Synopses: Stabilization With Landfill and Thermal Processing

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Profile of the author:

Mr. Gust has 30 years of experience in world-class incineration facilities utilizing rotary kiln, fluidized bed, fixed hearth, moving grate, utility, and other furnace designs at temperatures up to 4,000 degrees Fahrenheit. His technical credentials include years of design and pilot scale-through-commercialization development of thermal systems, emission controls, chemical treatment, treatability studies, dewatering, stabilization, materials handling, classification, insitu treatment, and other advanced technologies. His operations background includes start-up of the largest U.S. hazardous waste rotary kiln facility; start-up of the largest U.S. waste burning, fluidized-bed incinerators; operation of the largest U.S. hazardous liquids incinerator; operation of a large waste-to-energy incineration facility; and the management of chemical treatment, wastewater treatment, deepwell injection, ash stabilization, groundwater recovery, secured landfills, and other facilities. Mr. Gust has a current, working knowledge of environmental and safety regulations, participated in every phase of regulatory permitting and performance testing, and has worked in community relations. He has served as an officer for major environmental corporations in operations, strategic planning, technology development, and human resource management.

Summary of the Presentation:

Municipal and sanitary landfills can pose environmental problems due to leachate, landfill gas and unstable geotechnical properties. Most governmental bodies delay the correction of landfill problems or landfill replacement until a crises stage is reached. The replacement of a landfill is often made difficult due to costly regulatory controls, public opposition to siting and the high cost of closure for the previous landfill unit. Solutions to extending landfill life and capacity involve waste minimization by recycling, refuse compaction and waste-to-energy incineration. Incineration can reduce the volume of refuse by 50-95%. The largest installed bases of municipal waste incinerators are located in Japan and the U.S.

The volume of waste contained in a landfill can be estimated by load count tabulations, weight-and-volume measurements or a material balance analysis based on the trash profile of user categories. For an existing landfill, core samples may be collected and analyzed for use in a material balance analysis. Newly generated refuse contains approximately 50% of the heating value of coal. However, landfill properties vary significantly due to the waste profile of the contributors and biodegradation due to time and weathering. The volume of the Nanji-do landfill

was estimated to be 119,667,204 metric tons using the load count analysis method. Boring samples suggest that up to 30% of the contents may have useful heating value.

The most common waste-to-energy incinerator technologies are: Mass Burn as modular or field erected facilities, Refuse Derived Fuel (RDF) facilities, Rotary Combustors and the increasingly obsolete Stationary furnaces. The largest field erected mass burn facilities are constructed for high reliability by combining multiple incinerator / boiler lines, each with 250-1,000 tons per day (tpd) of capacity. The mass burn design feeds the incinerator with a clamshell or bucket loader and uses little presorting. Modular mass burn units up to 300 tpd may be factory assembled and shipped skid-mounted. Typically, 100 tons of refuse will generate 1.4 MW of power. The most efficient units can achieve 2.5 MW per 100 tons of refuse. RDF technology was developed to provide alternate fuels to power plants by presorting and concentrating high energy waste materials. The sale of RDF fuels was not commercially successful in the U.S. Most RDS fuels are incinerated in dedicated furnaces. The fundamentals of incineration require: reaction time, temperature, turbulence (mixing of the refuse) and the control of combustion air. Typical air emissions for modern municipal solid waste (MSW) facilities are listed in the presentation. Multiple emission control systems are required to ensure the achievement of stringent pollution standards.

The disposal of heavy (bottom) ash and fly ash from MSW incinerators is tightly regulated in the U.S. Ash is analyzed for toxic metals leachability (TCLP) and pH. Although recent studies indicate the suitability of combining MSW ash with untreated refuse, U.S. regulations typically specify composite or double synthetic lined monofills for ash placement. Ash containing leachable toxic metals is stabilized using pozzolanic mixtures of cement, lime, silicates and polymers. With size reduction and compaction, blends of ash and refuse can achieve low permeability and high load-bearing capacity suitable for redevelopment. Although other limited uses of ash have been documented as road base aggregate, masonry block fabrication and as fill for artificial water structures (reefs), few businesses will risk the legal liabilities of ash recycling or reuse, particularly where low-cost, natural materials are available.

The redevelopment of the Nanji-Do Landfill was recently investigated in a Conceptual Design and Feasibility Study prepared for the Sunkyong Group. The study confirmed that the land could be redeveloped by integrating many of the technologies presented. The sequence of useful technologies includes:

- Establishment of low permiability landfill liners
- Mining and recovery of ferrous and nonferrous metals
- Size reduction of untreated refuse to enhance compaction / fill properties
- Use of the RDF sorting process to minimize refuse requiring incineration
- Bioremediation by composting low organic content refuse
- Mass burn waste-to-energy processing of high organic content refuse
- Landfill gas and refuse fuel value recovery to generate US$590 million in electricity

- Stabilize and compact the refill material to achieve an engineered, stabile base for future redevelopment
- Establish a secure landfill cell for toxic refuse that cannot be economically treated
- Provide careful attention to manage existing and remedial environmental problems to eliminate future liabilities of leachate and landfill gas, while minimizing noise and odors during the remedial phase.
- Following remediation, the plant and equipment will be removed to allow commercial development
- Maintain long-term environmental monitoring and groundwater remediation, as needed