RESIDUALS/ENERGY CONSERVATION

It is all about energy—power generation through heat recovery in Hartford

Co-digestion with food waste organics—the next step toward net zero operation at Greater Lawrence Sanitary District

Energy recovery using raw wastewater—Barnstable pilot project

After 40 years of successfully composting biosolids, Merrimack plans for the future
This year has seen major strains in the markets for wastewater solids (sludge) management, especially in southern New England. From January through June, some managers of wastewater solids scrambled to find disposal and end use options. Trucks stood in lines for hours at some incinerators, waiting to dispose of solids. Others hauled solids to upstate New York and New Jersey. The routine flow of solids from some southern New England facilities into northern New England increased. Some municipalities were caught off guard and scrambled to find disposal options, incurring thousands of dollars in extra expense.

Sequence of Events
One factor in this market upset was the March 21, 2016 compliance deadline for new Environmental Protection Agency (EPA) air emissions regulations for sewage sludge incinerators (SSIs). The new regulation (Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources, Sewage Sludge Incineration Units, Subparts LLL and MMMM of 40 CFR Part 60), finalized in 2011, requires all SSIs to meet prescribed ceiling limits on emissions of specific contaminants, including particulates, carbon monoxide (CO), nitrogen oxides (NOx), and mercury (Hg). In addition, the new regulation requires site-specific emissions monitoring tests and plans, operator training, and record-keeping.

As the regulations’ compliance deadline approached, some SSI operators took only limited steps to prepare, in part because of involvement in a major, multi-party legal challenge brought against EPA that may have changed or delayed the requirements. In contrast, other SSIs had prepared for several years, including installing new emissions control equipment. In response to developing regulation, each SSI owner and operator had to analyze its needs and best options, and the local decisions and actions regarding each of the 15 SSIs in New England (as well as some in New York) had their impact on what became a crisis in the solids management market in 2015. But the March 21 compliance deadline was not the only factor. There was the normal uptick in solids production that occurs each year in late winter and spring as wastewater flows increase from snowmelt and precipitation. And, over the past few years, there had been other solids management capacity reductions that played a role as well, such as:

- Rhode Island’s 2013 floods wiped out the biosolids compost operation at West Warwick, Rhode Island, and eventually that operation was closed permanently, pushing about 6,000 wet tons (6,400 tonnes) per year (1,000 dry tons, 1,000 tonnes/year) onto the market.
- In recent years, several communities (e.g., most recently Dover, New Hampshire) abandoned on-site composting, and their solids entered the market.
- In 2012, Fitchburg, Massachusetts, faced aging infrastructure upgrades in addition to the projected cost of meeting the new SSI air emissions regulations. The SSI, which had processed liquid solids from Fitchburg and many smaller communities, was closed. Communities that had relied on Fitchburg scrambled to find other options for their liquid solids disposal—a precursor of what was to come in 2015.
- In 2013, the Monteverde, Vermont landfill closed; it had taken in mostly Vermont wastewater solids.
- For several years, the VeCare Environmental alkaline stabilization facility in Plymouth, Maine, has faced increasing local opposition due to its inability to control malodors. It has received numerous Notices of Violation (NOVs) from the Maine Department of Environmental Protection. In the past year, managers reduced the volumes of incoming solids, some of which had been hauled from as far away as Rhode Island. The facility, which has a permitted capacity of 60,000 wet tons (54,600 tonnes) per year, was receiving only about 10,000 (9,100 tonnes) in 2015. By June 2016, the facility was closing and all solids on site were removed (facility management talked about developing a gasification system on the same site, but that is only in the early exploratory stage, and because of technical and financial challenges in operating full-scale gasification facility for wastewater solids in North America exists despite several attempts.)
- In 2015, the Barre, Massachusetts landfill closed and that town’s solids went onto the market. The same thing may happen in the next year or two in Massillon, Connecticut.
- And, in April 2016, not far away, Mansfield, Massachusetts, stopped taking in outside solids from area towns as the plant’s treatment system hit capacity, local politics arose, and its solids destruction system came under increased scrutiny.

