

# AMMO LASER Leak Detection System

## The #1 Safety Measure for Urea Plants with a Guaranteed Pay Back

### Question 8:

### How a vacuum system is able to distinguish a false indication from an ammonia cloud in the atmosphere from a real liner leak ?

High pressure urea equipment consists of a carbon steel pressure bearing wall, which is protected against corrosion by a protective stainless, titanium or duplex steel layer. This protective layer can be an overlay welding, an explosive cladded layer or a loose liner. Any leak in a loose liner will lead to a dangerous situation in that a large surface of the carbon steel pressure bearing wall underneath the leaking loose liner compartment will be exposed to the extremely corrosive ammonium carbamate. Experience has shown that ammonium carbamate can corrode carbon steels with very high corrosion rates up to 1,000 mm (40 inch) per year.

When talking about active leak detection systems, one can distinguish a pressurized system, in which an inert carrier gas stream flows through the leak detection circuits and a vacuum based system, where one pulls vacuum pressure behind the liner. We recommend a vacuum based leak detection system for several reasons.

But how can a vacuum system distinguish a false indication from for instance an ammonia cloud in the atmosphere from a liner leak ?

Active leak detection systems consist of a network of gas-tight high quality instrumentation stainless steel tubing but, even gas-tight tubing may leak to a certain extend depending on the quality of the connections made.

In case of an active vacuum system depends the actual vacuum pressure on the result of the sum of all leaking connections on one side and the capacity of the vacuum pump on the other side.

Typically, the vacuum pressure will be in the range of 0.2 to 0.5 bar-abs depending on the quality of the installation.

Together with the continuous monitoring of the vacuum pressure an active vacuum leak detection system also contains a continuous ammonia analyser. Our AMMO LASER Leak Detection System makes use of a very reliable, accurate, self-calibrating and multi-purpose ammonia analyser and alarms at an ammonia level of 100ppm.

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An ammonia cloud in the atmosphere will most probably be sucked into the vacuum leak detection system. It is however impossible that the ammonia cloud will penetrate via all the leak detection connections of the tubing. That will only be the case in the unlikely situation that such ammonia cloud covers the complete high pressure urea synthesis section.

It is much more likely that an ammonia cloud will penetrate in only a part of the connections while all other connections will suck in air with hardly any ammonia. This situation will result in a small increase of the ammonia level from 2-3ppm to some 10-20ppm. The DCS operator will then be notified of an ammonia leak in the synthesis section, like there can be a leaking flange connection or a local small ammonia cloud as a result of taking a sample. Subsequently one is able to take proper actions. After the leak has been eliminated, the ammonia level in the leak detection system will reduce again and return to the normally existing background ammonia level in the atmosphere in the urea plant (for example 2-3ppm).



**Figure: A leaking flange connection**

A liner leak will cause that the leaking fluid in the leak detection system will be sucked by the vacuum pump to the ammonia analyser. The leaking fluid contains minimum 30wt% ammonia (note that ammonium carbamate dissociates into ammonia and carbon dioxide). Even a small liner leak will quickly result in an ammonia level of 100ppm and thus an alarm will sound. Furthermore one can be sure that a liner leak will slowly increase in size due to corrosion and erosion and this will result into a continuously and gradually increasing ammonia level.

In this way the AMMO LASER Leak Detection System distinguishes a false indication from an ammonia cloud in the atmosphere from a real liner leak.

Furthermore the AMMO LASER Leak Detection System will be able to inform the DCS operator that for example a flange connection in the high pressure urea synthesis section starts to leak.