Operation optimisation and troubleshooting for Ammonia and Urea technologies

Case Study

About us

UreaKnowHow.com (UKH) and AmmoniaKnowHow.com (AKH) provide Engineering support and Operational expertise specifically to operators in the Nitrogen Fertiliser Industry.

UKH and AKH comprise a team of Ammonia and Urea specialists with experience in operation, project development, revamp solutions and mechanical completion of large scale fertilizer projects worldwide.

Our services include, but not limited to:

- Greenfield and Revamp projects support for Nitrogen Fertilizer technologies,
- Commissioning and Operation support for Nitrogen Fertilizer technologies,
- Training courses for Operation, Process Safety and Maintenance for Ammonia and Urea plants.

Introduction

Recently AKH and UKH were engaged by a European fertilizer manufacturer to support with:

- Identification of causes of major operational issues for Ammonia and Urea plants;
- Identification of other potential threats for operator safety and plants integrity, and
- Provide recommendations and technical solutions for future improvements.

Background

The scope of work covers two Ammonia plants based on KBR technology, and one Urea plant based on Stamicarbon technology. Build in the 1970's all three plants benefit of various degrees of revamps and modifications with various contractors. The latest revamp was in 2014-2015 with the following goals:

Ammonia plant:

- Increase production capacity;
- Reduce energy consumption;
- Meet all environmental requirements;
- Upgrade the automated control and control system.

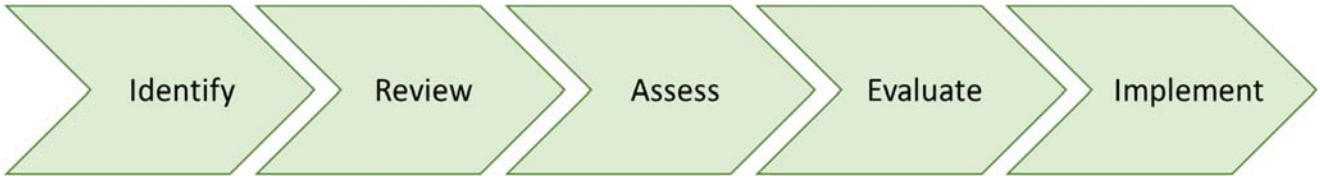
Urea plant:

- Increase name plate capacity;
- Urea production for UAN, Melamine and/or granules instead of prills;
- Flexible, reliable and safe operation;
- Minimizing the HP steam consumption and LP steam export of the urea plant;
- Low dust emission of the granulation via a water scrubbing system;
- Low ammonia emission of granulation and urea plant via an acidic scrubbing system;
- Good effluent quality (low ammonia and urea content) of the purified process condensate from the waste water section.

Our approach

Due to the Project complexity and large volume of available information UKH and AKH team decides to split the job in five different phases and approach them one by one using different engineering and safety studies techniques to maximise the quality of results.

The project phases are described below and detailed further in this paper.



Identify

The initial phase consists in identification of major operational issues that client operator must deal with during commissioning and start-up as well as in normal operation.

Client operators did provide a comprehensive list with problems and detailed description of the plant upsets and behaviour during operation.

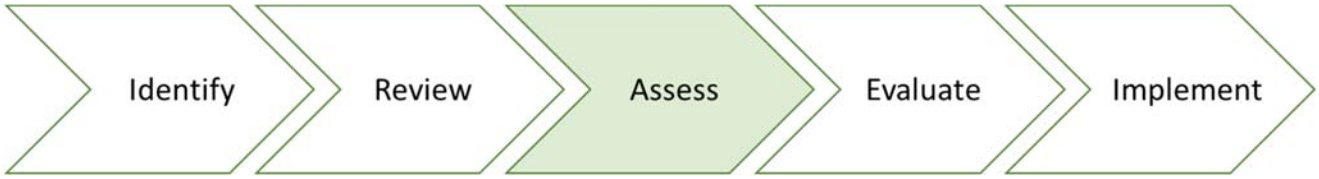
Additional site visits and meeting with client helped to provide more clarity around the major concerns.

Review

In the second phase Client documentation was received and reviewed in association with information provided initially, during the first phase, regarding plant issues.

Weekly Skype meetings with Client operators were held with the purpose to put more clarity around the context, to understand the operation parameters, the As Built design and to prepare the next phases of the Project.