In the last five years, the only new capacity offsetting these losses has been minor expansion at a few merchant facilities, filling of excess capacity here and there (e.g., Merrimack, New Hampshire, and Lewiston-Auburn, Maine), and now composting solids from a few other water resource recovery facilities (WRRFs), and a new digestion facility opening this year in Brunswick, Maine plans to take in outside wastewater solids. In 2015, incinerator capacity had expanded considerably in the 2000s (Table 1), creating a sense of plenty of capacity, and prices actually were stable for about 10 years and even fell, as merchant SSIs competed for solids to fill their increased space.

Table 1. Status and capacity of New England’s sewage sludge incinerators (dry U.S. tons of solids per day)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Manchester, NH (Manchester)</td>
<td>54</td>
<td>36</td>
<td>No</td>
<td>Fluidized bed; has proactive work toward compliance with new air emissions regulation.</td>
</tr>
<tr>
<td>Lynn, MA (Veolia)</td>
<td>10</td>
<td>15</td>
<td>No</td>
<td>Fluidized bed; has installed upgrades to comply with new air emissions regulation.</td>
</tr>
<tr>
<td>Fitchburg, MA</td>
<td>CLOSED (2012)</td>
<td>Yes, until closed</td>
<td>Fluidich salts go to landfill now.</td>
<td></td>
</tr>
<tr>
<td>Brockton, MA (Veolia)</td>
<td>18</td>
<td>18</td>
<td>No</td>
<td>Multiple hearth; completed upgrades to meet new air emissions standards in January 2015.</td>
</tr>
<tr>
<td>Fall River, MA (Fall River)</td>
<td>CLOSED (2016)</td>
<td>No, now closed</td>
<td>Costs to meet new air emissions regulation; too great; solids now going to merchant incineration facilities.</td>
<td></td>
</tr>
<tr>
<td>Upper Blackstone WPCF (Upper Blackstone)</td>
<td>91</td>
<td>144</td>
<td>Yes, but more selective than before</td>
<td>Multiple hearth: SSI permitted throughput is now limited by stack test.</td>
</tr>
<tr>
<td>Hartford WPCP (MDC)</td>
<td>60</td>
<td>120</td>
<td>Yes, but less than before</td>
<td>3 multiple hearth units (permit limits operations to 2 units at one time). Takes in less outside solids now. Has energy recovery system.</td>
</tr>
<tr>
<td>New Haven, CT (Synagro)</td>
<td>42</td>
<td>42</td>
<td>Yes, but less than before</td>
<td>Multiple hearth: Takes in less outside solids now. Has energy recovery system.</td>
</tr>
<tr>
<td>Mattabassett – Cromwell, CT (Mattabassett District)</td>
<td>36</td>
<td>Taked in liquid only, but less than before</td>
<td>Fluidized bed; has proactive work toward compliance with new air emissions regulation.</td>
<td></td>
</tr>
<tr>
<td>Naugatuck, CT (Veolia)</td>
<td>54</td>
<td>84</td>
<td>Yes</td>
<td>Fluidized bed; Provides significant capacity; contract for operations expires in 2020.</td>
</tr>
<tr>
<td>Waterbury, CT (Synagro)</td>
<td>60</td>
<td>60</td>
<td>Yes</td>
<td>Fluidized bed; Currently seeking input on future options; current contract expires soon.</td>
</tr>
<tr>
<td>West Haven, CT (West Haven)</td>
<td>10</td>
<td>10</td>
<td>No</td>
<td>Fluidized bed.</td>
</tr>
<tr>
<td>Cranston, RI (Veolia)</td>
<td>40</td>
<td>66</td>
<td>Yes</td>
<td>Multiple hearth. Takes liquid solids only; has been reliable outlet.</td>
</tr>
<tr>
<td>Woonsocket, RI (Synagro)</td>
<td>70</td>
<td>110</td>
<td>Yes</td>
<td>Fluidized bed; has completed significant upgrades to meet new air emissions regulation.</td>
</tr>
</tbody>
</table>

Note: Glens Falls and, occasionally, other incinerators in New York (e.g., Saratoga Springs) have taken New England wastewater solids in the past. Glens Falls and Saratoga Springs incinerators are now closed due to costs of aging infrastructure and upgrades to meet new air emissions regulation.
ease its own operations; Hartford stopped taking it. Thus, a considerable portion of West Haven’s solids have been hauled out of state. In August, the SSI shut down again.

