Closure of the City of Key West, Southernmost Waste to Energy Facility

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ABSTRACT

The Southernmost Waste-to-Energy Facility, is a 150 ton per day, stoker fired, mass burn facility located on Stock Island in the City of Key West, Florida. The facility is owned and operated by the City of Key West and is categorized as a Small MWC, Class II facility under the Emission Guidelines for Existing Small Municipal Waste Combustors, 40 CFR 60 subpart BBBB. In order to reliably comply with the requirements of the small MWC regulations, the facility air pollution control trains were required to be retrofitted to include acid gas control and improved particulate control through the installation of scrubbers and baghouses. Additional controls for metals including mercury may have been added in order to assure compliance with these regulations. Other facility upgrades including combustion enhancements may have been required to assure compliance with allowable carbon monoxide limitations of the Small MWC regulations.

The need for the air pollution control retrofit project represented a major expenditure for the City of Key West. Faced with a decision regarding its long term future waste handling and disposal methods, the City examined various options for future solid waste handling and disposal including the option to proceed with retrofitting the waste-to-energy facility and relying on waste-to-energy as a long-term major component of Key West’s solid waste handling and disposal plans. Alternatively, the City explored the option of building a transfer station, either privately or publicly operated, and contracting the hauling and disposal of the City’s waste to a private firm. The transfer station option would require a conversion of the waste-to-energy facility to a transfer station through a major demolition and reconstruction project.

The City also considered available alternative technologies such as gasification for example.

In order to help the City sort through the many issues associated with the solid waste handling and disposal options, a Technical Advisory Committee was formed consisting of engineering and legal consultants, City commission members, and other City representatives. Dvirka and Bartilucci Consulting Engineers, as a member of the Technical Advisory Committee, was responsible for estimating the costs associated with the design, construction and operation of a waste-to-energy facility air pollution control retrofit project.

This paper describes the facility and discusses the decision making process of the technical advisory committee and the ultimate decision of the City Commission to close the Southernmost Waste to Energy Facility. The paper includes the requirements for closure of the facility and discusses how the City arrived at its final decision.

Facility Description

The Southernmost Waste to Energy Facility, which began operations in 1986, is located on a site contiguous with an inactive 20 acre landfill. The facility has two identical boiler trains of mass burn design. The rating of each of the two combustion units is 75 tons per day. The boilers were each designed to generate approximately 21,000 pounds per hour of steam at 675 psig and 500 degrees F but have since been modified to generate superheated steam at 675 psig and 580 degrees F. The steam is utilized to generate approximately 3,500 kilowatts at 4,160 volts using a multistage condensing turbine and an 1,800 rpm generator. An air-cooled condenser is utilized for condensing turbine exhaust and is
capable of 100% steam bypass. This allows the plant to operate at full load with the turbine generator unit off line.

The facility required a number of capital improvement projects in order to enhance its overall operating condition and to bring the facility in compliance with applicable codes and standards.

Existing APC Equipment

The air pollution control equipment currently installed and operated consists of (one) Belco two field electrostatic precipitator for each combustion train. Flue gas is drawn through the precipitators and discharged to a common 140 foot steel flue concrete encased stack utilizing an induced draft fan for each combustion train. The electrostatic precipitators have operated satisfactorily but are likely insufficient to meet the particulate requirements of the new small MWC regulations. In order to assure that the regulations will reliably be met, and with the new requirement for acid gas control, the electrostatic precipitators must be replaced with fabric filters.

For small Municipal Waste Combustors such as the Key West facility, constructed on or before August 30, 1999, the Emission Guidelines under 40 CFR 60, Subpart BBBB establish December 6, 2005, or three years after the effective date of a State Plan Approval as the date for final compliance. Subpart BBBB defines a Small Municipal Waste Combustor as a combustion unit which has a design combustion capacity of 35 TPD through 250 TPD of Municipal Solid Waste and commenced construction on or before August 30, 1999. The Southernmost Waste-to-Energy Facility fell within the Small MWC Class II category and thus was required to comply with the applicable emission limitations shown in Table 1 by December 2005.

