

Reference letter

Concerning:

Reference Letter – Risk Based Inspection at OCI Nitrogen

Geleen (NL), May 1, 2021.

In the name of OCI Nitrogen, I state that PDM has successfully completed the assignment to implement our Risk Based Inspection process for our ammonia plants at Chemelot.

During this assignment, PDM has implemented the RBI process in our organization, which enables us to better manage the integrity of our assets, ultimately resulting in less unplanned shutdowns and higher utilization rates.

The project description is attached to this certificate.

We wish PDM success with their future projects

Sincerely,



Gert-Jan de Geus
CEO
OCI Nitrogen B.V.

Case: OCI Nitrogen Manufacturing Ammonia

Risk Based Inspection (OMA Reliability By Integrity)

OCI Nitrogen is a nitrogen fertilizer and melamine producer with nine plants located at a fully integrated production site in Geleen, the Netherlands. The main raw material for these plants is ammonia that OCI produces in two ammonia plants (OCI Nitrogen Manufacturing Ammonia, OMA).

BACKGROUND

OCI understands their production facilities may experience unplanned shutdowns or utilization rate reductions, which will result in lost volumes and unplanned costs.

From that vision, the OCI organization highly values the integrity of the ammonia plants. Good integrity prevents unsafe situations, failure of static equipment, insufficient availability of the plants, and impact on interconnected plants.

To improve the integrity and reliability of the ammonia plants, the Risk Based Inspection methodology had to be implemented and the related way of working had to be changed. The new 'fit for the future' situation should be usable as a blueprint for other OCI entities. For this purpose, OCI executed the **ORBI** project (OMA Reliability By Integrity).

ASSIGNMENT

OCI has asked PDM to design and implement the RBI process, fully embedded in the organization. OCI also involved their regular technology partner Sitech Services B.V. PDM and Sitech collaborated closely, each with their own responsibilities. PDM implemented the RBI process and managed the associated change; Sitech provided technological expertise, particularly with regard to the manufacturing process and materials (corrosion).

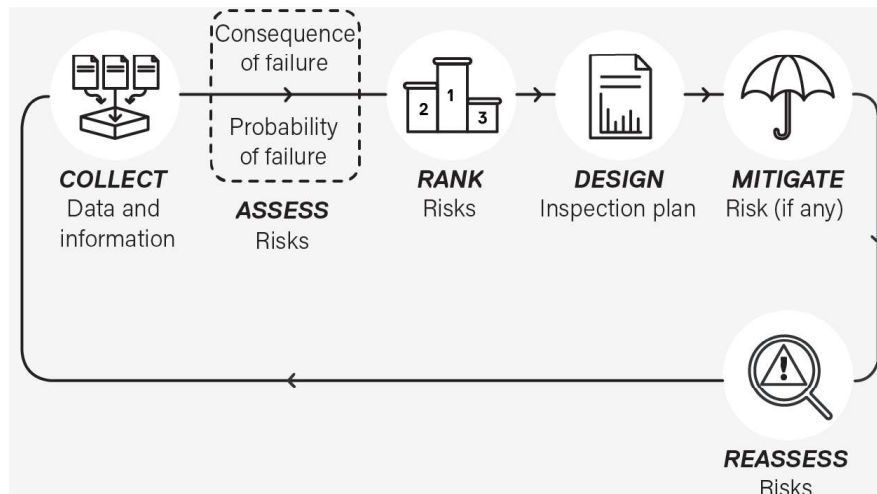
PDM's impact is described below, after a brief introduction, which shows that RBI has clear relevance to OCI's ammonia plants.

RISK BASED INSPECTION

Risk Based Inspection (RBI) is an effective and efficient inspection management & planning methodology. RBI contributes to the integrity and reliability of **static assets** in industrial facilities. It helps to properly allocate the inspection resources to the static assets with the highest risk profiles that need the most attention. Therefore, it is recommended to use RBI as a default method, rather than waiting for static asset failures, with related unsafe situations and consequential damage.

RBI helps to control deterioration mechanisms, such as corrosion, corrosion under insulation, metal fatigue, stress, and chemical attack, which can cause serious incidents like explosions, emissions of toxic gases, or large fires.

Case: OCI Nitrogen Manufacturing Ammonia



RBI has five deliverables, notably:

1. Prioritization of high-risk components: WHAT to inspect
2. Determination of inspection intervals: WHEN to inspect
3. Expected damage mechanisms: WHERE to inspect
4. Selection of best inspection method: HOW to inspect
5. Data requirements for continuous improvement: WHAT to report.

RBI is a cyclical process with six steps (see figure):

1. Data and information collection
2. Risk assessment
3. Risk ranking
4. Inspection plan
5. Mitigation
6. Reassessment.

PDM has published the white paper "Risk Based Inspection – Setting the Right Priorities". This document describes the RBI background and methodology in more detail and is available upon request.

