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Where the urea industry meets

How to manage Leaks in Urea Plants

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Content

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Introduction

AmmoniaKnowHow.com & UreaKnowHow.com

Internet platforms to exchange technical information
within the nitrogen fertilizer industry
with the target to improve the Safety and Performance of all nitrogen fertilizer plants

Urea in China
www.ureanet.cn

nitrogen+syngas
Published by BCInsight

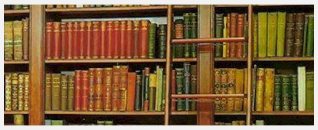
AmmoniaKnowHow
NH_3 HNO_3 CH_3OH NPK $(NH_4)(NO_3)$

Partnerships

Round Tables

>12.500 Members representing all nitrogen fertilizer plants worldwide

Catalyzing Safety & Performance



E-library

Biweekly a Technical paper

Introduction

AmmoniaKnowHow.com
NH_3 HNO_3 CH_3OH NPK $(NH_4)(NO_3)$

FIORDA
www.fiorda.eu

Risk Registers

Incident Databases & HAZOPs

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Introduction

Why HP section Leaks are critical ?

Corrosion challenges

- A urea plant continuously fights against corrosion (due to presence of ammonium carbamate)
- Passive corrosion reduces wall thicknesses continuously
- Several reasons can cause active corrosion with high corrosion rates

Sealing challenges

- Due to the corrosion challenges, only a limited number of special urea grade materials can be applied
- Hardness figures do not always differ a lot
- More attention required to properly seal two parts

Why many leaks in piping systems

- A relative large number of safety incidents occur with high pressure 316L UG carbamate lines and NH_3 and CO_2 carbon steel feed lines
- Many failure modes exist when using standard materials like 316L UG and carbon steel
- Many welds of piping systems are made in the field instead of shop
- Welds in low pressure parts of feed lines are typically considered a lower risk level
- Piping systems are typically difficult to inspect and to reach

What happens when it leaks?

- Toxic ammonia gas is released directly and via dissociation of ammonium carbamate.
- Carbamate flashes from high pressure to low pressure, below 60 °C solids occur. When urea is present solids occur more easily
- These solids increase the risk of erosion damages along the leak path and/or cause clogging
- Ammonium carbamate is very corrosive for carbon steel and also for stainless steel when oxygen gets depleted (active corrosion)
- In case leak stops, pressures and temperatures increase leading to higher corrosion rates

What are Critical Leaks ?

Case 1: A leaking HP flange connection

What are Critical Leaks ?

Case 2: A solidified HP flange leak

What are Critical Leaks ?

Case 3: A solidified leak along stuffing box of a HP butterfly valve

What are Critical Leaks ?

Case 4: Cracks in HP gas line

What are Critical Leaks ?

Case 5: A leaking threaded connection of a HP drain valve

What are Critical Leaks ?

- Leaks touching carbon steel (bolts & nuts, tubesheets, loose liners)
- Along threaded connections
- Leaking HP piping accessories
- Cracks
- Be aware of end of lifetime conditions

Prevention Measures

- Minimise number of flange connections
- Choose a better (crevice free) design
- Apply more corrosion resistant materials (super duplex)
- Make use of high quality and experienced fabricators
- Perform risk based corrosion inspections including HP piping systems
- Pay more attention to flange connections (flange passport, perform soap test)
- Perform regular plant tours looking for leaks
- **Apply Zero Tolerance for leaks**

Mitigation Measures

- Install ammonia leak detection systems
- Shut down the plant
- Perform a risk assessment
- Flush away solids / dilute and monitor
- No clamping on ammonium carbamate and ammonia lines
- Avoid dripping on carbon steel wall of HP vessels

Conclusions

- Detect leaks at an early stage
- Shut down the plant
- Perform a proper Risk Assessment and assure you know all the possible failure modes. Perform all possible NDT inspections. Search for similar cases in the industry
- Never clamp ammonium carbamate and ammonia lines
- In case of a crack or leak along a threaded connection, shut down the plant
- Take all possible preventive measures to avoid leaks
- **Apply Zero Tolerance for leaks**

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Thank You
Any Questions ?