Integrated Solid Waste Management in Northwest Minnesota

Willard Wilson, Facilities Manager
Polk County Solid Waste
708 8th Street NW P. O. Box 605
Fosston, MN 56542
Telephone: 218-435-6501 Fax: 218-435-6619
Email: county@gvtel.com

Abstract

In the early 1980's Polk County and four other partner counties in rural Northwest Minnesota made the decision to incorporate a waste to energy (WTE) plant into their solid waste management program. This decision was made to comply with the Minnesota hierarchy for solid waste management, to extend the life of the Polk County landfill, and to recover valuable energy from the waste. The plant was constructed in 1987 and began burning MSW in 1988. The processing technology consisted of two starved air mass burn municipal solid waste combustors each with a combustion capacity of 40 tons of MSW per day, and produced energy in the form of saturated steam for customers in the adjacent industrial park. Initially each train utilized a two field electrostatic precipitator (ESP) as the air pollution control (APC) device.

In 1996, a materials recovery system (MRF) was constructed in front of the waste combustors to remove problem/objectable items most of which are recyclable. This facility has been a tremendous success providing many benefits including reduced stack emissions, lower O & M costs for the WTE units, and revenues from the sales of extracted recyclables.

In 1998 Polk began injecting powdered activated carbon (PAC) into the flue gas of each unit upstream of the ESP to attain compliance with new State limits for dioxin/furans and mercury. Then in 2000 Polk County proceeded with an APC retrofit project designed to meet revised EPA emission guidelines which set more stringent limits for pollutants currently regulated and added limits for several other pollutants previously unregulated.

In 2001 and 2004 Polk County performed research demonstration projects substituting screened WTE combined ash for a portion of natural aggregate in two asphalt road construction projects. Both projects passed stringent environmental testing and demonstrated superior strength and flexibility performance compared to conventional asphalt.

Polk County is now proceeding with the installation of a turbine/generator to produce renewable electricity with excess steam. The electricity produced will be used to reduce the demand for incoming power from the local utility. Initially this may be only a twenty-five percent reduction but has the potential to be more in the event one or more of the steam customers reduces their dependence on steam from the WTE plant.

All of these projects received funding assistance from the State of Minnesota in the form of Capital Assistance Grants. In 2003 the WTE plant and MRF became debt free and Polk County lowered the tip fee resulting in a disposal rate that is fairly competitive with that of most out of state landfills.

This paper will discuss the development, success, and benefits of this completely integrated solid waste management system for these five counties located in Northwest Minnesota.
Polk County Integrated Solid Waste Management History
In the early 1980's Minnesota adopted a Solid Waste Management Act that set forth a hierarchy for Solid Waste Management. That hierarchy is: reduce/reuse, recycle, compost, waste-to-energy, and landfill. That hierarchy remains in place today and is supported by the MPCA and the State legislature. Currently, the recycling rate in Minnesota is approximately 40 percent. This is a great accomplishment but only so much can be recycled and this rate is not expected to increase significantly in the future. The rest of the trash goes to waste-to-energy plants or a landfill or other places. In 2002 the amount of waste sent to landfills – the least preferred disposal method - increased 3.4 percent. At this rate most Minnesota landfills will be filled to permitted capacity in around 10 years, and it will be very difficult to site a new landfill anywhere in Minnesota. Grand Forks North Dakota after expending over $2.0 million dollars has been unsuccessful in locating a site for a landfill for over 10 years and is still looking. Some out-of-state landfills may be willing to accept more waste but many states are looking at this as a means to generate revenues through a fee assessment. While some Minnesota landfills may be able to increase capacity by obtaining additional permits the solution to managing solid waste involves changing the perception of waste and recognizing it as a resource, not something that has no value.

State Support
Minnesota is one of the leading States in the U.S. to support waste-to-energy (WTE). Currently there are 9 WTE plants operating in the State; 4 large facilities processing over 250 tons of MSW per day and 5 small plants at less than 250 tons per day (see map). These plants serve 28 counties with a population of 2.8 million, and process over 1.4 million tons of municipal solid waste annually. Energy in the form of electricity and/or steam is produced and sold to local utilities or industries. Over 111,000 homes in Minnesota are served by WTE renewable energy. This energy is classified as renewable and the electricity delivered to utilities can be credited to meet renewable energy goals (possibly a mandate) as set by the State.

Polk County Plan
Following the State hierarchy, Polk County along with four other Counties in NW Minnesota made the decision to incorporate a WTE plant as a component of their solid waste management programs. These counties encompass an area of 6000 sq. miles and have a population base of approximately 85,000. The primary reason for selecting the waste-to-energy plant was to extend the life of the Polk County landfill. The secondary reason was to recover energy from the waste and make it available to a nearby steam customer.

