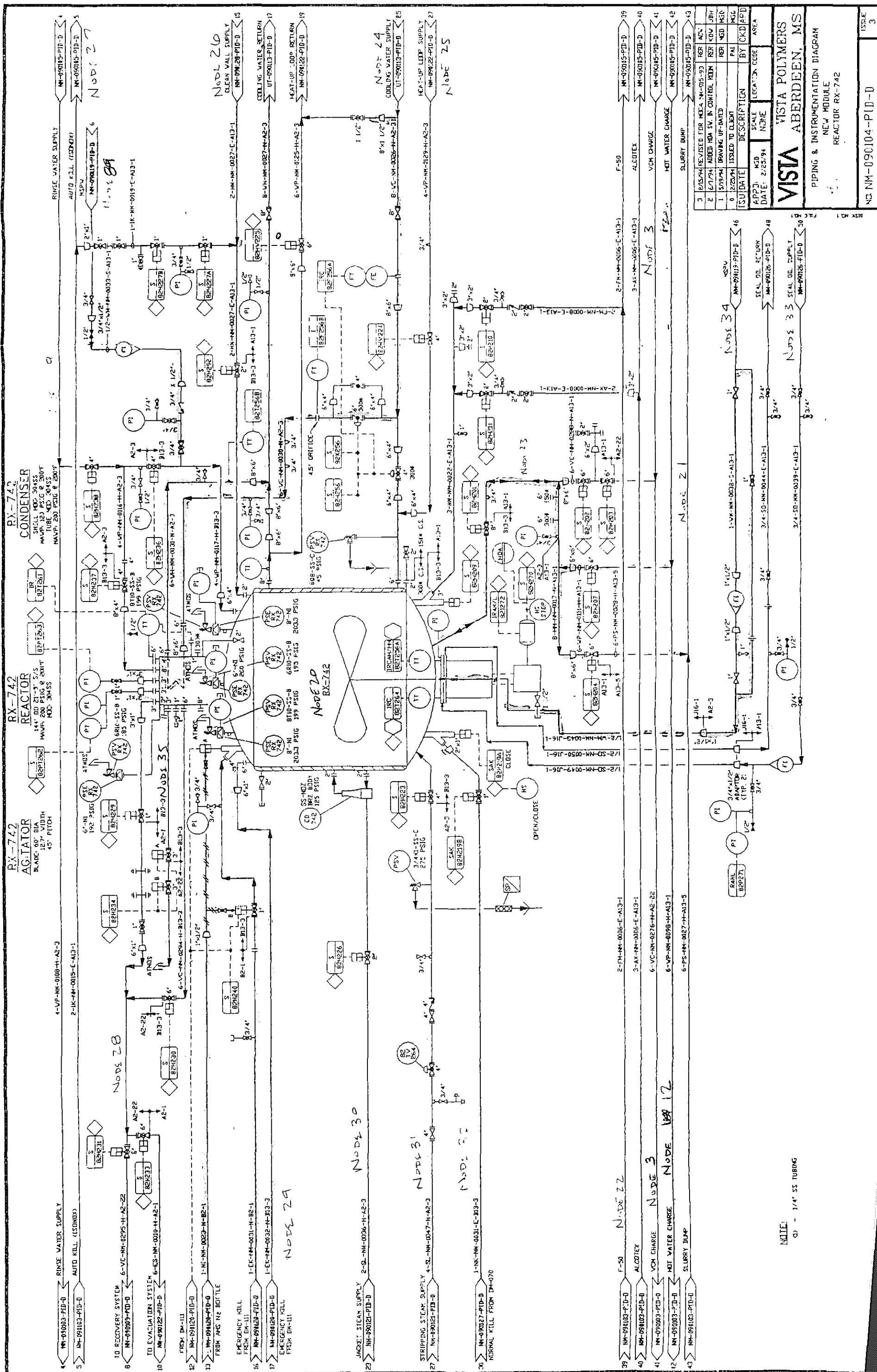
PROCESS & INSTRUMENTATION DIAGRAM
NEW MODULE
HOT WATER CHARGE & RINSE SYSTEM
SHEET 2 OF 2

NC. NM-090102-PID--D	ISSUE	1
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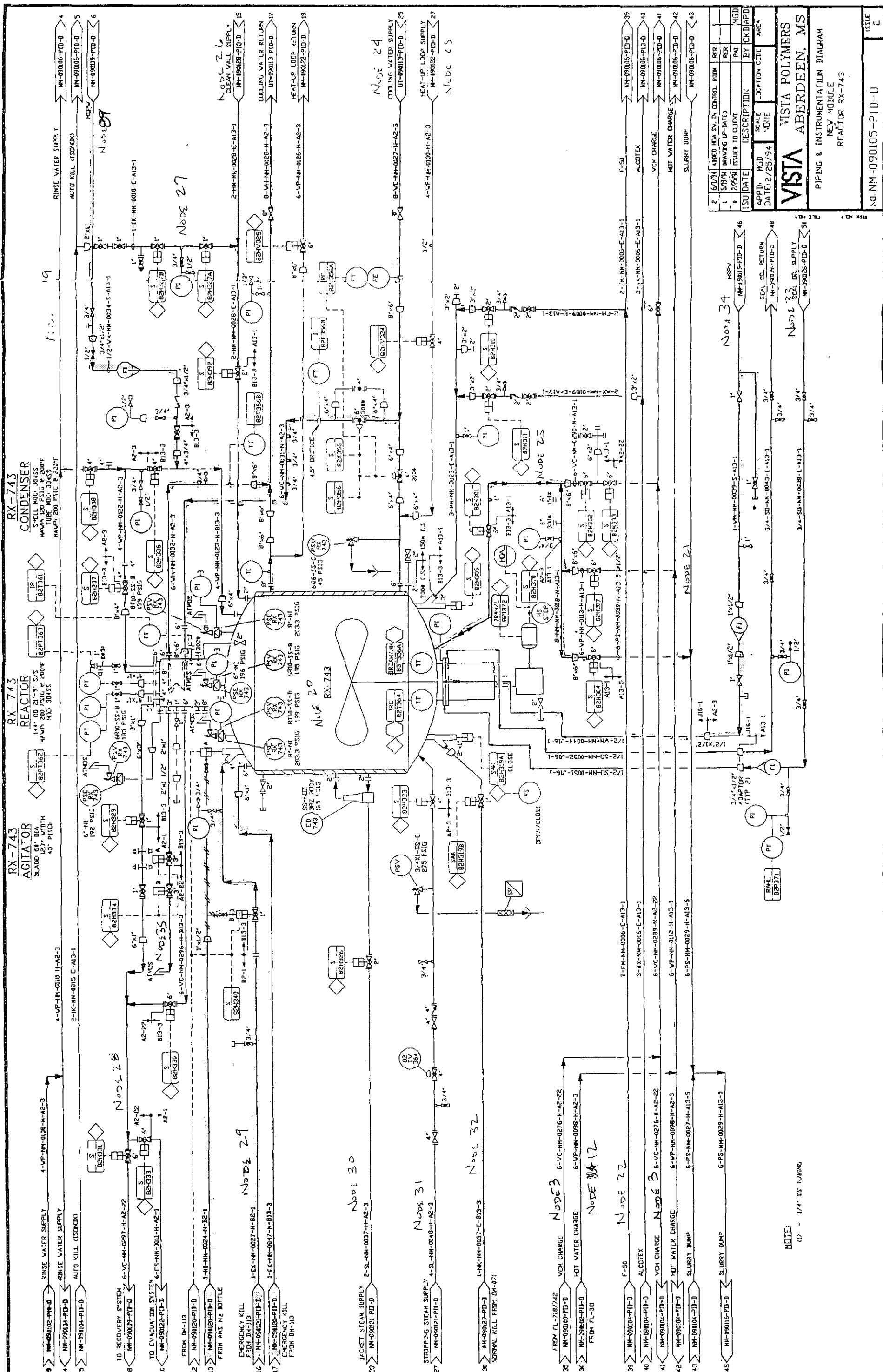


VISTA POLYMERS			
ABERDEEN, MS			
PIPING & INSTRUMENTATION DIAGRAM			
REV. MODULE			
REACTOR RX-741			
NO.	DESCRIPTION	DATE	BY
1	ISSUED TO FIELD	1/2/74	WGS
2	REVISION	2/25/74	WGS
3	REVISION	2/25/74	WGS
4	REVISION	2/25/74	WGS
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49	REVISION	2/25/74	WGS
50	REVISION	2/25/74	WGS

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Node 50



NOTE:
C) - 1/4" SS DURING



2	6/2/94	418ED PMA SV IN CONTROL ROOM	REF	
1	5/29/94	MOVING UP-14ED	REF	
6	2/26/94	ISSUE TO QJDR	PAI	MGD
[SU DATE]		DESCRIPTION:	BY	OKD/AFD
APPD: MGD	SCALE	LOCATION	CIDE	AREA
DATE: 2/25/94	NORE			

