

Scale Diverter Chute

Incitec Pivot Limited

The Problem or Initiative

During the production of fertiliser, a Sulphuric Acid/Phosphate rock slurry is filtered with the aid of a vacuum process to extract Phosphoric Acid. During the extraction process Gypsum scale builds up on the internal walls of the filter vessels and pipes. The traditional way of cleaning these vessels is to shut the plant down and High Pressure Water blast the acidic scale off the walls. Due to the configuration of the vessels and pipes the removed scale can build up and fall down into the suction side of the acid pumps. This results in further cleaning of the acid pumps. If the scale is not removed totally the acid pumps can be damaged on start-up.

To prevent the pump contamination from happening Maintenance Fitters are required to remove a section of pipe above the pump (just above floor level) and place a cap over the open end of the pipe leading to the pump. When cleaning commences all of the acidic scale spills directly over the floor creating a Health and Safety risk to everyone in the area. The removed scale would then be manually cleaned up using a shovel. Also, the removal of the pipe section would constantly disrupt the integrity of the vacuum system. The section of pipe also holds up other components that have to be manually held in situ during removal and manoeuvred back into place upon assembly.

The cleaning of the filter vessel is an important and routine task but it generates a lot of extra work by having to clean up the hazardous contamination resulting from the High Pressure Water Blasting. The opportunity to “shortcut” the removing and fitting of pipe work exists by not re-fitting all of the pipe flange bolts. This leads to continued disruption to the integrity of the vacuum system. A solution was needed to improve the contamination clean-up process and to maintain the integrity of the vacuum system.

The Solution

A section of the pipe directly below the filter vessel was cut away and fitted with a “Quick Release Insert”. The insert was shaped in the same profile as the internal pipe so as not to disrupt the flow of the Phosphoric Acid. A “Scale Diverter Chute” was manufactured to use the same mounting flange as the Insert. This chute married up to the internal profile of the pipe so that when it was installed it created a seal inside the pipe wall. When the Scale Diverter Chute is installed and cleaning is in progress the removed scale falls down the pipe, hits the Scale Diverter Chute and leaves the pipe to be collected in a wheelbarrow/industrial bin that can be emptied at a later time.



Quick Release Insert in place



Scale Diverter Chute in place



Scale Diverter Chute



View inside pipe
when fitted



View showing
Pipe Assembly
at bottom of
Filter Vessel

Benefits / Effects

- It no longer requires 2 Maintenance Fitters 2 hours to remove the section of pipe and install the blank. The Scale Diverter Chute can be fitted in 5 minutes by one Maintenance Fitter.
- The time taken to dispose of the removed Acidic Scale has been dramatically reduced as it is diverted directly into a wheelbarrow/bin which is emptied at the end of the job.
- It has reduced people's exposure to Phosphoric Acid as the Acidic Scale is diverted directly into a container and not onto the floor to be cleaned up later.
- The integrity of the vacuum pumping system has increased due to less interference in the gaskets surrounding the pipe work.
- The re-work in tightening the flanges surrounding the pipe work after start-up has ceased.
- The manual handling risk has reduced due to the fact that these large sections of pipe are no longer being man-handled in and out of position.

Transferability

The Scale Diverter Chutes are being retro-fitted to all other down-leg pipes where scale collection is an issue. Our Phosphoric Acid Plant expansion project is having Scale Diverter Chutes fitted as standard equipment to all down-leg pipes identified for cleaning.

The Scale Diverter Chute could be used in other industries where a temporary diversion of material is required. The ease of installation and low maintenance design make it a viable solution in hazardous cleaning environments.

The cost is largely driven by the physical size of the chute and the type of material used in its construction. In our highly acidic environment the chute assembly is made from Super Duplex Stainless Steel but there is no reason why it can not be manufactured from mild steel or whatever is appropriate for the material being diverted.

Innovation

The problem was identified by our Production Department with the Health and Safety of the staff conducting the clean up task the driving influence. The challenge to find a solution was placed with our Maintenance Department. A "brain-storming" session was conducted around the pipe work and vessel with various solutions put forward. A prototype of the chute was manufactured and installed and further suggestions for improvement made. The design achieved its purpose however further modifications were made to reduce the physical size and weight of the chute. A new design is being tested for curved sections of pipe work.

The Scale Diverter Chute was designed, built and tested on site.