Polk County is the sole owner/operator of the facility and the four partner counties signed fifteen year contracts committing to a minimum annual MSW tonnage to be delivered to the plant. This helped provide the guarantees that Polk needed to obtain the necessary bonding to fund the project. Polk was awarded a Grant through the State Capital Assistance Program (CAP) of $2.0 million to assist with funding for the $6.8 million project. The balance of $4.8 million was secured through General Obligation Revenue Bonds with a fifteen year payout.
Service Fee

Four of the five counties initially established a service fee that was included with the tax statements. One county decided on a user fee, but unfortunately with a user fee there was no incentive for residents to deliver their trash. The county ended up not meeting their minimum tonnage commitment and had to pay the difference. That county then adopted a service fee and the following year the tonnage increased by about 25 percent far exceeding the minimum. The service fees were accumulated by the counties to pay the WTE plant a tip fee for tonnage delivered on a monthly basis. The tip fee was calculated by simply dividing the projected annual O & M costs less a portion of the revenues from steam sales, by the minimum tonnage quantities. This results in a zero tip fee for the haulers who then only charge their customers for the pick up service. This approach creates an economic flow control mechanism to insure that all of the trash from these five counties is delivered to the WTE plant.

Facility Design

The WTE plant was built in 1987 and began processing MSW in 1988. The facility is centrally located within the five county area in Fosston, Polk County, MN, and the initial steam customer was a Land-O-Lakes milk processing plant. Because of the dairy buy out program LOL made the decision to close the plant and sold it to Northern Food & Dairy (now SunOpta) of Alexandria, who have been operating the plant ever since. In 1990 another company decided to build in Fosston primarily because of the reasonable energy source (steam) offered by the WTE plant. These two facilities offer a great economic benefit to this small community operating almost year round and employing over 80 workers.

Two mass burn starved air units with a capacity to burn 40 tons of mixed municipal solid waste (MSW) per day per unit were installed along with boilers to produce steam and electrostatic precipitators for air pollution control. These two units are capable of processing over 30,000 tons per year of mixed municipal solid waste, and each boiler can produce an average of 10,000 pounds per hour of steam for internal use as well as for sale to the two customers. Studies at that time indicated using the steam to generate electricity was not a feasible option. The facility operates 24 hours per day seven days a week and has 18 employees including maintenance personnel, and office staff. WTE operators and their supervisor must have a State high pressure steam engineer's license and obtain full certification as a waste combustor operator in order to work at the facility.

Problems

For the first few years of operation all seemed to go well although plant personnel were in the learning process. These units were designed to burn mixed municipal solid waste but someone forgot to define exactly what MSW really is. It soon became evident that MSW is everything that people want to dispose of from soup to nuts including the kitchen sink and more. Problem/objectionable materials in the incoming waste stream soon began causing many operational problems. Downtime and breakdowns were ever increasing as well as maintenance cost
for repairs. Polk decided to find out just what quantities of objectionable items existed in the waste stream and what they were. Polk hired and trained two employees to sort through the trash on the tipping floor for a two week period to pull out and stockpile all of the problem materials that were in the incoming MSW. We were not surprised at the results.

Materials Recovery
A solution to this problem was to add a Materials Recovery Facility (MRF) in front of the WTE plant to preprocess all incoming material. The MRF goals included: removing the problem/objectionable materials as well as recyclable components that remained in the waste stream, maintaining steam capacity for the customers, reducing stack emissions, removing burnable recyclable materials (cardboard and/or paper), and reducing ash quantities and toxicity. Extracting burnable materials would allow the WTE plant to handle the increasing MSW from the five counties that was exceeding the plants burning capacity (especially in the summer months) resulting in material being sent to the landfill. The decision was made to proceed with the installation of the MRF and startup occurred in late 1996. Once operational Polk discovered that almost all of the problem/objectionable items collected were recyclable and there was a market for their disposal. Corrugated, ferrous and aluminum products were easily extracted manually and mechanically and the glass was removed with the fines that exit through small holes in the trommel. The fines are used as alternate daily cover at the landfill. Since the landfill now accepts mostly large bulky items the fines make excellent cover and tend to fill all the cracks and voids improving landfill cell space utilization. Over 98% of all of the materials extracted in the MRF are sold for recycling.

The MRF cost $1.8 million and Polk was awarded a Grant ($725,000) to help fund the project. A call feature with the original General Obligation Bonds allowed the financing for the MRF to be included with these bonds and a more favorable interest rate was secured. This did however require that the new debt for the MRF be retired in a shorter period of only seven years which remained on the original bond issue. O & M for the MRF including the debt service was funded through revenues generated by the sales of the recyclables and a fee assessed to the WTE plant for cleaning up the incoming MSW and removing the problem/objectionable items that were causing many operational problems. As it turned out the MRF has paid for itself through the sales of recyclables and the processing fee. The savings from reduced maintenance, downtime, and ash hauling for the WTE plant, more than justified the processing fee. This facility is designed to operate 8 hours per day, five days a week producing enough material (fluff) to keep the WTE plant operating 24/7. The MRF has six employees and shares a supervisor with the landfill.