• The larger privately run merchant facilities in Connecticut and Rhode Island mostly operated on an online and offline basis up until this year. More than $4 million were spent on upgrades at the Woonsocket, Rhode Island SSI. The Cranston, Rhode Island MHI facility can meet the new air emissions standards. It has remained a reliable outlet for liquids. But that reliability has led to lines of trucks waiting at the gate, as other options for liquid solids have diminished.

• Wastewater, Connecticut, is facing challenges. Busted infrastructure repairs are needed, and upgrades needed to meet the new air emissions requirements add to the cost of continued operations. In the past 18 months, the city has issued three requests for proposals of interest seeking suggestions—upgrade the SSI or do something else with the solids. Three bidders presented ideas at a meeting in early July and a decision was expected in late summer.

And most significantly in late January, the Naugatuck SSI, one of the large merchant facilities (64 dry tons [66 tonnes] per day), had mechanical issues and shut down. Repairs continued until close to March 20 in compliance deadline, and rather than operate out of compliance, the shut-down was extended. (A contract dispute with the town of Naugatuck was an added complication.) Negotiations with the enforcement staff at EPA Region 1 resulted in a plan to move forward, and the facility started up again on June 25.

The facility operator absorbed the costs of the shut-down, which was larger than anticipated due to need capacity heightened the solids management crisis.

Suddenly, haulers now had to take loads of solids—especially liquid solid waste—out of state. Companies holding solid waste contracts with municipalities tried not to have to default on the contracts, but some were renegotiated. “I had one customer in New York whom I advised to find a closer source,” said a CT-based line hauler. “But that is not where the issue was. They were disconnected with the service they found there locally. So they came back to our facility and accepted a substantial rate increase to cover the remaining transportation costs of our operators is, for the most part, fixed. It is extremely difficult to site new disposal facilities, and the ones we have operating now are becoming increasingly expensive due to their age and new regulatory requirements” (Jager, 2000). At the same time, the late 1990s had seen a public debate about onshore biosolids land application that led to restrictions in numerous towns in lower New England. In May, eight towns—out of a few hundred—voted down a solid waste ordinance. As municipal officials responsible for establishing safe, environmentally, and economically sound programs are dealing with a mounting crisis, it is keeping them awake at night.

A few years later; another NEWA Journal article counted 14 SSIs in New England, which, along with thermal-drying facilities at Greater Lawrence Sanitary District (GLSD) and the Millstone Power Plant in Waterbury, Connecticut, were operated by Northwater Inc (NWRI) served “some 8.5 million people” and managed “more than 75 percent of the municipal wastewater sewage solids generated in Connecticut, Massachusetts, and Rhode Island” (Donovan, 2004). The author touted the benefits of regional facilities, especially the cost benefits for smaller communities that transport their solids—often in liquid form—to a moderately remote disposal facility. For example, he noted that Plymouth, Massachusetts, decided to abandon a plan to build a new drying system. “Too often—a case in point—the solid waste market in southern New England” By simply trans- porting liquid (not dried) solids to incineration, they saved $1 million in capital costs. In 2004, there was adequate capacity, and costs for solids disposal were reasonable.

Indeed, according to several solids management professionals, for much of the past decade there had been adequate or excess capacity in the solids management market in New England—especially in the incineration market. As Donovan reported in 2004, several of the region’s larger SSIs at that time were installing new fluidized bed burners or flue gas recirculation systems, significantly increasing the amount of solids they could process (Table 1).

