

Project Report

HADEK

**PROTECTING POWER
PLANT CHIMNEYS**

Spurlock Power Station

Key facts about Spurlock Power Station

- 1 x 325 MW,
1 x 525 MW and
2 x 268 MW coal
fired power station
- Wet limestone FGD
on Unit 1 and Unit 2
- No flue gas reheat
- Two new concrete
chimneys with a
Pennguard® lined
steel flue



Large coal fired power station in Kentucky builds two chimneys with Pennguard® lined steel flues for FGD wet stack service.

The East Kentucky Power Cooperative (EKPC) produces electricity for 16 regional power cooperatives, which between them serve one million consumers in 89 counties. The Spurlock Power station near Maysville, Kentucky, is EKPC's largest power station. Spurlock station has recently completed two wet limestone flue gas desulfurization (FGD) systems, each with a new, Pennguard® lined chimney.

The two FGD systems were fitted to the 325 MW Unit 1 (in service since 1977) and the 525 MW Unit 2 (in service since 1981). Both are conventional coal fired Units, using coal with a sulfur content of 3.5 - 4.2 %. The two FGD's will remove some 98 % of the sulfur oxides from the exhaust gas flows of Units 1 and 2. In addition to Units 1 and 2, the

Spurlock station operates two 268 MW circulating fluidized bed (CFB) boilers, which are among the cleanest coal fired units in the United States.

The addition of FGD systems to Units 1 and 2 presented EKPC with several options for the chimneys. Together with their consulting engineers, Stanley Consultants from Muscatine, Iowa, EKPC looked at the possibility of relining the existing Unit 2 chimney to make it suitable for carrying FGD treated, water saturated flue gas.

It was found however, that the fast construction and commissioning schedule of the FGD retrofit project would not allow a sufficiently long outage to achieve this.

Following a technical and economical investigation of all options, EKPC decided to award to Karrena International LLC the design and construction of two, 650 ft high concrete chimneys, each with a single, Pennguard® lined steel flue.

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PENNGUARD® Block Lining System

Construction and lining of the Spurlock steel chimney flues: well planned, well executed, systematically supervised

After considering the jobsite layout, the project time schedule and the weather conditions in Kentucky, Karrena International decided that they would build, grit blast and primer coat steel flue sections on ground level. Once a steel flue was erected by welding these sections together in the windshield, the Pennguard® lining was applied in the erected flue, using a movable work platform.

To ensure the quality of the installed Pennguard® linings in the two Spurlock chimneys, a team of up to three Hadek Quality Assurance (QA) Supervisors was present on-site during the surface preparation and lining installation process. Between its offices in Rotterdam, the Netherlands and Pittsburgh, Pennsylvania, Hadek Protective Systems has a group of 14 Quality Assurance Supervisors who are trained to supervise the complete field installation process of a Pennguard® lining.

These pages show some pictures of the process of constructing and lining the Spurlock steel chimney flues.



1. The steel flue diameter of the Unit 1 chimney is 21 ft. The Unit 2 steel flue is 27 ft in diameter. Karrena decided to pre-fabricate steel flue sections on-site, close to the new chimneys. The grit blasting required for the Pennguard® Block Lining System, as well as the application of Pennguard® Block Primer, were also performed on ground level.
2. Once grit blasted and primer coated, the steel flue sections were carried to the chimney with a mobile crane. The sections were then attached to the flue in the chimney by welding from two sides. The welds were cleaned with power brushes and then hand painted with Pennguard® Block Primer.



3



3. With flue erection complete, Karrena installed a full size suspended work platform to facilitate the installation of the Pennguard® lining system. The platform accommodated a team of up to 10 installers and support workers, who applied the Pennguard® lining from the bottom to the top of each flue. A smaller, faster lift moving through a hatch in the center of the platform was used for transportation of the installation crew, their tools and the Pennguard® lining materials. The lining of the 531 ft tall Unit 1 flue took 45 days and the lining of the 541 ft tall Unit 2 flue took 38 days.

4. Mixing of the two component Pennguard® Adhesive Membrane is a critical step in the application process. For the Spurlock project, Karrena used two of Hadek's proprietary, automated mixing machines. In order to track the quality of the mixing process on a pail-by-pail basis, the staff in charge of the mixing machines produce a small sample card for each pail. Hadek's QA Supervisors will systematically check the curing of the adhesive on the cards, as a first confirmation that mixing has been successful.

5. On the work platform, the installers apply the Pennguard® lining using a double buttering technique while minimizing any air inclusion. The installers apply the adhesive back and side joints at the required 1/8" thickness. The application process is monitored by Hadek QA Supervisors, who also keep track of temperature and humidity at regular intervals. The two steel flues in the Unit 1 and Unit 2 wet stacks have a combined surface of 87,511 ft².

4



5



Fire safety in power plant chimneys: Pennguard® linings reduce fire risk both during and after construction

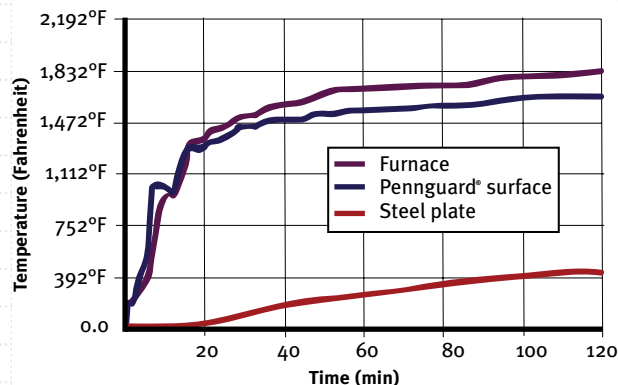
For any power station owner, fire is one of the more serious risks both during the construction of new plant and during operation and maintenance of existing equipment. FGD plants and the chimneys built directly next to FGD plants are no exception. Ever since the introduction of FGD, a number of large fires have occurred in FGD plants in North America, Europe and Asia.

At Hadek's request, the Thermal Sciences group of the Exponent engineering company have performed a study entitled "Performance of Different Chimney Flue Designs During Large Power Plant Fires".

Exponent's study report shows how Pennguard® lined steel chimney flues are effectively insulated from overheating, as they are filled with extremely hot smoke from an FGD or power plant fire. By comparison, steel flues without a Pennguard® lining or FRP flues are more likely to overheat, catch fire and collapse (study report is available on request).

Exponent's test work also included a fire propagation test, to see how a fire could escalate if the joints between Pennguard® Blocks are accidentally set on fire. The test showed that although the joint will catch fire, it will burn slowly and has a tendency to extinguish by itself after some minutes.

The Exponent study shows that although good fire safety practice still has to be followed during construction and operation, the use of Pennguard® lined chimney flues is a valuable, additional step in improving power plant fire safety.



Temperatures measured during the ASTM E-119 test.

Pennguard® lined test wall before the ASTM E-119 test.



Thermocouples for monitoring of steel substrate temperature.



Inside of test chamber during the ASTM E-119 test.

