Public Service Company of New Mexico Switches to High-Tech Rigid Plastic Lining System to Rescue Failing SO_2 Scrubbers

The San Juan Generating Station of the Public Service Company of New Mexico (PNM), located near Waterflow, New Mexico, is one of the largest coal-burning power plants in the United States.

Approximately 10 years ago, an SO_2 scrubber system was built for this facility. The absorber cells of the scrubber system have presented maintenance problems from the time of installation, since their corrosion-resistant acid brick protective system would bulge and erode. Corrosion, which was controlled, also penetrated the structural walls of the cells.

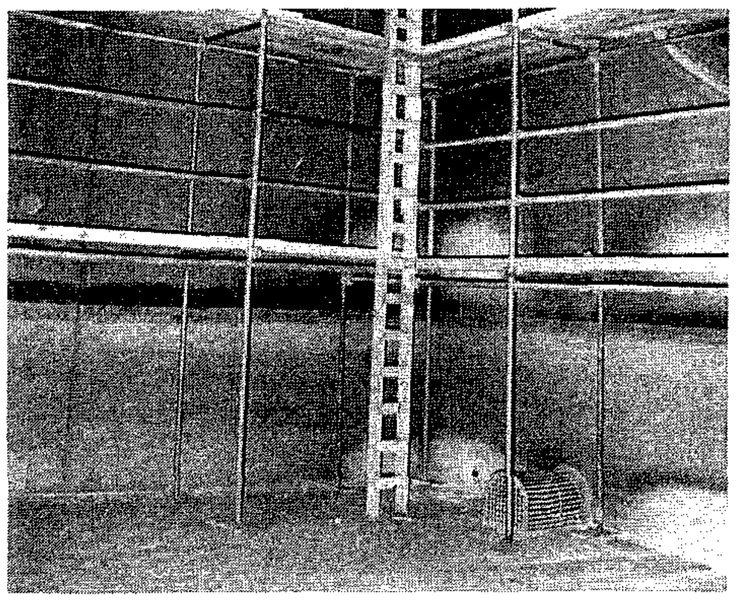
Designed to remove SO_2 from low-sulfur coal flue gases, the scrubber consists of four banks, each with four cells. Chris Budd, PNM's Project Engineer, explains, "Each absorber cell is about 35 feet long by approximately 33 feet wide and over 70 feet high."

Flue gas containing ash, sulfur dioxide and varying other compounds is forced into electrostatic precipitators which remove the ash particulates. Sulfur dioxide (SO_2) and other flue gas components are removed in the absorber cells, where the hot flue gas is scrubbed with a sodium solution before the scrubbed gas is released into the atmosphere. The flue gases are highly corrosive when quenched, and as a result, the cells must be lined with a corrosion-resistant material to prevent damage to the structure.

The Problem

"The original acid-resistant brick liner had collapsed into the sumps of a number of cells, causing costly downtime and very high repair costs," Budd explains. "We knew we needed a different solution to the brick liner failure problem and investigated several different options."

PNM commissioned a number of studies to find the reasons for the membrane, tile, and brick lining failures. Some of the conclusions which resulted from these studies indicate that:



Seen is interior of cell along with Bekaplast floor.

- Thermal upset temperatures of 275°F./135°C. were too high for the acid brick lining, membrane and expansion joints.
- The gases scrubbed in these cells are a constantly changing mix, based on the quality of coal being burned. While the original brick lining was not designed to accommodate fluorides, trace amounts scrubbed out of the flue gas were sufficient to cause severe erosion of the fireclay brick lining while leaving the carbon-filled resin mortar joints intact.
- Thermal expansion and contraction during operation reduced the compressive force on the lining allowing it to buckle.

The Solution

When asked to submit a proposal for retrofitting a new lining in one cell, Atlas offered both the Bekaplast Lining System and a brick system, and urged PNM to consider the Bekaplast as the best alternative.

Bekaplast, a unique patented rigid plastic lining system, consists of flat thermoplastic sheets and anchoring studs sonically welded to the back side. The anchors, once embedded in concrete, mechanically hold the sheets in place without relying on surface bonding of the sheet to the concrete substrate. The Bekaplast system offers many unique features unavailable in a tile, brick or resin lining system:

- It is cost-effective when compared to the brick lining systems, which would have required considerable structural work.
- Bekaplast offers high abrasion resistance, resistance to all potential corrosives in quenched flue gas and a smooth, non-porous, easy-to-clean surface.
- The anchor studs embedded in the "concrete over pour" make the Bekaplast Lining System an integral part of the scrubber's structure.
- The Bekaplast Lining System compensates for the differences in expansion and contraction between the concrete and the rigid plastic sheet material during thermal cycling, normal service temperature, and in upset conditions of 275°F./135°C. for one hour.
- The elasticity of the thermoplastic Bekaplast Lining System allows it to bridge small cracks in the concrete substrate without rupturing.
- The Bekaplast can be spark-tested to insure the integrity of the lining.
- The Bekaplast Lining System would also features a leak detection system. PNM decided that the Bekaplast Lining System offered a cost-effective, long-term solution to the problem of acid brick liner failures.

