Alaska Nitrogen Products, LLC
Kenai Plant
Plant 2 Hydrolyzer/Stripper & In-plant Utilities And Plants 2 & 5 CO_2 Compression Systems 38/39, and 30/80 Process Hazards Analysis Revalidation

Final Report

April 7 2000

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Project No.: K00S47R1

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1.0 ABOUT THIS STUDY

The Process Hazards Analysis, K00S0047 conducted between May 14, 1996 to June 26, 1996 was revalidated at Unocal Corporation (Alaska Nitrogen Products, LLC) Kenai Plant on March 14th, to March 21st, 2000. The original PHA, as well as the revalidation, focused on the Plant 2 Hydrolyzer/Stripper & In-plant Utilities and Plants 2 & 5 CO_2 Compression, Systems 38/39, and 30/80.

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 HAZOP deviation guideword technique and the "What-If" technique.

HAZOP Deviation Guideword Technique

The guidewords, in conjunction with key process parameters, prompt the Process Hazards Analysis team to brainstorm possible causes and potential consequences of deviations from expected operation. For example, the deviation of "NO FLOW" would prompt the leader to ask the team, "What could cause no flow in this section or line segment?" The "Possible Cause/Potential Consequence" scenarios were documented in the report worksheets along with "Existing Systems and Safeguards," that either reduce the likelihood of the cause occurring or reduce the potential consequences. For scenarios involving significant risk, "Recommendations," which the team believed, may further reduce the risk or improve the operability of the facility were also documented.

The specific steps of the HAZOP methodology used in the baseline PHA were:

- Choose study node
- Apply a deviation (parameter + guideword)
- Brainstorm causes of the deviation
- For each cause, identify ultimate global consequences
- Identify existing safeguards
- Qualitatively assess the risk of the scenario
- If warranted, make recommendation(s) to reduce risk and/or improve the operability of the facility

This process is repeated for each deviation and node until the entire process has been analyzed.

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 (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 the Plant 2 Hydrolyzer/Stripper & In-plant Utilities and Plants 2 & 5 CO_2 Compression, 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 Unocal Corporation (Alaska Nitrogen Products, LLC) representatives on March 14th, 15th, 16th, 17th, & 20th, 2000. 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 open recommendations from the baseline PHA, see Attachment 4;
2. General discussion regarding incidents occurring in the process since the baseline PHA; see Attachment 8;
3. A review of those documented changes since the baseline PHA, see Attachment 5;
4. The completion of the Change Evaluation Checklist, see Attachment 6;
5. The completion of the Human Factors Issues Checklist, see Attachment 7;
6. A review of the Revalidation Guideword List, see Attachment 8;
7. Consideration of those scenarios with potential off-site consequences, see Attachment 9;
8. The completion; of the Wrap-up Discussion Checklist, see Attachment 11; and
9. The completion of the Additional Areas "What- If" Worksheets, see Attachment 12.

"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 Attachment 9.

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 10 shows the criteria for applying risk rankings to various scenarios.

Other Issues

Facility Siting – The Unocal Corporation (Alaska Nitrogen Products, LLC) Kenai Plant has recently 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 March 14th, 15th, 16th, 17th, & 20th, 2000 at Unocal's (Alaska Nitrogen Products, LLC) Kenai Plant in Kenai, Alaska.

The study team consisted of the following people

Name	Title	Years Experience
Rob Ross	Mech./Maint. Engineer	7
Raymond Hanson	P & C Engineer	23
Russell R Peterson	P & C Engineer	26
Stephen Morgan O/U Inspector	Inspection's	27
Tom Burg	Plant 2 Operator	22
Linda Ruiz	Plant 5 Operator	6
Steve Milliron	Plant 5 Operator	6
Edward J. Aisenbrey	PHA Facilitator/PSM Coordinator	23
Licia Piceno	Project Aide/Scribe	5 1/2

Process Description

Hydrolyzer/Stripper

The Hydrolyzer/Stripper's purpose is to clean up the wastewater from the Urea Plant, which consists of a dilute aqueous solution containing NH_3, CO_2, and urea.

The Hydrolyzer/Stripper 2D404 employs a tower that contains a series of trays and reaction zones to accomplish the hydrolysis of urea to form NH_3 and CO_2, strip NH_3, and CO_2 from the wastewater recycle. The stripped NH_3 and CO_2 to the Low Pressure Condenser 2E426, and discharge the waste water for possible re-use or to the environment.