Assess



During Assess phase the AKH and UKH specialists did meet with Client operators and engineering team in a formal Operational HAZOP meeting, specially tailored for their purpose, that included discussion around the major operational issues identified in the previous phases. The purpose of the Operational HAZOP was:

- Check the safety and operability of a new design;
- Check the safety and operability of a proposed modification;
- Reducing / eliminating commissioning, start-up and shut-down problems;
- Reducing / eliminating plant operating problems;

- If existing safeguards are considered inadequate, propose actions to address the potential hazard or operability problem.

The AKH and UKH team did comprise the following specialists:

- HAZOP Chairman for Urea and Ammonia study;
- Independent process expert for Ammonia technology;
- Independent process expert for Urea technology;
- Independent process safety expert with Ammonia expertise.

The AKH and UKH specialists were responsible for the following activities and deliverables:

- HAZOP study methodology and strategy;
- HAZOP preparation and node selection;
- Sharing technical experience from multiple projects to improve study outcome and results;
- Sharing knowhow and expertise with the Client operators during the study to improve operability;
- Recommend actions to improve operability and reduce the likelihood of potential hazards;
- Implement and Action Tracking software system and action close-out procedure;
- Develop and implement the Risk Register platform;
- Deliver the HAZOP report.

The total duration of the studies was:

- 8 weeks for Urea plant (135 P&ID's) and
- 10 weeks for Ammonia plants (53 P&ID's).

The outcome consists in:

- 742 actions for Urea plant;
- 525 actions for Ammonia plants.

All actions will be part of an evaluation process consisting in prioritisation based on criticality. A close out procedure will be developed by AKH and UKH specialists.

A custom build software platform that includes both Action Tracking Register and Risk Register will be implemented for monitoring the risks level and action close-out progress.

Note:

Extensive international project experience from countries like Saudi Arabia, Egypt, Holland, Algeria, Vietnam, Emirates, Romania, Turkmenistan and others was brought to the table during the meeting to improve the HAZOP study results.

Various case studies were presented and debated and the overall outcome of the study was significantly improved comparing with a standard HAZOP study where only local operation knowledge is used.

Studies results:

The detailed HAZOP study analysis performed by UKH and AKH with the advantage of using external independent expertise allow us to accurately identify actions for future implementation with the purpose of increasing the operation safety and reliability.

To increase the level of accountability and responsibility, we also identify the area of cross collaboration between various disciplines. These joint responsibilities will be implemented in the Action Tracking Register to ensure the collaboration and technical support between disciplines.

The actions distribution based on disciplines is as following:

For Urea plant, a total of 742 corrective actions was distributed as following:

Instrumentation	16%
Revamp Project team	30%
Operation	18%
Maintenance	6%
Safety	5%
Operation/ Instrumentation	4%
COMPANY	3%
Engineering	3%
Operation/Safety	2%
Operation/ Project team	1%
Operation/ Maintenance	1%

