Summary of Session 8

Energy Release Characteristics and Controls

by

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This session was structured to reveal areas requiring development and/or research needs by fostering direct communication and interchange between:

1) Those currently responsible for operating and maintaining systems for receiving and processing wastes into useful fuels and the on-going use thereof in steam generating systems

2) The designers or constructors of these systems

3) The academic/researchers conversant and involved in developing cause and effect relationships of phenomena encountered

4) The equipment or systems suppliers

The need for fostering and maintaining meaningful communication between the involved entities is acknowledged but is infrequently practiced.

An effort was made to have the panel participants represent these sectors particularly those who can relate actual operating experiences encountered at municipal, industrial and utility factilities utilizing the common spectrum of fuel combinations in the different operating modes and requirements.

The panelists generally described and discussed the following areas:

1) the arrangement of their steam generating facility

2) the type and form of waste fuels and fossil fuels burned

3) the ratio of fuels burned:

- ° areas of constraint
- ° problems encountered and corrective steps attempted

4) design capacity of boilers:

- ° normal operating load
- ° operation limiting factors

5) Discussion of experience with:

- ° fuel preparation
- ° fuel feeding to furnace
- ° fuel distribution in furnace
- ° primary air control
- ° secondary air control
- ° furnace temperatures (what loads-where measured)
- ° excess air (what loads-where measured)
- ° particulate entrainment variation
  - at different burning rates/excess air
  - during swinging loads
  - change in waste fuel character
- ° furnace slagging and clinkering
- ° boiler bank fouling
- ° soot blower operating experience
- ° carbon burnout in fly-ash
  - reinjection of fly-ash
- ° carbon burnout in bottom ash

6) combustion control and instrumentation:

- ° fuel metering system and effectiveness
- ° air metering system and effectiveness
  - to maintain furnace stability with change in load or fuel character

The operating experiences of these representative types of steam generating plants using solid wastes in different forms as a fuel separately or in combination with fossil fuel was presented and discussed at some length. Wastes types included municipal refuse, general and special industrial plant solid and liquid waste, and dried sludge. Operation of utility, municipal and industrial boilers utilizing these salvage fuels within the spectrum of full suspension, semi-suspension and mass-grate firing.

Subsequent to placing the fuel preparation and combustion processes in the perspective of fuel combinations, particle size, chemical reactions and configuration of the combustion chamber, the facility operators described their experiences with their systems and specific mechanical/pneumatic equipment subsystems.

Some of the significant experiences indicate:

1. Gas side metal wastage has not been a real concern except where there is concentrated firing (nozzles in close proximity to adjacent furnace wall surfaces) of wastes high in chlorides with those systems burning RDF.

2 Mechanical, wear and separation problems in pneumatic systems for fuel feed and ash removal; principally attibuted to inadequate metals and ceramics removal from RDF. Mechanical handling system problems downstream of each fuel processing component due to the marked volume expansion of the fuel product.

3. A relationship exists between the nature of the RDF e.g., particle size, moisture, combustibility and type of firing (suspension - w/wo grate, semi-suspension) on the ratio of RDF to fossil fuel, combustible in the bottom ash, particulate entrainment, boiler turn-down and the ability to follow variations in steam load.

   Ratios of RDF to sustaining fuel reported were 1:6 to 1:0 depending on the real need to respond to steam demand variations. Attainable RDF turn-down was reported to be 1/8 to 1/2 of full steaming capacity--contingent upon RDF sizing, moisture, burnability, and type of firing.

4. Shredder maintenance has been tolerable. However, in general, for producing RDF a single size reduction machine is inadequate for coping with a very wide variety of as-discarded waste and providing the desired product size and quality. Two stages of size reduction facilitates RDF beneficiation and improves system availability. Fire as well as explosion suppression systems are necessary.

5. Effective dust control is essential to maintain a tolerable working environment.

6. In general, raw waste storage seems more practical than storage of processed RDF. RDF should be supplied directly from process to the boiler furnace if possible, with storage only for surge control in view of the 10 times volume expansion experienced.

Development and Research

A. Specific coarse size reduction and fine size reduction machines with sustained operation capability at design capacity of at least 150 hours.

B. Mill fire suppression system without water deluge.

C. Pneumatic conveyor systems with higher availability, lower maintenance and power.

D. Devices and methods for obtaining three dimension profiles of combustion gas character and constituents in the primary furnace.

E. Flame length suppression through use of strategically located fixed or induced turbulence systems, or other approach, with associated devices and methods for assessing cause and effect relationships to establish need and/or duration of engagement.

F. Analytical devices and methods to predict RDF combustion characteristics and energy values with associated procedures for correlation to practical combustion situations. R & D should be directed at MMR heterogeneous mix RDF as well as discrete industrial waste materials.

G. Cause and effect relationships when combination firing of reliably characterized RDF in various forms with sustaining fossil fuels of different types and quality, in various ratios, in the predominant types of firing systems at least while operating at nominal boiler design capacity; load swing capability and turn-down capability while maintaining sustained controlled operation.

The panel members which had participated and the sectors represented were:

Industrial Operations

Ronald E. Bastion Hubert G. Hoben	EASTMAN KODAK COMPANY Rochester, New York
B. Frank Rogers Francis Crews	GENERAL MOTORS CORPORATION Pontiac, Michigan

Municipal Operations

Harold Saunders	EAST HAMILTON SWARU Hamilton, Ontario

Utility Operations

David L. Klumb	UNION ELECTRIC COMPANY St. Louis, Missouri

University/Research

Richard C. Bailie	WEST VIRGINIA UNIVERSITY Morgantown, West Virginia

Systems Contractor

Floyd C. Hasselriis Session Co-chairman	COMBUSTION EQUIPMENT ASSOC. New York, New York

Consulting Engineers

Herbert I. Hollander Session Chairman	GILBERT/COMMONWEALTH Reading, Pennsylvania

Representative Operating Multiple Fuel Waste-to-Energy Plants - 1976

Plant	Entity	Type of Fuel	Degree of Preparation	Type of Firing	Steam Use
Kodak	Industrial	Industrial Refuse - RDF Dewatered/dried sludge Waste Liquors	Single fine Shred Classified	Suspension with grate	Process/heating
GMC - Pontiac	Industrial	Industrial Refuse - RDF Bituminous Coal	Single coarse shred Classified	Semi-suspension	Process/heating
Hamilton	Municipal	MMR - RDF Gas/oil	Single medium shred	Semi-suspension	Steam drivers District heating
*Nashville	Municipal	MMR Oil	None	Mass - grate	District heating Chilled water
Union Electric	Utility	MMR - RDF Bituminous Coal Gas/oil	Single fine shred Classified	Suspension without grate	Electric generation

*Scheduled but did not participate

MMR - Mixed Municipal Refuse

RDF - Refuse Derived Fuel