The wastewater is collected in the Hydrolyzer/Feed Tank 2F467 and fed into the Hydrolyzer/Stripper Tower after being preheated in the Feed Effluent Exchangers 2E433A/B. A Reboiler 2E434, steam heated, provides the heat necessary for hydrolysis and stripping to take place in the tower. The stripped NH_3 and CO_2 flash overhead and enter the Overhead Condenser 2E435. Cooling water provides the cooling to condense the gasses on the shell side of this horizontal exchanger. This solution is then recycled back through the tower for temperature control, while the excess (net overhead product) is recycled through the urea process, primarily the Low Pressure Condenser 2E426.

EQUIPMENT:

2D404 ***HYDROLYZER/STRIPPER TOWER*** System 39

Wastewater containing urea, ammonia, and CO_2 is pumped via flow control, 2FCV101, controlled by panel-mounted 2FRC101 from 2F467 Feed Tank through the feed effluent exchangers, 2E433A/B, to tray 30 of the Hydrolyzer tower. The feed effluent exchangers heat the feed from 116°F to 267°F while cooling the bottoms from 319°F to 160°F.
The vapor travels up the tower and the liquid leaves the bottom as product water. The bottoms product water leaves the tower on level control and flows through the feed effluent exchanger on its way to the following, as conditions change in composition of bottoms sample:

1. Waste Heat Boiler Feed Water
2. Cooling Tower, 3E611
3. Ponds
4. Slop Tank, 2F434
5. Hydrolyzer Feed Tank, 2F467

The 2D404 tower overhead enters the 2E435 condenser through a gas sparger.
The Hydrolyzer Tower consists of seven distinct sections, as follows:

a) Trays #31-40 are rectification trays for reducing the water content of the stripped vapor. Reflux is introduced on tray #40.

b) Trays # 17-30 are stripping trays having the main purpose of reducing the free ammonia content of the liquid before it enters the urea hydrolysis zones. Some hydrolysis also occurs in these trays.

c) Four reaction stripping cells are provided below tray #17. The purpose of each cell is to increase the liquid residence time in the tower to provide more time for urea hydrolysis and to strip away the NH_3 and CO_2 formed by the hydrolysis. Each cell consists of a reaction zone and a four tray stripping section. The reaction zone is located in an annular section bounded by the outer shell and the wall of the stripping section. The top reaction zone receives the liquid down flow from tray #17. A ring header provides for uniform distribution of this liquid around the periphery of the reaction zone at the bottom. As the liquid passes upward through the reaction zone, urea is hydrolyzed. None of the vapor up flow contacts this liquid; therefore, all of the volume in each reaction zone is available for maximum liquid retention time. When the liquid reaches the top of the reaction zone, it overflows the serrated edge of the inner wall and enters a collector trough. The trough diverts the overflow to a downcomer above the top tray of that cell. The stripping trays in each cell serve to reduce the ammonia content of the down flowing liquid. The alternation of reaction zones with stripping sections enables the ammonia formed by urea hydrolysis to be stripped from the liquid. The liquid leaving the bottom tray of the first three cells flows to the next reaction zone below. The vapor passing upward through the four cells stays only in the trayed area. The down flow from tray #1 is sent to the reboiler from a trap-out tray. Normally all of this liquid goes to the reboiler, but should an excessive flow occur, it can overflow the trap-out pan weir. Reboiler vapor enters below tray #1 and rises through the trayed area.

d) The tower sump receives the net bottoms product as liquid return from the reboiler. The sump volume is sufficient to permit the bottoms product to be removed on level control, 2LCV301 with panel-mounted 2LIC301. A level glass 2LG304 is also provided. This volume is also designed to accomplish the remainder of the desired destruction of urea. Because the ammonia from this final destruction does not get stripped out, it exits the tower with the bottoms product. At design conditions, just under 2.0 lb/hr of free ammonia (30 ppm) and 3.4 lb/hr of urea (55 ppm) leave the sump with the bottoms water.

The Hydrolyzer/Stripper Tower uses valve trays throughout. These are expected to allow operation of the column at rates as low as 40% of design.

Sampling connections are provided so the liquid composition in and out of each reaction zone can be determined by analysis.

A small flow of process air (5 lb/hr) that has been reduced in pressure is continuously admitted below tray #1. The purpose is to maintain the passivation of the stainless steel surfaces within the tower, thus minimizing corrosion. For all portions of the tower from tray #30 down, Type 304 or Type 304L stainless steel is used. Above tray #30, ammonium carbamate is high enough in concentration to require the provision of Type 316 or Type 316L stainless steel.