Installing the Bekaplast System

Installation of the Bekaplast Lining in SO_2 Scrubber Unit 3 "K" cell was begun June, 1988 and the work was completed November, 1988.

"This was a new kind of installation for Atlas and for us," Budd said. "As a result, there were a lot of things to work out."

Before the Bekaplast System could be put in, Public Service Company of New Mexico had to remove the existing brick lining. Next, the wall was cleaned, preparing it for installation of an additional steel-reinforced concrete wall-over-pour. Dowels were installed and tied with vertical reinforcing steel on all four old walls.

A leak detection and drainage system was installed at the base, between the existing wall and the new concrete over pour, for three reasons. Bob Wagner, Atlas' Engineering Manager explains:

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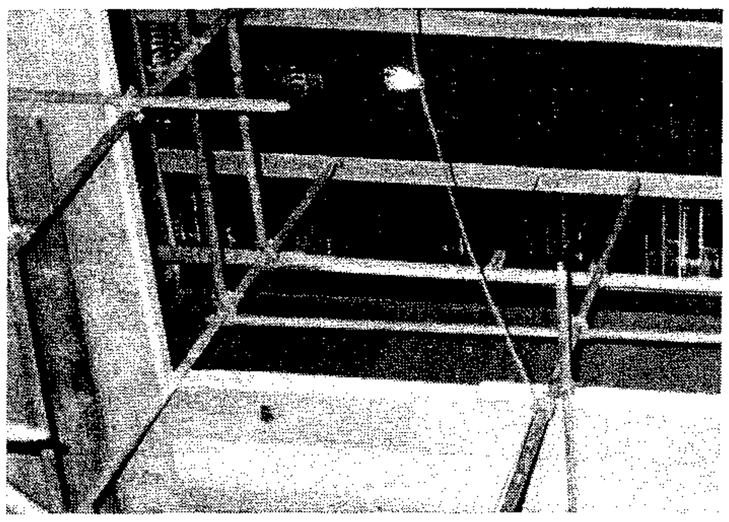
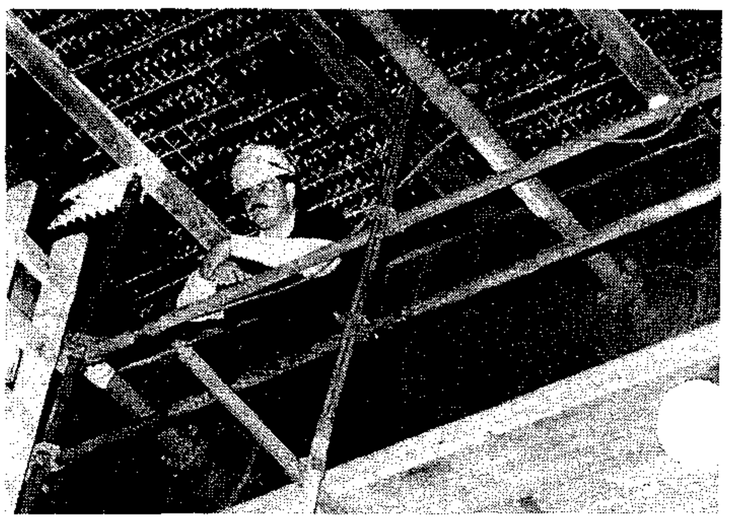
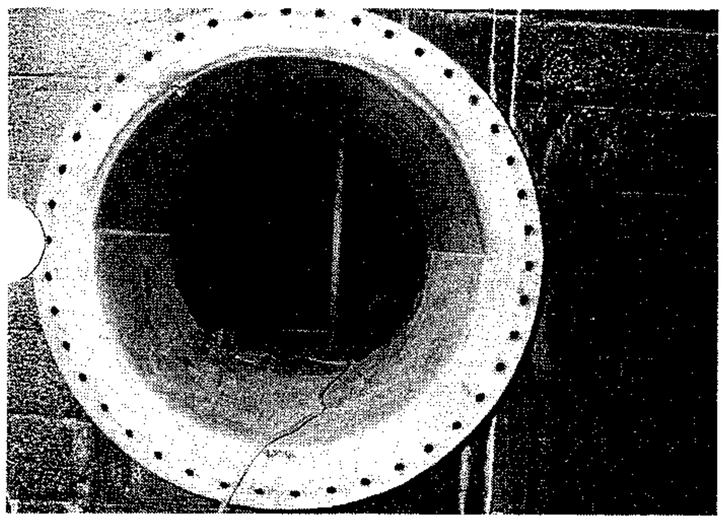




Views are of lower mist eliminators and spray headers at top of scrubber cell.



