<table>
<thead>
<tr>
<th>Ref No.</th>
<th>Hazard #</th>
<th>Hazard Type</th>
<th>Event / Condition</th>
<th>Root Cause</th>
<th>Mitigation Measures</th>
<th>Safety Study</th>
<th>Reference</th>
<th>Link</th>
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<tbody>
<tr>
<td>10</td>
<td>H100</td>
<td>NH3 piping</td>
<td>NH3 heat exchangers</td>
<td>High pressure</td>
<td>Fit proper sealing</td>
<td>BHTD</td>
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<td><a href="http://www.ureaknowhow.com/ukh2/round-446">446</a></td>
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<tr>
<td>12</td>
<td>H120</td>
<td>HP CO2 piping</td>
<td>HP CO2 piping</td>
<td>High pressure</td>
<td>Fit proper sealing</td>
<td>BHTD</td>
<td><a href="http://www.ureaknowhow.com/ukh2/table/viewtopic.php?f=33&amp;t=1476">table/viewtopic.php?f=33&amp;t=1476</a></td>
<td><a href="http://www.ureaknowhow.com/ukh2/round-446">446</a></td>
</tr>
</tbody>
</table>

*Note: This table provides a summary of risk register safety hazards in Urea plants.*
Operations

- **Incident 82-001**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Insignificant
  - **Causative:** Gas pipeline ruptures during maintenance job.
  - **Consequence:** People enter a pipeline (confined space) while welding was performed and welding gas was applied (inerts) leading to backflow scenario.
  - **Outcome:** One casualty and one person injured.

- **Incident 15-002**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** One casualty, one person injured during several incidents.
  - **Consequence:** Operations.

- **Incident 03-001**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

Maintenance

- **Incident XX-018**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Moderate
  - **Causative:** Finishing.
  - **Consequence:** Operations.

- **Incident XX-008**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Finishing.
  - **Consequence:** Operations.

- **Incident 10-004**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Finishing.
  - **Consequence:** Operations.

Feed

- **Incident 907**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Finish.
  - **Consequence:** Operations.

- **Incident 896**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Feed.
  - **Consequence:** Operations.

- **Incident 109007**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Feed.
  - **Consequence:** Operations.

- **Incident 1303**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Feed.
  - **Consequence:** Operations.

Operations

- **Incident 1336**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 1457**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 1504**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 1460**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 1420**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 1315**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0921**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0899**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0898**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0897**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0896**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0895**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0894**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0893**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0892**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0891**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0890**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0889**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0888**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0887**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0886**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0885**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0884**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0883**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0882**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0881**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.