A conductivity transmitter, 2CT801, is provided on the discharge line from the tower sump and is transmitted to panel-mounted 2CR801.

Tower pressure (top) is transmitted to panel-mounted 2PI201 and controlled by 2PCV201 from panel-mounted 2PIC201.

Tower bottom pressure is transmitted to panel-mounted 2PI205.

Temperature transmitters are located at periodic tray positions throughout the height of the tower and read on panel-mounted LED temperature panel on the Hydrolyzer/Stripper board. These include tray 19, 24, 29, 34, and 39 to include the 4 reaction zones and the tower sump. 2D404 is located on the west side of the Prill Tower. See P&ID drawing 2140.

Plant #2 CO_2 Compression

CO_2 provided by Ammonia Plants 1 and 4 at 10 to 13 psig is compressed by the CO_2 Booster Compressor to approximately 1100 psig. The CO_2 flows to the suction of the CO_2 Reciprocating Compressors where it is compressed to 3400 psig for delivery to the Urea Reactor.

The CO_2 Booster Compressor is a two case Clark Brother's centrifugal compressor with three compression stages. The first two compression stages are housed in the low case and the third compression stage is housed in the high case.

The CO_2 gas is cooled between each compression stage to remove the heat of compression. The first and second stage CO_2 Intercoolers and the third stage CO_2 Aftercooler are fan-driven air-cooled exchangers. The temperature is controlled by adjusting the side louvers and by the recycle louvers on top. Additional cooling is accomplished with the CO_2 Aftercooler, which uses service water as the cooling medium.

The Suction Separator removes any water that may have been condensed in the piping outside the battery limits and is then drained to the sewer. In the First and Second Stage Separators the condensed water, generated from cooling the hot CO_2, is separated and drained to the sewer. The CO_2 Booster Compressor is driven by a General Electric Condensing Turbine. 550 psig steam enters the inlet of the turbine and passes through five sets of nozzles and wheels to exhaust into a vacuum of approximately 17 to 22 inches of water. The vacuum will deviate some as it is influenced by ambient conditions and current rates.

Located on the turbine exhaust line is a 16" Atwood vacuum relief valve. The exhaust piping is designed to handle vacuum but not pressure. To protect the piping, the vacuum relief valve is set to open if the exhaust pressure reaches 5 psig.

The efficiency of the CO_2 Booster Compressor turbine is increased by exhausting into a vacuum. The vacuum pulls the steam across the turbine so less steam is required to drive the compressor. The exhaust steam is condensed in the 2E416 Steam Condensers for reuse. The air temperature in each bay is controlled by operation of the recycle louvers and the side louvers. The recycle louvers can be operated in the manual or automatic mode. Proper operation of the 2E416s can result in a lower 550 psig steam usage and increased rates. A Steam Condenser Shutdown Heater at the south end of the 2E416s is for use during cold weather shutdowns to prevent freezing of the tubes.

Vacuum for the exhaust system is generated by the Precondenser, the Inter/Aftercondenser, and the Steam Air Jet Ejectors. During the initial startup, the Hogging Ejector is used to rid the system of inerts (air is considered an inert along with other non-condensables) and to establish vacuum. During warm days the Hogging Ejector is put in service to increase vacuum as needed. Once established, the vacuum is self-sustaining along with help from steam condensing in the 2E416s.

The CO_2 Booster is provided with anti-surge and flow ratio controllers to insure a minimum flow at reduced rates or upset conditions. The anti-surge valve vents CO_2 to the atmosphere if the flow requirements are below the setpoint. A 1" and 3" bypass line is provided to recirculate CO_2 from the 3rd stage to the 1st stage in order to meet the necessary flow requirements of the compressor while at very low rates.