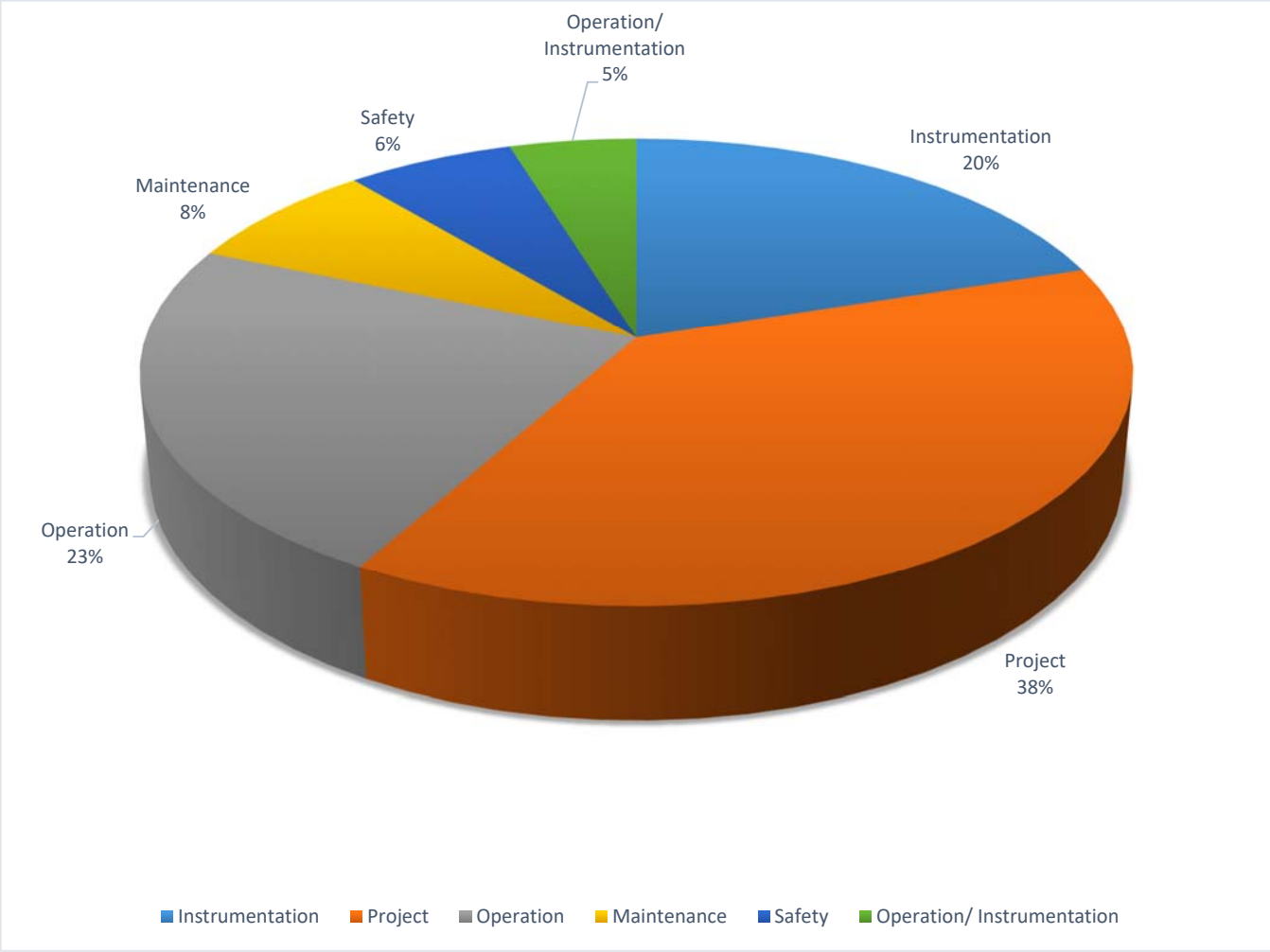


Chart 1. Urea HAZOP actions distribution based on discipline.

For Ammonia plant, a total of 525 corrective actions was distributed as following:

Operation/Instrumentation	46%
Operation/ Instr./ Machinery	17%
Operation/ Maintenance	16%
Operation/ Maintenance/ Machinery	10%
Operation	7%
Operation/ Instr./ Machinery/Safety	1%
Maintenance/Operation/Instr.	1%

