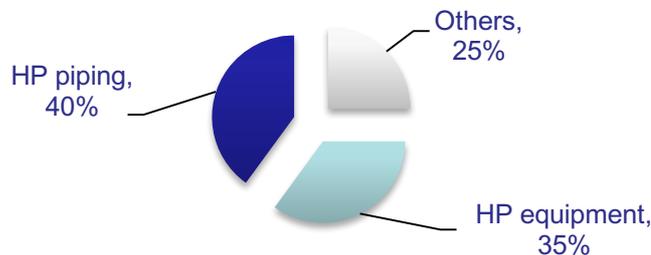


Corrosion Inspection Services of High Pressure Piping in Urea Plants

High-pressure piping is often an area that receives almost no attention during the lifetime of a urea plant; there is no logical reason for this. Paying not enough attention or wrong inspection/repair procedures can lead to catastrophic incidents. During the AIChE Ammonia Safety Conference in 2010 UreaKnowHow.com did present "High Pressure Piping Safety Incidents in Urea Plants" illustrating the risks involved and showing the importance to pay sufficient attention to this part of the urea plant. Furthermore the UreaKnowHow.com Urea Incident Database shows that 40% of the incidents are related to high-pressure piping. Refer to the figure below.



In urea plants typically 316L urea grade is applied as the material of construction for high pressure piping systems; these materials experience corrosion in the presence of ammonium carbamate. Two principle types of corrosion need to be distinguished: passive corrosion as occurs in liquid lines and active corrosion. Active corrosion phenomena like crevice corrosion and erosion corrosion are dangerous type of corrosion in pipelines. A very critical failure mode is condensation corrosion that easily occurs in gas pipelines. All abovementioned forms of corrosion need to be detected in an early stage and well-timed corrosion inspections are key to detect such corrosion forms in time and avoid incidents and unplanned shut downs.



The pictures above show typical consequences of condensation corrosion and in which forms condensation corrosion may occur. Carbamate containing gas condenses on cold spots and the then formed liquid ammonium carbamate does not contain sufficient oxygen so active corrosion instantly starts.

It is good practice to apply properly tracing and carefully insulate gas phase high-pressure lines to maintain a process temperature higher than the dew point of ammonium carbamate gas phase. However damaged insulation or water ingress as a result of wrong application of the supports/tracing/insulation can cause heat sinks leading to condensation corrosion. Refer to the picture on the right side.



Also atmospheric corrosion phenomena from the outside of high-pressure piping can endanger the integrity of high-pressure pipeline systems in urea plants. During asset lifetime studies in urea and ammonia plants several times severe external corrosion was encountered.

Corrosion under insulation is one of the key items for further detailed investigation as it is a significant concern for safety and costs of the piping systems.

Many incidents of Stress Corrosion Cracking are known and reported in literature. The trans crystalline cracks in an austenite form a vicious kind of failure mechanism as the loss of integrity can occur by surprise. In the high-pressure pipeline system of a urea plant the most common critical combination is austenitic stainless steel with chloride ions, especially in plants in coastal areas. The reported incidents show that the sources of chlorides are not always obvious and one should realize that already small quantities and then accumulating can cause already problems.

It is recommended to have a corrosion inspection of 316L Urea Grade high pressure piping in urea plants after some 10 years on stream time.

UreaKnowHow.com has the expertise and experience in corrosion inspections of high pressure piping in several urea plants.

UreaKnowHow.com offers the following services for your next corrosion inspection of the high pressure piping system:

- ✓ Advise to determine the scope of corrosion inspection
- ✓ Advise which corrosion inspection techniques to be applied
- ✓ Support to interpret the corrosion inspection results
- ✓ Recommendations how to minimize future corrosion failure modes
- ✓ Recommendations how to repair / replace high pressure piping parts
- ✓ Recommendations how to improve the reliability of piping accessories and valves
- ✓ Recommendations when to perform follow up corrosion inspections

Please contact us for more information or an offer:

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