

ProDecon® Case Study UK Refinery

Pyrophoric Direct Reduction Plant



PROJECT HIGHLIGHTS

- ▶ PYROPHORIC IRON SULPHIDE DECONTAMINATION
- ▶ PYROPHORIC REACTIONS PREVIOUSLY
- ▶ DECON-88™ AND PRO-OX™ CHEMISTRY UTILISED
- ▶ TESTING PROVED PYROPHORIC NEUTRALISATION
- ▶ PROJECT DELIVERED EFFECTIVELY AND ON SCHEDULE
- ▶ VESSEL CLEANLINESS REPORTED TO BE VERY GOOD

THE CHALLENGE

ProDecon was asked by a steel producing company in Middle East to decontaminate the CO₂ absorption system on their Direct Reduction Plant (DRP). As a by-product of the process hydrogen sulphide gas is produced and found in the Amine system. Combined with iron, this produces pyrophoric iron sulphide which accumulates in the stripper and absorber columns. When exposed to atmospheric oxygen a strong exothermic reaction is initiated which releases toxic gases. If the reaction cannot be controlled or stopped, it has the potential to permanently damage the equipment and has been known to cause columns to collapse. Previous attempts to complete these works by other contractors had been unsuccessful with violent pyrophoric reactions evolving significant toxic vapour and preventing planned maintenance works.

The target of the works was to provide a safe working environment for the subsequent maintenance works with no H₂S and no pyrophoric materials. In addition to the safety requirements for maintenance, the process should ensure the amine solvent used in the absorption process did not foam on startup, a notorious problem in these systems.

THE SOLUTION

ProDecon developed a 3 stage process utilising its Decon-88™ and Pro-Ox™ chemistries in both liquid and vapour phase. This procedure was employed individually on each column due to the different decontamination requirements. ProDecon's fleet of decontamination equipment enabled rapid international mobilisation of the required temporary piping, pumps and steam

supply, which were connected to client's equipment at predefined points indicated by ProDecon's engineers.

The oxidation stage using Pro-Ox™, a strong oxidiser, was conducted in multiple stages, both in liquid and vapour phase until all the pyrophoric materials had been oxidised. Field and laboratory tests conducted by ProDecon during the process indicated that there was significant solids held up in the columns. This demanded a change to the original planning to mitigate the additional solids levels and potential channelling in the packing. ProDecon's engineers reacted and adapted quickly to these unexpected field conditions and the decontamination was successful and carried out safely.

THE RESULTS

ProDecon successfully completed the project within the allowable timeframe. Sampling and testing proved the efficiency of decontamination and pyrophoric neutralisation. The manways were opened to allow safe packing removal without exothermic reaction and potential fire. The subsequent packing removal was able to proceed immediately and on site comments from the mechanical contractor and client's staff indicated that the work was able to proceed faster than expected. The cleanliness of the vessels' internals was reported to be very good as shown below.



Figure 1: Column packing after decontamination

Following the success of the decontamination on the first Amine system, ProDecon in conjunction with its local partner Petromar, have been invited back multiple times for each of the subsequent shutdowns



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