Revenues
Since startup in 1988, Polk has collected over $5.0 million dollars in net steam sales, sold almost $3.0 million dollars since 1997 in recyclables extracted in the MRF, operated safely, efficiently, and in compliance with all EPA/MPCA rules and regulations. All of the five counties receive credit for
the recyclables removed in the MRF. This credit has almost doubled these counties recycling rates helping to guarantee the continuation of recycling funding assistance provided by the State. The intent of the MRF was to compliment county recycling programs not to replace them. Polk also utilizes the MRF to sort commingled recyclables from several of the five counties as well as an adjacent county not in the five county consortium.

Air Pollution Control
In 2000 Polk began a project to upgrade the air pollution control equipment to meet revised EPA air emission rules and regulations. The cost for this project was $2.0 million and another Grant was awarded to Polk to help fund approximately half of the costs. The balance was paid out of accumulated savings. This project is now complete and the results of a stack test conducted in March/April 2005, show that Polk is in compliance with all of the new and revised air rules and regulations.

Ash Utilization
In 2001 and 2004 Polk received approval from the MPCA to construct demonstration research projects (DRP) substituting screened combined ash from the WTE plant for a portion of natural aggregate in two Polk County asphalt road paving projects. These two projects recycled approximately 3000 tons of ash which was stored in expensive lined cells at the Polk County landfill. Both ash utilization projects have shown no adverse impact to the environment and demonstrate superior performance as compared to conventional asphalt. The asphalt is significantly stronger and more flexible which is very beneficial in the weather extremes that occur in summer and winter seasons. Polk has submitted an application to the MPCA for a Case Specific Beneficial Use Determination (CSBUD) which will allow the use of ash in similar road paving projects without having to obtain MPCA approval for each project.

Capital Assistance
As reported earlier, all of these projects including the original plant received approval and support from the State of Minnesota through Capital Assistance Program (CAP) Grants administered by the Office of Environmental Assistance. In most cases this covered almost fifty percent of the capital costs. CAP Grant funding is not available for landfill construction with the exception of methane gas recovery projects.

New Steam Customer
Polk has recently conducted a study to evaluate the feasibility of using excess steam to generate electricity. However a new steam customer entered the picture and decided to construct a plant in the Fosston Industrial Park. The decision to locate here was partly influenced by the reasonable cost of energy (steam) furnished by WTE plant. Polk made the decision to install steam service for the processing operations similar to what Polk had done for their other two customers. While the capital investment is similar for a turbine/generator or the steam line (approximately $500,000 each) the payback on the investment for selling steam versus electricity is much more attractive (one/two years versus five/six years). Mandating renewable energy could improve the negotiation process with the utilities and make electricity generation more competitive with selling steam. The new facility began operation in August 2005 and in
six months Polk has collected over $150,000 in steam revenues from this new customer. The three processing facilities and the WTE plant offer employment for over 150 residents in the immediate area which is a significant economic advantage.

**Turbine/Generator**

A component of the APC retrofit project included the addition of economizers to control flue gas temperature. These units have also added steam capacity and even with the three steam customers online sufficient excess steam is available to run a turbine generator to produce electricity and reduce incoming power from the local utility. Polk is now proceeding with a turbine generator project estimated at $600,000 and a seven year payout. Funding assistance has been provided with available dollars remaining in the original Grant for the APC retrofit project. Estimated completion for this project is December 2006. This unit will not only make use of excess steam but act as a backup in case there is a loss of incoming power or one or more of the steam customers.

**Tip Fee**

The initial WTE tip fee was set at $45.00 per ton and increased to $55.00 per ton in 1990 as a result of new ash disposal rules. Economics and revised air rules necessitated a slow growth in this fee to $70.00 in 2001. In 2003 Polk became debt free and reduced the tip fee from $70.00 per ton to $55.00 per ton to the five counties. This rate is very competitive to the alternative of these counties shipping waste to out-of-state landfills especially with the current price of fuel. Without the WTE plant the Polk County landfill would be filled to permitted capacity. It now has well over 30 years of life remaining and possibly more with ash utilization.

**Conclusions**

These counties have developed a very successful and complete integrated solid waste management system that includes recycling, composting, materials recovery, waste-to-energy and a landfill. All MSW generated in these counties is handled safely, efficiently, and within all EPA and MPCA rules and regulations.

The County Commissioners, past and present, that had the foresight and guts to develop and support this program despite some controversy at the beginning should be very proud of what they have accomplished. This is a program that is designed to last many years into the future while maintaining control of its own destiny.

Several other county groups within Minnesota are now evaluating solid waste management options, and using the Polk County system as a model in their planning. With increasing pressures to close landfills and the difficulty in locating a new one, a complete integrated solid waste management system has benefits that are certainly worth considering.