VISTA

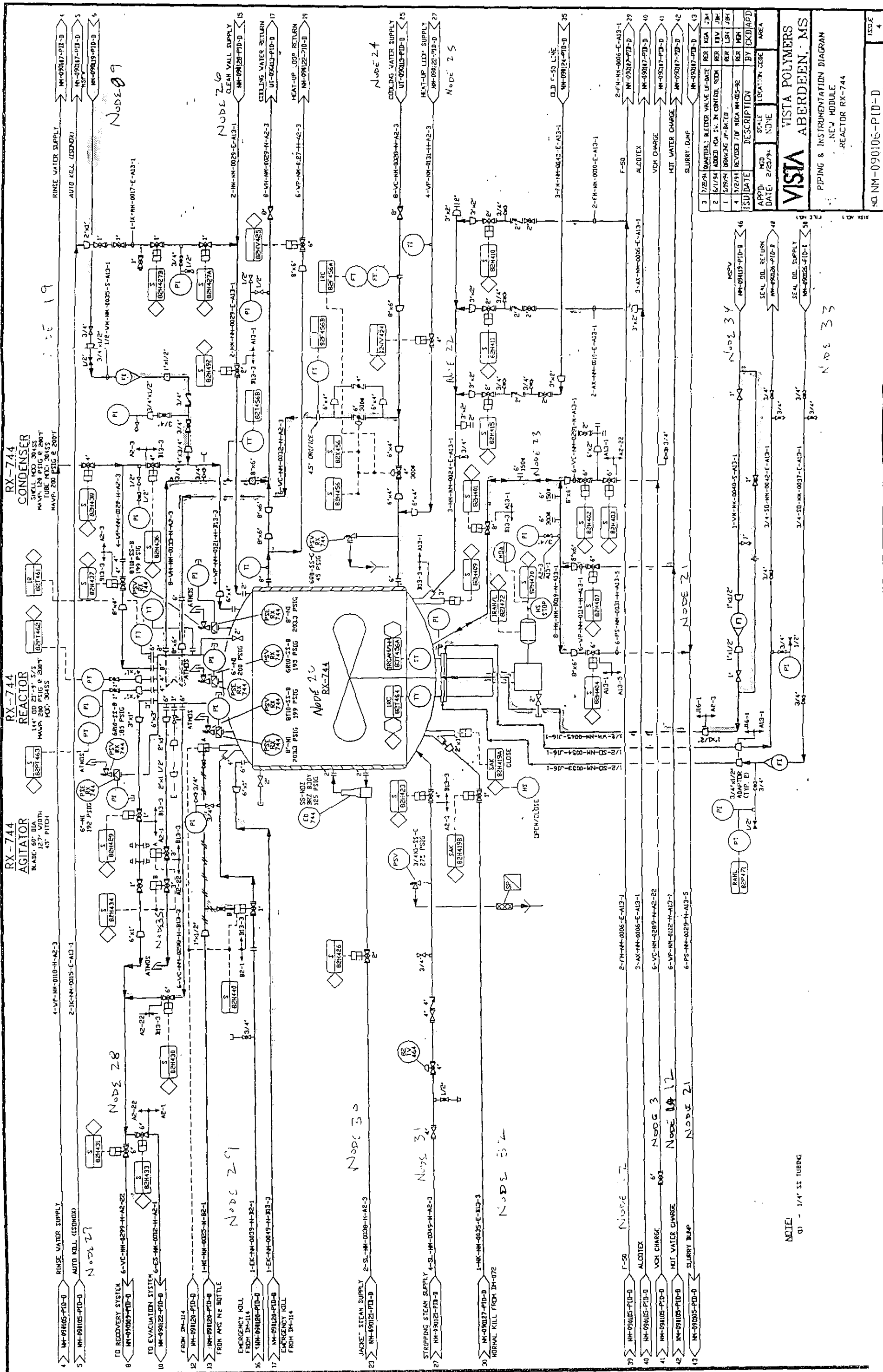
VISTA POLYMERS ABERDEEN, MS

PIPING & INSTRUMENTATION DIAGRAM
NEW MODULE
REACTOR RX-743

NA. NM-090105-210-D

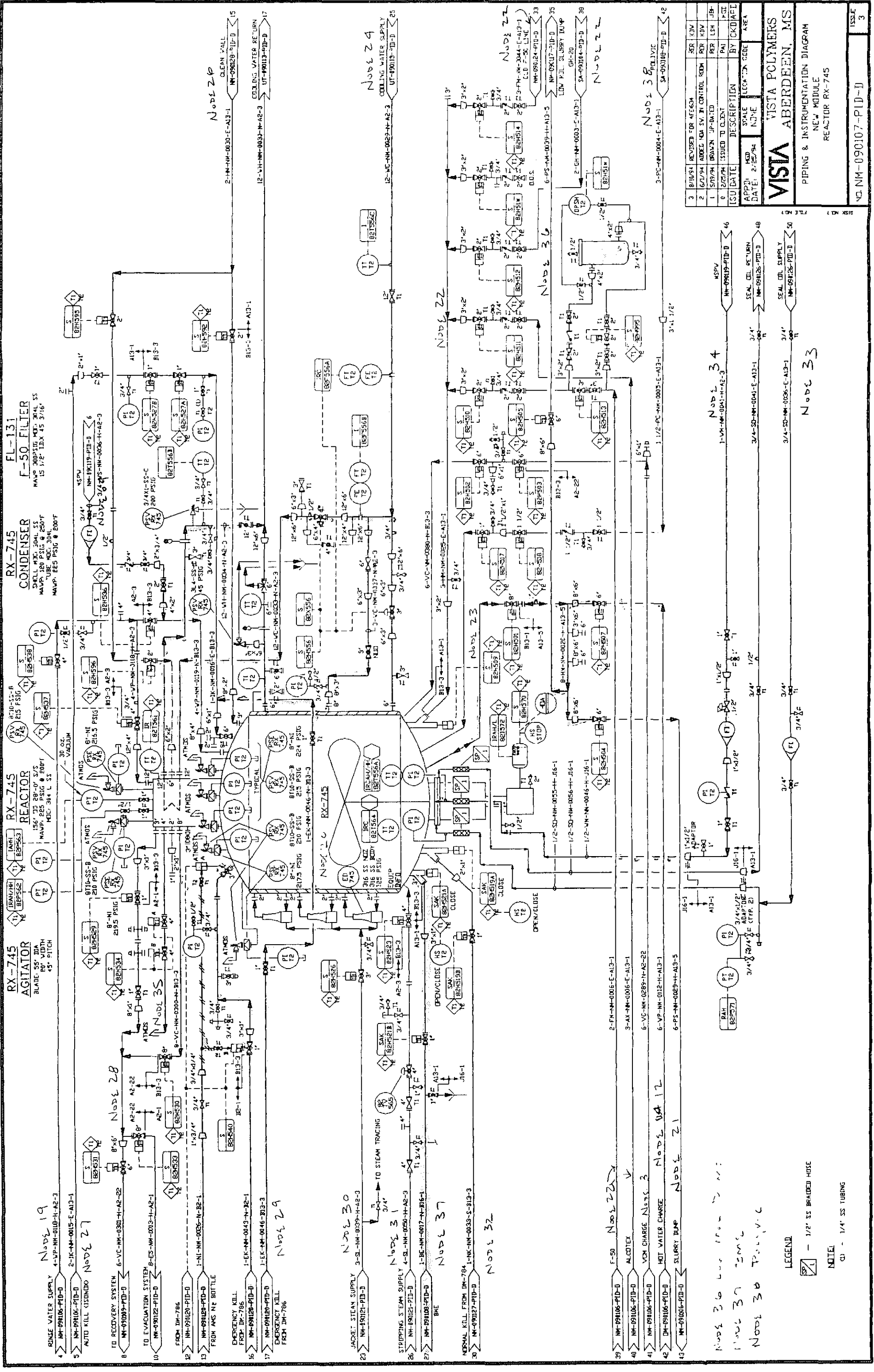
ISSUE
2

NOTE:
(1) - 1/4" SS TUBING



NOTE:
Q1 - 1/4" SS TUBING

VISTA POLYMERS			
ABERDEEN, MS			
PIPING & INSTRUMENTATION DIAGRAM			
NEW MODULE			
REACTOR RX-744			
NO. NM-090106-PID-D			
ISSUE 4			
NO.	DESCRIPTION	BY	DATE
1	ISSUED FOR CONSTRUCTION	RSR	12/1/94
2	REVISED FOR CONSTRUCTION	RSR	12/1/94
3	REVISED FOR CONSTRUCTION	RSR	12/1/94
4	REVISED FOR CONSTRUCTION	RSR	12/1/94
5	REVISED FOR CONSTRUCTION	RSR	12/1/94
6	REVISED FOR CONSTRUCTION	RSR	12/1/94
7	REVISED FOR CONSTRUCTION	RSR	12/1/94
8	REVISED FOR CONSTRUCTION	RSR	12/1/94
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96	REVISED FOR CONSTRUCTION	RSR	12/1/94
97	REVISED FOR CONSTRUCTION	RSR	12/1/94
98	REVISED FOR CONSTRUCTION	RSR	12/1/94
99	REVISED FOR CONSTRUCTION	RSR	12/1/94
100	REVISED FOR CONSTRUCTION	RSR	12/1/94



3	8/10/94	REVISED FOR ATECH	REV	KIV
2	6/1/94	ADDED NEW SV IN CONTROL ROOM	REV	KIV
1	5/19/94	DESIGN UP-DATED	REV	LHM
0	2/28/94	ISSUED TO CLIENT	PAI	KSI
TSU	DATE	DESCRIPTION	BY	CHK/APP
APP'D	DATE	SCALE	LOCATION	CODE
DATE	2/28/94	NAME		AREA

VISTA
VISTA POLYMERS
ABERDEEN, MS
PIPING & INSTRUMENTATION DIAGRAM
NEW MODULE
REACTOR RX-745

NO. NM-090107-PID-D
ISSUE 3

LEGEND

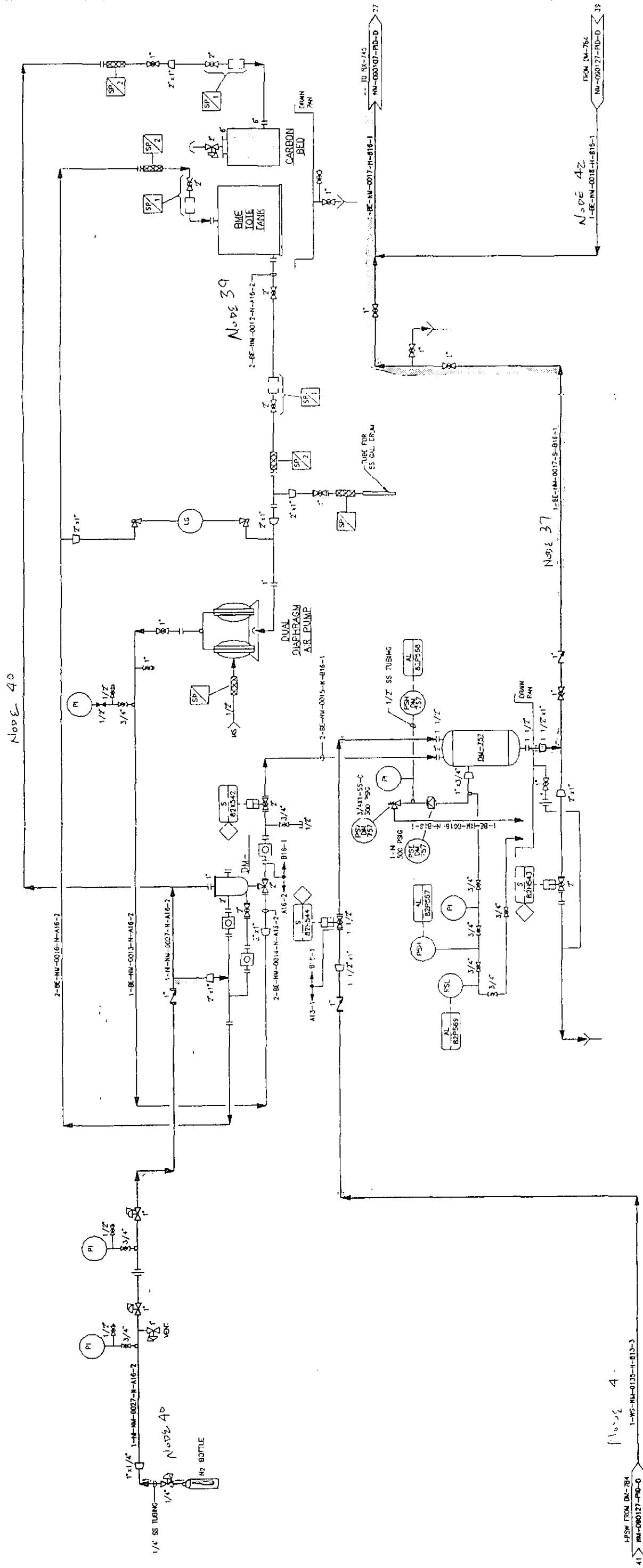
1/2" SS BRAIDED HOSE

NOTE

1/4" SS TUBING

DM-757
RX-745 BME MEETING POI
5' 00" x 2'-5" S/S
WAVE: 200 PSIG @ 100' F
WVC: 304 SS

DM-757
RX-745 BME CHARGE POI
10' 00" x 1'-8" S/S
WAVE: 300 PSIG @ 125' F
WVC: 304 SS



1	5/19/94	DRAWING	UP-DATED	REV	LSH
0	7/25/94	REVISED TO	CLINT	PM	WCD
1	7/25/94	DESCRIPTION	BY	CKO	AFO
APPD:	DATE:	SCALE	LOCATION	CODE	AREA
DATE:	7/25/94	SCALE	LOCATION	CODE	AREA
VISTA POLYMERS					
VISTA ABERDEEN, MS					
PROCESS & INSTRUMENTATION DIAGRAM					
NEW MODULE					
BME MEETING POT					
NO. NM-090108-PID-0					
ISSUE 1					