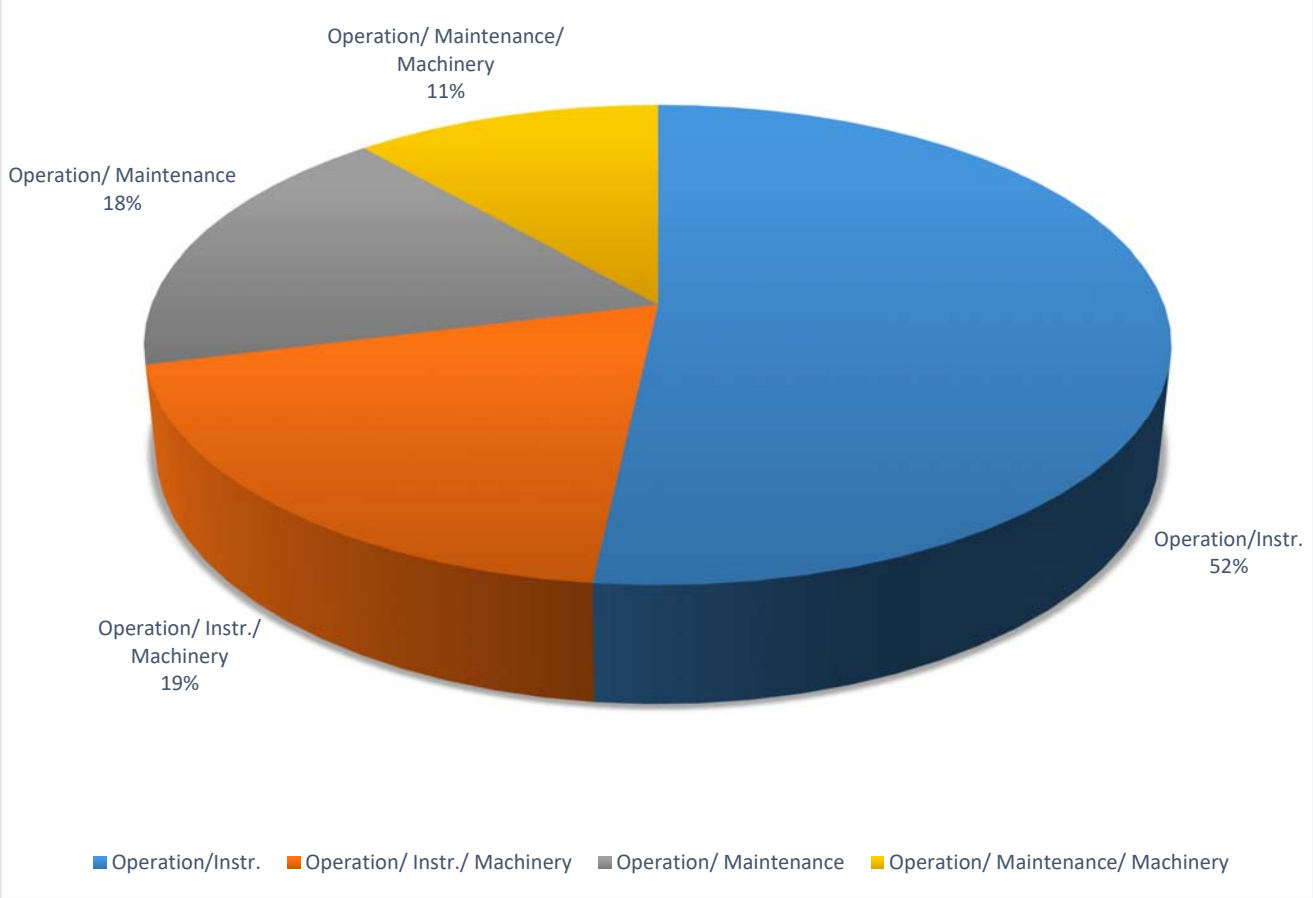


Chart 2. Ammonia HAZOP actions distribution based on discipline.

Evaluate

During the Evaluation phase each risk identified will be discussed and ranked based on Client risk tolerability criteria. Additional actions may be raised during this phase to reduce the level of risk up to ALARP level (As Low As Reasonably Practicable) as per international standards requirements.

All actions will be reviewed and addressed based on a standard close-out procedure developed by UKH and AKH specialists. Some of the actions may require additional studies, and engineering effort to be closed. They will be addressed by the Client engineering team with support from AKH and UKH specialists when required.

A specially designed software tool by AKH, Action Tracking Register, will be used to monitor and track each individual action progress and close-out quality.

Implement

The last phase of the project, the Implementation, consists in application of engineering solution identified during the 'Evaluate' phase and reviewed by a technical committee.

The AKH and UKH specialists may support by advising in selection of best method of implementation, subcontractors, planning strategy and execution.

Industries and technologies

UreaKnowHow.com and AmmoniaKnowHow.com specialists have broad experience with the following technologies:

Fertilizer Technologies
Ammonia
Urea
Ammonium Nitrate
NPK
Nitric Acid

UreaKnowHow.com
Where the urea industry meets

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

Contact details:

Mark Brouwer

Email: mark.brouwer@ureaknowhow.com

Mobile: +31 6 295 76 845

Web site: www.ureaknowhow.com

Dan Cameron Cojocaru

Email: dan.cojocaru@ammoniaknowhow.com

Mobile: +44 7494 783 534

Web site: www.ammoniaknowhow.com