

Agrium

Kenai Nitrogen Operations

Plant Instrument and Utility Air

Systems: 04/54

Process Hazards Analysis Revalidation

Final Report

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Project No.: K00S49R1

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1.0 ABOUT THIS STUDY

The Process Hazards Analysis, K00S0049 conducted between September 3, 1996 to September 19, 1996 was revalidated at Agrium's Kenai Nitrogen Operations on April 24, 2001 to April 25, 2001. The original PHA, as well as the revalidation, focused on the plants Instrument and Utility Air Systems: 04 and 54.

EPA RMP 40 CFR Part 68 Section 112 (7) and OSHA Rule 1910.119, "Process Safety Management of Highly Hazardous Chemicals" requires that the initial Process Hazard Analysis (PHA) for a covered process be updated and revalidated by a knowledgeable team at least every five years. The objective of PHA revalidation is to assure that the PHA is consistent with the current process. The PHA is revalidated, by evaluating and addressing the following questions:

1. Have significant new hazards been created or introduced into the process?
2. Has the possible occurrence of a catastrophic release in the process unit become significantly more likely?
3. Have consequences of previously identified toxic or flammable material releases become more severe?
4. Have consequences that could go "off-site" been identified?
5. Have previously identified safeguards become compromised or challenged?

METHODOLOGIES

Baseline PHA

The original, or baseline, PHA was conducted primarily using the "What-If" technique.

What-If Technique

The "What-If" technique involves asking questions that require the team to analyze deviations from the procedure. An example is, "What-If" ...the drying step were left out of the procedure?" The team then develops consequences of this action (or inaction) and documents the safeguards in a manner similar to HAZOP. The "What-If" scenario is then ranked for risk, and recommendations are made if appropriate, similar to the HAZOP technique.

Revalidation

The PHA procedure used to revalidate Plant Instrument and Utility Air System was the Guideword/Checklist PHA Revalidation Method. This methodology was organized into the following tasks, and are described below:

1. Collection of Information
2. Information Review
3. Revalidation Study Sessions (with PHA Team)

Collection of Information

The following information was collected prior to the Revalidation Study Sessions:

1. Baseline PHA, including worksheets, Action Item list, P&IDs reviewed, and status of recommendations.
2. Documented changes to the design or operation of the process since the baseline PHA (including MOCs).
3. Documented incident reports from this unit.
4. Latest revision of Piping and Instrument Diagrams (P&IDs) that describe the process.
5. Other Process Safety Information, such as PRV design basis and data and Standard Operating Conditions and Limits (SOCLs).

Information Review

The collected information was reviewed by the Revalidation Team Leader and Agrium Kenai Nitrogen Operations representatives on January 22 2001 to April 20, 2001. The purpose of the Information Review is to screen the baseline PHA for content and quality, and to identify concerns and issues that need to be reviewed by the Revalidation Team during the study sessions. This resulted in the generation of an agenda or work plan for the sessions. The Information Review included the following tasks required to identify items for discussion with the team:

1. Review the baseline PHA and complete the Initial PHA Content Checklist, see Attachment 2, and the Baseline PHA Screening Checklist, see Attachment 3. Evaluate the baseline PHA to ensure that off-site consequences were adequately discussed and addressed.
2. Review and verify the documented status of recommendations from the baseline PHA and any project PHAs affecting this unit.
3. Review all incidents occurring in the system since the baseline PHA, and develop a list of those pertinent to the revalidation process.
4. Develop a list of all changes that have occurred to the design or operation of the process since the baseline PHA, see Attachment 5. This is done by comparing the latest P&IDs with the P&IDs reviewed during the baseline PHA, and by reviewing those changes to the design or operation of the process that have been analyzed by the MOC process.
5. Develop an agenda, or work plan for the study sessions, see Attachment 1.

Revalidation Study Sessions (with PHA Team)

The revalidation study was discussed and prepared by a multi-disciplined team knowledgeable in the process and in the PHA method used. At the beginning of the session, the Team Leader reviewed the PHA revalidation scope and purpose, and reviewed the completion of the Initial PHA Content Checklist and the Baseline PHA Screening Checklist. The group was then lead through the revalidation procedure, which included:

1. General discussion regarding the status of open recommendations from the baseline PHA, see Attachment 4;
2. Work through the Change Evaluation Checklist to identify undocumented changes, see