LEGEND

SP 1 MAXIMUM COUPLER VALVE Z

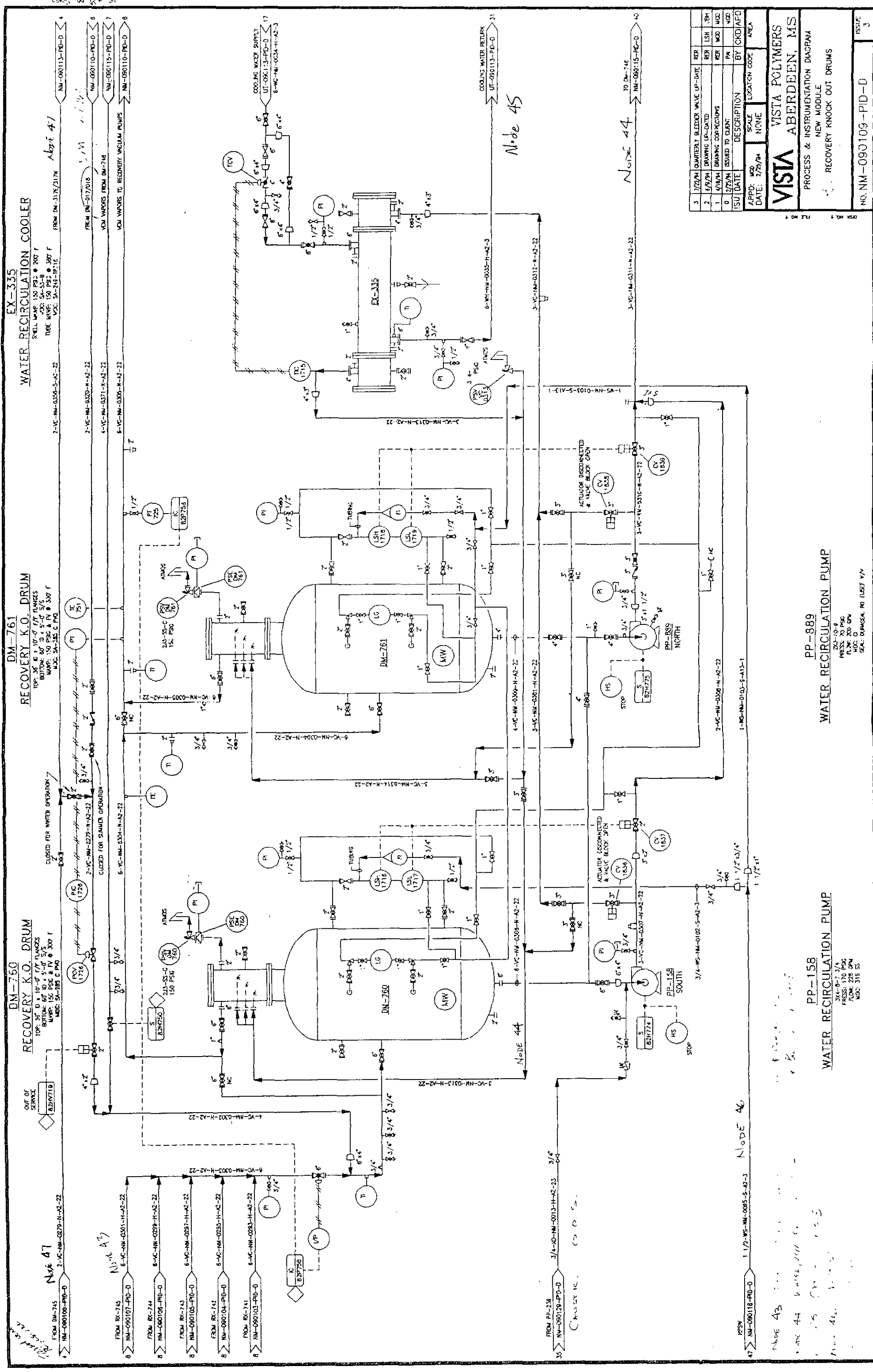
SP 2 FLEX HOSE SS PLANGED ONE END

39 BME MEETING TANK

40 BME / MEETING TANK

41 HPSU 100 PSIG CHARGE TANK

42 10' 00" x 2'-5" S/S TANK

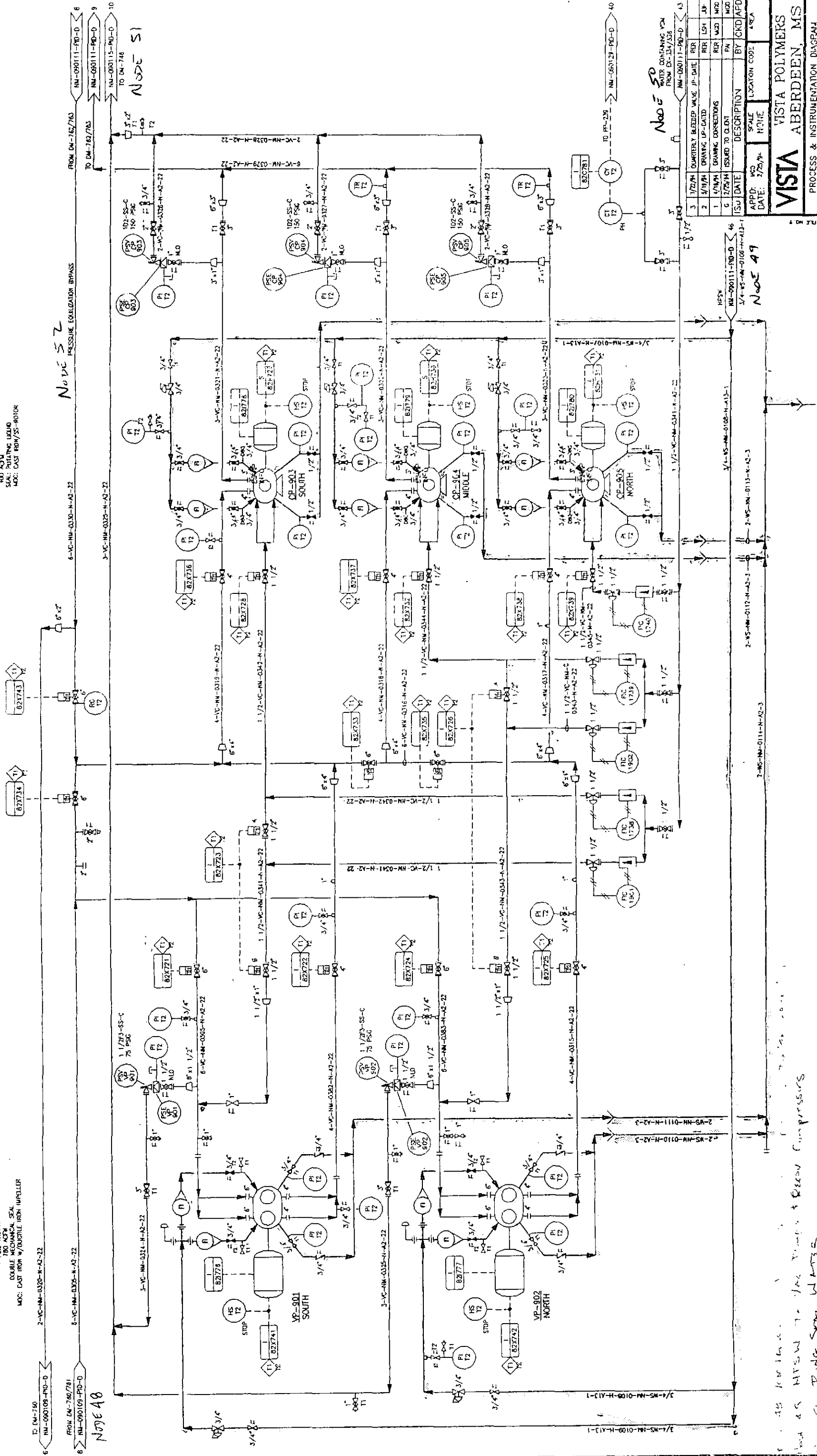


CP-903/CP-904/CP-905
RECOVERY COMPRESSORS

413-22 1/2
PRESS: 80 PSIG
100 ACFM
SCALE: PULLING VALVE
MOC: CAST IRON/SS-ROTOR

VP-901/VP-902
RECOVERY VACUUM PUMPS

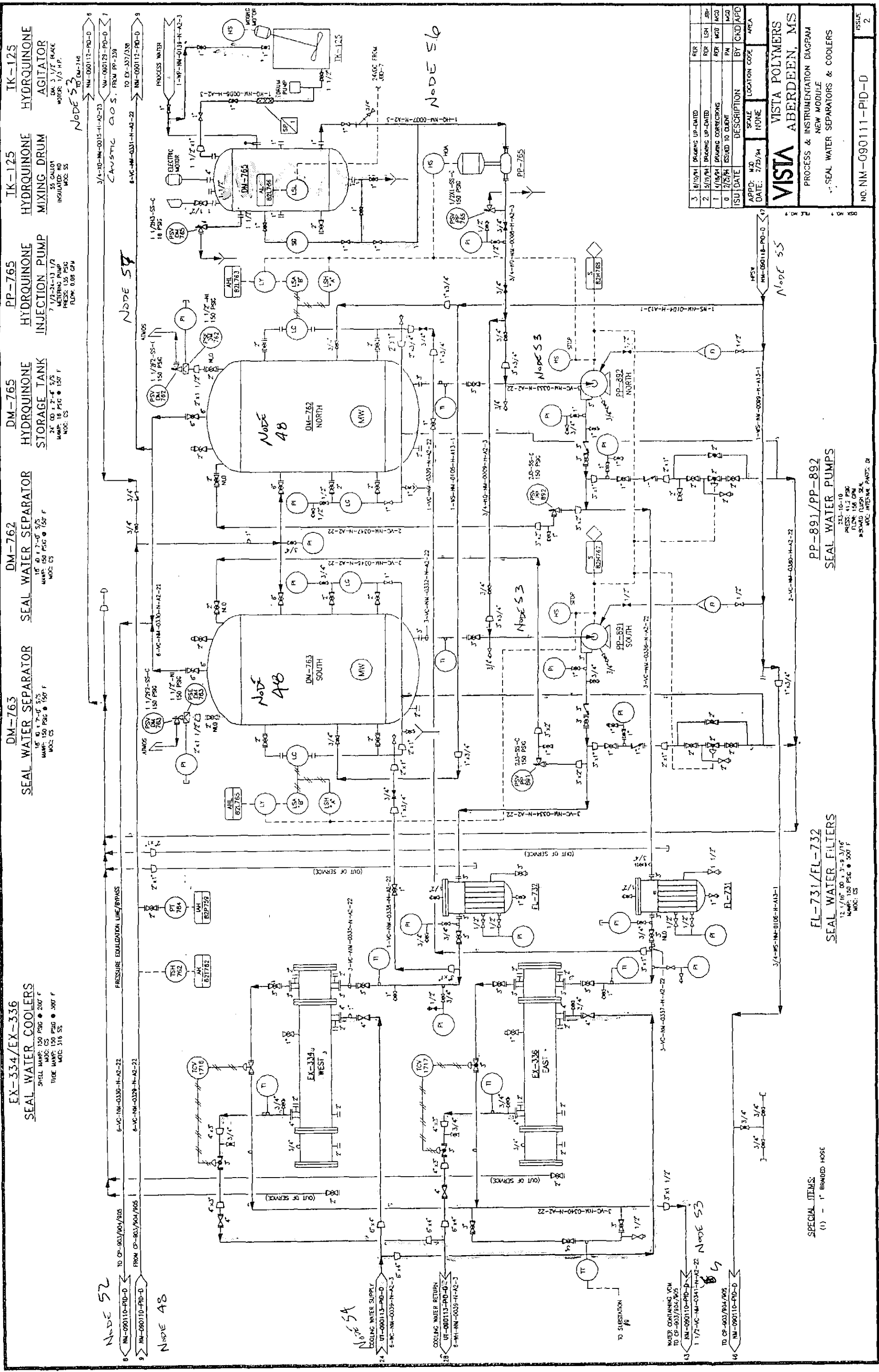
313-22
7 PSIG VACUUM
180 ACFM
DOUBLE MECHANICAL SEAL
MOC: CAST IRON W/ROTOR IRON IMPELLER



VISTA		VISTA POLYMERS	
ABERDEEN, MS		PROCESS & INSTRUMENTATION DIAGRAM	
NEW MODULE		RECOVERY COMPRESSORS & VACUUM PUMPS	
NO. NM-090110-PID-D	ISSUE 2		

AS NOTED IN THE PUMP & RECOVERY COMPRESSORS
NODE 50 BEING SEEN WATER
NODE 51 RELIEF SYSTEM
NODE 52 PRESSURE EQUALIZATION BYPASS

Node 53
Node 54
SS
SG
HPSW
HYDROQUINONE SYSTEM



SPECIAL ITEMS
(1) - 1" BRANDED HOSE

FL-731/FL-732
SEAL WATER FILTERS
12 1/16" OD x 3'-9 3/16"
WMP: 150 PSIG @ 500 F
MOC: CS

PP-891/PP-892
SEAL WATER PUMPS
23 1/2" OD x 3'-9 3/16"
WMP: 150 PSIG @ 500 F
MOC: CS

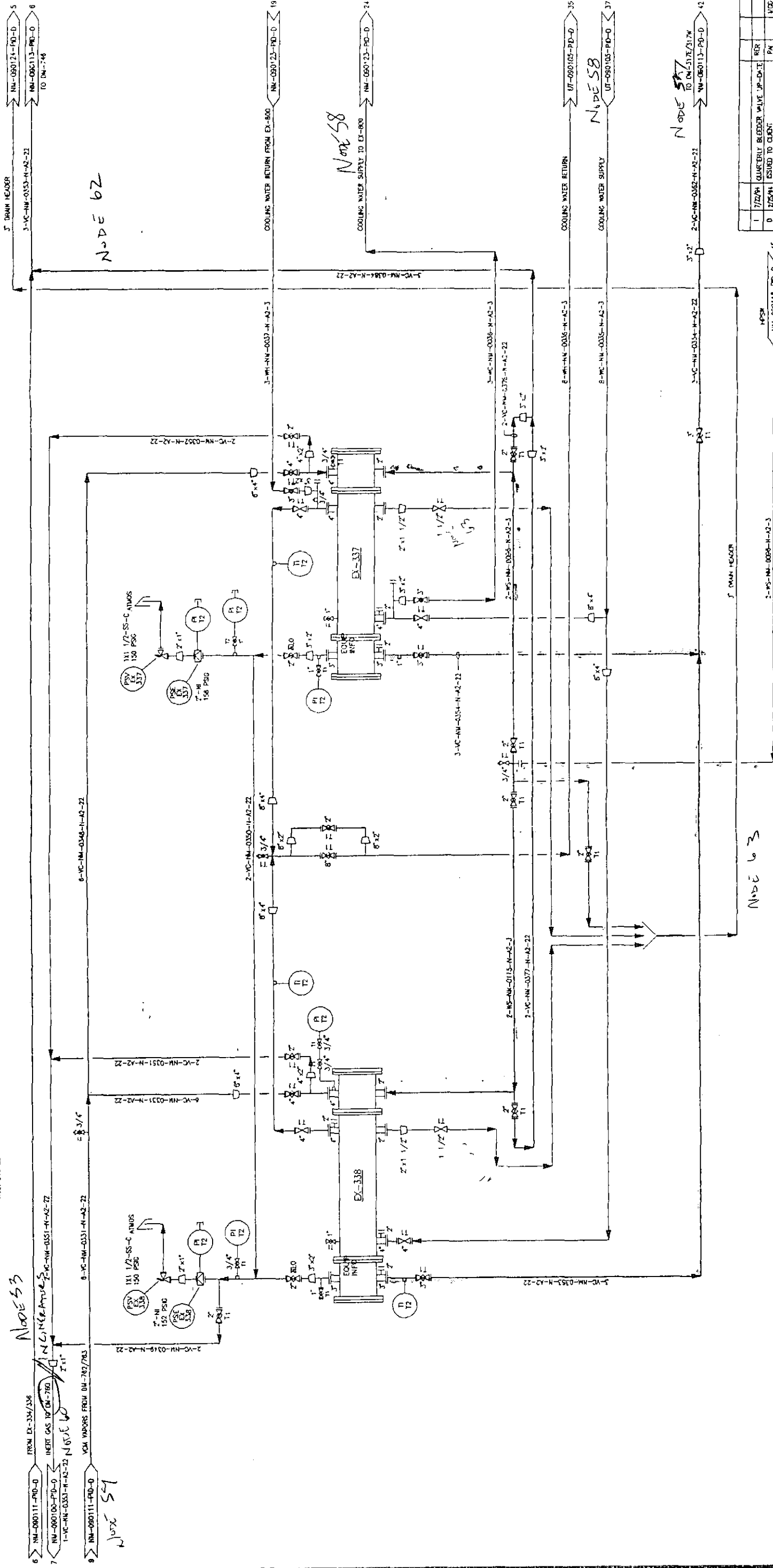
3	8/10/94	DRAWING UP-DATED	REP	LSH	JOB
2	5/15/94	DRAWING UP-DATED	REP	LSH	JOB
1	4/15/94	DRAWING CORRECTIONS	REP	WGO	MCO
0	2/25/94	DESIGNED TO CLIENT	PA	WGO	MCO
ISU DATE	DESCRIPTION	BY	CHKD	APD	
APPRO: WGO	SCALE: NONE	LOCATION CODE	AREA		
DATE: 7/25/94					
VISTA POLYMERS					
VISTA ABERDEEN, MS					
PROCESS & INSTRUMENTATION DIAGRAM					
NEW MODULE					
SEAL WATER SEPARATORS & COOLERS					
NO. NM-090111-PID-0					
ISSUE 2					