The CO_2 Booster Compressor turbine speed will have an affect on the CO_2 flow to the Urea Reactor. Other factors include:

- The number of CO_2 Reciprocating Compressors in service
- Ambient conditions
- The CO_2 suction pressure and temperature
- The operation of the steam condensers (2E416s) and inter/after coolers (2E417, 18, 19, and 2E430)
- The mechanical efficiency of the CO_2 Booster and Reciprocating Compressors

To protect the compressor from physical damage, the system is equipped with an alarm and trip circuit, which will first sound a warning alarm if dangerous conditions occur and then trip the compressor if the trip setpoints are exceeded. These trips include:

- Low level in the high and low case seal oil pots
- High water level in the suction separators
- Low pressure lube oil header
- CO_2 Booster Compressor overspeed
- Manual trip from the board or the field
- Inverter AC power supply failure (Plant 1)

The CO_2 Booster Compressor trip circuits use a pair of Programmable Logic Controllers (PLCs) that monitor the status of the input trips. Both PLCs must indicate a trip condition before the unit will trip the compressor.

The urea reaction uses components that contain reducing impurities, and it is necessary to oxidize these impurities. This is done by introducing process air into the CO_2 Booster Compressor. Process air from Ammonia Plants 1 and/or 4 flows through a control valve to the third stage suction of the Booster and on to the Urea Reactor. Air, while not beneficial to the urea reaction, protects the stainless steel liner of the Urea Reactor from corrosion. Process air used for oxidation purposes is known as passivation air.

The CO_2 Reciprocating Compressors are single stage, gas-engine driven 440 horse power compressors made by Clark Brothers. They receive CO_2 gas from the discharge of the CO_2 Booster Compressor at approximately 1100 psig and compress it to 3400 psig for delivery to the Urea Reactor. The speed control for each recip is usually maxed out and is controlled from the control room by the Board Operator.

A closed cooling system is provided to remove heat generated by the power cylinders, compression cylinders and compression packing. The Recip. Jacket Coolant Pumps circulate a 50% glycol solution through the water jacketing on each recip. The glycol/water solution is cooled in the Jacket Water Cooler with 50m and 68m cooling fans. A slipstream from the discharge of the Recip. Jacket Coolant Pumps flows through the Gland Water Cooler and onto the glands on each recip.

Plant #5 CO_2 Compression

The purpose of the CO_2 Compressor (5GC500) is to provide a constant supply of CO_2 to the Plant 5 urea process high pressure system. Strict adherence to temperature, pressure, and composition specifications must be maintained.

Carbon dioxide (CO_2) at about 15 psig from the Ammonia Plant Regenerator (4D207) is delivered to the First Stage Suction Intercooler (5E552) for cooling and condensing of vapors, then to the First Stage CO_2 Suction Separator (5F550) to remove entrained water. The CO_2 is then directed to the first stage of the 5GC500, where the pressure is increased to approximately 170 psig.

Compression of CO_2 gas causes an increase in temperature, which is reduced in the Second Stage CO_2 Intercooler (5E545). The liquid resulting from the cooling is removed by the Second Stage CO_2 Separator (5F524), before entering the compressor. Discharge pressure reaches approximately 575 psig exiting the low case second stage.

The Third Stage CO_2 Intercooler (5E519) cools the gas and condenses entrained liquids, which are extracted in the Third Stage CO_2 Separator (5F525). The CO_2 pressure is increased to about 1300 psig in the third stage of the compressor. Hydrogen Destruct Catalyst Vessel (5F581) is located on the third stage discharge for hydrogen removal. This is to insure that an explosive concentration of gases does not build up in the High Pressure Scrubber (5E503).

The Fourth Stage CO_2 Intercooler (5E551) along with the Fourth Stage CO_2 Suction Separator (5F551) allow for cooling, condensing, and removal of added water formed in the 5F581. CO_2 from the 5GC500 is injected into the bottom of the High Pressure Stripper (5E501) requiring the fourth stage discharge pressure to be approximately 2300 psig, dependent on the high pressure system operating pressure.

The CO_2 compressor is driven by a 550 lb. General Electric Turbine (5GCT500) using steam which is condensed and exhausted to vacuum. The vacuum is maintained on the turbine exhaust by two sets of eight condensing fans (5E516), two sets of ejectors (5E550A/B) and (5E550C/D), and a hogging ejector (5F551) for startup and shutdown. Lube oil and governor oil systems with their associated equipment are also provided.