- Attachment 5;
3. Work through the Operations Change Evaluation and Wrap-up Checklist Issues, see Attachment 6;
4. Work through the Maintenance Change Evaluation and Wrap-up Checklist Issues, see Attachment 7;
5. Work through the Engineering Change Evaluation and Wrap-up Checklist Issues, see Attachment 8;
6. Work through the Inspection Change Evaluation and Wrap-up Checklist Issues, see Attachment 9;
7. Work through the Emergency Response Change Evaluation and Wrap-up Checklist Issues, see Attachment 10;
8. Work through the Safety Group Change Evaluation and Wrap-up Checklist Issues, see Attachment 11;
9. Work through the General Change and Wrap-up Checklist Issues, see Attachment 12;
10. Review Human Factors Issues/Checklist, see Attachment 13;
11. Discuss Previous Incident Reports, see Attachment 14;
12. Evaluate Potential Off-Site Consequences, see Attachment 15;
13. Discuss Additional Areas "What-If" Worksheets, see Attachment 16;
14. Review Revalidation Guideword Checklist, see Attachment 17;
15. Review Risk Ranking Matrix, see Attachment 18.

"What-If" - The team utilized the "What-If" technique to identify potential hazards and areas of concern when it was determined that those hazards or concerns were not adequately addressed by the baseline PHA, such as potential off-site consequences. The "What-If" technique was also utilized to evaluate potential hazards caused by new or modified equipment as the review team deemed appropriate. OSHA recognizes the "What-If" as an acceptable method of evaluating process hazards. Those scenarios evaluated using the "What-If" technique can be found in Attachments 15 and 16.

The "What-If" technique involves asking questions that require the team to analyze deviations from the design intent. An example is: "What-If...the drying step were left out of the procedure?" The team then develops consequences of this action (or inaction) and documents the safeguards in a manner similar to HAZOP. The "What-If" scenario is then ranked for risk, and recommendations are made if appropriate, similar to the HAZOP technique. Attachment 18 shows the criteria for applying risk rankings to various scenarios.

Other Issues

Facility Siting – Agrium Kenai Nitrogen Operations has completed a plant-wide facility siting study, which adequately addresses those issues; therefore, the Facility/Plant Siting Issues checklist was not utilized.

Compliance with OSHA Rule 1910.119 and EPA RMP Rule

This study complies with OSHA rule 1910.119, "Process Safety Management of Highly Hazardous Chemicals" and EPA 40CFR Part 68 Section 112, "Risk Management Program."

In particular, this study complies with paragraph (e,6) of the OSHA rule that states; "At least every five 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." The study also complies with Subpart D (68.67) of the RMP Rule covering the same requirements as OSHA 1910.119 and potential off-site consequences.

The study was completed within five years of the baseline PHA. A multi-disciplined team, including at least one person with knowledge and experience in the process, discussed and prepared the study in a manner to ensure that the baseline PHA is consistent with the current process.

Process Hazards Analysis Team (e, 4)

The PHA Revalidation was discussed and prepared by a team with expertise in engineering and operations, with at least one employee having specific expertise in the process being evaluated. The Process Hazards Analysis Revalidation was conducted on April 24, 2001 to April 25, 2001 at Agrium Kenai Nitrogen Operations in Kenai, Alaska.

The study team consisted of the following people:

Name	Title	Years of Experience
Mike M. Thompson	Mechanical Engineer	4
William R. Switzer	Advising Chemical Engineer	32
Michele Grzybowski	Environmental	6
Chuck Bergonzini	Safety Specialist	20
Edward J. Aisenbrey	PHA Facilitator/PSM Coordinator	24
Keith Chilson	Utility Plant A Operator	9
America Dukowitz	PSM Administrative Assistant/Scribe	3

Process Description

All instrument and utility air in the Kenai Plant is compressed to 100 psig and dried to prevent moisture from freezing in air lines and instruments, as well as protecting delicate instruments from water, which may cause corrosion.

There are five Air Compressors in the plant that could be used to supply air to these two air headers. Two of these are located in the Ammonia Plants and are primarily used for process. They can be used to assist the Utility Plant Compressors if necessary. There are three Compressors in Utility Plants 3 and 6.

Plant 3 has two Worthington two-stage Compressors driven with electric motors that can compress 600 scfm each. In Plant 6, one Elliott, three-stage Compressor driven with a 550 psig steam turbine can compress 1500 scfm.

All air used in instrument and utility air headers must be clean and moisture free. The air is first filtered, compressed, cooled, moisture separated, dried, and then filtered again before it can go into the instrument air header.