APC Retrofit Plan

For the purpose of estimating the cost of the planned air pollution control equipment system upgrade, the City solicited budget proposals from various air pollution control vendors. The City decided to base its estimate on one of the budget proposals received, which provided a significant amount of detail and cost breakdown. The budget proposal was based on a process design utilizing an evaporative cooler to reduce
Bypassing waste during construction would be a significant cost to the project since the waste, rather than the ash, must be hauled to a landfill approximately 200 miles from Key West, representing a significant increase in the tonnage of material to be hauled. Various options were reviewed for constructing the facility in a manner which would reduce facility downtime during construction. Based on a review of various construction options, it was decided to base the project estimate on constructing the fabric filters and miscellaneous equipment on a new footprint, allowing the existing equipment to continue to operate as long as possible during construction.

The estimated operating cost differential after the addition of the APC retrofit consisted of the cost of hydrated lime and activated carbon in the required quantities, bag and cage replacement, and the differential cost for utilities including water and electricity, and added operating costs for hauling, and disposal of spent hydrated lime and carbon reagents.

**Combustion Issues and Carbon Monoxide**

As illustrated in Table 2, the CO concentration in a December 2002 stack test was 90 ppm. The ability of the combustors to consistently meet the 100 ppm CO limit of the new regulations after the retrofit was completed was a concern. The facility was not equipped with CO continuous emission monitors and there are no permanent instruments in place for the facility staff to monitor CO levels during stack testing. During the past year the facility staff performed a series of tests using a portable CO monitoring device to obtain information regarding actual CO levels in the combustion gas. The monitoring arrangement included an indicator allowing the monitoring of CO levels on a continuous basis.

The information gathered during testing indicated that the CO concentrations in the combustion gas was below the regulatory limit as set by the new regulations, even when burning wet waste, tires, and as much as 50% yard waste. Large spikes of CO concentration were noted during the testing. These spikes caused the average of the CO concentrations during testing to increase significantly. The spikes in CO concentration were the result of large variations in the quantity of combustion air, as manually adjusted by the operators, in order to maintain proper combustion temperatures. The facility’s current pneumatic controls allow for as much as 100% air bias in manual mode. Training the operators to make control adjustments incrementally to avoid CO upsets resulted in much lower average runs.

In order to help reduce the level of CO emissions and provide more stable combustion over varying load levels, the current pneumatic controls would be replaced with a distributed control system. The new control system would incorporate bias control parameters which would eliminate the possibility of operator caused over-bias.

Other combustion modifications would be necessary to assure acceptable CO levels. Modifications in the control and distribution of overfire and underfire air were being considered as a further means of reducing and stabilizing CO levels. This modification would include dividing the underfire air and overfire air into drying and combustion zones, which could be balanced and biased to produce desired combustion conditions. The current design allows for overfire air underfire air bias along the entire stoker grate as a single undivided unit. Creating drying and combustion zones was expected to improve combustion control and waste burnout as a result of improved and more efficient air distribution.

The original combustion design included a waterwall curtain directly in front of the screen tubes. The waterwall curtain was never installed as intended, although the steam drum was

<p>| TABLE 2 |</p>
<table>
<thead>
<tr>
<th>Results of Emissions Stack Test Conducted on Unit 1 December 11, 2002</th>
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<tr>
<td><strong>Carbon Monoxide (CO)</strong></td>
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<tr>
<td><strong>Particulate Matter</strong></td>
</tr>
<tr>
<td><strong>Cadmium</strong></td>
</tr>
<tr>
<td><strong>Lead</strong></td>
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<tr>
<td><strong>Mercury</strong></td>
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<tr>
<td><strong>Sulfur Dioxide (SO2)</strong></td>
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<tr>
<td><strong>Hydrogen Chloride (HCl)</strong></td>
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installed with the necessary ports to accept the waterwall curtain and therefore would be compatible with the installation. This modification, which was also planned, would improve combustion efficiency by providing a more torturous gas path than presently exists and by increasing the gas residence time in the combustion zone.

