

HIGH-TEMP 'EYES' WATCH ENCAPSULATION OF RADIOACTIVE WASTE

Disposing of radioactive waste by encapsulating it in glass is a precise process demanding the utmost care and caution.

Lenox Instrument Co. Inc., Treviso, Pa., has developed FireSight, an advanced solid-state color video viewing system that can operate in temperatures to 3500°F (1927°C). The system monitors the furnace melter process, called vitrification, which encapsulates the waste in glass "gems" about one third the size of a man's fist.

G.T.S. Duratek, Columbia, Md., purchased FireSight systems in 1998 after successfully using a test model with a melter at the Vitreous State Laboratories of Catholic University in Washington earlier in the year.

"The system performed very well," said Rich Kilianny, electrical engineer at Duratek's headquarters. "We were able to view process changes and verify the bubbling rates of our glass. The successful test was a big selling point for us."

One of the largest processors of radioactive waste in the United States, Duratek processes spent fuel rods and other radioactive waste from the nuclear power and other industries. Its principal disposal facilities are at the DOE's Hanford, Wash., and Savannah River, Aiken, S.C., waste sites.

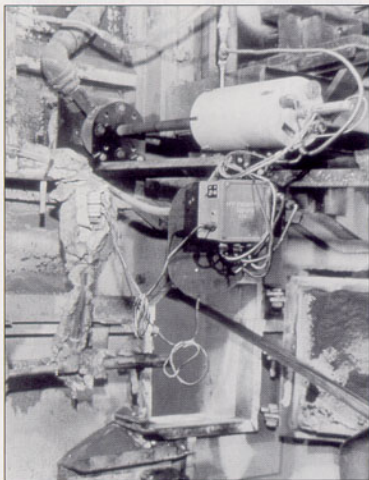
Duratek uses two high-temperature

FireSight "eyes" in its furnaces that closely watch the process and detect any problems.

Installed opposite each other in the wall of the furnaces, the systems clearly show process changes and interior conditions on a color TV monitor, and record everything on videotape.

In the process, radioactive waste from underground storage tanks is mixed with glass material

and put into a melting furnace in liquid or slurry form. The mixture then is heated into a molten combination of chemicals and glass, which reduces its volume. After being discharged, the molten mass cools to glass-encapsulated solid waste, safe for storage, that can be cut to whatever size pieces the client requires, and stored in large drums or boxes. The glass enclosures and the broken-up pieces ensure that the waste is not a hazard to the environment and cannot leak into groundwater.



Lenox Instrument Co. Inc.'s FireSight system.

Each FireSight system installed in a melter has a 90° field of view. The two cameras can see the entire interior of the melter, one viewing the section that primarily holds glass; the other viewing the area that is primarily air and chemicals.

"Being able to view inside our furnaces and watch our process so that we can detect any possible fault condition is a great benefit," Kilianny said. "We can verify our pro-

cessing rates and detect any abnormal wear on components that are visible to the camera. The high-temperature video camera is a window into our process that you don't normally get. Operators previously looked through open viewing ports and would see much less.

"Viewing the system's videotape provides an extra insight into the process and any failure mechanisms," Kiliány said. "If we see failures, we can use some of the views to understand why they happened."

FireSight operates in temperatures as high as 2200°F (1204°C) within Duratek's furnaces. The remote viewing system also withstands corrosive products such as sulfur dioxide, nitrous oxide, sulfur and nitrogen, which are parts of the mix.

The FireSight systems are enclosed in an air-cooled housing, called a wallbox, which is the primary cooling shroud. A water-cooled furnace lens periscope within the wallbox

penetrates the furnace wall, enclosing and protecting a radiation-resistant quartz objective lens at its tip (flush with the interior wall). The water cooling enables FireSight to withstand high temperatures.

A series of achromatic relay lenses carry images from within the furnace to a CCD camera, which is also within the furnace lens. An operator can actuate a motorized iris to adjust the amount of light reaching this camera.

Duratek's melting furnaces range from as small as 2 × 2 × 2 ft. to large models 20 × 16 × 10 ft. They are being used around the clock at the company's field facilities at DOE's Hanford and Savannah River sites.

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