- **Incident 0880**
  - **Type:** Catastrophic
  - **Severity:** Major
  - **Likelihood:** Rare
  - **Causative:** Operations.
  - **Consequence:** Operations.
<table>
<thead>
<tr>
<th>Incident Database</th>
<th>Incident Identification</th>
<th>Incident Date</th>
<th>Equipment</th>
<th>Phase</th>
<th>Operation Steps</th>
<th>Description</th>
<th>Recommendations</th>
<th>Follow-Up Information</th>
</tr>
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<tbody>
<tr>
<td>HAZO-001</td>
<td>16-007</td>
<td>November 2017</td>
<td>HP Equipment</td>
<td>Recycling/Evaporation and waste water treatment</td>
<td>Hydrogen enbrittlement (hydrogen is formed with carbamate corrosion reaction without oxygen)</td>
<td>Assure a proper active vacuum based leak detection system with a reliable and accurate ammonia detector. Avoid that leaking carbamate can drip on high pressure urea equipment. Pay proper attention to design (sufficient flushing, slope lay out, proper pipe diameters, etc) and operation procedures. Apply high quality high pressure switch activates synthesis blocking situation. Apply a reliable safety valve.</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>HAZO-002</td>
<td>09-004</td>
<td>November 2017</td>
<td>HP Equipment</td>
<td>Synthesis</td>
<td>Hydrogen enbrittlement (hydrogen is formed with carbamate corrosion reaction without oxygen)</td>
<td>Assure a proper active vacuum based leak detection system with a reliable and accurate ammonia detector. Avoid that leaking carbamate can drip on high pressure urea equipment. Pay proper attention to design (sufficient flushing, slope lay out, proper pipe diameters, etc) and operation procedures. Apply high quality high pressure switch activates synthesis blocking situation. Apply a reliable safety valve.</td>
<td>None</td>
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<tr>
<td>HAZO-003</td>
<td>99-001</td>
<td>November 2017</td>
<td>HP Equipment</td>
<td>Synthesis</td>
<td>Hydrogen enbrittlement (hydrogen is formed with carbamate corrosion reaction without oxygen)</td>
<td>Assure a proper active vacuum based leak detection system with a reliable and accurate ammonia detector. Avoid that leaking carbamate can drip on high pressure urea equipment. Pay proper attention to design (sufficient flushing, slope lay out, proper pipe diameters, etc) and operation procedures. Apply high quality high pressure switch activates synthesis blocking situation. Apply a reliable safety valve.</td>
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<tr>
<td>HAZO-004</td>
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<td>November 2017</td>
<td>HP Equipment</td>
<td>Recirculation/Evaporation and waste water treatment</td>
<td>Hydrogen enbrittlement (hydrogen is formed with carbamate corrosion reaction without oxygen)</td>
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<td>HAZO-005</td>
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<td>November 2017</td>
<td>HP Equipment</td>
<td>Synthesis</td>
<td>Hydrogen enbrittlement (hydrogen is formed with carbamate corrosion reaction without oxygen)</td>
<td>Assure a proper active vacuum based leak detection system with a reliable and accurate ammonia detector. Avoid that leaking carbamate can drip on high pressure urea equipment. Pay proper attention to design (sufficient flushing, slope lay out, proper pipe diameters, etc) and operation procedures. Apply high quality high pressure switch activates synthesis blocking situation. Apply a reliable safety valve.</td>
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<td>HAZO-006</td>
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<td>HP Equipment</td>
<td>Synthesis</td>
<td>Hydrogen enbrittlement (hydrogen is formed with carbamate corrosion reaction without oxygen)</td>
<td>Assure a proper active vacuum based leak detection system with a reliable and accurate ammonia detector. Avoid that leaking carbamate can drip on high pressure urea equipment. Pay proper attention to design (sufficient flushing, slope lay out, proper pipe diameters, etc) and operation procedures. Apply high quality high pressure switch activates synthesis blocking situation. Apply a reliable safety valve.</td>
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<td>HP Equipment</td>
<td>Recirculation/Evaporation and waste water treatment</td>
<td>Hydrogen enbrittlement (hydrogen is formed with carbamate corrosion reaction without oxygen)</td>
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<td>HAZO-008</td>
<td>99-001</td>
<td>November 2017</td>
<td>HP Equipment</td>
<td>Synthesis</td>
<td>Hydrogen enbrittlement (hydrogen is formed with carbamate corrosion reaction without oxygen)</td>
<td>Assure a proper active vacuum based leak detection system with a reliable and accurate ammonia detector. Avoid that leaking carbamate can drip on high pressure urea equipment. Pay proper attention to design (sufficient flushing, slope lay out, proper pipe diameters, etc) and operation procedures. Apply high quality high pressure switch activates synthesis blocking situation. Apply a reliable safety valve.</td>
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<tr>
<td>HAZO-009</td>
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<td>November 2017</td>
<td>HP Equipment</td>
<td>Synthesis</td>
<td>Hydrogen enbrittlement (hydrogen is formed with carbamate corrosion reaction without oxygen)</td>
<td>Assure a proper active vacuum based leak detection system with a reliable and accurate ammonia detector. Avoid that leaking carbamate can drip on high pressure urea equipment. Pay proper attention to design (sufficient flushing, slope lay out, proper pipe diameters, etc) and operation procedures. Apply high quality high pressure switch activates synthesis blocking situation. Apply a reliable safety valve.</td>
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**Recommendations:**
- Assure a proper active vacuum based leak detection system with a reliable and accurate ammonia detector.
- Avoid that leaking carbamate can drip on high pressure urea equipment.
- Pay proper attention to design (sufficient flushing, slope lay out, proper pipe diameters, etc) and operation procedures.
- Apply high quality high pressure switch activates synthesis blocking situation.
- Apply a reliable safety valve.