EX-337
RECOVERED VCM CONDENSER

SHELL WARP: 150 PSIG
TUBE WARP: 150 PSIG
TUBE WARP: 150 PSIG

EX-338
RECOVERED VCM CONDENSER

SHELL WARP: 150 PSIG
TUBE WARP: 150 PSIG
TUBE WARP: 150 PSIG

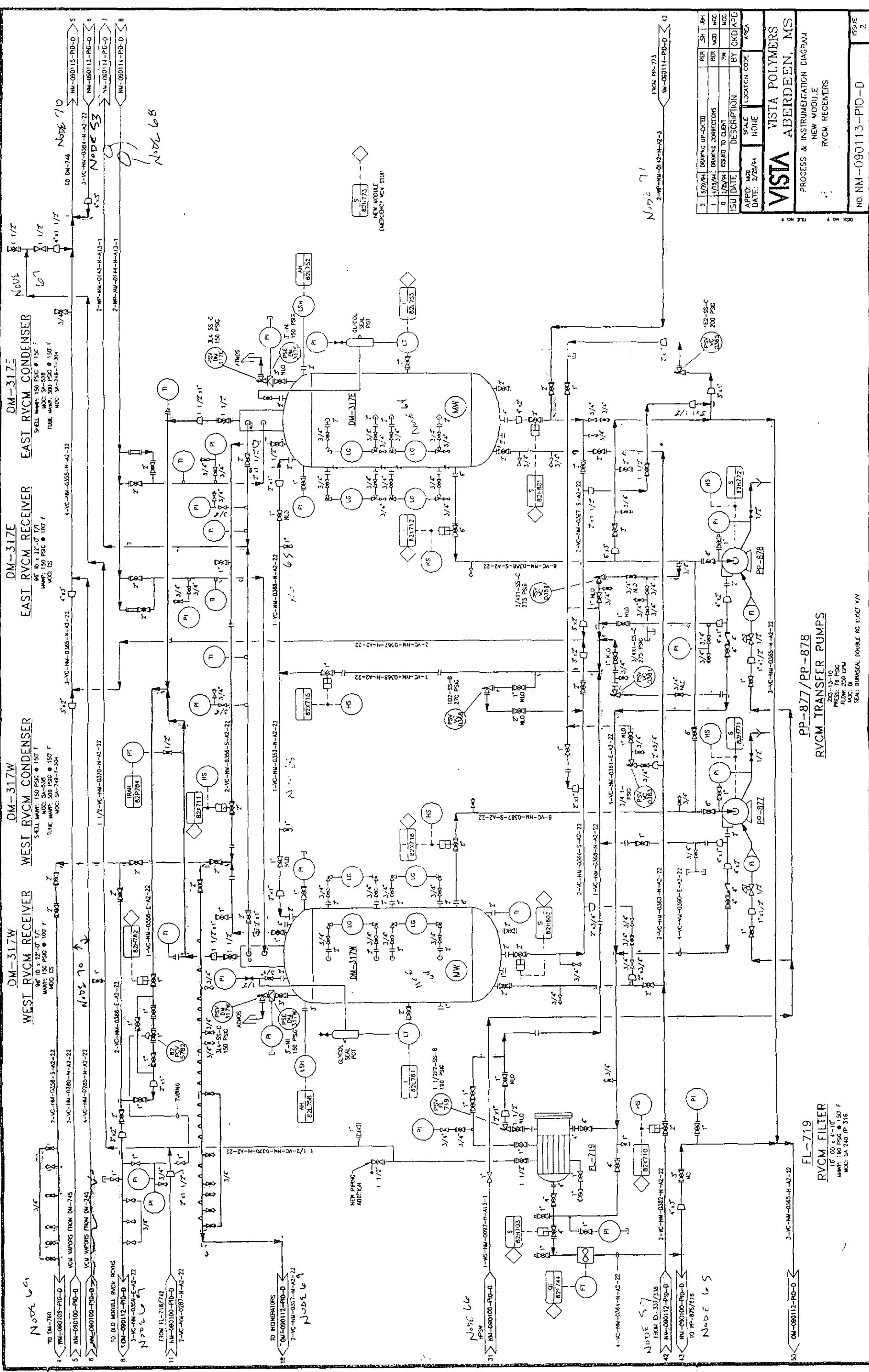


QUARTERLY BLEEDER VALVE	DATE	BY	AREA
1	7/2/94	PA	VER
2	7/2/94	PA	VER
3	7/2/94	PA	VER
4	7/2/94	PA	VER
5	7/2/94	PA	VER
6	7/2/94	PA	VER
7	7/2/94	PA	VER
8	7/2/94	PA	VER
9	7/2/94	PA	VER
10	7/2/94	PA	VER
11	7/2/94	PA	VER
12	7/2/94	PA	VER
13	7/2/94	PA	VER
14	7/2/94	PA	VER
15	7/2/94	PA	VER
16	7/2/94	PA	VER
17	7/2/94	PA	VER
18	7/2/94	PA	VER
19	7/2/94	PA	VER
20	7/2/94	PA	VER
21	7/2/94	PA	VER
22	7/2/94	PA	VER
23	7/2/94	PA	VER
24	7/2/94	PA	VER
25	7/2/94	PA	VER
26	7/2/94	PA	VER
27	7/2/94	PA	VER
28	7/2/94	PA	VER
29	7/2/94	PA	VER
30	7/2/94	PA	VER
31	7/2/94	PA	VER
32	7/2/94	PA	VER
33	7/2/94	PA	VER
34	7/2/94	PA	VER
35	7/2/94	PA	VER
36	7/2/94	PA	VER
37	7/2/94	PA	VER
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44	7/2/94	PA	VER
45	7/2/94	PA	VER
46	7/2/94	PA	VER
47	7/2/94	PA	VER
48	7/2/94	PA	VER
49	7/2/94	PA	VER
50	7/2/94	PA	VER
51	7/2/94	PA	VER
52	7/2/94	PA	VER
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78	7/2/94	PA	VER
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91	7/2/94	PA	VER
92	7/2/94	PA	VER
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95	7/2/94	PA	VER
96	7/2/94	PA	VER
97	7/2/94	PA	VER
98	7/2/94	PA	VER
99	7/2/94	PA	VER
100	7/2/94	PA	VER

Node 58
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Node 99
Node 100

DRAIN LINES

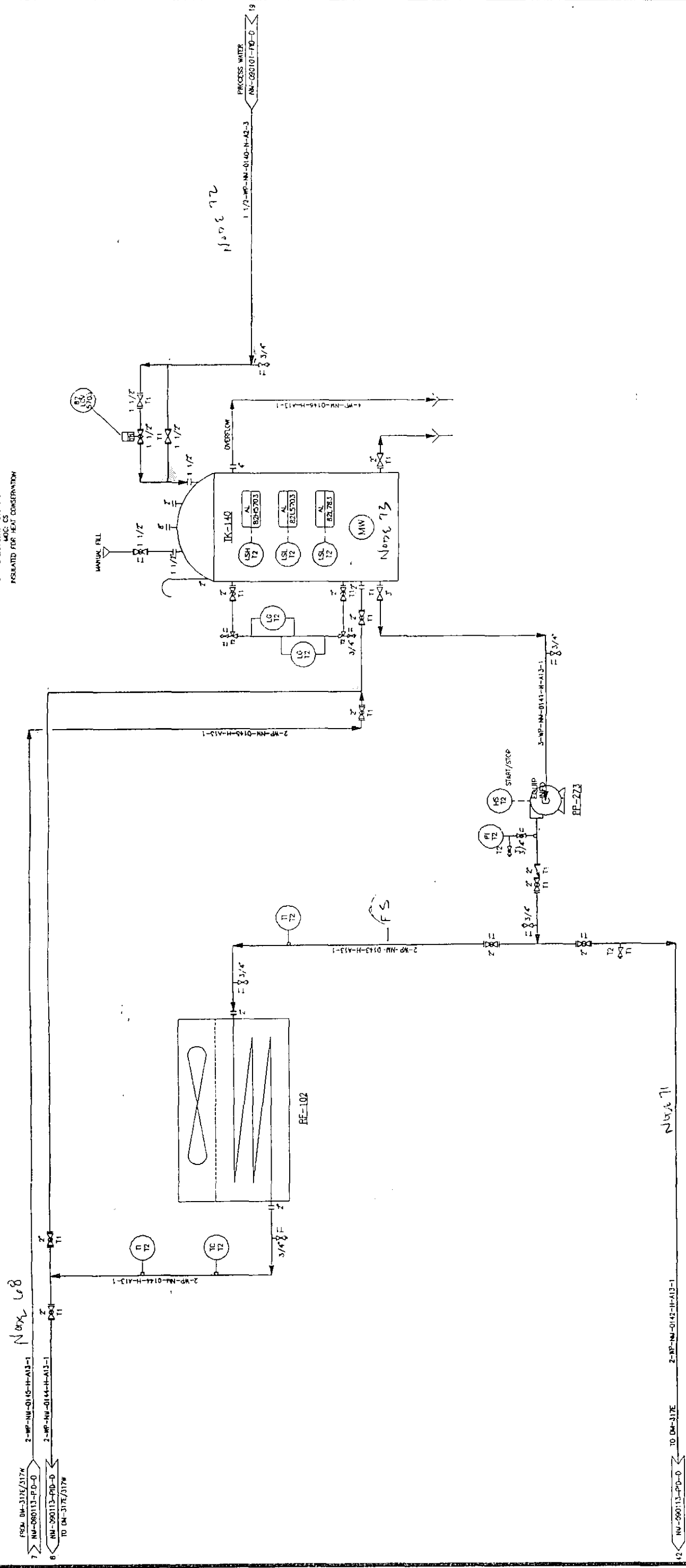
Notes 61 240A 240C 240S
62 RVCN CONDENSER
63 RVCN CONDENSER
64 RVCN CONDENSER
65 RVCN CONDENSER
66 RVCN CONDENSER
67 RVCN CONDENSER
68 RVCN CONDENSER
69 RVCN CONDENSER
70 RVCN CONDENSER
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94 RVCN CONDENSER
95 RVCN CONDENSER
96 RVCN CONDENSER
97 RVCN CONDENSER
98 RVCN CONDENSER
99 RVCN CONDENSER
100 RVCN CONDENSER



2	5/2/94	DRAWING UP-DATED	PER	SH	BA
1	1/2/94	DRAWING CORRECTIONS	PER	WCD	WCD
0	1/2/94	ISSUED TO CLIENT	PM	WCD	WCD
0	1/2/94	DESCRIPTION	BY	CKD	WCD
0	1/2/94	SCALE	LOCATION	CODE	AREA
0	1/2/94	DATE	2/2/94	NONE	

VISTA POLYMERS
PROCESS & INSTRUMENTATION DIAGRAM
NEW MODULE
RVCN RECEIVERS
NO. NM-090113-PID-D
ISSUE 2

RF-102
RVCM RECEIVERS
CHILLER UNIT
25 TON



772 1946-47 white to yellowish tan
13 filler, white stones - tan

PP-273
CHILLER CHARGE PUMP

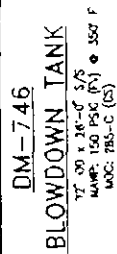
ZXS-B-8
RESS: 140 PSIG
FLOW: 60 GPM
MOD: DI CASE/SS NP
SEN: DURAMETALIC X100 (SINGLE)

[illegible]

FL-386/FL-
BLOWDOWN TANK STRAINERS

Note

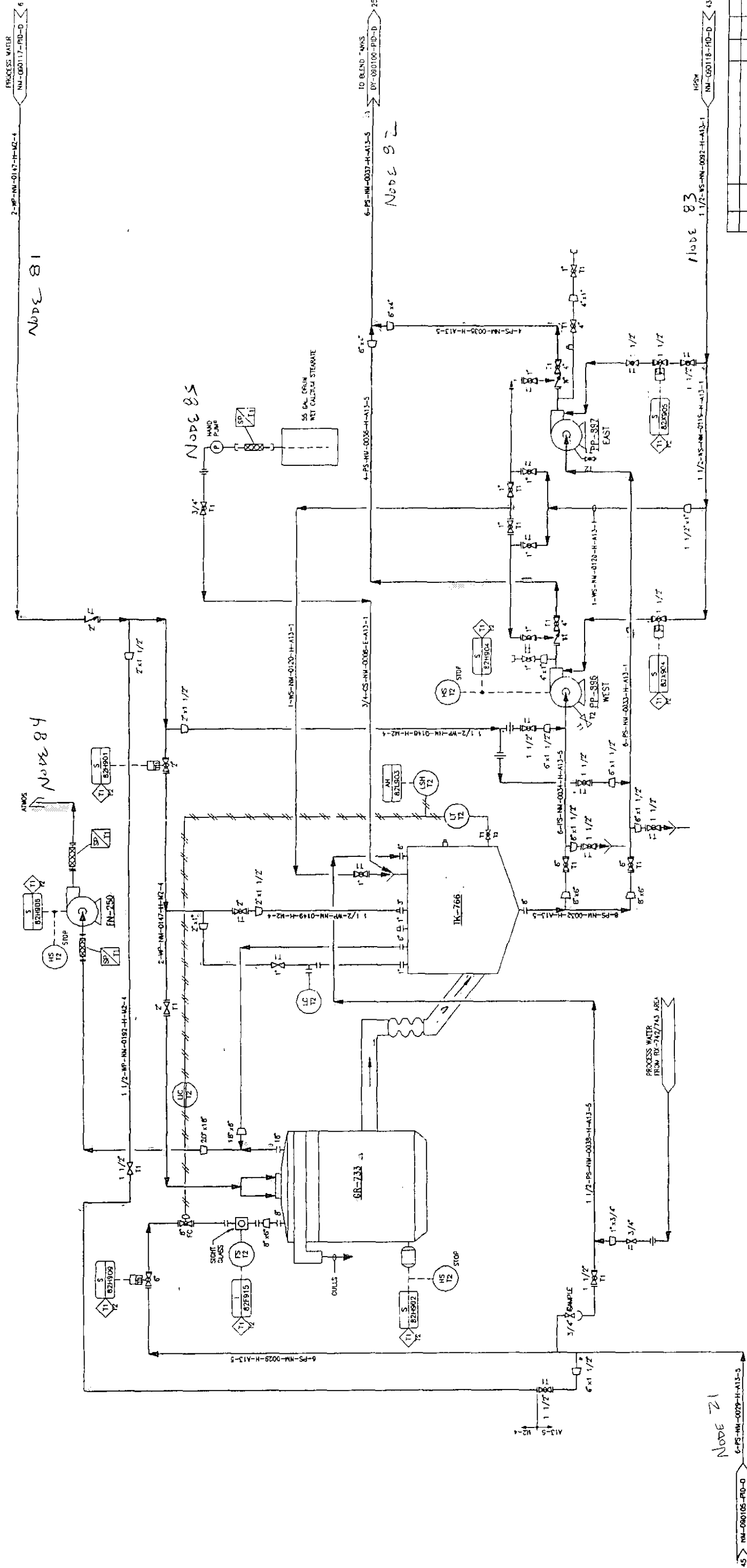
- '74 Blawdon tank
- 5 VCM VMADE VENT LINES
- '16 STEAM SUPPLY
- '77 FROM RY-741 (103, "
- '83 WATER TO BATCH WORK. TANKS
- " HPSW
- PO PROCESS WATER



GR-733
SLURRY SCREENER
4 WASH 316 SS SCREEN
FLOW 4000 GPM
PRESS 2" H₂O
WCC 316 SS

FN-250
SLURRY SCREENER EXHAUST FAN
5" Ø D 1.3" Ø STR SKE
WCC 316 SS
WCC 316 SS
NO PERCUSSION

IK-766
SLURRY DUMP TANK
5" Ø D 1.3" Ø STR SKE
WCC 316 SS
WCC 316 SS
NO PERCUSSION



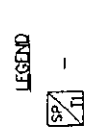
Node 81 Process and Material
82 Primary Recirculation and Pump Control
83 HPSW
84 Screen, Separator & Dump Tank Exhaust
85 Airflow, Pressure & Temperature

LEGEND
T1 -

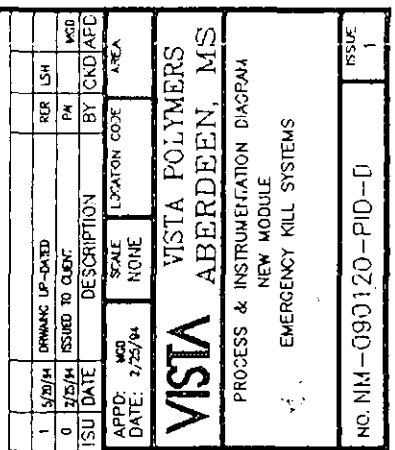
PP-896
WEST SLURRY TRANSFER PUMP
418-13-11 1/16
PRESS 55 PSC
FLOW 100 GPM
WCC 316 SS
DUMP TO DISEM