Bekaplast lined access manway (looking into scrubbers) is 36" in diameter.

1. "Should the Bekaplast Lining crack, because of an earthquake or other mechanical damage, the liquid would flow between the back of the lining and the concrete substrate and drain into a sump, triggering an alarm.
2. "If the original brick lining left intact above 32' height leaked, liquids would travel to the leak detection system, also triggering an alarm.
3. "The newly installed wall was not designed to resist hydrostatic forces greater than a couple of feet of water. Without a drain, a leak behind the new wall could build hydrostatic forces to 35 feet and could force out the new concrete wall. By installing the new peripheral drain on the inside, it would draw off all internal leaks and avoid overstressing the new concrete-over-the-pour wall."

Next, the over-pour reinforcement was tied to the dowels, and forms were constructed in succession to a height of approximately 9 feet each. The first lift was poured with concrete and given from 24 to 48 hours to cure. The forms were then stripped from the concrete and new forms were erected above the previous lift until the full height was achieved.

"The first section consisted of one pour of concrete around the bottom of the absorber, approximately 9 feet high and anywhere from 6 to 12 inches thick. We did the same thing 3-1/2 times, until the poured walls were about 32 feet high," Budd says.

"Some of the major problems that Atlas faced," says Wagner, "were not due to the Bekaplast System, but the magnitude of the formwork, sealing the lining to the many metallic outlets, and the difficulty of access to the K cell."

"The largest manway had only a 36-inch diameter," Budd remarks. "It was tough getting all the material through this narrow opening."

The Guarantee Inspection

A one-month, six-month and eleven-month in-service inspection would evaluate the new liner system. The first two, completed in early 1989, seem to bear out the system's promise of longer life and better performance.

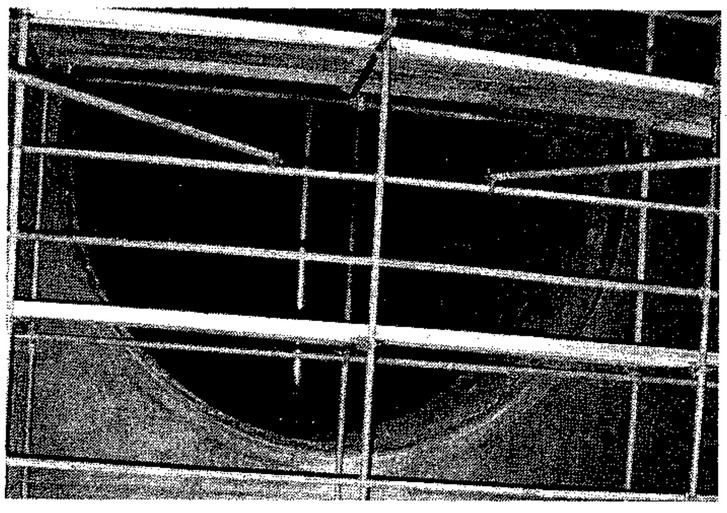
As Budd said after the six months inspection completed on May 23, 1989, "The Bekaplast appeared in excellent shape. There were no signs of any thermal, corrosion or erosion damage. We're very pleased with the outcome.

"At this stage, and judging from past experience, Bekaplast seems far superior to our tile and brick lining systems. Of course, we'd only had the absorber on line six months when we last inspected it, but the liner seems in such good condition and so firmly bonded to the concrete wall, that at this point, we anticipate no problems. Of course, time alone will tell."

