Project Report

HADEK

PROTECTING POWER PLANT CHIMNEYS

Sadara
Steam Station

Key facts about Sadara Steam Station

- 6 x 80 MW oil and gas fired steam plant
- Alstom New Integrated Design (NID) FGD system
- Six free-standing steel chimneys
- Pennguard® lining system installed in the steel chimneys

Oil and gas fired steam station in Saudi Arabia uses Pennguard® lined free-standing steel chimneys downstream of its FGD systems.

In 2011, The Dow Chemical Company and Saudi Aramco formed a joint venture, the Sadara Chemical Company, which is currently constructing one of the world's largest integrated chemical complexes to be built in a single phase. When it is fully operational in 2016, the Sadara complex near al-Jubail will consist of 26 highly efficient manufacturing plants.

Fluor Corporation has been awarded the EPC contract for all of the utilities at Sadara, which will include a 6 x 80 MW oil and gas fired steam plant.

For the design and construction of the six boilers and the air quality control system, Fluor selected a consortium of Alstom and Cerrey SA de CV. Within this consortium, Cerrey built the boilers and Alstom supplied the Selective Catalytic Reduction (SCR) plants needed for NOx emissions reduction, as well as the Flue Gas Desulphurization (FGD) plants needed for SOx emissions reduction.

For the Sadara FGD system, Alstom used its New Integrated Design (NID) technology, which is a proprietary, semi-dry FGD technology. At Sadara, the treated flue gas has an exit temperature of around 80°C and it is released into the atmosphere through six separate 76 metre high chimneys.

Because of their height, the designers decided that these chimneys would be most efficiently built as free-standing steel stacks. In order to protect these steel chimneys against any risk of acid dew point corrosion, the designers decided to internally line the chimneys with a Pennguard® lining system using 51 mm thick Pennguard Block type 55.

Weld it. Stack it. Line it.

The construction of a very large project like the Sadara chemical complex requires that each and every part is completed reliably, on time, and on budget. This rule also applies to the welding, the erection, and the lining of the six steel chimneys.

The climate in Saudi Arabia is always warm but the region around Jubail, close to the Arabian Gulf, is particularly hot. This had to be taken into account for planning the work sequence on the six chimneys.

Each chimney was welded on ground level, with all ladders, lighting and appendages already installed before erection. Then, the sections were stacked using a very large crane.

Once the chimneys were in place, the Pennguard® lining system was installed in three steps.

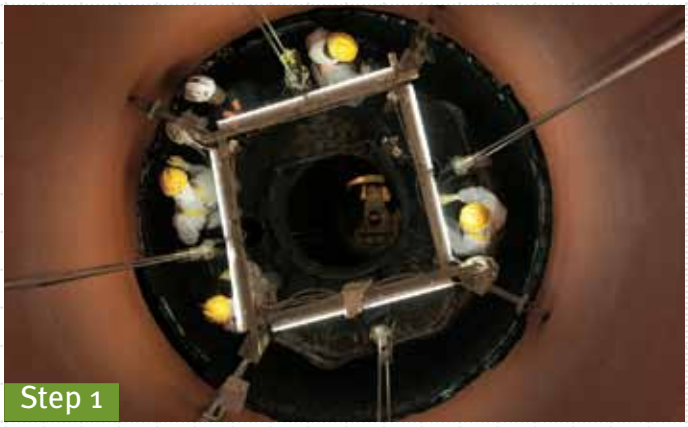
Step 1

A suspended, motor driven platform was installed to allow the installation crews to reach all internal surfaces of the chimneys. Through the center of the platform, a smaller, faster hoist was used to transport the installation team and their tools, as well as the Pennguard® lining materials.

Step 2

The internal steel surface of each chimney was grit blasted to SA 2 1/2 cleanliness (ISO 8501-1:1988). At the end of each work day, the grit blasted area was cleaned and coated with Pennguard® Block Primer.

The grit blasting and primer application work took seven days per chimney, including a final water wash after all primer had sufficiently dried.



The suspended work platforms in the chimneys were big enough for teams of four installers plus Hadek's QA Inspector

Grit blasting the steel substrate

Step 3

Installing the Pennguard® lining

The lining installation team

Hadek's QA Inspector examines the installed Pennguard® lining

Step 3

The Pennguard® lining was applied from bottom to top by teams of four installers. Due to the very hot climate in the area, this work had to be limited to the evening hours.

On this work schedule, the Pennguard® lining installation in each chimney, including Hadek's final QA inspection, took 11 days to complete.

The floors of the chimneys have an additional protection of Tufchem® Silicate Concrete

The six Pennguard®-lined steel chimneys

Pennguard® linings minimize maintenance and repair – both internally and externally

The Pennguard® linings in the Sadara chimneys will protect the internal surfaces of these steel stacks from acid dewpoint corrosion. In the long term, they will also help to prevent external corrosion to these chimneys.

This is because Pennguard® linings are strongly insulating, so the designers can avoid using any external insulation system.

Why is this a good thing?

The answer is that external insulation systems are fixed to the external surface of a steel chimney using anchors and supports, and that they are typically protected against ingress of rain water by a metallic plating system. Over time, the influence of rain, wind and thermal cycles can cause leaks to develop in the metallic plating system. This allows water and condensate to become trapped in the insulation system, creating a severe corrosion hazard that could potentially threaten the structural integrity of the steel chimney.

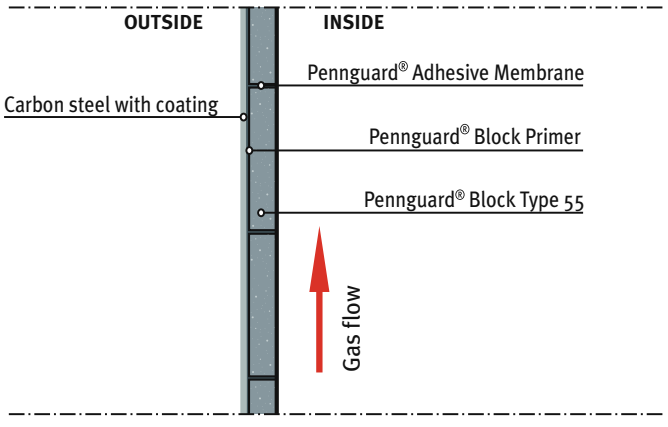
Pennguard®-lined steel chimneys avoid this risk, using only an external coating system to protect the structure against the elements. A modern, well applied coating can protect these chimneys over many years, possibly for the life of the chimney itself.

This photo shows an example of severe external corrosion to a steel chimney that had been externally insulated.

Photo courtesy of Zenith SAS Ltd.

Pennguard® linings are strongly insulating, so no external insulation system is needed

Schematic cross section of the Sadara steel chimney



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