# Breathing New Life into Biosolids Incinerators

## Choice: Renew a commitment to incineration, or go in a different direction with biosolids management.

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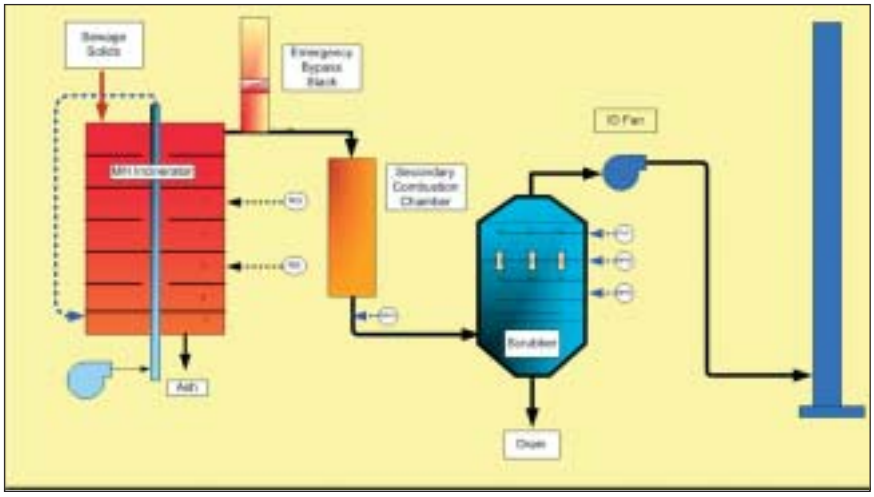
During the 1960s, 1970s, and 1980s, many publicly owned wastewater treatment works (POTWs) built incinerators as their primary means of processing plant-generated solids into an inert ash with greatly reduced volumes of material for disposal compared to the more common hauling of dewatered cake. Most of these plants used multiple-hearth furnaces (MHFs) for incineration, and many also incorporated thermal conditioning to enable producing cake solids of about 40 percent dry solids when using vacuum filters. The high-solids cake burned well without adding purchased fuel.

The Green Bay Metropolitan Sewerage District in (GBMSD) in Green Bay, WI, built two 22-ft, 9-in. diameter multiple hearth furnaces (seven hearths each), which were placed in service more than 30 years ago. While many incinerators were shut down by the 1990s, the GBMSD units remained in service. However, belt filter presses replaced vacuum filters and thermal conditioning at the GBMSD wastewater treatment plant, so the sludge being processed after the transition could only be dewatered to 22 to 28 percent dry solids. The decrease in dry solids content put additional strain on the MHF units, which were limited in water evaporation capacity.

Questions arose about the physical condition of the incinerators after more than 20 years of service and about the adequacy of capacity with the wetter solids. In 1996, GBMSD was faced with choosing whether to renew its commitment to incineration by upgrading the MHFs or whether to take biosolids management in a new direction.

Because POTWs must have a year round way to reliably dispose of their wastewater solids, incineration has remained popular in northern areas of the country where weather conditions limit hauling of dewatered solids from plants to landfills or to agricultural sites for land application. Incineration reduces the quantity that must be hauled to ten to 15 percent compared to dewatered solids. The resulting ash is sterile and can be landfilled with few restrictions.




### Review and Recommitment

GBMSD retained Black & Veatch Corporation (www.bv.com) to conduct physical inspections of the incinerators, auxiliaries, and stacks. The inspections showed that although the incinerators were in good condition, the stacks and secondary combustion chambers (afterburners) needed repair. Black & Veatch's "desktop" review of the incinerator capacity revealed a sizable shortfall in meeting future capacity needs with the wetter cake. The global engineering, construction, and consulting company reviewed other technologies such as thermal drying that might be employed in lieu of incineration to provide "greener" solids processing solutions, but found none superior to continuing incineration after upgrading emissions control and making other improvements to enable increased operational efficiency and flexibility.

Implementation of the Black & Veatch-designed improvements for the first MHF unit was completed in fall 2005, and the second unit was scheduled for completion in July 2006.

### Specific Improvements

The original incinerators were equipped with secondary combustion chambers for improved combustion. These afterburner chambers were completely refitted with a new refractory, the insulating layer that protects the outer steel shell from the high temperatures inside the chamber. The castable-type refractory was "gunned" into place,

replacing the original refractory block. The lowest section of each vertical chamber required replacement of the metal duct also.

The incinerators were originally equipped with impingement tray scrubbers that have provided only a thin margin of compliance with particulate emission limits. Plant operators were restricted to a rigid mode of operation to attain the particulate limit and maintain acceptable opacity in the stack gases. The existing scrubber bodies were in good condition. Consequently, the old internal parts were removed and new multiple fixed venturi sections and mist eliminators were installed, enabling excellent emissions controls and greatly reduced opacity. Near-autogenous combustion has been achieved with 28 percent dry solids cake at full design loads. The capacity of each unit is now near what was available when 40 percent thermal conditioned sludge was combusted.

The scrubbers were installed for greater operator flexibility, both in burning more efficiently and easily achieving particulate and opacity limits. Old fans were replaced by new induced-draft fans to compensate for the increased pressure losses associated with improved scrubbing. The fans use adjustable-frequency drives to control speed for draft control for the MHFs and allow a wide range of feed rates to the incinerators.

Other improvements include non-slagging burners to provide warming and maintain heat for the incinerators. This is one of the first installations of this type dual-fuel (natural gas and fuel oil) burner.

The original installation included a shared waste-heat boiler that provided high pressure steam from the incinerator exhaust gases. This was originally used for the thermal conditioning system, but can now be used to heat the building. The original installation also included a dedicated fan for when the waste heat boiler was in use in series with the scrubbers. This fan was replaced, with the incinerator fans providing the needed energy for the gases to pass through the waste heat boiler. The GBMSD staff also incorporated new computer-based controls for the incinerators to replace the original analog- and panel-based control systems. Devices and wiring were provided under the general improvements contract, and GBMSD staff provided the programming in cooperation with contractors.

***Burning sludge and ash cascade from hearth to hearth at the GBMSD facility. (Photo credit: Incinerator Rx)***

## Benefits of Optimizing Operations

The operational improvements implemented by GBMSD will yield substantial benefits beyond a greater margin of compliance with emissions standards. One such benefit is the anticipated future reduction in fuel costs. The district spent about $300,000 in 2004 for natural gas to provide auxiliary fuel for incineration. In the future, the incinerators can be operated to be largely autogenous—self-sustaining in their ability to maintain combustion using the fuel content of the solids, without purchases of natural gas/or fuel oil.

The improvements also will provide more flexibility for operators in meeting air quality requirements and biosolids reduction requirements despite fluctuating solids feed conditions and other variables. The additional control and adaptability provided by the improvements will alleviate many operations headaches and free operations staff for other duties.

The approximately $4.5 million upgrade will keep the plant operating effectively and efficiently for another 15 to 20 years at one-third to one-fourth the cost of building new facilities.

Finally, the increased capacity provided by the upgrade has led GBMSD to consider an offer to assume responsibility for additional WWTP operations, which would contribute additional revenue. The district is now in an ideal position to handle solids from the neighboring wastewater plant because of the additional capacity.

"Due to the age of our facility, rebuilding plant systems is critical for reliable wastewater treatment operations, and the time had come to extend the lives of our two incinerators," said GBMSD Executive Director Paul Thormodsgard. "Utilities such as ours are being challenged to deliver services more efficiently, and being able to operate our incinerators to achieve autogenous burning nearly continuously was a very welcome side benefit of this refurbishment project." GE

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