

Case history

*Tile, tile, on the wall...
Who's the most abrasion-resistant of them all?*

A wastewater treatment plant installs abrasion-resistant tiles inside 24 cyclones to prevent abrasive wear and lengthen their operating life.

The Milwaukee Metropolitan Sewerage District (MMSD), Milwaukee, treats wastewater from the Milwaukee metropolitan area and surrounding municipalities at the Jones Island Wastewater Treatment Plant, located along Lake Michigan on a peninsula in Milwaukee's harbor. More than 100 million gallons of wastewater are conveyed to the Jones Island plant each day, where it's treated, cleaned, and purified before being discharged into Lake Michigan. MMSD processes the solids from the wastewater into a commercial fertilizer. After building a new solids drying and dewatering facility for the fertilizer production process, MMSD noticed that the cyclones installed to remove airborne dust from the dryers' exhaust air were showing signs of wear on their interior walls. MMSD needed to find a way to prevent this problem.

Treating the wastewater

After the wastewater enters the plant, the solid waste materials are separated

from the liquid. The liquid travels through the liquid-treatment track and, after proper treatment, discharges into the lake. The solids travel through the solids-treatment track where they're conditioned with chemicals, treated, dewatered, and then dried. The resulting product is a commercial fertilizer called Milorganite, which is used for home and professional lawn care. MMSD produces more than 40,000 tons of this fertilizer each year.

In 1994, as part of Wisconsin's Water Pollution Abatement Program, MMSD expanded and renovated the Jones Island Wastewater Treatment Plant. The project included building a new drying and dewatering facility for producing the fertilizer. The facility contains 12 new dryers and 24 new stainless steel cyclones. Each dryer is connected to two cyclones by ductwork. As the solids pass through a dryer, hot air and small airborne dust particles are exhausted from the dryer and conveyed to the two cyclones. After the cyclones remove the dust



Two cyclones remove airborne dust particles from a dryer's exhaust air before the air is dispersed into the atmosphere.

particles from the air, the air is sent through a precipitator and exhausted into the atmosphere. On any given day, MMSD typically runs nine or 10 dryers and 18 to 20 corresponding cyclones all day and night.

When building the new facility, MMSD had specified that abrasion-resistant lined pipe be installed in certain areas of the solids-treatment track just as had been done in the old plant. The lined pipe was installed to prevent abrasive wear caused by the solids and the finished product. The lined pipe was manufactured by Abresist Corp., Urbana, Ind., the same supplier that had provided the lined pipe in the old facility.

Unfortunately, while the lined pipe was holding up well, after just 8 years of operation, the cyclones' interior walls began showing signs of wear. "From normal inspections we could see that the dust was abrading and wearing the side walls," says Mike Novak, MMSD contract administrator. "Originally, we had hoped to get about twenty years of operating life out

of them, but they wore out and needed to be replaced much sooner than that."

Using a proven solution

MMSD decided to replace the worn cyclones with new ones lined with abrasion-resistant tiles. Based on positive experiences using the liner supplier's lined pipe in both the old and new plants, and knowing that the cyclone supplier had worked with the liner supplier in the past on similar projects, MMSD decided to install the same liner supplier's tiles in the new cyclones.

MMSD developed a list of cyclone and tile specifications and hired a general mechanical contractor to handle all aspects of the project, including the cyclone and tile purchase orders. MMSD specified that the cyclone supplier manufacture the new cyclones with oversized dimensions to accommodate the tile linings. This ensured that the cyclones' interior dimensions met MMSD's specifications, which were calculated for passing air-emissions tests. MMSD specified that the tiles be made of

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Abrasion-resistant basalt tiles line a cyclone's cone section.

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After receiving the purchase orders from the general contractor, the cyclone supplier manufactured the cyclones and sent them to the liner supplier's facility. The liner supplier then installed the basalt tiles in each cyclone and shipped the tile-lined cyclones to the Jones Island plant for the general contractor to assemble and install.