PP-897
EAST SLURRY TRANSFER PUMP
418-13-11 1/16
PRESS 55 PSC
FLOW 100 GPM
WCC 316 SS
DUMP TO DISEM

ISSUE	0	NO. NM-090115-PID-D
PROCESS & INSTRUMENTATION DIAGRAM	NEW MODULE	OLD SLURRY DUMP SYSTEM
VISTA ABERDEEN, MS		
VISTA POLYMERS		
SCALE	NONE	LOCATION CODE
DATE	2/25/94	BY
APPROVED	WCC	WCC
ISSUED TO CLIENT	PM	WCC
DESCRIPTION	BY	WCC
SCALE	NONE	LOCATION CODE
DATE	2/25/94	BY
APPROVED	WCC	WCC
ISSUED TO CLIENT	PM	WCC



PP-224	PP-225
WEST SLURRY TRANSFER PUMP	EAST SLURRY TRANSFER PUMP
416-13-16 3/8	416-13-10 3/8
PRESS. 43 PSI	PRESS. 43 PSI
FLOW 300 GPM	FLOW 300 GPM
MOSE 316 SS	MOSE 316 SS
SEAL DURA 40 EDSNTH	SEAL DURA 40 EDSNTH

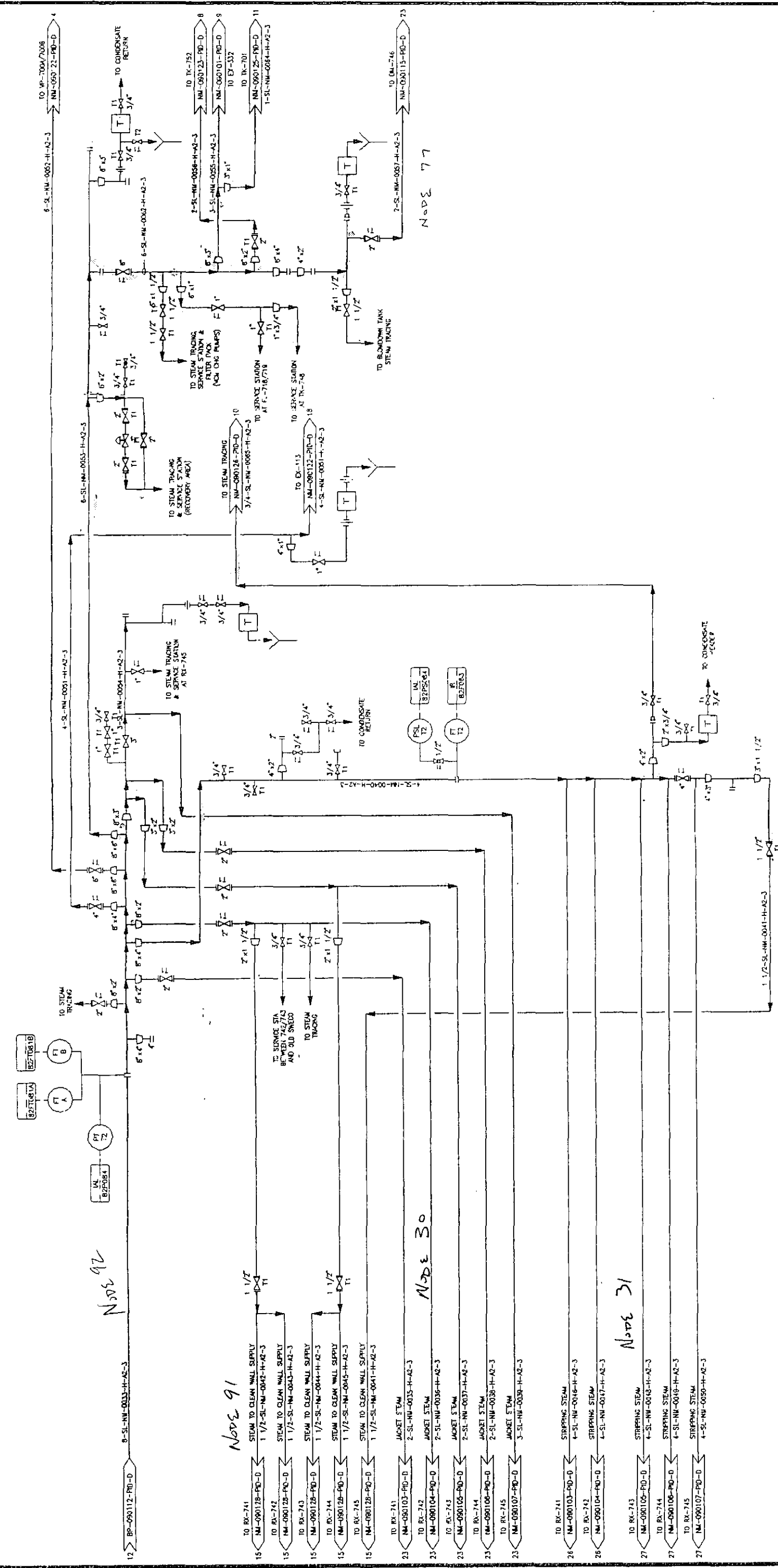


N2 BOTTLES AMS VALVES
EMERGENCY AMS KILL SYSTEM CONTROL
VALVE NITROGEN CYLINDER

VAL CYLINDER PRESSURE: 600 PSIG
ACTUATED VALVE REGULATOR
SET PRESSURE: 80 PSIG

NO. NM-090120-PID--0

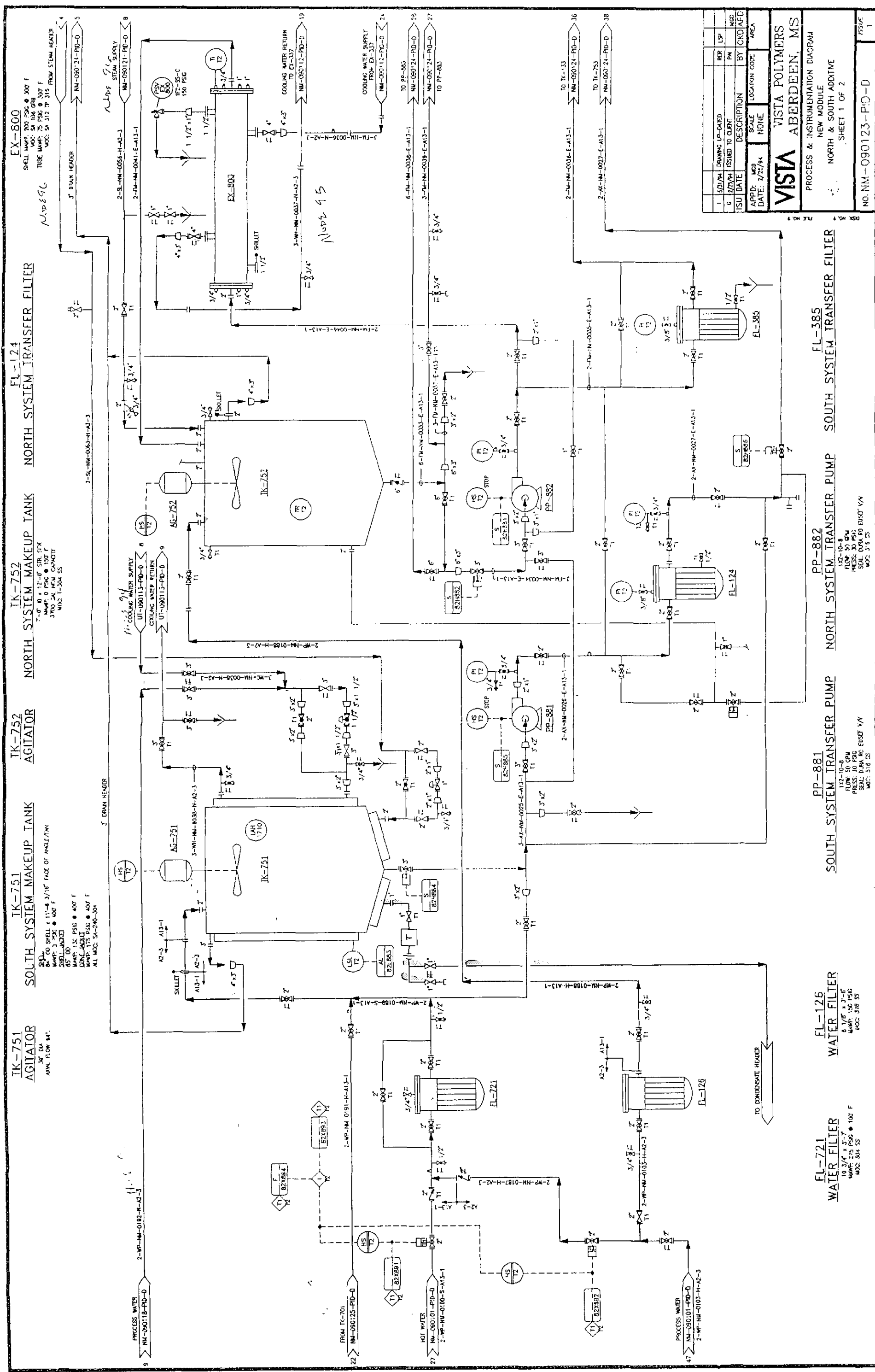
0		ISSUED TO CLIENT		PM		WCD		WCD	
ISU DATE		DESCRIPTION		BY		CHKD/AFD			
APPRO: WCD		SCALE		LOCATION CODE		AREA			
DATE: 7/5/74		NONE							
VISTA VISTA POLYMERS									
PROCESS & INSTRUMENTATION DIAGRAM									
NEW MODU-E									
STEAM & REACTOR EVACUATION SYSTEMS									
SHEET 1 OF 2									
NO. NM-090121-PID-0									
ISSUE 0									



91 Steam to Cool Supply

72 Steam to Cool Supply

Node 97 N/S Systems Integration



1	150/150	DRAWING UP-DATED	REVISION	150
2	150/150	ISSUED TO CLIENT	PM	150
3	150/150	DESCRIPTION	BY (CRO) AFD	150
4	150/150	SCALE	LOCATION CODE	AREA
5	150/150	DATE: 7/25/94	NONE	
6	150/150	APPD: MGR		
7	150/150	DATE: 7/25/94		

VISTA

VISTA POLYMERS

ABERDEEN, MS

PROCESS & INSTRUMENTATION DIAGRAM

NEW MODULE

NORTH & SOUTH ADDITIVE

SHEET 1 OF 2

NO. NM-090123-PID-D

FL-126 WATER FILTER
10 3/4" x 3'-7"
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM

FL-721 WATER FILTER
10 3/4" x 3'-7"
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM

PP-881 SOUTH SYSTEM TRANSFER PUMP
12" DIA. x 3'-6" H.
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM

PP-882 NORTH SYSTEM TRANSFER PUMP
12" DIA. x 3'-6" H.
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM

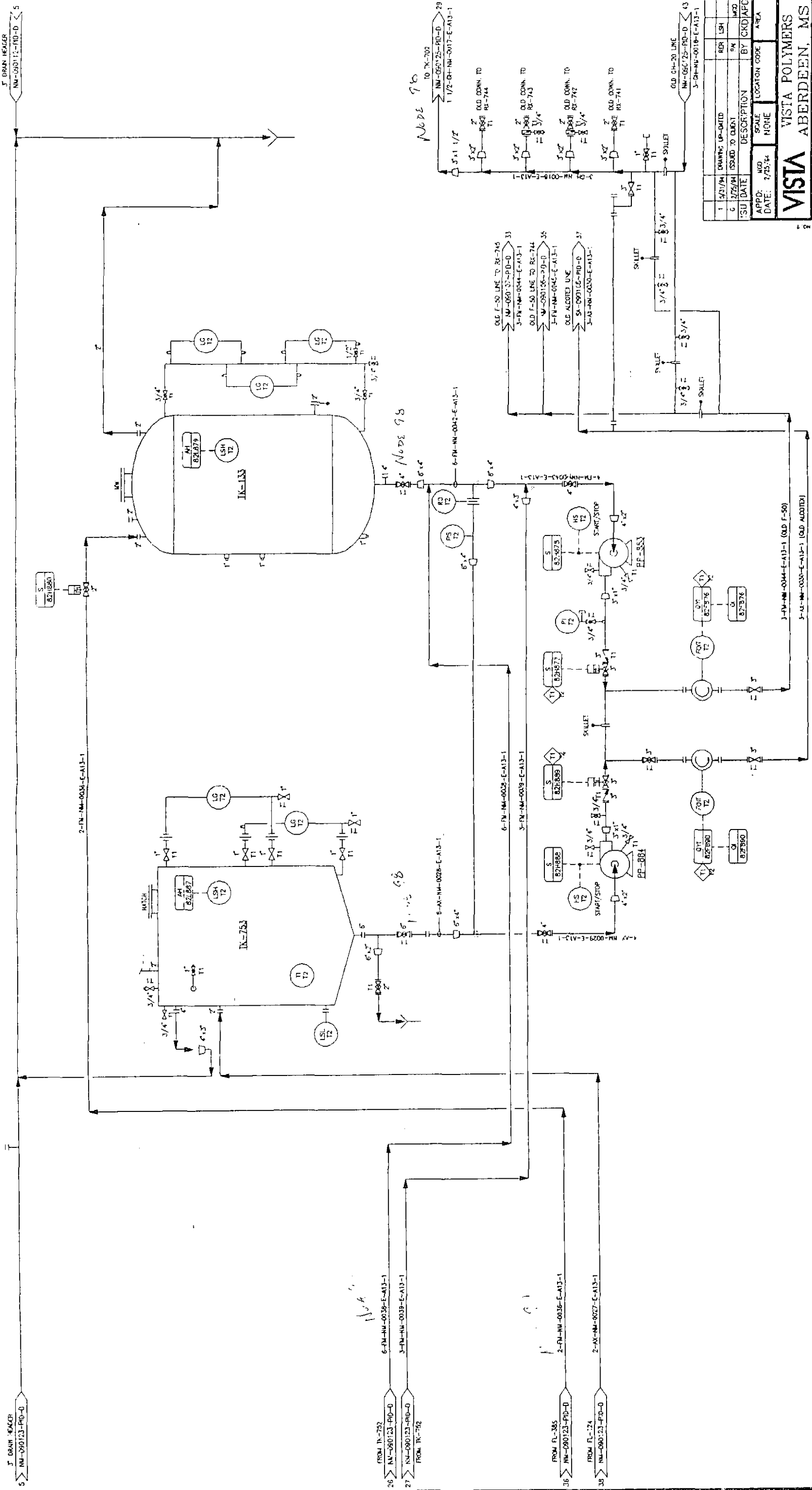
FL-124 NORTH SYSTEM TRANSFER FILTER
12" DIA. x 3'-6" H.
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM

