"USER PERSPECTIVE" ON RESEARCH NEEDS IN ENERGY RECOVERY FROM WASTES

by

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Introduction

Users are wary of implementing refuse to energy projects in the United States because of questionable cost-effectiveness and concern whether these plants will meet environmental criteria - present as well as future - and the resulting potential for excessive Owner liability.

Refuse to electric energy could be readily implemented if an assured technical, economic and environmental package can be arranged.

Standards of acceptable practice need to be developed to give designers and operators guidance. Today there are no references of the kind needed to achieve an economic balance among costs, performance and overall environmental protection.

For this, Government aid by subsidy, guarantee, tax benefit or other form, may be needed.

Research and demonstration areas are identified to yield engineering bases for advancing such projects.

I. Cost Effectiveness and Future Environmental Criteria

A substantial public or private investment in energy recovery plant must take account of future burdens on the operation arising from changing environmental standards. With those changing standards will come demands for additional pollution defenses, litigation for medical claims, and possible interruption of operations.

A large corporation recently reported that in the past 5 years its awards, in excess of $1,000,000 each case, for occupational injuries were 10 times that of all previous such awards.

For these reasons possibly the most important research need in energy recovery from waste would be that going to the financial dependability underlying investment. Perhaps a form of federal guarantee may be needed, otherwise insuperable burdens may fall on both the investor and the community. There is no need here to recite the potential hazards of the various steps of processing and emissions. But their threat to the financial dependability of the process is just as real as a threat of breakdown in the mechanical or technical aspects.

Congress is showing some more receptivity toward a product charge such as the penny-a-pound concept whereby a fund is developed via a charge on the articles making up solid waste. Such a fund could be coordinated as part of a financial guarantee. One hesitates to throw problems back at the federal government but the federal government does have the enormous flow of revenue via the federal income tax, whereas the localities must depend largely on property and sales taxes. Put another way, the federal government holds the funds but the localities hold the problem and the responsibilities.

Specific technical aspect needs in research and demonstration which could be helpful in gaining User acceptability of waste to energy projects follow.

II. Pollution Measurements

There is a need for a simplified method of obtaining representative gas samples in a stack or duct in order to determine concentration of particulates in the effluent gas stream from waste-to-energy combustion plants.

USEPA air pollution stationary source test methods (Appendix to New Stationary Source Standards 40CFR60) stipulates a minimum of twelve traverse points in sampling gas effluents from stacks or ducts 2 feet and larger. The minimum number is allowed only if the sampling site is at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, contraction, or visible flame. Often these conditions cannot be met and the number of traverse points needs to be increased. For example, if physical layout allows only two duct diameters downstream for testing, 48 traverse points are required.

Traversing of a duct requires frequent indexing of the sampling probe during the test. This is a tedious process which in itself introduces errors. Testing is often done on high scaffolds under adverse weather conditions, further compounding difficulties.

There is a greater concern for fine particles -- less than 5 microns. These fine particles contribute to smog formation, are more likely to bypass respiratory filters and penetrate deep into the lungs and they may act synergistically with other pollutants.

Fine particles would have a tendency to diffuse more readily throughout the cross-section of a duct, perhaps obviating the need for extensive traversing that might be needed if particle sizes were larger and more susceptible to stratification.

Research could be done to determine if number of traverse points can be reduced and, if at all possible, a sampling probe fixed in the center of the stack or duct can provide reasonably representative test data for the particulate matter of consequence -- the fines.

It is recommended that the research be performed in the field, testing actual emissions in various arrangements of ducts and stacks downstream of air pollution control devices on full scale plants. USEPA approved test procedure employing extensive traversing would be compared to data obtained by the single probe-center duct system. Analysis would be made for particle size ranges such as 0-5 microns, 5 to 10 microns, 10 to 15 microns, 15 to 20 microns, etc.

The research could provide a basis for adoption of a simplified sampling procedure, particularly appropriate for fine particles. The procedure would in turn facilitate and encourage cost effective surveillance of existing waste-to-energy combustion systems in providing easy monitoring procedures that can assure continued compliance with air pollution control regulations.

III. Spray Water Conditioning Tower

The spray water conditioning tower upstream of an electrostatic precipitator should be investigated as an alternative to scrubbers downstream of electrostatic precipitators in controlling gaseous pollutants such as HCl and HF from waste-to-energy combustion processes and also for improving particulate emission collection efficiencies, particularly when waste is dry, as it is more likely to be if prepared as a refuse derived solid fuel (RDSF) by prior shredding and air classification before combustion.

Control of gaseous pollutants is obtained by partial absorption of the gases in the moisture atmosphere of the spray water conditioning tower and the gases in solution adhere to the particulates which are collected in the precipitator.

Efficiency of electrostatic precipitators is known to fall off as moisture content of effluent gases is reduced below 12% by volume. The spray water conditioning towers can serve to maintain the required moisture content in the effluent gases regardless of character of waste incinerated.

