A COMPREHENSIVE MUNICIPAL REFUSE CHARACTERIZATION PROGRAM

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The Central Wayne County Sanitation Authority MSW sampling program shows once again that published average data on the quality of MSW, compiled by other researchers, are just that—average data.

While such data is generally suitable for very preliminary feasibility determinations, it is foolish to apply them, not only in the final implementation phases of various resource recovery projects, but even in the preliminary design stages, without at least a cursory verification.

A recent qualitative survey of MSW in a section of Brooklyn, N.Y. by the Port Authority of New York and New Jersey, showed a calorific value of "as received" MSW of 4100 Btu/lb, which is at odds with the past New York City surveys giving an average value of 5100 Btu/lb.

Similarly, a just completed survey of MSW in Fayetteville, N.C. yielded a High Heat Value in excess of 6000 Btu/lb.

The CWCSA sampling program and results are well presented and clearly show that unless the impact of special wastes, such as yard waste, industrial and chemical wastes, etc., can be clearly determined, an MSW qualitative evaluation is of great importance for the proper planning of any resource recovery project.

Discussion by
Roger S. Hecklinger
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Armonk, New York

This paper describes the truly Herculean (or Hadean?) task of hand sorting more than 30 tons of garbage in one week. But what has been learned on this occasion? The extraordinary amount of yard waste present each day is an indication that refuse during the sample week was not representative of the average refuse received in the course of a year. Otherwise, the constituent makeup and heating value appear to be about what one would expect. Perhaps the real lesson learned is that a plant can and must be designed to handle a broad range of feed material and not a "characteristic" material.

One of the 16 categories into which the refuse was sorted is OBW (oversize bulky waste). This constituent is listed under the broad category of Noncombustible. Figure 4 is a photograph, presumably typical, of this category. The material pictured may be considered oversize and bulky as far as laboratory analysis is concerned, but all of the material is of the sort that would be routinely processed in a mass burning incinerator. Further, much of the material pictured is identifiable as rubber or plastic, both of which are highly combustible. A small but significant increment of heating value may have been overlooked.

Under Summary and Conclusions, we learn that
the sorting team was "suitably equipped" and "well motivated". Equipment and motivation of personnel are not discussed in the body of the paper. Those that have been involved in sorting efforts well know the difficulty in motivating refuse sorters who do not have an abiding interest in the outcome of the program. Can the authors tell us how the team members were equipped and how they were motivated? Maybe they, like the room, should be well lit.

Discussion by

Floyd Hasselriis
Combustion Equipment Associates
New York, New York

The authors have made a great contribution to our knowledge of MSW by doing a detailed and precise analysis on the entire contents of refuse trucks on five successive days.

The care taken to prevent loss of moisture is a major contribution in the light of failure to do so in many previous sampling programs. As a result, they have obtained a revealing picture of the role of moisture in refuse, and the amounts characteristically found in the various species when they have been packed together with and without plastic bags in the refuse container.

The collection of data is an update on our refuse, revealing the diaper as a significant component, and the increase in the use of plastics, which was predicted by Niessen rather conservatively.

The care to isolate different types of materials, especially film versus rigid plastics, resulted in new information of the heating value of these plastics, and the relatively high ash content they carry in the fillers.

For some time I have been tracking the relationship between the moisture and ash free HHV of RDF, after Dr. Garvin of NBS noted a correlation of MAFHHV with ash content. Analysis of many data bases has indeed confirmed that the higher the ash content of the refuse, the higher the MAFHHV. This is of course surprising until the realization comes that the high ash and the high heating value both derive from the plastics, which are 6 to 10 percent of the refuse, and therefore significant.

The correlation gives equations roughly like this:

$$\text{MAFHHV} = 8800 + 60 \times \%\text{ASH}$$

The affect of yard waste on the refuse is a major factor, and a difficult one to handle. The authors did admirably in unraveling the data to exclude the yard waste, while permitting the reader to put it back in as he wishes.