FL-385 SOUTH SYSTEM TRANSFER FILTER
12" DIA. x 3'-6" H.
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM
MOTOR: 1/2 HP, 115V, 1725 RPM

TK-753 SOUTH SYSTEM CHARGE TANK
TK-133 F-50 CHARGE TANK

TK-753 SOUTH SYSTEM CHARGE TANK
TK-133 F-50 CHARGE TANK

5" SDR 100
100' L
100' W
100' H

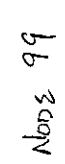


PP-883
F-50 CHARGE PUMP
(NOT IN SERVICE)
100' L
100' W
100' H
PRESS. 220 PSIG
FLOW 100 GPM
MAX. 316 SS
SEAL: DURA RO DURET V/V

PP-884
ALCOHOL CHARGE PUMP
(NOT IN SERVICE)
100' L
100' W
100' H
PRESS. 220 PSIG
FLOW 100 GPM
MAX. 316 SS
SEAL: DURA RO DURET V/V

PP-885
F-50 CHARGE PUMP
(NOT IN SERVICE)
100' L
100' W
100' H
PRESS. 220 PSIG
FLOW 100 GPM
MAX. 316 SS
SEAL: DURA RO DURET V/V

VISTA POLYMERS			
ABERDEN, MS			
PROCESS & INSTRUMENTATION DIAGRAM			
NEW MODULE			
NORTH & SOUTH ADDITIVE			
SHEET 2 OF 2			
NO. NM-090124-P.D-D			
ISSUE 1			
NO.	DESCRIPTION	BY	DATE
1	DRIVING UP-OUT	RED	LSH
2	ISSUED TO CLIENT	PA	WFO
3	DATE	SCALE	LOCATION CODE
4	DATE	SCALE	LOCATION CODE
5	DATE	SCALE	LOCATION CODE



1	5/31/74	DRAWING UP - DTD	REF.		
0	7/25/74	ISSUED TO CLIENT	PM		
ISU	DATE	DESCRIPTION	BY	ORD. APPROV.	WCC
APPD:	MOD.	SCALE	LOCATION CODE		
DATE:	7/25/74	NONE			AREA

VISTA

VISTA POLYMERS ABERDEEN, MS

PROCESS & INSTRUMENTATION DIAGRAM

NEW MODULE

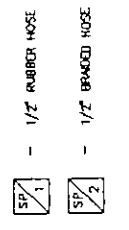
EAST ADDITIVE SYSTEM

ISSUE

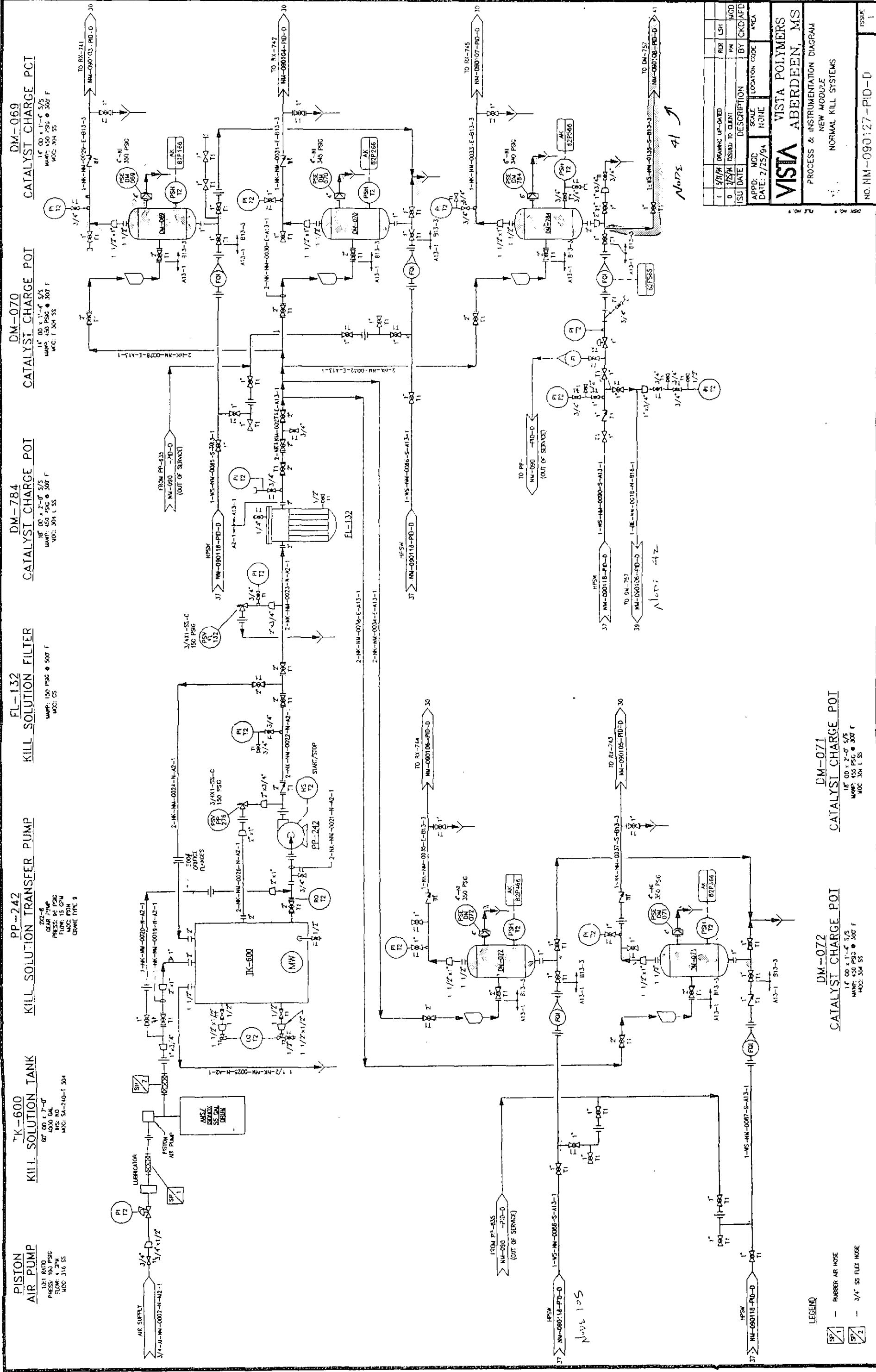
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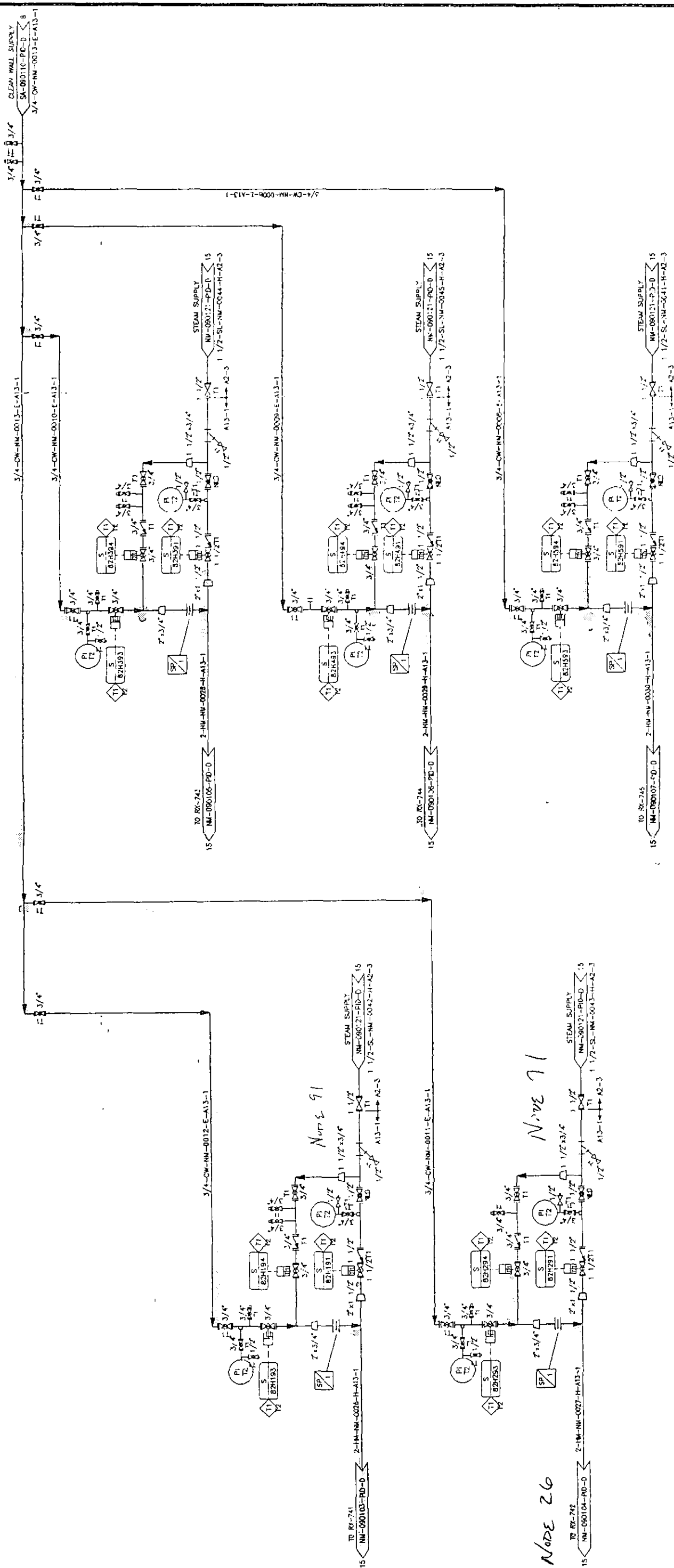
NO. NM-090125-PID-0

PP-701	PP-702
EAST ADDITIVE TRANSFER PUMP	EAST ADDITIVE CHARGE PUMP
1.304-13-12A	100-10
400 316 SS	400 316 SS



105 HPSW - Kill Solution Tank Pumps
106 Kill Solution Transfer Pump System





LEGEND

— CLEAN WALL FOG NOZZLE

1	2/21/94	DRAWING UP-DATED	REF	LSH	
0	2/25/94	ISSUED TO CLIENT	PA		WCD
TSU	DATE	DESCRIPTION	BY	CHKD	APCD
APCD	WCD				
DATE:	2/25/94	SCALE	LOCATION CODE		AREA
		HOME			

VISTA

VISTA POLYMERS ABERDEEN, MS

PROCESS & INSTRUMENTATION DIAGRAM
NEW MODULE

CLEAN WALL SUPPLY SYSTEMS

ISSUE
1

NC: NM-090128-PID-0

1

APPENDIX F

OSHA PSM Regulation 29CFR 1910.119

the country. Nonetheless, states with occupational safety and health plans approved under section 18 of the OSHA Act will be able to develop their own state standards to deal with any special problems which might be encountered in a particular state. Moreover, because this standard is written in general, performance-oriented terms, there is considerable flexibility for state plans to require, and for affected employers to use, methods of compliance which are appropriate to the working conditions covered by the standard.

In brief, this proposed rule addresses a clear national problem related to occupational safety and health in general industry. Those states which have elected to participate under section 18 of the OSHA Act are not preempted by this standard, and will be able to address any special conditions within the framework of the Federal Act while ensuring that the state standards are at least as effective as that standard. State comments were considered prior to promulgation of this final rule.

VII. State Plan States

The 25 States and Territories with their own OSHA approved occupational safety and health plans must adopt a comparable standard within six months of the publication date of this final standard. These 25 States and Territories are: Alaska, Arizona, California, Connecticut (for State and local government employees only), Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, New York (for State and local government employee only), North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Virgin Islands, Washington, and Wyoming. Until such time a state standard is promulgated, Federal OSHA will provide interim enforcement assistance, as appropriate, in these states.

List of Subjects in 29 CFR Part 1910

Explosive, Flammable liquids and gases, Hazard analysis, highly hazardous chemicals, Hazardous materials, Occupational safety and health, Safety, Process hazard analysis, Pyrotechnics.

Authority

This document has been prepared under the direction of Dorothy L. Strunk, Acting Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, 200 Constitution Avenue, NW., Washington DC 20210.

Accordingly, pursuant to sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655,

657); Section 304, Clean Air Act Amendments of 1990 (Pub. L. 101-549, Nov. 15, 1990, reprinted at 29 U.S.C. 655 Note (Supp. 1991)); Secretary of Labor's Order No. 1-90 (55 FR 9033); and 29 CFR part 1911, 29 CFR part 1910 is amended as set forth below.

Signed at Washington, DC, this 14th day of February, 1992.

Dorothy L. Strunk,

Acting Assistant Secretary of Labor.

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

1. The authority citation for Subpart H of Part 1910 is revised to read as follows:

Authority: Secs. 4, 6, 8, Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736) or 1-90 (55 FR 9033), as applicable.

Sections 1910.103, 1910.106, 1910.107, 1910.108, 1910.109, 1910.110, 1910.111 and 1910.119 are also issued under 29 CFR part 1911.

Section 1910.119 is also issued under Sec. 304, Clean Air Act Amendments of 1990 (Public Law 101-549, Nov. 15, 1990, reprinted at 29 U.S.C. 655 Note (Supp. 1991)).

Section 1910.120 is also issued under Sec. 126, Superfund Amendments and Reauthorization Act of 1986 as amended (29 U.S.C. 655 note), 5 U.S.C. 553, and 29 CFR part 1911.

2. Section 1910.109 is amended by revising paragraph (k) to read as follows:

§ 1910.109 Explosives and blasting agents.

(k) *Scope.* (1) This section applies to the manufacture, keeping, having, storage, sale, transportation, and use of explosives, blasting agents, and pyrotechnics. The section does not apply to the sale and use (public display) of pyrotechnics, commonly known as fireworks, nor the use of explosives in the form prescribed by the official U.S. Pharmacopeia.

(2) The manufacture of explosives as defined in paragraph (a)(3) of this section shall also meet the requirements contained in § 1910.119.

(3) The manufacture of pyrotechnics as defined in paragraph (a)(10) of this section shall also meet the requirements contained in § 1910.119.

