ErgonArmor™ | PROJECT PROFILE

Relining of Kraft Pulp Mill Chimney Ends Failures in Corrosive Environment

LOCATION
Everett, Washington

OPERATION
Kraft paper production

PRODUCTS
PENNGUARD™ Block Lining System

Challenge: Replacement chimney liner needed given increased corrosion protection demands

Solution: PENNGUARD Block Lining System over reinforced gunite used as parging material

Chimney and stack problems are a way of life in the pulp and paper industry. Acidic, wet flue gasses are a constant source of potential trouble and expense.

Part of the problem is that the chimneys and stacks of several decades ago didn't have to stand all the abuse that is inflicted on them today. The advent of wet scrubbers has helped to produce environments that can be extremely hostile to certain types of lining systems.

Case in point: in 1952, Custodis-Ecodyne Constructors, Inc. of Arlington Heights, Illinois, built a 275 foot chimney for a kraft pulp plant in Everett, Washington. At that time, the chimney was used to vent dry gasses from a chemical recovery boiler used in the pulp-making process. The sectional lining of the chimney was of acid-resistant brick set in PENCHLOR® Mortar, a combination designed to handle the particular requirements at that time.

In 1959, the plant added a wet scrubber to the system, and although this did not create a major drop in the pH within the chimney, it was felt that the lining should be replaced and a more suitable type of mortar used.

A new 4 inch section brick liner was constructed that same year, using a fire-clay solid double-size acid-resistant brick, laid up in a carbon-filled furan resin mortar. A bitumastic liner was troweled onto the inside of the concrete column prior to the installation of the brick.

In 1975, a second recovery boiler was added and the pH of the chimney dropped from 6 to a highly acidic 1.5. By 1978, the lining was showing noticeable signs of chemically-induced failure. In an effort to save it, a fiberglass-reinforced lining was sprayed over the brick liner.

Because of the difference in material properties-primarily expansion coefficients, the FRP lining eventually cracked. Coupled with this was a loss of bonding between the bricks and mortar which allowed corrosive moisture to penetrate the liner system and damage the concrete chimney shell.

The composition of the flue gasses is typical for a kraft pulp mill and includes carbon dioxide, oxygen, sulfur dioxide, reduced sulfur, water and particulates.
Temperatures range from approximately 90°F — 350°F, depending on the combination of boilers, kiln and scrubbers in use. For the most part, the operation is such that a highly-corrosive wet environment is produced.

In the Fall of 1982, Custodis was awarded a contract to remove the FRP/brick liner and replace it with a lining of closed cellular foamed borosilicate glass block (ErgonArmor's PENNGUARD Block), a lightweight, totally inorganic material that is highly resistant to high-temperature flue gasses as well as acidic flue gas condensates.

The lining was removed, the corbels inside the chimney were cut out, and the concrete cleaned and then restored with a 2 inch reinforced gunite liner, troweled to a continuous, uniform surface.

Custodis used nearly ten thousand square feet of PENNGUARD Blocks, each 6 inch x 18 inch, bonding them directly to the applied gunite lining with a 1/8 inch thick layer of an acid-resistant urethane asphalt adhesive membrane (PENNGUARD Adhesive/ Membrane). A 2½ inch thick block used in the lower portion of the chimney insulated the adhesive membrane from the higher temperatures in that area; 2 inch thick block was used in the remainder of the column.

After 14 months, a scaffolding was hung inside the chimney so that a full, 360° top-to-bottom inspection could be made. It showed the lining to be performing most satisfactorily. There was no evidence of cracking or of thermal or chemical damage.

Observed performance to date points to a very long life for the PENNGUARD Block lining system in the kraft pulp mill chimney project.

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