All compressed air, after it has been filtered and dried, is put into the instrument air header. Utility air is then passed through two let down stations—PCV382 in Plant 3, located near the 3F603A–D Dryers, and PCV337 in Plant 6, located at the northwest corner of 3B600C Boiler.

Presently, these valves are set to start closing off at 94 psig falling. Instrument air has priority over utility air. **In the case of an air shortage, it may be necessary to manually block in both of these stations.** Instrument and utility air headers in Plants 1, 2, and 3 and Plants 4, 5, and 6 are intertied in Pipe Alley, overhead, behind 3B600C, and are labeled and painted orange.

The instrument header is controlled by a DSPR pressure controller on 6GC703 (PAP) in Plant 6 set at 100 psig on the instrument air header when the 6G703 is fully loaded. If the pressure should continue to rise, this DSPR controller and the unloader valves on 3G603 and 3G605 will open and unload the Compressors. There are flow indicators on both the instrument and utility air headers to indicate the amount of flow that is going into the headers for both Plants 3 and 6. In Plant 3, the instrument airflow to the old header is FI324, located south of the south set of 3F603A–D Air Dryers. The utility airflow FI333 measures air going through PCV382 to the old utility air header. It is located right at the let down valve on the wall west of the south set of 3F603C/D Air Dryers.

In Plant 6, the FI1264 instrument airflow to the new instrument air header is located south of 6B700B next to the feed water loop. The FI1263 utility airflow is the flow of air going through PCV337 to the new utility air header located at the let down valve north of 3B600C.

Other related equipment used in the Air Systems are inter and after coolers. These are Exchangers with cooling water used to cool the air after it has been compressed. Knockout pots are used to separate out any water in the air before it can enter the other stages of compression and before it goes to the dryers.

The Receivers are large tanks used for volume and to drop out oil and moisture.

There are four sets of instrument Air Dryers. Each set of dryers has two towers. One is always in service while the other is being reactivated. These towers contain a desiccant to absorb moisture and are reactivated by being heated up with electric coils to drive out the absorbed moisture. Not only can moisture cause problems by freezing; it can also cause corrosion in lines or instruments. Upstream and downstream of each set of dryers are fine filters to insure that instrument air is free of debris and desiccant dust, which could foul delicate instruments.

Loss of instrument air pressure, dirty air, or moisture that could freeze lines or instruments is to be considered among the most severe catastrophes at the Kenai Plant.

The following are the three compressed air interties in the plant:

Compressor Discharge Intertie:

That is the compressed saturated air that comes out of each Compressor, including the air let down by Ammonia Plant air machines. This is normally left open.

In Plant 3, the saturated compressed air intertie valves are ahead of the Air Dryer sets. Both are labeled and painted orange; they connect together and go to Plant 6. In Plant 6, the saturated compressed air intertie valve is downstream of the 6G703 Air Compressor and the tie-in from Plant 4 air machine and upstream of 6F703 Air Dryers; is labeled and painted orange, and can also go to the 6F787 Air Dryers.

Instrument Air Intertie:

The instrument air intertie is located overhead in Pipe Alley behind 3B600C and is normally left open, and is labeled and painted orange.

Utility Air Intertie:

The utility air intertie is in Pipe Alley, overhead behind 3B600C, is normally left open, and is labeled and painted orange.

During new or old plant shut downs or turnarounds, interties on the various plant Air Systems will have to be closed to have an air outage. Specific instructions will be written in each case.

Study P&IDs

The following Process & Instrument Diagrams (P&IDs) were studied during the PHA:

P&ID	DESCRIPTION	LATEST REVISION
R3I-3020	Instrument and Utility Air Process	Rev. 9
R3I-3100	Air, N ₂ , and Gas Distribution	Rev. 5
R6I-6020	Instrument and Utility Air Process	Rev. 6
R6I-6090	Air, Gas, and N ₂ , Distribution	Rev. 9

Due to the size of the P&IDs used for this study, the actual drawings will not be included in this report. The P&IDs used during the study have been retained by Agrium Kenai Nitrogen Operations, PSM Group, and will be maintained in the PHA Revalidation P&ID file drawer.

Other Available PSI

Operating Procedures, Standard Operating Conditions and Limits (SOCLs), and Material Safety Data Sheets were available for review by the revalidation team as needed. Included in the SOCLs are the consequences of deviating from established safe operating limits. Design criteria and maintenance history for relief devices in this system were available for review as necessary.