**Follow-Up Information:**
- None

**Incident Database:**
- HAZO-001
- HAZO-002
- HAZO-003
- HAZO-004
- HAZO-005
- HAZO-006
- HAZO-007
- HAZO-008
- HAZO-009

**Incident Identification:**
- Incident 16-007
- Incident 09-004
- Incident 99-001
- Incident 99-001
- Incident 99-001
- Incident 99-001
- Incident 99-001
- Incident 99-001
- Incident 99-001

**Incident Date:**
- November 2017

**Equipment:**
- HP Equipment

**Phase:**
- Recycling/Evaporation and waste water treatment
- Synthesis
- Recirculation/Evaporation and waste water treatment
- Synthesis
- Synthesis
- Synthesis
- Synthesis
- Synthesis
- Synthesis

**Operation Steps:**
- Hydrogen enbrittlement (hydrogen is formed with carbamate corrosion reaction without oxygen)

**Description:**
- Hydrogen enbrittlement (hydrogen is formed with carbamate corrosion reaction without oxygen)

**Recommendations:**
- Assure a proper active vacuum based leak detection system with a reliable and accurate ammonia detector.
- Avoid that leaking carbamate can drip on high pressure urea equipment.
- Pay proper attention to design (sufficient flushing, slope lay out, proper pipe diameters, etc) and operation procedures.
- Apply high quality high pressure switch activates synthesis blocking situation.
- Apply a reliable safety valve.

**Follow-Up Information:**
- None
Rupture high pressure flange during hot bolting. Gasket fails, be aware of flushing with condensate in HP scrubber which can increase H2/NH3 ratio (larger pump vibrations). In case of severe vibrations, stop the plant and improve the installation, consider dampeners. Pay proper attention to the welding and installation of discharge pipelines of high pressure systems. Never apply hot bolting at high pressures. Always assure the quality of the applied materials fulfills the minimum requirements; Apply higher alloy materials (316L, 25-22-2 or 317L) and check conductivity of steam side of HP heat exchangers. Leaks in tubes or tube-tubesheet welds remains necessary (assure safety location of blow off). In case of cooling water on shell side a rupture disc location (suitable for large ammonia release). In case of cracking/water lines is some 30 years. Apply high pressure valves from a reliable and experienced high pressure urea valve vendor, in this case Meessen and 00-002. Incidence Database table/viewtopic.php?f=33&t=1446 and 884 and 12-001. https://www.ureaknowhow.com/ukh2/table/viewtopic.php?f=33&t=946 and https://www.ureaknowhow.com/ukh2/table/viewtopic.php?f=33&t=1446

Major damage ruptures, hot carbamate sprays of damages, 5 days plant shut down and repair. Luckily no injuries, unplanned.

Unsafe situation, large ammonia plants risk for fire, leaks, risk of loss of integrity. Four casualties and 4 people injured. Most cases are from leaks. Carbamate/ammonia can injure eyes, skin, respiratory tract. In another case one person injured due to inappropriate handling during storage. In case of hot carbamate sprays the risk of thermal injury is high. Carbamate entering the steam / water side of HP heat exchangers remains necessary and causes corrosion of carbon steel. Critical buttons should be considered to be used (suitable for large ammonia release). In case of hot carbamate sprays the risk of thermal injury is high. Carbamate entering the steam / water side of HP heat exchangers remains necessary and causes corrosion of carbon steel. Critical buttons should be considered to be used. (suitable for large ammonia release).

Catastrophic (12) Intolerable

Rupture of HP drain valve due to high corrosion rates. Consequence higher corrosion stripper leaks due to relatively high pressure pocket during start up. gaskets that fail in service. Baffles, tubes, tubesheet and shell remain necessary due to leakage of gaskets in the shell interior. Another case one person injured due to inappropriate handling during storage. In case of hot carbamate sprays the risk of thermal injury is high. Carbamate entering the steam / water side of HP heat exchangers remains necessary and causes corrosion of carbon steel. Critical buttons should be considered to be used (suitable for large ammonia release). In case of hot carbamate sprays the risk of thermal injury is high. Carbamate entering the steam / water side of HP heat exchangers remains necessary and causes corrosion of carbon steel. Critical buttons should be considered to be used (suitable for large ammonia release). In case of hot carbamate sprays the risk of thermal injury is high. Carbamate entering the steam / water side of HP heat exchangers remains necessary and causes corrosion of carbon steel. Critical buttons should be considered to be used (suitable for large ammonia release).
### Incident Database

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<tr>
<th>ID</th>
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<th>Subject</th>
<th>Harm.</th>
</tr>
</thead>
<tbody>
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<td>Incident 08-002</td>
<td>Catastrophic</td>
<td>Start Up</td>
<td>Moderate</td>
</tr>
<tr>
<td>Incident 16-003</td>
<td>Catastrophic</td>
<td>Production</td>
<td>Moderate</td>
</tr>
<tr>
<td>Incident 16-001</td>
<td>Major</td>
<td>Operations</td>
<td>Rare</td>
</tr>
<tr>
<td>Incident 04-001</td>
<td>Minor</td>
<td>Maintenance</td>
<td>Rare</td>
</tr>
</tbody>
</table>

#### Procedures for draining and venting for start-up and normal cases in both ammonia and urea plants.

- **Hydrolyser**
  - Start-up procedures for Hydrolyser.
  - In case of a leak stop the plant.