Process Safety Information

Study P&IDs

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

P&ID	DESCRIPTION	LATEST REVISION
R2I-2000, Rev. 5	Steam & Condensate Distribution Process	1/7/2000
R2I-2020, Rev. 6	CO_2 Booster Compression Process	5/28/98
R2I-2021, Rev. 3	CO_2 Booster Lube/Cooling Auxiliary	6/3/99
R2I-2030, Rev. 3	CO_2 Recip. Compressors Process	12/11/97
R2I-2040, Rev. 2	GC-401 Recips. Lube/Cooling Auxiliary	11/20/97
R2I-2110, Rev. 6	Crystallization Process	10/18/99
R2I-2140, Rev. 5	Stripper/Hydrolyzer System Process	4/23/99
R2I-2150, Rev. 4	Effluent Collection Tanks Process	8/18/98
R2I-2160, Rev. 4	Vent & Blowdown System Distribution	1/7/2000
R2I-2170, Rev. 3	HYD/Strip GES Collection Distribution	12/11/97
R2I-2180, Rev. 5	Urea Reclaim and Recycle System Distribution	9/13/99
R5I-5100, Rev. 8	CO_2 Compression Process	1/25/2000
R5I-5110, Rev. 5	CO_2 Comp Aux. Oil System Auxiliary	9/1/99
R5I-5120, Rev. 1	CO_2 Blower Process & Aux. Process	11/18/97

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 Unocal's (Alaska Nitrogen Products), LLC, 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:

- "Actions" are relatively simple tasks that were assigned to team members, and could be completed before the end of the study.
- "Recommendations" are those tasks that require more evaluation, and possibly engineering or management direction.
- "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 recommendation is 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.

RECOMMENDATION : 5-1 Install lifting levers on PSV002, 2PSV011, & 2PSV012 (P&ID R2I-2000). Team discussed MOC 501704 (KP-244—PHA K00P0058), fix relief valve deficiencies found during the Brown & Root Safety Valve Audit. (Reference: Attachment 5, page 1 of this report)
RECOMMENDATION: 5-2 Update P&ID R2I-2000 to show the removal of 2E411 (see P&ID redline change). Team discussed, and field checked to verify as to whether or not the 2E411 was actually there and found that it had been removed. (Reference: Attachment 5, page 4, of this report.)
RECOMMENDATION: 5-3 Update P&ID R2I-2000 to show the reference to 2E420 and PCV001 (see P&ID redline change). Team discussed the removal of the reference to the 2E420 and PCV001A/B, and felt these should have not been removed from drawing. (Reference: Attachment 5, page 4, of this report.)

RECOMMENDATION: 5-4 Remove "I" at the end of PI020 and update P&ID R2I-2000 (see P&ID redline change). Team discussed and felt that the numbering was incorrect. (Reference: Attachment 5, page 6. of this report.)
RECOMMENDATION: 5-5

Update P&ID R2I-2000, there is no line from 2G411 to 2G416A/B (see P&ID redline change).

Team discussed and field verified and found that P&ID is incorrect.

(Reference: Attachment 5, page 6, of this report.)

RECOMMENDATION: 5-6

Update P&ID 2I-2000 to show the addition of an LP alarm (see P&ID redline change).

Team discussed and found that PA412 should be PAL412.

(Reference: Attachment 5, page 7, of this report.)

RECOMMENDATION: 5-7

Update P&ID R2I-2000 to show space between C50 & 82059-AA (see P&ID redline change).

Team discussed and found that the line on P&ID R2I-2000 Rev. 5 now reads as ½"-C5082059-AA and should read as ½"-C50 82059-AA.

(Reference: Attachment 5, page 7, of this report.)

RECOMMENDATION: 5-8

Update P&ID R2I-2020 to show relief valve (see P&ID redline change).

Team discussed and found that P&ID had not been updated.

(Reference: Attachment 5, page 9 of this report.)

RECOMMENDATION: 5-9

Investigate to determine if high level trip on 2F422 is still bypassed and if so, generate new KPE-129 to run with trip bypass.

Team discussed the bypass high level trip on 2F422 (MOC 505564).

(Reference: Attachment 5, page 11 of this report.)

RECOMMENDATION: 5-10

Engineering to review over pressure protection for 2E417 and determine adequacy.

Team discussed MOC 505566 and SOCL, which had been changed to indicate 105 psig and found that a review was needed for the over pressure protection of 2E417 and its adequacy.

(Reference: Attachment 5, page 11, of this report.)

RECOMMENDATION: 5-11

Update P&ID 2I-2020 to show blind.

Team discussed and Tom Burg field checked and found a blind should be shown on P&ID R2I-2020 (see P&ID redline change).

(Reference: Attachment 5, page 13 of this report.)

RECOMMENDATION: 5-12

Update P&ID R2I-2020 to reflect MOC 501701 changes (see P&ID redline changes.