PROJECT APPROACH

An important aspect of the ORBI project was the multidisciplinary approach, which was continued after the project was completed. This means that people from different disciplines in the organization are involved in RBI, notably:

- Material & corrosion expert
- Reliability engineer
- Integrity engineer
- Process engineer
- Inspection personnel
- Production representative
- Technical Manager.

Sitech provided expertise with regard to the assets and the set-up of the library with descriptions of failure mechanisms.

Case: OCI Nitrogen Manufacturing Ammonia

1. Setting up the RBI process

PDM developed the optimized **RBI process** in collaboration with stakeholders, who participated in several workshops. In fact, PDM tailored the standard API 580 process to the OCI organization. Since RBI is a **cyclical** process, it triggered several changes in the organization, such as:

- Increased risk awareness with regard to integrity
- Optimization of the inspection & monitoring planning (proactive), instead of efforts after incidents (reactive)
- All static equipment is covered by the RBI approach
- The inspection & monitoring planning is based on data and involves multidisciplinary collaboration
- Continuous improvement of the failure mechanisms library
- All failure mechanisms are described for all parts of the installation
- More attention for critical failure mechanisms through better risk assessment
- More (online) monitoring of failure mechanisms with a high risk, for example in locations that are difficult to reach
- Workload is based on the Integrity Operating Windows (IOW) instead of the Operating Windows (OW)¹
- One user-friendly APM system, in which knowledge and the process are secured, available to all involved
- Inspections are performed and reported with a tablet.
- The stakeholders were encouraged to adopt the new way of working.

2. Meeting structure conform PDM Best Practice

PDM also provided guidance in setting up a new **meeting structure** to ensure that the RBI process is maintained.

There are two meetings:

- Plant Integrity Meeting (PIO)
- Management Integrity Meeting (MIO).

These meetings were crucial in implementing the above changes. In fact, these meetings are now considered part of the RBI process; with experts in the PIO and management in the MIO.

PDM has described in detail the roles of the participants, including RASCIs. PDM has introduced the Terms of Reference (TOR). The TOR describes the characteristics of these meetings: dates / times, location, purpose, participants (functions, names), basic agreements, required input (including key performance indicators via dashboard), output (including action and decisions logs), and agenda.

PDM guided the implementation of the TOR, which led to a greater efficiency of the meetings, especially in terms of output.

The PIO provides input for the MIO, such as inspection results with proposals for mitigating measures and risk assessments. The MIO makes decisions and sets priorities to address integrity issues. The PIO has executive and advising roles, while the MIO has a decision-making role and is concerned with getting and staying in control.

¹ The Operating Windows provides the margins for manufacturing a good product, the Integrity Operating Window also takes the integrity of the plant into account.

Case: OCI Nitrogen Manufacturing Ammonia

PDM has defined a few key performance indicators that are displayed in a dashboard, developed by Sitech:

- Number of unresolved overruns of OW/IOW
- Follow up of work orders
- Follow up of mitigating measures
- % of inspections that lead to follow-up actions
- % of inspections completed on time (plan versus actual).

3 – Way of working

The RBI planning in the organization is now a **continuous process**, including ongoing management, regulatory inspections and status monitoring.

PDM was not involved in the way in which the inspections and monitoring are carried out.

PROJECT RESULTS

Success factors were creating support, connecting people, and guaranteeing continuity. OCI has estimated that the entire integrity management process has improved from a score of 6+ to 8. This improvement was accompanied by a change in mindset.

The most notable results of the practical approach of PDM's change and project management are:

- Updating failure mechanisms is now a continuous process, instead of a periodic bulk upload
- There is an automatically updated monitoring plan, with actions per critical location, instead of a reassessment plan that is periodically updated manually
- Inspections and monitoring are based on assessments and reassessments, instead of the current status of equipment
- The updating of risk assessments follows a cyclical process that has replaced periodic meetings
- And – probably most importantly – the employees involved are enthusiastic about the new way of working. They are aware of the new methodology and their roles in a multidisciplinary setting
- The way of working at OMA can be implemented at other OCI entities.

The new meeting structure has enabled the organization to better assess the results of inspections. Thanks to the multidisciplinary approach, experts are getting more hearing and integrity issues are judged from different perspectives. For example, different than expected it can be concluded that a specific part does not need replacement, so that it's not necessary to shut down the whole plant.

The impact of our work

“We now look much more multi and interdisciplinary and discuss the consequences based on the failure mechanisms. This provides insights into what could possibly be done differently. For example, that we can perform certain inspections externally instead of during the turnaround. It has been a very pleasant and interesting project. We really started looking at the installation from a different perspective.”

Rita Joosten – Technical Manager – OCI Nitrogen

“I’m most excited about the PIO, how we implemented that. I think that the integrity status of the plant is much more visible than three years ago. With a focus on the failure mechanisms and how we look at those. It was an eye-opener that much more is possible. In this way we can prevent incidents in the future. It looks like a well-oiled machine.”

Patric de Konink – Plant Manager – OCI Nitrogen