- **Synthesis**
  - Start-up procedures for Synthesis.
  - In case of a leak stop the plant.

- **Urea Reactor**
  - Start-up procedures for Urea Reactor.
  - In case of a leak stop the plant.

- **Steam boiler**
  - Start-up procedures for Steam boiler.
  - In case of a leak stop the plant.

- **Stripper**
  - Start-up procedures for Stripper.
  - In case of a leak stop the plant.

#### Operations

- **Utilities**
  - Operations for Utilities.

- **Equipment**
  - Operations for Equipment.

- **Incident XX-003**
  - Operations for Incident XX-003.

- **Incident 08-002**
  - Operations for Incident 08-002.

- **Incident 16-003**
  - Operations for Incident 16-003.

- **Incident 16-001**
  - Operations for Incident 16-001.

- **Incident 04-001**
  - Operations for Incident 04-001.

#### Operations

- **Hazardous Materials**

- **HAZOP**
  - Operations for HAZOP.

- **Injuries**
  - Operations for Injuries.

- **Procedures for draining and venting for start-up and normal cases in both ammonia and urea plants.**
  - Operations for Procedures for draining and venting for start-up and normal cases in both ammonia and urea plants.

- **Plant Safety - A**
  - Operations for Plant Safety - A.

- **Plant Safety - B**
  - Operations for Plant Safety - B.

- **Plant Safety - C**
  - Operations for Plant Safety - C.

- **Plant Safety - D**
  - Operations for Plant Safety - D.

- **Plant Safety - E**
  - Operations for Plant Safety - E.

- **Plant Safety - F**
  - Operations for Plant Safety - F.

- **Plant Safety - G**
  - Operations for Plant Safety - G.

- **Plant Safety - H**
  - Operations for Plant Safety - H.

- **Plant Safety - I**
  - Operations for Plant Safety - I.

- **Plant Safety - J**
  - Operations for Plant Safety - J.

- **Plant Safety - K**
  - Operations for Plant Safety - K.

- **Plant Safety - L**
  - Operations for Plant Safety - L.

- **Plant Safety - M**
  - Operations for Plant Safety - M.

- **Plant Safety - N**
  - Operations for Plant Safety - N.

- **Plant Safety - O**
  - Operations for Plant Safety - O.

- **Plant Safety - P**
  - Operations for Plant Safety - P.

- **Plant Safety - Q**
  - Operations for Plant Safety - Q.

- **Plant Safety - R**
  - Operations for Plant Safety - R.

- **Plant Safety - S**
  - Operations for Plant Safety - S.

- **Plant Safety - T**
  - Operations for Plant Safety - T.

- **Plant Safety - U**
  - Operations for Plant Safety - U.

- **Plant Safety - V**
  - Operations for Plant Safety - V.

- **Plant Safety - W**
  - Operations for Plant Safety - W.

- **Plant Safety - X**
  - Operations for Plant Safety - X.

- **Plant Safety - Y**
  - Operations for Plant Safety - Y.

- **Plant Safety - Z**
  - Operations for Plant Safety - Z.

#### Procedures for draining and venting for start-up and normal cases in both ammonia and urea plants.

- **Start-up**
  - Procedures for draining and venting for start-up and normal cases in both ammonia and urea plants.

- **Normal**
  - Procedures for draining and venting for start-up and normal cases in both ammonia and urea plants.

- **Plant**
  - Procedures for draining and venting for start-up and normal cases in both ammonia and urea plants.

- **Safety**
  - Procedures for draining and venting for start-up and normal cases in both ammonia and urea plants.

- **System**
  - Procedures for draining and venting for start-up and normal cases in both ammonia and urea plants.

#### Operations

- **Utilities**
  - Operations for Utilities.

- **Synthesis**
  - Operations for Synthesis.

- **Urea Reactor**
  - Operations for Urea Reactor.