As indicated in the test results shown in Table 2, current cadmium, lead, and mercury emissions would meet the new emission regulations as shown in Table 1. However, the results of particulate matter testing indicate that the current particulate emissions may exceed the limit required under the new regulations. After being retrofitted, the facility was expected to readily meet the new particulate standard.

**Facility Historical Background**

As a historical perspective, the city of Key West contracted with a private firm to build and operate the waste-to-energy facility in 1986. Contractual difficulties arose and actually resulted in a grand jury investigation into the waste-to-energy operating contract as well as lawsuits about the relationship between the City and the private operator. Key West eventually bought out the private operating contract so that it could operate the facility with City staff. Further, there were certain operational problems which plagued the facility from the start of its operations.

**Technical Advisory Committee (the TAC)**

As described above, the plan to retrofit the facility and install required upgrades was well established and the funds were already available to implement these projects. The City however was not ready to implement these projects until other waste disposal options were investigated. Particularly in light of the history of the early contractual and operating problems described above.

The City assembled a Technical Advisory Committee, which included engineering and legal consultants, a representative from the Florida DEP, two City commissioners and other City representatives. The TAC was charged with the task of preparing recommendations to the entire City commission regarding the options for Key West’s long term waste disposal. One important aspect of the decision making process was to determine the long-range costs of the options under consideration. In order to accomplish this task the Technical Advisory Committee estimated the cost of various options under consideration and utilized these costs as part of a comprehensive rate model to project the City’s long term waste handling and disposal costs. The Technical Advisory Committee reviewed information provided by various alternative technology vendors and decided that none of the alternative technologies reviewed could demonstrate the ability to provide successful long term operations based on commercial operating experience, and also could not adequately demonstrate that the technologies offered would be competitively priced. The TAC therefore recommended that the City’s waste disposal options should be limited to “waste-to-energy” or “transfer, haul and disposal” utilizing a new City transfer station, either privately operated or City operated.

The cost for privately operating a new transfer station, hauling the waste from the transfer station to disposal sites located outside the Keys, and disposing of the waste was obtained through a request for proposal (RFP) process. In response to the RFP prepared by the TAC for the City, one responsive proposal was received for long term hauling and disposal of waste, and alternately, for the operation of a new transfer station.

The TAC prepared the estimated cost of constructing a transfer station based on demolition of a portion of the waste-to-energy structure and utilization of the site as a transfer site.

The costs for transfer station construction, operation of the transfer station, and the proposed prices for hauling and disposal of the City’s waste, along with the estimated cost of construction and operation of the retrofitted waste-to-energy facility, were all included in the rate model scenarios in order to establish a comparison of system costs and future rates. The rate model accounted for all of the City’s solid waste handling and disposal costs in thorough detail. The comparison of the various options under consideration by the City resulted in there being virtually no difference in twenty year system life cycle costs to the City between the waste-to-energy and the haul and disposal options as shown below in Table 3.
TABLE 3

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<th>Present Worth of System Costs</th>
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<tr>
<td>Long Term Disposal Alternative</td>
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<tr>
<td>City Operated Transfer Station</td>
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<tr>
<td>WTE Retrofit</td>
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<td>Contractor Operated Transfer Station</td>
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Since there was no statistically significant difference in the present value costs of the various options, considering the assumptions made for the twenty year operating period, the TAC prepared a set of evaluation criteria other than cost upon which to make its recommendation. The evaluation criteria included such variables as:

- Ability to handle waste in the event of a disaster (hurricane).
- Budget predictability
- Energy production
- Exporting waste to other communities
- Flexibility in operations
- Liability exposure
- Potential for litter and odor problems
- Public Perception
- Truck Impacts
- Local Economy effects

Based on these and other factors, the TAC prepared an evaluation methodology and voted individually on the waste disposal options. The result of the vote was strongly in favor of recommending to the City the retrofit of the waste-to-energy facility, with reliance on the upgraded and improved waste-to-energy facility, as an integral part of the City’s long term waste handling and disposal system.