So was this year’s crisis an anomaly? Perhaps, maybe? But the timing of the crisis could have been foreseen, with the March 21 compliance deadline for the new EPA air emissions regulation piling on the fact that the region’s incinerator—in other infrastructure—have been aging while municipal budgets and regulations have been tightening.

Was Over-Reliance a Factor?

The constraints of the new air emissions regulation strained the New England markets for wastewater solids use and disposal in part because of southern New England’s long-term heavy reliance on incineration. That region holds the operations of the only SSI in North America (Table 1).

In 1989, Connecticut and Rhode Island especially have relied on incineration for disposal (Donovan, 2004), and a good amount of Massachusetts solids (liquid and cake) were also incinerated as well. At the turn of the century, New England produced roughly 282,000 dry U. S. tons (265,000 tonnes) of solids annually, and 13% of New England’s wastewater solids were incinerated at many smaller ones—incinerated their sludge at facilities in Connecticut, Massachusetts, New York, and Rhode Island (Jager, 2000). In 2004, 34% of the 189,000 dry tons (170,000 tonnes) of Massachusetts solids (liquid and cake) were incinerated. In 2007, 282,000 dry tons (250,000 tonnes) of solids produced in Rhode Island were incinerated, mostly at SSIs in those two states. Much of Massachusetts wastewater solids were incinerated, mostly at several in-state SSIs, and one SSI has long served New Hampshire’s largest city, Manchester. In 2004, 203 WWRFs (40 percent of New England’s facilities) were sending solids to Connecticut, Massachusetts, and Rhode Island, and 57% of New England was about 370,000 dry U. S. tons (335,000 tonnes) (North East Biosolids & Resources Association (NEBRA) et al., 2007). Today more than 400,000 dry U. S. tons (365,000 tonnes) of wastewater solids are produced in New England (Figure 1).
Note: This list does not include larger water resource recovery facilities (WRRFs) that accept and process small amounts of outside solids.
A stand-alone anaerobic digestion system can serve as a recharge mechanism for a limited group (FOG) of feedstock to take in outside wastewater solids. This was the first new anaerobic digestion system at a New England WRF since GLSD in Massachusetts was started. Although, few digestion systems have seen upgrades (e.g., Pittsfield, Massachusetts).

Soon after Fairhaven, the Lewiston-Auburn Water Pollution Control Authority (LAWPCA) in Maine installed new digesters and is now experimentally treating with taking in outside waste to the digesters. In addition, by reducing the final biosolids volume exiting the LAWPCA WRF, the new anaerobic digestion system has freed up capacity at LAWPCA compost facility for other facilities’ wastewater solids.

The greatest expansion of digestion capacity in the region in the near term will likely be at GLSD, where upgrades will include a new 1.2 million-gallon (5 million-liter) digester, and SSO capacity, biogas treatment systems, and two co-generation engines. But GLSD expects to fill this additional capacity only with SSO (e.g., food residuals and other high-strength wastes such as FOG), providing an outlet for a significant portion of the 350,000 wet tons (377,000 tonnes) of food waste that MassDEP hopes to see diverted under the 2014 enhanced food waste disposal ban. MWRA is considering taking in SSO as well, but that potential is challenged by the need to convey SSO to the Deer Island Treatment Plant by barge.

Thus, expansion of New England’s anaerobic digestion capacity is focused mostly on SSO—and almost none of the new capacity can be expected to provide an outlet for wastewater solids anytime soon.