- **Steam boiler**
  - Operations for Steam boiler.

- **Stripper**
  - Operations for Stripper.

#### Operations

- **Hazardous Materials**

- **HAZOP**
  - Operations for HAZOP.

- **Injuries**
  - Operations for Injuries.

#### Procedures for draining and venting for start-up and normal cases in both ammonia and urea plants.

- **Start-up**
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- **Normal**
  - Procedures for draining and venting for start-up and normal cases in both ammonia and urea plants.

- **Plant**
  - Procedures for draining and venting for start-up and normal cases in both ammonia and urea plants.

- **Safety**
  - Procedures for draining and venting for start-up and normal cases in both ammonia and urea plants.

- **System**
  - Procedures for draining and venting for start-up and normal cases in both ammonia and urea plants.

### Plant shut down procedures due to combining NH3 and urea.

- **Safety valve cracking**
  - Plant shut down procedures due to combining NH3 and urea.

- **Bearung wall due to atmospheric liner**
  - Plant shut down procedures due to combining NH3 and urea.

### Rupture of urea reactor due to detection holes in multi layer pressure bearing wall due to weld clip to liner.

- **Rupture of reactor due to active the manway cover**
  - Plant shut down procedures due to combining NH3 and urea.

- **Rupture of reactor due to bad connection of a urea reactor**
  - Plant shut down procedures due to combining NH3 and urea.

- **Failure of flanged head during blocking in situation**
  - Plant shut down procedures due to combining NH3 and urea.

- **Steam supply to the HP stripper**
  - Plant shut down procedures due to combining NH3 and urea.

#### Significant damage and leading to potential damage and production loss.

- **Hot fluid splashes, balloon (12) Intolerable**
  - Significant damage and leading to potential damage and production loss.

- **3 casualties and 5 people injured**
  - Significant damage and leading to potential damage and production loss.

- **Almost certain**
  - Significant damage and leading to potential damage and production loss.

- **Unlikely**
  - Significant damage and leading to potential damage and production loss.

- **(12) Intolerable**
  - Significant damage and leading to potential damage and production loss.

- **(10) High**
  - Significant damage and leading to potential damage and production loss.

- **(11) High**
  - Significant damage and leading to potential damage and production loss.

- **(7) High**
  - Significant damage and leading to potential damage and production loss.

### Potential toxic ammonia release.

- **Almost certain**
  - Potential toxic ammonia release.

- **Unlikely**
  - Potential toxic ammonia release.

- **(12) Intolerable**
  - Potential toxic ammonia release.

#### Almost certain Injuries

- **Almost certain**
  - Almost certain Injuries.

- **Unlikely**
  - Almost certain Injuries.

- **(12) Intolerable**
  - Almost certain Injuries.

#### Almost certain Major damage

- **Almost certain**
  - Almost certain Major damage.

- **Unlikely**
  - Almost certain Major damage.

- **(12) Intolerable**
  - Almost certain Major damage.

#### Almost certain Catastrophic

- **Almost certain**
  - Almost certain Catastrophic.

- **Unlikely**
  - Almost certain Catastrophic.

- **(12) Intolerable**
  - Almost certain Catastrophic.

#### Almost certain Major damage

- **Almost certain**
  - Almost certain Major damage.

- **Unlikely**
  - Almost certain Major damage.

- **(12) Intolerable**
  - Almost certain Major damage.

#### Almost certain Catastrophic

- **Almost certain**
  - Almost certain Catastrophic.

- **Unlikely**
  - Almost certain Catastrophic.

- **(12) Intolerable**
  - Almost certain Catastrophic.

#### Almost certain Unlikely

- **Almost certain**
  - Almost certain Unlikely.

- **Unlikely**
  - Almost certain Unlikely.

- **(12) Intolerable**
  - Almost certain Unlikely.

#### Almost certain Rare

- **Almost certain**
  - Almost certain Rare.

- **Unlikely**
  - Almost certain Rare.

- **(12) Intolerable**
  - Almost certain Rare.

#### Almost certain Unlikely

- **Almost certain**
  - Almost certain Unlikely.

- **Unlikely**
  - Almost certain Unlikely.

- **(12) Intolerable**
  - Almost certain Unlikely.

#### Almost certain Intolerable

- **Almost certain**
  - Almost certain Intolerable.

- **Unlikely**
  - Almost certain Intolerable.

- **(12) Intolerable**
  - Almost certain Intolerable.