3. A new § 1910.119 and appendices A through D to § 1910.119 are added to read as follows:

§ 1910.119 Process safety management of highly hazardous chemicals.

Purpose. This section contains requirements for preventing or minimizing the consequences of

catastrophic releases of toxic, reactive, flammable, or explosive chemicals. These releases may result in toxic, fire or explosion hazards.

(a) *Application.* (1) This section applies to the following:

(i) A process which involves a chemical at or above the specified threshold quantities listed in Appendix A to this section;

(ii) A process which involves a flammable liquid or gas (as defined in 1910.1200(c) of this part) on site in one location, in a quantity of 10,000 pounds (4535.9 kg) or more except for:

(A) Hydrocarbon fuels used solely for workplace consumption as a fuel (e.g., propane used for comfort heating, gasoline for vehicle refueling), if such fuels are not a part of a process containing another highly hazardous chemical covered by this standard;

(B) Flammable liquids stored in atmospheric tanks or transferred which are kept below their normal boiling point without benefit of chilling or refrigeration.

(2) This section does not apply to:

(i) Retail facilities;

(ii) Oil or gas well drilling or servicing operations; or,

(iii) Normally unoccupied remote facilities.

(b) *Definitions.* *Atmospheric tank*, means a storage tank which has been designed to operate at pressures from atmospheric through 0.5 p.s.i.g. (pounds per square inch gauge, 3.45 Kpa).

Boiling point means the boiling point of a liquid at a pressure of 14.7 pounds per square inch absolute (p.s.i.a.) (760 mm.). For the purposes of this section, where an accurate boiling point is unavailable for the material in question, or for mixtures which do not have a constant boiling point, the 10 percent point of a distillation performed in accordance with the Standard Method of Test for Distillation of Petroleum Products, ASTM D-86-62, may be used as the boiling point of the liquid.

Catastrophic release means a major uncontrolled emission, fire, or explosion, involving one or more highly hazardous chemicals, that presents serious danger to employees in the workplace.

Facility means the buildings, containers or equipment which contain a process.

Highly hazardous chemical means a substance possessing toxic, reactive, flammable, or explosive properties and specified by paragraph (a)(1) of this section.

Hot work means work involving electric or gas welding, cutting, brazing, or similar flame or spark-producing operations.

Normally unoccupied remote facility means a facility which is operated, maintained or serviced by employees who visit the facility only periodically to check its operation and to perform necessary operating or maintenance tasks. No employees are permanently stationed at the facility.

Facilities meeting this definition are not contiguous with, and must be geographically remote from all other buildings, processes or persons.

Process means any activity involving a highly hazardous chemical including any use, storage, manufacturing, handling, or the on-site movement of such 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.

Replacement in kind means a replacement which satisfies the design specification.

Trade secret means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. Appendix D contained in § 1910.1200 sets out the criteria to be used in evaluating trade secrets.

(c) *Employee participation.* (1) Employers shall develop a written plan of action regarding the implementation of the employee participation required by this paragraph.

(2) Employers shall consult with employees and their representatives on the conduct and development of process hazards analyses and on the development of the other elements of process safety management in this standard.

(3) Employers shall provide to employees and their representatives access to process hazard analyses and to all other information required to be developed under this standard.

(d) *Process safety information.* In accordance with the schedule set forth in paragraph (e)(1) of this section, the employer shall complete a compilation of written process safety information before conducting any process hazard analysis required by the standard. The compilation of written process safety information is to enable the employer and the employees involved in operating the process to identify and understand the hazards posed by those processes involving highly hazardous chemicals. This process safety information shall include information pertaining to the

hazards of the highly hazardous chemicals used or produced by the process, information pertaining to the technology of the process, and information pertaining to the equipment in the process.

(1) *Information pertaining to the hazards of the highly hazardous chemicals in the process.* This information shall consist of at least the following:

- (i) Toxicity information;
- (ii) Permissible exposure limits;
- (iii) Physical data;
- (iv) Reactivity data;
- (v) Corrosivity data;
- (vi) Thermal and chemical stability data; and

(vii) Hazardous effects of inadvertent mixing of different materials that could foreseeably occur.

Note: Material Safety Data Sheets meeting the requirements of 29 CFR 1910.1200(g) may be used to comply with this requirement to the extent they contain the information required by this subparagraph.

(2) *Information pertaining to the technology of the process.* (i) Information concerning the technology of the process shall include at least the following:

- (A) A block flow diagram or simplified process flow diagram (see Appendix B to this section);
- (B) Process chemistry;
- (C) Maximum intended inventory;
- (D) Safe upper and lower limits for such items as temperatures, pressures, flows or compositions; and,
- (E) An evaluation of the consequences of deviations, including those affecting the safety and health of employees.

(ii) Where the original technical information no longer exists, such information may be developed in conjunction with the process hazard analysis in sufficient detail to support the analysis.

(3) *Information pertaining to the equipment in the process.* (i) Information pertaining to the equipment in the process shall include:

- (A) Materials of construction;
- (B) Piping and instrument diagrams (P&ID's);
- (C) Electrical classification;
- (D) Relief system design and design basis;
- (E) Ventilation system design;
- (F) Design codes and standards employed;
- (G) Material and energy balances for processes built after May 26, 1992; and,
- (H) Safety systems (e.g. interlocks, detection or suppression systems).

(ii) The employer shall document that equipment complies with recognized

and generally accepted good engineering practices.

(iii) For existing equipment designed and constructed in accordance with codes, standards, or practices that are no longer in general use, the employer shall determine and document that the equipment is designed, maintained, inspected, tested, and operating in a safe manner.

(e) *Process hazard analysis.* (1) The employer shall perform an initial process hazard analysis (hazard evaluation) on processes covered by this standard. The process hazard analysis shall be appropriate to the complexity of the process and shall identify, evaluate, and control the hazards involved in the process. Employers shall determine and document the priority order for conducting process hazard analyses based on a rationale which includes such considerations as extent of the process hazards, number of potentially affected employees, age of the process, and operating history of the process. The process hazard analysis shall be conducted as soon as possible, but not later than the following schedule:

- (i) No less than 25 percent of the initial process hazards analyses shall be completed by May 26, 1994;
- (ii) No less than 50 percent of the initial process hazards analyses shall be completed by May 26, 1995;
- (iii) No less than 75 percent of the initial process hazards analyses shall be completed by May 26, 1996;
- (iv) All initial process hazards analyses shall be completed by May 26, 1997.

(v) Process hazards analyses completed after May 26, 1987 which meet the requirements of this paragraph are acceptable as initial process hazards analyses. These process hazard analyses shall be updated and revalidated, based on their completion date, in accordance with paragraph (e)(8) of this section.

(2) The employer shall use one or more of the following methodologies that are appropriate to determine and evaluate the hazards of the process being analyzed.

- (i) What-If;
- (ii) Checklist;
- (iii) What-If/Checklist;
- (iv) Hazard and Operability Study (HAZOP);
- (v) Failure Mode and Effects Analysis (FMEA);
- (vi) Fault Tree Analysis; or
- (vii) An appropriate equivalent methodology.

(3) The process hazard analysis shall address:

- (i) The hazards of the process;

(ii) The identification of any previous incident which had a likely potential for catastrophic consequences in the workplace;

(iii) Engineering and administrative controls applicable to the hazards and their interrelationships such as appropriate application of detection methodologies to provide early warning of releases. (Acceptable detection methods might include process monitoring and control instrumentation with alarms, and detection hardware such as hydrocarbon sensors.);

(iv) Consequences of failure of engineering and administrative controls;

(v) Facility siting;

(vi) Human factors; and

(vii) A qualitative evaluation of a range of the possible safety and health effects of failure of controls on employees in the workplace.

(4) The process hazard analysis shall be performed by a team with expertise in engineering and process operations, and the team shall include at least one employee who has experience and knowledge specific to the process being evaluated. Also, one member of the team must be knowledgeable in the specific process hazard analysis methodology being used.

(5) The employer shall establish a system to promptly address the team's findings and recommendations; assure that the recommendations are resolved in a timely manner and that the resolution is documented; document what actions are to be taken; complete actions as soon as possible; develop a written schedule of when these actions are to be completed; communicate the actions to operating, maintenance and other employees whose work assignments are in the process and who may be affected by the recommendations or actions.

(6) 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 in paragraph (e)(4) of this section, to assure that the process hazard analysis is consistent with the current process.

(7) Employers shall retain process hazards analyses and updates or revalidations for each process covered by this section, as well as the documented resolution of recommendations described in paragraph (e)(5) of this section for the life of the process.

(f) *Operating procedures* (1) The employer shall develop and implement written operating procedures that provide clear instructions for safely conducting activities involved in each

covered process consistent with the process safety information and shall address at least the following elements.

(i) *Steps for each operating phase:*

(A) Initial startup;

(B) Normal operations;

(C) Temporary operations;

(D) Emergency shutdown including the conditions under which emergency shutdown is required, and the assignment of shutdown responsibility to qualified operators to ensure that emergency shutdown is executed in a safe and timely manner.

(E) Emergency Operations;

(F) Normal shutdown; and,

(G) Startup following a turnaround, or after an emergency shutdown.

(ii) *Operating limits:*

(A) Consequences of deviation; and

(B) Steps required to correct or avoid deviation.

(iii) *Safety and health considerations:*

(A) Properties of, and hazards presented by, the chemicals used in the process;

(B) Precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment;

(C) Control measures to be taken if physical contact or airborne exposure occurs;

(D) Quality control for raw materials and control of hazardous chemical inventory levels; and,

(E) Any special or unique hazards.

(iv) *Safety systems and their functions.*

(2) Operating procedures shall be readily accessible to employees who work in or maintain a process.

(3) The operating procedures shall be reviewed as often as necessary to assure that they reflect current operating practice, including changes that result from changes in process chemicals, technology, and equipment, and changes to facilities. The employer shall certify annually that these operating procedures are current and accurate.

(4) The employer shall develop and implement safe work practices to provide for the control of hazards during operations such as lockout/tagout; confined space entry; opening process equipment or piping; and control over entrance into a facility by maintenance, contractor, laboratory, or other support personnel. These safe work practices shall apply to employees and contractor employees.

(g) *Training.* (1) *Initial training.* (i) Each employee presently involved in operating a process, and each employee before being involved in operating a newly assigned process, shall be trained in an overview of the process and in the operating procedures as specified in

paragraph (f) of this section. The training shall include emphasis on the specific safety and health hazards, emergency operations including shutdown, and safe work practices applicable to the employee's job tasks.

(ii) In lieu of initial training for those employees already involved in operating a process on May 26, 1992, an employer may certify in writing that the employee has the required knowledge, skills, and abilities to safely carry out the duties and responsibilities as specified in the operating procedures.

(2) *Refresher training.* Refresher training shall be provided at least every three years, and more often if necessary, to each employee involved in operating a process to assure that the employee understands and adheres to the current operating procedures of the process. The employer, in consultation with the employees involved in operating the process, shall determine the appropriate frequency of refresher training.

(3) *Training documentation.* The employer shall ascertain that each employee involved in operating a process has received and understood the training required by this paragraph. The employer shall prepare a record which contains the identity of the employee, the date of training, and the means used to verify that the employee understood the training.

(h) *Contractors.* (1) *Application.* This paragraph applies to contractors performing maintenance or repair, turnaround, major renovation, or specialty work on or adjacent to a covered process. It does not apply to contractors providing incidental services which do not influence process safety, such as janitorial work, food and drink services, laundry, delivery or other supply services.

(2) *Employer responsibilities.* (i) The employer, when selecting a contractor, shall obtain and evaluate information regarding the contract employer's safety performance and programs.

(ii) The employer shall inform contract employers of the known potential fire, explosion, or toxic release hazards related to the contractor's work and the process.

(iii) The employer shall explain to contract employers the applicable provisions of the emergency action plan required by paragraph (n) of this section.

(iv) The employer shall develop and implement safe work practices consistent with paragraph (f)(4) of this section, to control the entrance, presence and exit of contract employers and contract employees in covered process areas.

(v) The employer shall periodically evaluate the performance of contract employees in fulfilling their obligations as specified in paragraph (h)(3) of this section.

(vi) The employer shall maintain a contract employee injury and illness log related to the contractor's work in process areas.

(3) Contract employer responsibilities.

(i) The contract employer shall assure that each contract employee is trained in the work practices necessary to safely perform his/her job.

(ii) The contract employer shall assure that each contract employee is instructed in the known potential fire, explosion, or toxic release hazards related to his/her job and the process, and the applicable provisions of the emergency action plan.

(iii) The contract employer shall document that each contract employee has received and understood the training required by this paragraph. The contract employer shall prepare a record which contains the identity of the contract employee, the date of training, and the means used to verify that the employee understood the training.

(iv) The contract employer shall assure that each contract employee follows the safety rules of the facility including the safe work practices required by paragraph (f)(4) of this section.

(v) The contract employer shall advise the employer of any unique hazards presented by the contract employer's work, or of any hazards found by the contract employer's work.

(i) **Pre-startup safety review.** (1) The employer shall perform a pre-startup safety review for new facilities and for modified facilities when the modification is significant enough to require a change in the process safety information.

(2) The pre-startup safety review shall confirm that prior to the introduction of highly hazardous chemicals to a process:

(i) Construction and equipment is in accordance with design specifications;

(ii) Safety, operating, maintenance, and emergency procedures are in place and are adequate;

(iii) For new facilities, a process hazard analysis has been performed and recommendations have been resolved or implemented before startup; and modified facilities meet the requirements contained in management of change, paragraph (l).

(iv) Training of each employee involved in operating a process has been completed.

(f) **Mechanical integrity.** (1) **Application.** Paragraphs (j)(2) through

(j)(6) of this section apply to the following process equipment:

(i) Pressure vessels and storage tanks;

(ii) Piping systems (including piping components such as valves);

(iii) Relief and vent systems and devices;

(iv) Emergency shutdown systems;

(v) Controls (including monitoring devices and sensors, alarms, and interlocks) and,

(vi) Pumps.

(2) **Written Procedures.** The employer shall establish and implement written procedures to maintain the on-going integrity of process equipment.

(3) **Training for process maintenance activities.** The employer shall train each employee involved in maintaining the on-going integrity of process equipment in an overview of that process and its hazards and in the procedures applicable to the employee's job tasks to assure that the employee can perform the job tasks in a safe manner.

(4) **Inspection and testing.** (i) Inspections and tests shall be performed on process equipment.

(ii) Inspection and testing procedures shall follow recognized and generally accepted good engineering practices.