What About Composting and Other Class A Processes? In capacity, Connecticut provides landfill capacity. Maine, started processing wastewater solids and other organics. It later expanded and now receives material from numerous large and small WRRFs in Maine, New Hampshire, and Massachusetts on occasion from further north. The facility has had its challenges, and it benefits from its rural location (but odor management is still critical). Overall, though, the project is proceeding according to plan, for wastewater solids and organic residuand processing, and producing valuable products. Nevertheless, despite such new two regional facilities have been built for processing New England wastewater solids for beneficial use. The first is the Residuals Management Facility in New Hampton, New Hampshire. It treats raw and raw sludge digester underdigested with algae and anaerobic stabilization, creating biosolids that are land-applied on farm fields and reclamation sites. The second is actually not in New England. The Casella Grasslands facility in Chateaugay New York, produces Class A advanced alkaline stabilized biosolids for use on farms, seeps, and landfills. The state requires that the source of the wastewater solids it processes come from Chittenango County, Roscommon, New York area. While it changes, Connecticut Department of Energy and Environmental Protection has an existing and remains an option—Sanford, Maine, is just starting up composting. Being successful in making the output product requires marketing by people knowledgeable about the needs of field operators, growers, and other product end users. That kind of knowledge and experience is available and used in New England through contracts between WRRF biosolids generators and biosolids management companies that provide marketing, permitting, and land application services. (In some parts of North America, e.g., Chicago, that expertise is found in public utilities, which have soil scientists and agronomists on staff) One big advantage of biosolids products is continually addressing questions and concerns from the public. But, today, there is much information and help available for that from NERRA, NEPA, and its Residuals Management Committee, WEF, and others.

Another angle to consider is solids minimization. Less solids to manage means lower costs. While a quality biosolids product can have high demand (and some producers run out every year and have farmers on waiting list), every ton that needs to be managed still has net costs associated with it, even accounting for any revenues. Therefore, if you can produces less, you can save money. For LAWPCA, that was the main economic driver behind its new anaerobic digestion system; most of the savings came from reduced solids end-use costs, though that was not a primary driver for a majority of reasons. Anaerobic digestion is a proven form of solids minimization. Over the years, a variety of technologies or processes have been tested, but few have been adopted. You need to be magic black boxes that did not perform. Still, the goal is worthy of consideration by any WRRF solids management planner.

Diversification Options Diversification of options has long been a cornerstone of New England WWTPs (Marlborough, Dedham) for decades, and it is no different now. Many of the continent’s largest WRRFs use several different solids treatment processes as well as different contractors and market outlets. A benefit of making a quality biosolids product is an increased diversity of end-use and disposal options. MWRA and GLSD are currently the two producers of heated-clay PELLETS (60% moisture, 40% solids), an over-wintering benefit of the MWRA product has been used as an alternative fuel in a Maryland cement kiln, where it replaces some coal (with significant cost and environmental benefits). And, if necessary, pellets can easily go into a landfill. In southern New England, the reliance on incineration has been nearly universal for many utilities. For decades, the system has been a significant source of revenue, but in the more recent capacity crisis is a reminder that solids management planning should be ongoing, and back-up plans are crucial. A facility that produces liquid solids likely has the fewest options. That WRRFs solids treatment costs are minimal, but there is
real only one place to go for disposal—an incinerator. For a small facility that is not a problem, because the incinerator still operating in this region today are likely to continue to do so, and many are large enough to absorb a few truckloads a week from a small plant. But a larger facility, or a larger number of small facilities together, can begin to test the system’s capacity. Should the system reach capacity, liquid sludge cannot go to composting or landfill without dewatering and quickly becoming too large to be handled. In New England, liquidifying tars are $90 to $180/dry ton ($375 - $86/tonne) at landfills and $230 to $320/dry ton ($295 - $59/tonne) at incinerators and composting facilities.

The prices in contracts for biosolids management companies to take raw or processed biosolids from a WRRF vary much more than different facilities. Factors affecting the price a contractor charges for taking solids from a WRRF include:

- Changing fuel costs (Some contracts adjust the per-ton price based on actual fuel costs in New England, tipping fees are $90 to $180/dry ton ($375 - $86/tonne) at landfills and $230 to $320/dry ton ($295 - $59/tonne) at incinerators and composting facilities.

