

**Agrium**

# **Kenai Nitrogen Operations**

***K90S55R1***

***Plants 5 Utilities***

***System: 90***

## **Process Hazards Analysis Revalidation**

**Final Report**

**February 18, 2002**

Prepared by:

**Agrium**

**Kenai Nitrogen Operations  
Mile 21 Kenai Spur Hwy  
Kenai, Alaska 99611**

Project No.: K90S55R1

---

**TABLE OF CONTENTS**

*SECTION 1.0*  
**ABOUT THIS STUDY** ..... 3  
Methodology..... 3  
Baseline PHA..... 3  
Revalidation..... 3  
Other Issues... .. 6  
Compliance with OSHA Rule 1910.119 and EPA RMP Rule..... 6  
Process Hazards Analysis Team..... 7  
Process Description ..... 8  
Study P&IDs list..... 9  
Other Available PSI..... 9

*SECTION 2.0*  
**RECOMMENDATIONS** ..... 9

*SECTION 3.0*  
**STUDY WORKSHEETS & ATTACHMENT**..... 10  
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  
Attachment 8 – Engineering Change Evaluation and Wrap-up Checklist  
Attachment 9 – Inspection Change Evaluation and Wrap-up Checklist  
Attachment 10 – Emergency Response Change Evaluation and Wrap-up Checklist  
Attachment 11 – Safety Group Change Evaluation and Wrap-up Checklist  
Attachment 12 – General Change Evaluation and Wrap-up Checklist  
Attachment 13 – Human Factors Issues/Checklist  
Attachment 14 – Previous Incident Reports Checklist  
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

## **1.0 ABOUT THIS STUDY**

The Process Hazards Analysis, K90S0055 conducted between April 1, 1997 and April 11, 1997 was revalidated at Agrium's Kenai Nitrogen Operations February 12 & 13, 2002. The original PHA, as well as the revalidation, focused on the Plant 5's Utility System (System 90)

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:

- Have significant new hazards been created or introduced into the process?
- Has the possible occurrence of a catastrophic release in the process unit become significantly more likely?
- Have consequences of previously identified toxic or flammable material releases become more severe?
- Have consequences that could go "off-site" been identified?
- 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 5 Utilities 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 PSM Assistant prior to the study dates. 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 between February 12 and February 13, 2002 at Agrium Kenai Nitrogen Operations in Kenai, Alaska.

The study team consisted of the following people:

<b>Name</b>	<b>Title</b>	<b>Years of Experience</b>
Ed Aisenbrey	PSM Coordinator, PHA Team Leader	24
Steve Gillis	Plant 5 A Operator	
America Dukowitz	PSM Assistant, PHA Scribe	4
Dwayne Goche	Inspector	17
Michael Thompson	Mechanical Engineer	5
Michelle Grzybowski	Environmental Specialist	7
Dana Bassel	Safety Specialist	31

**Process Description**

The objective of Urea Plant #5 is to produce up to 2,000 TPD of urea by reacting liquid ammonia and carbon dioxide gas. This is done at elevated pressures and temperatures in the high-pressure urea synthesis system. This combination of CO<sub>2</sub> and NH<sub>3</sub> spontaneously forms an ammonium carbamate solution, via an exothermic heat (releasing reaction). With residence time and heat the reaction continues to form urea via an endothermic (heat absorbing) reaction. The process fluid is then let down in the low-pressure section for separation of the urea solution and water from the unreacted ammonia and carbon dioxide. The carbon dioxide and ammonia are condensed to form carbamate, which is recycled back to the high-pressure system. The remaining urea and water are sent to an evaporation section for water separation. The evaporated and condensed water is cleaned of ammonia and is used for boiler feedwater to make steam. The Process solution, 99 percent urea, is sprayed onto an existing “seed bed” of urea to form granules, using ambient air for cooling. This forms a suitable product for storage and shipping.

**Study P&IDs**

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

P&ID	DESCRIPTION	LATEST REVISION
R5I-5035	Ammonia Vent Recovery	23
R5I-5040	Steam Production	14
R5I-5090	Process Building Utilities Distribution	5
R5I-5100	CO2 Compression	16
R5I-5130	Granulation Process and Utility Distribution	3
R5I-5140	"A" Granulator Train	3
R6I-6071	BFW, Steam and Condensate	5

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 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. This list is to be used by management to resolve and document resolution of the suggested actions by the Process Hazards Analysis Revalidation team.

**RECOMMENDATION: 6-1**

Determine reason G1500 does not provide adequate pressure and correct as necessary.

(Reference: Attachment 6)

**RECOMMENDATION: 9-1**

Team believes that the current program execution does not result in timely repair and tracking of gonkased installations. Recommend that affected Maintenance, Inspection, and Planning groups review their responsibilities under AP-19.7 .

(Reference: Attachment 9)

**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
Attachment 8	Engineering Change Evaluation and Wrap-up Checklist
Attachment 9	Inspection Change Evaluation and Wrap-up Checklist
Attachment 10	Emergency Response Change Evaluation and Wrap-up Checklist
Attachment 11	Safety Group Change Evaluation and Wrap-up Checklist
Attachment 12	General Change Evaluation and Wrap-up Checklist
Attachment 13	Human Factors Issues/Checklist
Attachment 14	Previous Incident Reports Checklist
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