

■ **Course title:**

## **Stress Corrosion Cracking (SCC) in Anhydrous NH<sub>3</sub> Storage Tanks**

### **Root cause, preventive measures, inspection and repair**

■ **Introduction:**

This course will contribute to a better understanding in the root cause and mechanism of NH<sub>3</sub> Stress Corrosion Cracking (SCC). Information is presented regarding preventive measures and inspection technologies on this failure mode. The target group of this course comprises process, mechanical and inspection engineers of fertilizer plants handling liquid ammonia.

*Duration 3 hours.*

■ **Course outline:**

### **Module 1**

1. Introduction.
2. Kjeller Ammonia SCC projects (KASP), susceptibility of carbon steels to ammonia SCC and effect of oxygen and water content NH<sub>3</sub> SCC.
3. Stress corrosion crack growth studies.
4. Appearance and localization of cracks and stress corrosion cracking in different weld material.
5. Mechanism of NH<sub>3</sub> SCC and cathodic protection (CP) by zinc spray.

### **Module 2**

1. Practical experiences with NH<sub>3</sub> SCC in storage tanks/spheres.
2. Inspection of NH<sub>3</sub> storage tanks/spheres based on:
  - Risk Based Inspection (RBI) approach.
  - Inspection techniques.
3. Repair in case of defects and Conclusions.
4. Recommendations for reducing SCC.
5. Inspection of ammonia storage tanks and spheres.

Author(s) / Trainer(s):



### **Giel Notten**

Materials & Corrosion Engineer,  
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Giel Notten is a materials and corrosion expert who, spent thirty-eight years working with DSM in The Netherlands. After gaining his Chemical Engineering degree he joined DSM's Materials and Corrosion Department and was heading this Department as Managing Senior Corrosion Engineer. In this job he was involved in a broad range of consultancy activities for numerous (petro-)chemical plants. For Stamicarbon, a previous subsidiary company of DSM, and licensing DSM's know-how, he set up programs for lifetime assessment studies, based on RBI philosophy, in numerous urea and ammonia plants and supervised these studies. Giel was also involved in the development of Safurex<sup>®</sup>, the super-duplex stainless steel grade (developed by Sandvik in cooperation with Stamicarbon) for application in Stamicarbon urea plants.

He was a board member of NACE Benelux and a member of the Contact Group Corrosion of the Dutch Chemical Process Industry.

Since his retirement from DSM, Giel started his own company NTT Consultancy in 2006 and has remained active as a materials and corrosion engineering consultant for many companies all over the world. He has devoted much of his time to passing on his knowledge and experience on the topic of corrosion engineering to a new generation of engineers in corrosion courses and trainings; numerous trainings have been presented. In cooperation with UreaKnowHow (in-house) training sessions have been organized and presented to more than 1000 urea engineers, managers, (shift-) supervisors and operators from all over the world.

Several workshops have been presented in cooperation with UreaKnowHow for CRU in Nitrogen & Syngas Conferences.

Giel published many technical papers in reputable industry magazines and collected his knowledge and experience, illustrated with numerous cases of corrosion, in a book entitled Corrosion Engineering Guide.

#### ■ Learning outcomes:

By the end of this course, you will understand:

- The risks of NH<sub>3</sub> –SCC.
- The mechanism of NH<sub>3</sub> –SCC and the parameters influencing this failure mode.
- How to mitigate the risk of NH<sub>3</sub> –SCC.
- How to perform inspections based on an RBI philosophy.

#### ■ Who will benefit:

Employees who are responsible or share responsibility with respect to the mechanical integrity of equipment for storage and transport of liquid ammonia: process, mechanical and inspection engineers.

#### ■ Course materials:

- Hand-out presentation slides in PDF format
- Technical paper: **Stress corrosion Cracking in Anhydrous NH<sub>3</sub> Storage Tanks and Spheres**; Root cause, preventive measures and inspection; pdf of word file

#### ■ Price:

**€ 350**

#### ■ Discounts:

- 2 places – 10% discount
- 3 places – 15% discount
- 4 or more places – 20% discount.

#### ■ In-company training:

This course is also available as an in-company course (face-to-face or online) where content can be customised to meet your organisation's specific needs and delivered on a date/location that suits your requirements.

[Contact us](#) for more information.

#### ■ Training code: MAT01

On request the electronic (recently revised) version of the Corrosion Engineering Guide (> 800 pages) is available for additional costs of **€95.00**