Making the basalt tiles

To make the fused cast-basalt tiles for lining the cyclones, the liner supplier crushes basalt rock, heats it in a furnace until it melts, and pours the molten basalt into custom sand molds. Each tile's length and height dimension is determined by where the tile will be installed inside the cyclone. On average, the tiles are roughly 8 by 8 inches — the ones designed for the cone section are longer and narrower than those for the barrel section. The custom-engineered tiles match the radius of the cyclone walls and fit perfectly with no gaps or crevices.

After a certain time, the supplier turns the molds upside down, removes the newly formed tiles from the sand, and places them in an annealing oven. At first, the annealing oven's temperature is near the basalt's melting temperature. But over a period of about 30 hours, the oven's temperature incrementally decreases to slowly cool the tiles. This makes the tiles stronger and prevents cracks and fractures from forming during the cooling process. After the annealing process, the supplier removes the tiles from the oven, marks them with a number cor-

responding to their designated location in the equipment to be lined, and prepares them for installation.

The finished basalt tiles are about 1½ inch thick and have a surface texture that's typical of a product made with a sand mold (like the surface texture of a car's engine block). The tiles are installed in the cyclones with cement mortar, and their shape prevents long vertical or horizontal seams from forming, which increases the lining's service life.

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Increasing the cyclones' operating life

Since installing the tile linings in the cyclones, MMSD is no longer concerned about the cyclone walls being abraded and damaged. "The tile linings have successfully impeded the wear caused by the abrasive dust," says Novak. "Because of this, we currently anticipate getting at least twenty years of operating life out of the new cyclones."

Additionally, because the cyclones were designed to have the same interior dimensions and to function at the same efficiency level as the old cyclones, MMSD hasn't noticed any change in cyclone operating efficiencies. In fact, as MMSD continues using the cyclones, the abrasive dust will gradually polish the tiles, making them smoother and enhancing the cyclones' operating efficiencies. **PBE**



The abrasion-resistant basalt tiles in a cyclone's barrel section are larger than the tiles in the cone section.

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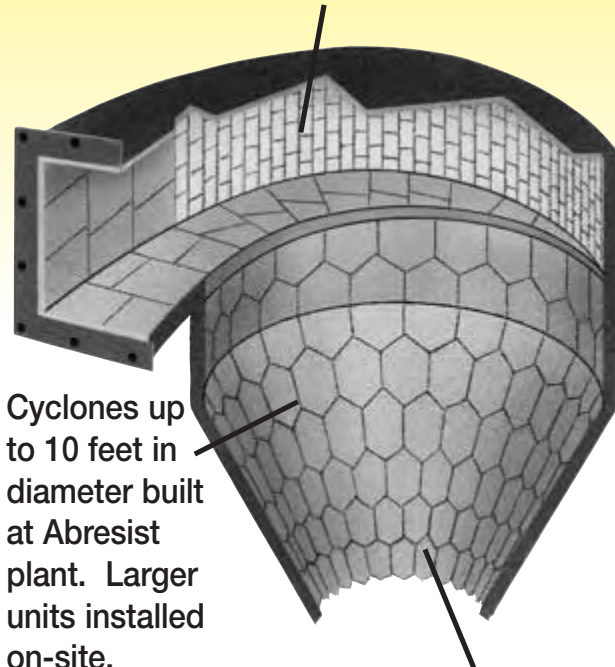


Give Cyclones a Hard-Core Edge.

ABRESIST® abrasion resistant basalt linings reduce costly maintenance repairs and production downtime. Documented cases show Abresist linings performing at optimum levels more than 20 years after installation. Abresist offers 75 years of experience and:

- full range of cost-effective linings including basalt, alumina, zirconium corundum and wear compound
- linings custom designed for any industrial application

ALRESIST® alumina tiles protect areas of extreme abrasion.



Cyclones up to 10 feet in diameter built at Abresist plant. Larger units installed on-site.

ABRESIST® tiles resist sliding abrasion and help reduce periodic cyclone maintenance.



The Wear Protection People

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