2.0 RECOMMENDATIONS

Along with appearing in the revalidation study sheets, suggested recommendations identified by the study team are documented below. The recommendations are divided into three categories:

1. "Actions" are relatively simple tasks that were assigned to team members, and could be completed before the end of the study.
2. "Recommendations" are those tasks that require more evaluation, and possibly engineering or management direction.
3. "Operability Recommendations" are those recommendations that have no impact on Safety or Environmental concerns, but would assist plant operability and/or efficiency.

The recommendations are numbered based on the attachment/worksheet in Section 3.0 where the cause/consequence scenario and the recommendations are documented. If there is more than one recommendation per worksheet, they are numbered chronologically. Where there are multiple/similar recommendations across several worksheets (i.e., drawing updates), they will be combined and presented as one, and tracked as a single recommendation. This list is to be used by management to resolve and document resolution of the suggested actions by the Process Hazards Analysis Revalidation team.

<p>RECOMMENDATION: 5-1 Update P&ID R3I-3020 to show "S" in boxes off Line ½"IA83035 for G603 (Reference: Attachment 5)</p>
<p>RECOMMENDATION: 5-2 Update P&ID R3I-3020 to show "S" in boxes off Line ½"IA83035 for G605 (Reference: Attachment 5)</p>
<p>RECOMMENDATION: 5-3 Update P&ID R3I-3020 to remove "!" from TSH3016A/B (Program conversion error) (Reference: Attachment 5)</p>
<p>RECOMMENDATION: 5-4 Update P&ID R3I-3100 to show section of line 1"UA83005 between 2"N002-1534 and 3"IA002-1534 (Reference: Attachment 5)</p>
<p>RECOMMENDATION: 5-5 Update P&ID R6I-6020 to show "S" in box off FV107 (Reference: Attachment 5)</p>
<p>RECOMMENDATION: 5-6 Update P&ID R6I-6090 to show 1 ½" x 2" reducer on Line 2"AU1017-L</p>

(Reference: Attachment 5)
RECOMMENDATION: 5-7 Update P&ID R6I-6090 to show 1" x 1 1/2" reducer on Line 1 1/2" AU7002-L (Reference: Attachment 5)
RECOMMENDATION: 5-8 Update P&ID R6I-6090 to show line break on 4" AI7001-LD (Reference: Attachment 5)
RECOMMENDATION: 5-9 Update P&ID R6I-6090 to show 4" x 3" reducer on Line 3" AI7006-LD (Reference: Attachment 5)
RECOMMENDATION: 6-1 Develop routine to test trip systems on Plant air compressors during startup. (Reference: Attachment 6)
RECOMMENDATION: 10-1 Review recommended upgrades to engine on water well #14 and implement. (Reference: Attachment 10)
RECOMMENDATION: 10-2 Discuss whether use of compressed or instrument air for breathing air is prudent with Emergency Response Coordinator and Industrial Hygiene contact. (Reference: Attachment 10)
RECOMMENDATION: 13-1 Install trip alarms on 3G603 & 3G605, install inline moisture analyzers exit each dryer. (Reference: Attachment 13)
RECOMMENDATION: 13-2 Install air dryer exit flow transmitters on each dryer. (Reference: Attachment 13)

RECOMMENDATION: 13-3

Develop procedures to require bypasses around utility air letdowns and filters remain closed.

(Reference: Attachment 13)

RECOMMENDATION: 16-1

Review regulations to determine if relief valve is required on this vessel.

(Reference: Attachment 16)

RECOMMENDATION: 16-2

Implement recommendation number 6-8 from PHA K00S29R1.

(Reference: Attachment 16)

RECOMMENDATION: 16-3

Chain lock bypass valve closed.

(Reference: Attachment 16)

3.0 STUDY WORKSHEETS & ATTACHMENTS

The following attachments were used throughout the PHA Revalidation and may be found on the following pages:

- Attachment 1 Revalidation Agenda
- Attachment 2 Initial PHA Content Checklist
- Attachment 3 Baseline PHA Screening Checklist
- Attachment 4 Discussion of Recommendations from Baseline PHA
- Attachment 5 Change Evaluation Checklist to Identify Undocumented Changes
- Attachment 6 Operations Change Evaluation and Wrap-up Checklist
- Attachment 7 Maintenance Change Evaluation and Wrap-up Checklist
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- Attachment 15 Evaluate Potential Off-Site Consequences Worksheet
- Attachment 16 Additional Areas "What-If" Worksheets
- Attachment 17 Revalidation Guideword Checklist
- Attachment 18 Risk Ranking Matrix