Results of RFI Process Discussion Draft for SWMP Steering Committee

May 19, 2009

Capital Region Solid Waste Management Plan Steering Committee

Technologies Represented in Submittals

- Aerobic Digestion – Composting- 1 respondent
- Single Stream Recycling – 1 respondent
- Mass Burn Waste-to- Energy – 2 respondents
- Mechanical Processing
  - Feedstock for Thermal Gasification – 3 respondents
  - Engineered Fuel for Off-site Combustion – 3 respondents
  - RDF for on-site combustion and electricity generation – 1 respondent

- Thermal Gasification
  - Pyrolysis –6 respondents
  - Plasma – 2 respondents
  - Other – 1 respondent

Aerobic Digestion – Composting

In the *aerobic digestion* process, the organic material is metabolized by microorganisms in the presence of oxygen. During the process, temperature and pH increase, carbon dioxide and water are liberated (reducing the mass of material), and pathogens are destroyed. Products of the aerobic digestion process can potentially be sold as compost or fertilizer products.

One company responded with information on this process, and their submittal indicated that feedstock would be limited to SSOW, not mixed MSW. Minimum facility size is noted as 20,000 tons per year, with potential expansion in 10,000 TPY increments. Minimum site size is 6 acres and up to 20 acres for a 75,000 TPY facility.

Aerobic Digestion – Composting

Potential Advantages

- Technology is reasonably proven, although not widespread.
- Possible private sector merchant plant
- Tipping fee at reference facility is $65
- Somewhat less capital intensive than other technologies
- Consistent with SWMP objective of more emphasis on recycling and reuse

Potential Disadvantages

- Can only manage SSOW fraction of waste stream
- Would necessitate a change in waste collection practices and infrastructure
- Urban location may be constrained due to buffer requirements for odor control

Single Stream Recycling

Single stream recycling refers to a system in which all paper fibers and containers are mixed together in a collection truck, instead of being sorted into separate categories or commodities by the resident and handled separately throughout the collection process. In single stream recycling, both the collection and processing systems must be designed to handle this fully commingled mixture of recyclables.

One company responded with information about this process. Facility size is noted as 65,000 tons per year, with maximum capacity of 120,000 TPY. The service area for facilities of this size will likely extend beyond the planning unit.

Single Stream Recycling

Potential Advantages

- Technology is reasonably proven, and becoming more widespread
- Somewhat larger array of recyclables could be collected (Plastic 1-7 are noted) and greater public participation and recovery of recyclables may result due to ease of participation
- Consistent with SWMP objective of more emphasis on recycling and reuse

Potential Disadvantages

- Would necessitate a change in waste collection practices and infrastructure, and new costs for example
  - carts
  - collection vehicles
- Paper quality may decline as paper is commingled with other materials and residue quantities may increase relative to existing dual stream systems

Mass Burn Waste-to-Energy

Waste-to-Energy (WTE) is defined as a solid waste management strategy that combusts wastes to generate steam or electricity and reduces the volume of municipal solid waste (MSW) that would otherwise need to be disposed of by approximately 80-90 percent (70% to75% by weight). Mass Burn WTE facilities combust post recyclable MSW without any front-end mechanical processing.

Two companies responded with information on this process, with one of the companies suggesting the use of existing facilities located outside the Capital Region. One submittal suggested the development of a single-train Advanced Thermal Recycling process WTE facility with an annual throughput capacity of 230,000 TPY. An alternate sized larger, dual-train facility could be sized at 300,000 TPY. Suggested site size for these facilities was 8 acres and 11 acres, respectively. The service area the larger facility would need to extend beyond the planning unit. Residue for disposal at several U.S. reference facilities varied between 27 to 31% by weight.

Mass Burn Waste-to-Energy

Potential Advantages

- Technology is well-proven, with 10 actively operating facilities in New York
- Landfill disposal volume can be reduced by 80-90% - additional volume reduction may be achieved by recycling of bottom ash.
- With full by-product recovery and re-use, only 2% of incoming waste weight would require land disposal
- Electricity is a useful by-product with a reliable market

Potential Disadvantages

- High Capital Cost
- Tipping Fee at a Reference facility is about US$159/ton
- Public support can be limited by concerns regarding emissions however actual operational data indicates emissions are extremely low.
- Extended timeframe for project development.

Mechanical Processing

Several of the RFI respondents included descriptions of mechanical processes for MSW, either as a precursor to further processing, or to create a solid fuel for combustion. These front end processes typically recover recyclable materials and well as remove non-processible or non-combustible materials from the waste stream. The rate and type of material recovery varies with the both the quality of the incoming waste stream and the type of process that is employed. RFI respondents did not always provide much information about their front-end mechanical processes. Three of the RFI respondents described mechanical processes which created an engineered fuel product that could be marketed as a solid fuel to an off-site user. One of the RFI respondents described the production of a refuse derived fuel (RDF) which would be burned in an on-site boiler to generate steam and electricity.

Reported facility sizes varied from 35,000 TPY to 400,000 TPY. Site requirements varied from 7 to 15 acres. Residue remaining for disposal varied from 5% to 34%, by weight.

Mechanical Processing

Potential Advantages

- Lower Capital cost relative to Mass Burn if no on-site boiler
- Front–end recovery of recyclables
- Electricity is a useful by-product with a reliable market
- Some processes report residue for disposal between 5% to 10%, by weight.

Potential Disadvantages

- European Reference facilities cited tipping fees at $126 to $165 US$/ton
- Performance history has favored mass burn over RDF
- Environmental restrictions may limit the interest of off-site fuel users
- Extended timeframe likely for project development.

Thermal Gasification

Gasification involves the thermal conversion of organic carbon-based materials in the presence of internally produced heat, typically at temperatures of 1,400°F to 2,500°F, and *in a limited supply of air/oxygen* to produce a synthesis gas or "syngas" composed primarily of H2 and CO. Inorganic materials are converted either to bottom ash or to a solid, vitreous slag, depending on the conditions materials are processed under.

Most gasification systems are closed systems and do not generate waste gases or air emission sources during the gasification phase. After cooling and cleaning in emission control systems, the syngas can be utilized in boilers, gas turbines, or internal combustion engines to generate electricity, or to make chemicals. Subsequent power generation using syngas does have air emissions that can be filtered through a stack and air emission control system.

Thermal Gasification

Nine respondents to the RFI described a thermal gasification process. Six of the respondent processes involved pyrolysis to generate syngas, and two utilized plasma arc technology. One respondent described a thermal conversion technology and the subsequent conversion of syngas to ethanol. Most of the respondents describing gasification systems included the use of electric power generation as well as other material recovery processes (e.g. biochar).

Reported facility sizes varied from 15,000 TPY to 290,000 TPY. Site requirements for all but two of these respondents varied from 5 to 20 acres. One respondent stated that as little as ½ acre was needed and another noted a minimum of 60 acres. Most respondents noted that residue remaining for disposal varied from 7% to 20%, by weight, although several claimed that there was no residue requiring landfill disposal.

Thermal Gasification

Potential Advantages

- If commercially proven, can minimize landfill disposal and create marketable fuels and products for end-use
- Electricity is a useful by-product with a reliable market
- May have application for specialized and hard to manage waste streams
- Process emissions are reportedly better than combustion based alternatives.

Potential Disadvantages

- Technology is not well proven and the few reference facilities have a very limited operating history with MSW at the required scale
- Project development timeframes are unknown and may be extensive because technology is new and emerging
- Relatively uncertain capital and operating costs