Coal fired Rybnik Power Station applied Pennguard lining to corroded steel chimney flue while leaving old coating system in place

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Albert de Kreij joined Hadek Protective Systems in 1989. He has been closely involved in a number of projects with the use of Borosilicate Glass Block Linings especially in wet stack operation conditions.

1. Introduction

Rybnik Power Station is a coal fired power station in the South of Poland. It has an installed power generation capacity of 1,775 MW, which is installed in eight units. Around 2007, the EDF Polska Rybnik Power Station constructed two wet FGD plants to treat the gas flows from units 5 - 8. In conjunction with these FGD plants, the power station built a new, 120 m high concrete chimney with two steel flues. To protect the flues against corrosion a sprayable organic vinyl ester coating system was applied to the inside surface of the steel flues.

2. Coated steel chimney flue performance

The 120 high chimney, with two 6.95 m diameter steel flues each, operates as a wet stack carrying non-reheated flue gas with an operating temperature of 52 °C. The organic coating system applied in these steel chimney flues appears not to be fully resistant to the acidic condensate caused by wet stack operation.

From the early days of operating the new wet stack, it was clear that the coating system was not functioning well. There were many failure spots over the height of the steel flues, resulting in corrosion and wet external insulation.

Beginning of 2012 the customer decided to investigate other lining solution options for the corrosion problem in the flues. In March 2012 the owner EDF Polska decided to protect one of the chimney flues by installing the Pennguard Block Lining System onto the corroded steel flue surface while leaving the old coating system in place. In April 2012 the project was executed by Uniserv S.A.. Hadek supplied the Pennguard Block Lining System materials as well as the Quality Supervision for all Pennguard lining activities.

Figures 2 and 3: In 2007 EDF Polska Rybnik Power Station constructed a new concrete chimney with two steel flues. An organic coating system was applied to the inside surface of the steel flues to protect the surface against FGD wet stack operation.

Figure 4: Cracking of existing coating
Following a short period of operation, many localized failures of the coating system were found over the complete height of the chimney flues.
3. Customer demands for new protective lining

The corrosion problem continued over the years and the parties involved in the project had to find a final solution. EDF Polska had several demands for a new protective lining. The most important ones:

- Proven resistance to sulfuric acid condensate
- Proven reliability in wet stack environment for 25 years or more
- Ability to apply the lining system within a short time, during a scheduled outage

Figure 9: Adhesion to the coating system surface is stronger than the internal strength of the Pennguard Adhesive Membrane.

Figure 10: Schematic cross section of the Pennguard Block Lining System. The Pennguard lining is applied to the corroded steel flue surface and existing coating system.

Figure 11: wet external insulation removed from the flue (right hand side).
The Pennguard Block Lining System was recognized as the best solution for this problem. Beginning of March 2012 a Pennguard lining test area was installed first and several tests (pull-off/adhesion, peel tests) were done on the old and new coating system.

One of the tests was to determine if the Pennguard Adhesive Membrane would have enough adhesion to the old coating system.

It was found that while pulling the Pennguard Adhesive Membrane, the membrane broke in the membrane material itself. The adhesion to the coating surface was stronger than the internal strength of the membrane.
For this application, Hadek has recommended the Pennguard Block Lining System, using Pennguard Block 55, 38 mm thick.

4. Repair program for steel chimney flue

The flue repair and relining work took place during a 36 days period between 26 March and 30 April 2012, within the time allowed by a scheduled outage.

The program started by the removal of the wet external insulation (figure 11) followed by steel repair activities (figures 12 – 13) from a movable work platform.

After light grit blasting of the complete flue and intensive grit blasting of selected spots (figure 14), the Pennguard Block Primer was applied to the selected spots (figure 15). The installation of the Pennguard lining (figures 16) took 11 days working in a two-shift schedule with 10 workers per shift excluding helpers.

A complete time schedule of the repair program is shown in figure 17.

5. Conclusions

- Localized failure of organic coating is extremely difficult to repair with another coating.
- A Pennguard lining can be applied over pitting corrosion and other small irregularities.
- A Pennguard lining can be applied over surface of organic coating following light grit blasting.
- The repair method used in this project is fast and effective.

<table>
<thead>
<tr>
<th>Task</th>
<th>Duration</th>
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<tbody>
<tr>
<td>Installation of work platform</td>
<td>2 days, 10 workers/shift</td>
</tr>
<tr>
<td>Steel repairs</td>
<td>3 days, 4 workers/shift</td>
</tr>
<tr>
<td>Installation of stopbars / nozzles</td>
<td>3 days, 4 workers/shift</td>
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<tr>
<td>Grit blasting of flue</td>
<td>14 days, 6 workers/shift</td>
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<tr>
<td>Application of Pennguard Block Primer</td>
<td>1 day, 6 workers/shift</td>
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<tr>
<td>Installation of Pennguard lining in flue</td>
<td>11 days, 10 workers/shift</td>
</tr>
<tr>
<td>Finishing works, including Tufchem concrete floor</td>
<td>2 days, 8 workers/shift</td>
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</tbody>
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Total number of work days required for all work in the flue was: 36 days

Figure 16: Corrosion holes and steel repairs

Figure 17. Time schedule of the repair program (two 10-hour shifts/day)