Team discussed and found that drawing needs to be updated to reflect MOC changes.

(Reference: Attachment 5, page 13, of this report.)

RECOMMENDATION: 5-13

Drafting to check numbering and update P&ID R2I-2021, R2I-2150 & R5I-5110 (see P&ID redline changes).

Team discussed the numbering for various instrument numbers, which were questionable.

(Reference: Attachment 5, page 14, of this report.)

RECOMMENDATION: 5-14

Drafting to update P&ID R2I-2021 to show "auto start" (see P&ID redline changes).

Team discussed original PHA drawings showing that G458 should be "auto start" and found that P&ID R2I-2021 needed to be updated.

(Reference: Attachment 5, page 14 of this report.)

RECOMMENDATION: 5-15

Drafting to check numbering and update P&ID R2I-2140 (see P&ID redline changes).

Team discussed instrument number is questionable (exclamation marks at end of numbering).

(Reference: Attachment 5, page 21, of this report.)

RECOMMENDATION: 5-16

Drafting to put AI920F back on P&ID R5I-5100 (see P&ID redline changes).

Team discussed the removal of AI920F from P&ID R5I-5100. Linda Ruiz checked in field and found that AI920F is still in the field, but is plugged.

(Reference: Attachment 5, page 27, of this report.)

RECOMMENDATION: 5-17

AI920E&F are both plugged and unusable. Fix during next turnaround.

Team discussed AI920E&F and felt that they needed to be fixed during next turnaround (field checked by Linda Ruiz).

(Reference: Attachment 5, page 27, of this report.)

RECOMMENDATION: 5-18

Update P&ID R5I-5100 to remove line added from line ¾" SL85004 (see P&ID redline changes).

Team discussed the additional line added from ¾" SL85004 and found that the line should not be on P&ID.

(Reference: Attachment 5, page 27, of this report.)

RECOMMENDATION: 6-1

Investigate other means to melt urea that do not have the safety and environmental concerns that are associated with melters.

Team discussed Change Evaluation Checklist, Attachment 6 Question O-28—Are there any habitual equipment problems that are of concern?

(Reference: Attachment 6, page 5 of this report.)

RECOMMENDATION:11-1

Provide first aid and CPR training for all employees.

Team discussed Wrap-Up Checklist Issues, Attachment 11, and Section: In-Plant Emergency Response Plan Question 1—Describe your Emergency Response Training Program for in-plant personnel?

(Reference: Attachment 11, page 8 of this report.)

RECOMMENDATION: 11-2

Provide additional ERT training to those interested.

Team discussed Wrap-Up Checklist Issues, Attachment 11, and Section: In-Plant Emergency Response Plan, Question 2—Which in-plant personnel are expected to respond to an accidental

release? (Reference: Attachment 11, page 8 of this report.)
RECOMMENDATION 12-1: P&C to evaluate whether CO_2 solid formation downstream of PSV2940 is possible. Team discussed Additional Areas To Be Discussed Worksheet, Attachment 12 Question: What-If PSV2940 discharge piping to atmosphere is plugged. (Reference: Attachment 12, page 2 of this report.)
RECOMMENDATION 12-2: P&C to investigate dry ice formation. Team discussed Additional Areas To Be Discussed Worksheet, Attachment 12 Question: What-If 2PSV105, 2PSV106, and 2PSV109 discharge piping is plugged by dry ice formation. (Reference: Attachment 12, page 17 of this report.)

RECOMMENDATION 12-3 P&C to investigate dry ice formation across relief valves. Team discussed Additional Areas To Be Discussed Worksheet, Attachment 12 Question: What-If 2PSV100A/B/C discharge piping is plugged for any reason. (Reference: Attachment 12, page 17 of this report.)
RECOMMENDATION 12-4: Update P&ID R2I-2020 to show line being removed (see P&ID redline changes). Team discussed Additional Areas To Be Discussed Worksheet, Attachment 12 Question: What-If 150# steam from Uraca exhaust and found that the line had been removed. (Reference: Attachment 12, page 28 of this report.)

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 Summary Worksheet
Attachment 6	Change Evaluation Checklist
Attachment 7	Human Factors Issues
Attachment 8	Revalidation Guideword Checklist
Attachment 9	Off-site Consequences "What-If" Worksheets
Attachment 10	Risk Ranking Matrix
Attachment 11	Wrap-Up Discussion Checklist
Attachment 12	Additional Areas "What-If" Worksheets