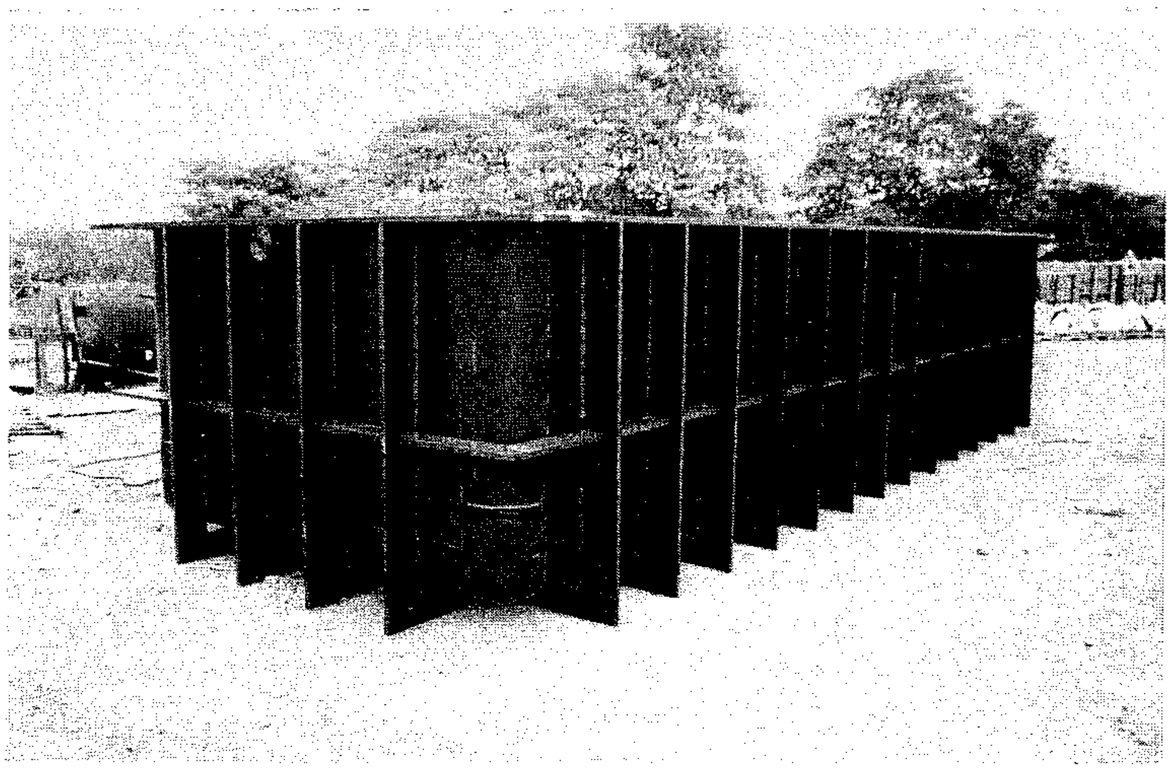
Other Applications

Bekaplast, marketed in North America since 1984, has an extensive international track record over more than 15 years. With the treatment of hazardous chemicals and waste a growing political and public issue, Bekaplast offers a solution to many of these concerns. It has numerous uses in industries that must contain or convey corrosive and other hazardous materials. Its advantages make it an attractive option to utility, waste water and other industries. Atlas' John Weber, who supervised the Bekaplast installation at PNM, puts it this way, "The proof is in the pudding—or rather in the performance.

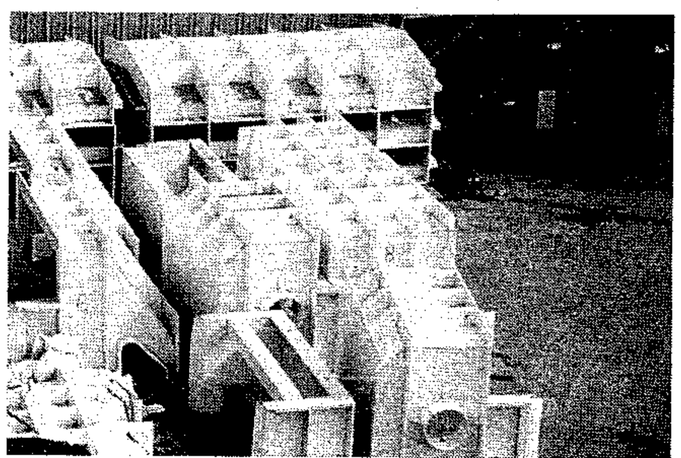
"We think the patented Rigid Plastic Bekaplast Sheet Lining System is the best technical and most cost-effective solution to PNM's scrubber problems and for trenches, pits and concrete tanks. Our customer is also convinced. We have now supplied Bekaplast for two additional cells."



Gas inlet was brick lined.



hown is one of four 8' w x 24' l x 5' d polypropylene tanks destined for a utheastern galvanizing operation. Outside dimensions for the tank are 9'4" w x 25'4" l x 5'6" d. The tank will contain 15% hydrochloric acid at 80°F. Because of the outdoor application, the tank was fabricated of UV stabilized polypropylene materal.



These 16'6" w x 60' l x 4' d tanks (top) were destined for a specialty stainless steel manufacturer. The tanks will contain 14% nitric and 4% hydrofluoric acid at maximum temperatures of 170°F. These flame-retardant grade polypropylene covers (bottom) will be used on the two specialty stainless steel tanks.