The Decision of the City Commission

A special meeting of the City Commission took place on January 14, 2004. During the meeting, members of the Technical Advisory Committee presented information to the Commission regarding the air pollution control retrofit project requirements and costs, the transfer station conversion project requirements and costs, and the details and costs associated with a haul and disposal contract to transfer and ship waste out of the Keys. The long term rate model, comparing waste-to-energy to the haul and disposal option was presented. The rate model presented, clearly indicated that the required rates and life cycle costs of each option were too close to be a significant factor.

The public meeting had one question on the ballot, which was whether or not to keep the waste-to-energy plant open. The meeting was well attended by the public, although it appeared to be one-sided in favor of closure. Members of the public who were present at the meeting included residents of a condominium complex located adjacent to the landfill and the facility. Also present as part of the public were representatives of the private firm which provided the only responsive proposal to the City’s hauling and disposal RFP.

The operating and contractual problems which plagued the facility during its early years of operation was still fresh in the minds of the City Commission. The commission was concerned that the bad experiences of the past would resurface and chose to disregard the advice of the Technical Advisory Committee. These feelings were reinforced by the private hauling and disposal interests which were very active within the City in promoting the haul and disposal option to the City.

Members of the public as well as the commissioners generally spoke in opposition to the waste-to-energy facility and to dispute the recommendations of the Technical Advisory Committee. The public was sensitive to the operational and contractual problems which the plant and the City experienced during early operations. There were statements made by the public claiming that odors from the plant (which they insisted was coming from the stack) were a serious and continuing problem. There were claims of chronic health problems which were attributed to the facility.

During the presentations, it became very apparent that there was little, if any, chance that the commission would favor the waste-to-energy facility and its required retrofit. With little debate, the Commission decided to reject the advice of the technical advisory committee and voted unanimously to close the facility.

Requirements for Facility Closure
It is not clear at this time when the facility will actually shut down. The current Title V permit expires on May 31, 2004. Therefore, the shutdown will likely occur by that date. Based on a discussion with the Florida Department of Environmental Protection regarding the requirements for a facility shutdown, the City will be required to submit a closure plan for approval, remove and dispose of all solid waste and residue from the site and submit a final statement of closure. The site may be used for waste transfer operations after the facility closes, and this must be reflected in the closure plan. Alternatively, an existing transfer station located in the Keys may be utilized for temporary transfer operations.

Conclusions

The City's Utilities Department, responsible for solid operations, was prepared to upgrade and modernize the Southernmost Waste to Energy Facility. The outcome of a retrofit and upgrading project would have been a modernized facility in full compliance with the latest air emission regulations. However, the facility's history of contractual and operating problems, the perception of plant related public health problems, and other underlying factors outweighed the recommendations of the Technical Advisory Committee. Although as a result of the TAC's work in preparing an RFP for hauling and disposal, the City was able to obtain an initial waste hauling and disposal fee which was lower than the existing fee charged for hauling and disposal of ash.

It is expected that there will be a significant increase in truck traffic and truck emissions with daily hauling on the two lane highway which is the only connection and evacuation route from the Keys to the mainland of Florida. For the Keys, which are very ecologically sensitive, the additional truck traffic and the transfer of waste could present serious environmental concerns which a modernized well operated waste to energy facility could have alleviated.

The City chose to assemble a group of solid waste experts and concerned City representatives to help the City of Key West decide on how it will handle solid waste in the future. The final recommendation of this group, after numerous meetings and the development of cost estimates, rate models and requests for proposals, which took place over a period of more than a year, was to keep the waste-to-energy facility open and perform the retrofit project. The City Commission rejected this recommendation and as a result, the facility is in the process of closure.