(iii) The frequency of inspections and tests of process equipment shall be consistent with applicable manufacturers' recommendations and good engineering practices, and more frequently if determined to be necessary by prior operating experience.

(iv) The employer shall document each inspection and test that has been performed on process equipment. The documentation shall identify the date of the inspection or test, the name of the person who performed the inspection or test, the serial number or other identifier of the equipment on which the inspection or test was performed, a description of the inspection or test performed, and the results of the inspection or test.

(5) **Equipment deficiencies.** The employer shall correct deficiencies in equipment that are outside acceptable limits (defined by the process safety information in paragraph (d) of this section) before further use or in a safe and timely manner when necessary means are taken to assure safe operation.

(6) **Quality assurance.** (i) In the construction of new plants and equipment, the employer shall assure that equipment as it is fabricated is suitable for the process application for which they will be used.

(ii) Appropriate checks and inspections shall be performed to assure that equipment is installed properly and

consistent with design specifications and the manufacturer's instructions.

(iii) The employer shall assure that maintenance materials, spare parts and equipment are suitable for the process application for which they will be used.

(k) **Hot work permit.** (1) The employer shall issue a hot work permit for hot work operations conducted on or near a covered process.

(2) The permit shall document that the fire prevention and protection requirements in 29 CFR 1910.252(a) have been implemented prior to beginning the hot work operations; it shall indicate the date(s) authorized for hot work; and identify the object on which hot work is to be performed. The permit shall be kept on file until completion of the hot work operations.

(l) **Management of change.** (1) The employer shall establish and implement written procedures to manage changes (except for "replacements in kind") to process chemicals, technology, equipment, and procedures; and, changes to facilities that affect a covered process.

(2) The procedures shall assure that the following considerations are addressed prior to any change:

(i) The technical basis for the proposed change;

(ii) Impact of change on safety and health;

(iii) Modifications to operating procedures;

(iv) Necessary time period for the change; and,

(v) Authorization requirements for the proposed change.

(3) Employees involved in operating a process and maintenance and contract employees whose job tasks will be affected by a change in the process shall be informed of, and trained in, the change prior to start-up of the process or affected part of the process.

(4) If a change covered by this paragraph results in a change in the process safety information required by paragraph (d) of this section, such information shall be updated accordingly.

(5) If a change covered by this paragraph results in a change in the operating procedures or practices required by paragraph (f) of this section, such procedures or practices shall be updated accordingly.

(m) **Incident investigation.** (1) The employer shall investigate each incident which resulted in, or could reasonably have resulted in a catastrophic release of highly hazardous chemical in the workplace.

(2) An incident investigation shall be initiated as promptly as possible, but not

later than 48 hours following the incident.

(3) An incident investigation team shall be established and consist of at least one person knowledgeable in the process involved, including a contract employee if the incident involved work of the contractor, and other persons with appropriate knowledge and experience to thoroughly investigate and analyze the incident.

(4) A report shall be prepared at the conclusion of the investigation which includes at a minimum:

- (i) Date of incident;
- (ii) Date investigation began;
- (iii) A description of the incident;
- (iv) The factors that contributed to the incident; and,
- (v) Any recommendations resulting from the investigation.

(5) The employer shall establish a system to promptly address and resolve the incident report findings and recommendations. Resolutions and corrective actions shall be documented.

(6) The report shall be reviewed with all affected personnel whose job tasks are relevant to the incident findings including contract employees where applicable.

(7) Incident investigation reports shall be retained for five years.

(n) *Emergency planning and response.* The employer shall establish and implement an emergency action plan for the entire plant in accordance with the provisions of 29 CFR 1910.38(a). In addition, the emergency action plan shall include procedures for handling small releases. Employers covered under this standard may also be subject to the hazardous waste and emergency response provisions contained in 29 CFR 1910.120 (a), (p) and (q).

(o) *Compliance Audits.* (1) Employers shall certify that they have evaluated compliance with the provisions of this section at least every three years to verify that the procedures and practices developed under the standard are adequate and are being followed.

(2) The compliance audit shall be conducted by at least one person knowledgeable in the process.

(3) A report of the findings of the audit shall be developed.

(4) The employer shall promptly determine and document an appropriate response to each of the findings of the compliance audit, and document that deficiencies have been corrected.

(5) Employers shall retain the two (2) most recent compliance audit reports.

(p) *Trade secrets.* (1) Employers shall make all information necessary to comply with the section available to those persons responsible for compiling the process safety information (required

by paragraph (d) of this section), those assisting in the development of the process hazard analysis (required by paragraph (e) of this section), those responsible for developing the operating procedures (required by paragraph (f) of this section), and those involved in incident investigations (required by paragraph (m) of this section), emergency planning and response (paragraph (n) of this section) and compliance audits (paragraph (o) of this section) without regard to possible trade secret status of such information.

(2) Nothing in this paragraph shall preclude the employer from requiring the persons to whom the information is made available under paragraph (p)(1) of this section to enter into confidentiality agreements not to disclose the information as set forth in 29 CFR 1910.1200.

(3) Subject to the rules and procedures set forth in 29 CFR 1910.1200(i)(1) through 1910.1200(i)(12), employees and their designated representatives shall have access to trade secret information contained within the process hazard analysis and other documents required to be developed by this standard.

Appendix A to § 1910.119—List of Highly Hazardous Chemicals, Toxics and Reactives (Mandatory)

This Appendix contains a listing of toxic and reactive highly hazardous chemicals which present a potential for a catastrophic event at or above the threshold quantity.

CHEMICAL name	CAS*	TQ**
Acetaldehyde.....	75-07-0	2500
Acrolein (2-Propenal).....	107-02-8	150
Acrylyl Chloride.....	814-68-6	250
Allyl Chloride.....	107-05-1	1000
Allylamine.....	107-11-9	1000
Alkylaluminums.....	Varies	5000
Ammonia, Anhydrous.....	7664-41-7	10000
Ammonia solutions (>44% ammonia by weight).....	7664-41-7	15000
Ammonium Perchlorate.....	7790-98-9	7500
Ammonium Permanganate.....	7787-36-2	7500
Arsine (also called Arsenic Hydride).....	7784-42-1	100
Bis(Chloromethyl) Ether.....	542-88-1	100
Boron Trichloride.....	10294-34-5	2500
Boron Trifluoride.....	7637-07-2	250
Bromine.....	7726-95-6	1500
Bromine Chloride.....	13863-41-7	1500
Bromine Pentafluoride.....	7789-30-2	2500
Bromine Trifluoride.....	7787-71-5	15000
3-Bromopropyne (also called Propargyl Bromide).....	106-96-7	100
Butyl Hydroperoxide (Tertiary).....	75-91-2	5000
Butyl Perbenzoate (Tertiary).....	614-45-9	7500
Carbonyl Chloride (see Phosgene).....	75-44-5	100
Carbonyl Fluoride.....	353-50-4	2500
Cellulose Nitrate (concentration > 12.6% nitrogen).....	9004-70-0	2500
Chlorine.....	7782-50-5	1500
Chlorine Dioxide.....	10049-04-4	1000

CHEMICAL name	CAS*	TQ**
Chlorine Pentafluoride.....	13637-63-3	1000
Chlorine Trifluoride.....	7790-81-2	1000
Chlorodiethylaluminum (also called Diethylaluminum Chloride).....	96-10-6	5000
1-Chloro-2,4-Dinitrobenzene.....	97-00-7	5000
Chloromethyl Methyl Ether.....	107-30-2	500
Chloroplatin.....	76-06-2	500
Chloroplatin and Methyl Bromide mixture.....	None	1500
Chloroplatin and Methyl Chloride mixture.....	None	1500
Cumene Hydroperoxide.....	80-15-9	5000
Cyanogen.....	460-19-5	2500
Cyanogen Chloride.....	506-77-4	500
Cyanuric Fluoride.....	675-14-9	100
Diacetyl Peroxide (Concentration > 70%).....	110-22-5	5000
Diazomethane.....	334-88-3	500
Dibenzoyl Peroxide.....	94-36-0	7500
Diborane.....	19287-45-7	100
Dibutyl Peroxide (Tertiary).....	110-05-4	5000
Dichloro Acetylene.....	7572-29-4	250
Dichlorosilane.....	4109-96-0	2500
Diethylzinc.....	557-20-0	10000
Diisopropyl Peroxydicarbonate.....	105-84-6	7500
Dilaluroyl Peroxide.....	105-74-8	7500
Dimethyldichlorosilane.....	75-78-5	1000
Dimethylhydrazine, 1,1-.....	57-14-7	1000
Dimethylamine, Anhydrous.....	124-40-3	2500
2,4-Dinitroaniline.....	97-02-9	5000
Ethyl Methyl Ketone Peroxide (also Methyl Ethyl Ketone Peroxide; concentration > 60%).....	1338-23-4	5000
Ethyl Nitrite.....	109-95-5	5000
Ethylamine.....	75-04-7	7500
Ethylene Fluorohydrin.....	371-62-0	100
Ethylene Oxide.....	75-21-8	5000
Ethyleneimine.....	151-56-4	1000
Fluorine.....	7782-41-4	1000
Formaldehyde (Formalin).....	50-00-0	1000
Furan.....	110-00-9	500
Hexafluoroacetone.....	684-16-2	5000
Hydrochloric Acid, Anhydrous.....	7647-01-0	5000
Hydrofluoric Acid, Anhydrous.....	7664-39-3	1000
Hydrogen Bromide.....	10035-10-6	5000
Hydrogen Chloride.....	7647-01-0	5000
Hydrogen Cyanide, Anhydrous.....	74-90-8	1000
Hydrogen Fluoride.....	7664-39-3	1000
Hydrogen Peroxide (52% by weight or greater).....	7722-84-1	7500
Hydrogen Selenide.....	7783-07-5	150
Hydrogen Sulfide.....	7783-06-4	1500
Hydroxylamine.....	7803-49-8	2500
Iron, Pentacarbonyl.....	13463-40-6	250
Isopropylamine.....	75-31-0	5000
Ketene.....	463-51-4	100
Methacrylaldehyde.....	78-85-3	1000
Methacryloyl Chloride.....	920-46-7	150
Methacryloyloxyethyl Isocyanate.....	30674-80-7	100
Methyl Acrylonitrile.....	126-98-7	250
Methylamine, Anhydrous.....	74-89-5	1000
Methyl Bromide.....	74-83-9	2500
Methyl Chloride.....	74-87-3	15000
Methyl Chloroformate.....	79-22-1	500
Methyl Ethyl Ketone Peroxide (concentration > 60%).....	1338-23-4	5000
Methyl Fluoroacetate.....	453-18-9	100
Methyl Fluorosulfate.....	421-20-5	100
Methyl Hydrazine.....	60-34-4	100
Methyl Iodide.....	74-88-4	7500
Methyl Isocyanate.....	624-83-9	250
Methyl Mercaptan.....	74-93-1	5000
Methyl Vinyl Ketone.....	79-84-4	100
Methyltrichlorosilane.....	75-79-6	500
Nickel Carbonyl (Nickel Tetracarbonyl).....	13463-39-3	150

CHEMICAL name	CAS*	TQ**	CHEMICAL name	CAS*	TQ**	CHEMICAL name	CAS*	TQ**
Nitric Acid (94.5% by weight greater).....	7697-37-2	500	Perchloryl Fluoride.....	7616-94-6	5000	Sulfuric Anhydride (also called Sulfur Trioxide).....	7446-11-9	1000
Nitric Oxide.....	10102-43-9	250	Peroxyacetic Acid (concentration > 60% Acetic Acid; also called Peracetic Acid).....	79-21-0	1000	Tellurium Hexafluoride.....	7783-80-4	250
Nitroaniline (para Nitroaniline).....	100-01-6	5000	Phosgene (also called Carbonyl Chloride).....	75-44-5	100	Tetrafluoroethylene.....	116-14-3	5000
Nitromethane.....	75-52-5	2500	Phosphine (Hydrogen Phosphide).....	7803-51-2	100	Tetrafluorohydrazine.....	10036-47-2	5000
Nitrogen Dioxide.....	10102-44-0	250	Phosphorus Oxychloride (also called Phosphoryl Chloride).....	10025-87-3	1000	Tetramethyl Lead.....	75-74-1	1000
Nitrogen Oxides (NO; NO ₂ ; N ₂ O ₄ ; N ₂ O ₃).....	10102-44-0	250	Phosphorus Trichloride.....	7719-12-2	1000	Thionyl Chloride.....	7719-09-7	250
Nitrogen Tetroxide (also called Nitrogen Peroxide).....	10544-72-6	250	Phosphoryl Chloride (also called Phosphorus Oxychloride).....	10025-87-3	1000	Trichloro (chloromethyl) Silane.....	1558-25-4	100
Nitrogen Trifluoride.....	7783-54-2	5000	Propargyl Bromide.....	106-96-7	100	Trichloro (dichlorophenyl) Silane.....	27137-85-5	2500
Nitrogen Trioxide.....	10544-73-7	250	Propyl Nitrate.....	627-3-4	2500	Trichlorosilane.....	10025-78-2	5000
Oleum (65% to 80% by weight; also called Fuming Sulfuric Acid).....	8014-94-7	1000	Sarin.....	107-44-8	100	Trifluorochloroethylene.....	79-38-9	10000
Osmium Tetroxide.....	20816-12-0	100	Selenium Hexafluoride.....	7783-79-1	1000	Trimethoxysilane.....	2487-90-3	1500
Oxygen Difluoride (Fluorine Monoxide).....	7783-41-7	100	Sibine (Antimony Hydride).....	7803-52-3	500			
Ozone.....	10028-15-6	100	Sulfur Dioxide (liquid).....	7446-09-5	1000			
Pentaborane.....	19624-22-7	100	Sulfur Pentafluoride.....	5714-22-7	250			
Peracetic Acid (concentration > 60% Acetic Acid; also called Peroxyacetic Acid).....	79-21-0	1000	Sulfur Tetrafluoride.....	7783-60-0	250			
Perchloric Acid (concentration > 60% by weight).....	7601-80-3	5000	Sulfur Trioxide (also called Sulfuric Anhydride).....	7446-11-9	1000			
Perchloromethyl Mercaptan.....	594-42-3	150						

*Chemical Abstract Service Number.
 **Threshold Quantity in Pounds (Amount necessary to be covered by this standard).

Appendix B to § 1910.119—Block Flow Diagram and Simplified Process Flow Diagram (Nonmandatory)

BILLING CODE 4510-26-M