The spray water conditioning tower upstream of an electrostatic precipitator is a preferred alternative to a scrubber downstream of the precipitator because it obviates problems of corrosion, water clarification and treatment, sludge handling and steam plume that characterize wet scrubber operation. These are problems that an Owner of a waste-to-energy facility would prefer not to contend with.

Spray water conditioning towers are widely used in refractory wall furnace incinerator systems but to date have not been adapted for water-wall incinerator plants.

IV. Bacteria and Virus Control

One of the Owner attractions for the concept of refuse derived solid fuel (RDSF) manufacturing is that it presumably does away with the combustion process, at least on the premises where the refuse is processed to a fuel. In the usual application, the refuse processing is done by or under the auspices of the municipality and, after the refuse is transformed to RDSF, it is shipped to a remote boiler site, owned and operated by a utility or industrial company who is then charged with the problem of combusting the RDSF in compliance with air pollution control regulations; this is done in exchange for the benefits of the heat energy contained in the RDSF.

Presumably the municipality has rid itself of the air pollution control problem that is associated with a combustion process. Unfortunately, in exchange for the combustion process the municipality has assumed responsibility for a manufacturing system that, without appropriate controls, may produce as much as or more particulate than would the combustion of refuse. The RDSF facility requires shredders, air classifiers and extensive handling of shredded refuse. Because of budgetary restrictions, RDSF installations to date are characterized by high concentrations of ambient dust which are hazardous to personnel working in these areas and, if wind blown, may be harmful to individuals outside of these areas. Refuse has a high component of glass bottles and jars which, when fractured in shredding equipment, causes fine slivers of glass to become air-borne. This type of pollution is particularly harmful to health if not controlled adequately.

Another problem is the juxtaposition of ferrous metal and combustible paper and plastics in refuse. Sparks caused by the ferrous metals as they are shredder with the combustibles may cause fires, resulting in particulate, gaseous, visual and ordorous emissions.

Studies have shown that along with the dust are a great number of microorganisms among which are some pathogens. These organisms, being dust- or droplet-borne, permeate the entire environment of the enclosed refuse handling facility. The concentration of microorganisms varies according to the distance from the source of the dust and the extent of natural or forced ventilation of the area.

It is proposed that a system be devised wherein dust and droplets generated in RDSF manufacturing, which may be carriers of bacteria and virus, be contained and not be permitted in the plant atmosphere.

This is to be accomplished by enclosing the shredders and conveyor systems and drawing suction on the enclosure. Exhaust fans are provided to create a face velocity across unavoidable clearances and openings to thereby prevent the pollutants from escaping.

Investigations are needed to develop guidelines on determining optimum volume flow of exhaust fans, static pressures and the selection of the preferred pollution control device before discharge to atmosphere -- bag filter, scrubber or others.

The exhaust fans, in addition to controlling dust, bacteria and virus emissions, may affect refuse shredding production rates and alter particle sizes of the shredded material -- this due to air sweeping of the shredder. This also may be influenced by the shredder mechanism (e.g., hammers, grate openings, configuration, etc.) and the amount of spray water used in the shredder.

This research should be done in the field, testing actual installations rather than in the laboratory or on pilot plants.

V. Pyrolysis Gas Driven Engines or Turbines for Electric Generation

A solid waste-to-energy process has been under development through an EPA research contract with Combustion Power Co. of Menlo Park, Calif. since 1967.

Pyrolysis gas products from a 90.7 metric ton (100 U.S. Ton) per day fluidized bed combustor, after clarification through a newly developed granular filter, is being used to drive a 1000 kw gas turbine generator.

This research and demonstration could be expanded to include operation of a gas engine and/or gas turbine on the pyrolysis gases from the Union Carbide Corporation Purox plant at South Charleston, West Va.

The refuse-to-electric generation option is most attractive to municipalities because it removes a major obstacle in project implementation -- the need to site the refuse facility in a population center. Refuse-to-electric generating plants can be sited almost anywhere and preferably at existing landfill areas.

Additional advantages of such siting are:

- methane from decomposition of refuse in the landfill may be utilized in the energy conversion plant;
- in the event of plant outages, refuse may merely bypass the plant and be diverted to landfill;
- in the event of malfunction of air pollution defences provided, the plant's remote location at the landfill affords a higher tolerance level than were it located in a population center.

VI. Conclusion

In summary, I would say that the business end of refuse to energy projects warrants as much research attention as the traditional technical and mechanical development. One cannot expect the private sector to bear the risk and burdens of meeting new environmental standards and coping with the kind of accident claims that lie in the future. Similarly, it is unwise and inequitable to unload this on the back of the local taxpayer. Such a load will only contribute to the deterioration of the community. Public bodies such as Public Service Commissions have not shown a particularly admirable record in dealing with franchised services such as electric utilities, airlines and the like. We believe that research in this area must combine the roles played by manufacturers, operators, financiers, public officials, attorneys and engineers.