- Distance from the WRRF to the planned use or disposal site)

- Percent solids of the material

- Level of stabilization (Class A, Class B)

- Chemical quality (e.g., metals)

In general, use of biosolids on soils can be less expensive than for landfill disposal. But it does depend on the level of treatment at the WRRF. For taking raw dewatered solids and providing biosolids, tipping fuel, and land application, a biosolids management company may charge $390 to $396/dry ton ($157 - $183/tonne). However, if the WRRF treats its biosolids to Class A EU standards, the biosolids management company’s fees to market and distribute, and the price is around $105/dry ton ($145/tonne). One contract for land application (or other use or disposal) of a low-odor Class B biosolids produced in southern New England is priced at about $275/ton, depending on every shipment.

This year, however, prices are changing. Said one hauler of liquid solids: “Customers have had it good for a very long time... As contracts expire, prices will go up.” This sentiment was mirrored by all those interviewed for this article. Contract solids management prices for companies taking solids from a WRRF have increased from an average $85/ton ($126/tonne) in 2005 to $90 ($132/tonne) or more in mid-2006. Some contracts now show more than $600/ton ($91/tonne), which, assuming 25 percent solids, is more than $450/dry ton ($64/tonne).

In conclusion, since the spring of 2006, indications are that, for at least the next couple of years, New England will have little excess capacity in the solids management market. And when supply is short, prices go up. Companies that operate large merchant facilities and are able to form long-term contracts, with their contracts, standards, and pricing. Some public SSIs are doing the same. One incinerator operator said: “We’ve started to increase our rates. We’re being more careful looking at what comes in. Settage rates are going to go up as well... To set the price for a sludge, I look at how much capacity I have in my facility. Have you had large price increases for a long-term duration you get a better rate... But if you’re bringing just one truck a week that’s digester you’ll pay more. Also, we don’t have the ability to store solids, so we’ve been economically incentivized people to come at off-hours to equalize loading to the plant. We just started doing this in the past two years. We also prefer to provide service for Connecticut, so we’re only coming in during weekends and weekdays. And we encourage dry-ton contracts, not wet tons or gallons. We test every new customer for metals, doing testing for 20-20 screening and fees from the recent past. We had one Massachusetts customer show some normally non-detrit PCB congener, and we told the customer to clean it up before bringing in any more.”

In addition, solids managers and haulers are having to work harder on tracking the market to locate capacity. They need to be ready for unexpected shortages that may force them to haul solids to New York or New Jersey or wait hours in line at a disposal outlet—adding significant costs to their operations. Said one incinerator owner: “While the capacity used to be great enough for all of us to help each other out in a pinch, this spring that became no longer possible all the time. Each incinerator is having to protect its own operations and interests more carefully now.”

So the major message from this year’s crisis is that WRRF managers need to pay close attention to solids management. Review your options and contracts. Expect price increases in the next year or two. Have contingency plans. Talk regularly with your biosolids management contracted with and you want to do and when you get the call: “We have nowhere to go with your solids today.” Can you call on a back-up operator to take your solids? You are paying for the increased cost. This year’s events also remind the wastewater profession—operators, managers, engineers, and regulators—that solids management is a constant challenge. An increasing and uncertain market, rising costs, and fees are all impacting every operation.

The growth of beneficial use on soils is stymied by excessive regulation driven by public perception. New England’s Biosolids Program & Compliance (New England Biosolids Program) and the Vermont Department of Environmental Conservation (DEC) are working to address many of these concerns. A recent project, funded by the Vermont Health Endowment Fund, was designed to evaluate the potential for beneficial use of biosolids in Vermont’s soils, following a 2007 report on the uses of biosolids in Vermont. The report found that beneficial use of biosolids on Vermont soils is feasible, with proper safeguards and regulations. The project will focus on three key areas:

- Developing and implementing regulations for beneficial use of biosolids on Vermont soils
- Conducting research on the fate and effect of biosolids on Vermont soils
- Developing and promoting public outreach materials for beneficial use of biosolids on Vermont soils

The project will involve a team of experts from academia, government, and the private sector. The project will be conducted over a two-year period, with the goal of developing and implementing regulations for beneficial use of biosolids on Vermont soils. The project will also involve public outreach efforts to educate the public about the benefits of biosolids and the importance of proper safeguards and regulations.