When moisture is removed, and extraneous ash also, the nature of the MSW becomes remarkably consistent, and just like early studies showed. The problem is that real facilities have to cope with the wide range of properties on a truck by truck basis unless major mixing is possible within the facility.

Discussion by

Walter R. Niessen
Camp Dresser & McKee
Boston, Massachusetts

This paper presents a substantial body of data concerning the compositions and characteristics of refuse generated in the Central Wayne County Sanitation Authority service area. As such, it is a useful addition to the refuse composition data base; the data is sorely needed to understand the special problems of municipal incineration.

The paper is extremely thorough in documenting the methodology used for sampling and analysis. This is much appreciated since, too often, results are presented where the technique is unspecified. It would be appreciated, however, if the authors would comment on any differences between their methodology and that proposed by the EPA solid waste research staff.

In reviewing the reported results, two questions arise:

1. The observation that the plastics fraction exhibited a high moisture content due to surface moisture is reasonable. I suggest, further, that soluble chlorides deposited on the plastic by evaporation of the surface moisture accounts for the large fraction of "soluble chloride" reported for the plastic. Indeed, it is very unlikely that the plastic would contain any significant amount of soluble chlorine. The same explanation may apply to the textile data.

2. The reported MAF heating value for textiles seems high by about 1000 Btu/lb. Similarly, the wood MAF heating value appears about 500 Btu/lb high. Other Btu determinations, while not markedly higher than values reported by others, seem to cluster at the high end of the range. It may be
well to review the technique used to make the determinations to be assured that no unconscious bias has been introduced.

In closing, the authors must be complimented for the rigor of their work and their apparent thoroughness.

AUTHORS' REPLY

The remarks, comments and suggestions of the reviewers are very much appreciated, and we will endeavor to respond to most of them.

WASTE CHARACTER

The characterization data resulting from this effort reveals that the constituent mix of the refuse was significantly different from that reported in the literature; an effort was made to delineate the magnitude of these differences in the text as well as in the summary. Additional constituent mix information has become available since this technical paper was prepared and is displayed below on a yard waste free basis — please note the magnitude of some of the differences.

<table>
<thead>
<tr>
<th></th>
<th>CWCSA-Weight % - As Sorted</th>
<th>C E Q*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>August 1979</td>
<td>April 1980</td>
</tr>
<tr>
<td>Newsprint</td>
<td>13.5</td>
<td>53.5</td>
</tr>
<tr>
<td>Other Paper</td>
<td>40.0</td>
<td>58.2</td>
</tr>
<tr>
<td>Diapers</td>
<td>1.8</td>
<td>1.0</td>
</tr>
<tr>
<td>Tex tiles/Garments</td>
<td>6.7</td>
<td>4.0</td>
</tr>
<tr>
<td>Plastic - Film</td>
<td>5.2</td>
<td>4.0</td>
</tr>
<tr>
<td>Plastic - rigid</td>
<td>3.7</td>
<td>2.5</td>
</tr>
<tr>
<td>Food Waste</td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td>Wood</td>
<td>1.9</td>
<td>2.6</td>
</tr>
<tr>
<td>Sweepings</td>
<td>3.4</td>
<td>3.7</td>
</tr>
<tr>
<td>Ferrous</td>
<td>5.13</td>
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<td>Aluminum</td>
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<td>Nonferrous</td>
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<tr>
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<tr>
<td>Yard Waste</td>
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</tr>
<tr>
<td>OBW</td>
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</tbody>
</table>

*CEQ — U.S. Council on Environmental Quality

Certainly the disparity between the CEQ and CWCSA data for the metals and glass content of the waste should be of interest to those wishing to consider the recovery of these materials as commodities.

The intent of the sorting characterization program was to obtain information regarding the make-up of the waste to be processed which is better than that available from the published literature or just by visual observations (albeit observers with long experience).

Although yard waste has always been found to be a troublesome nuisance, the magnitude of the problem has never really been quantified, and certainly should not be ignored when considering waste (as discarded or processed) as an energy source.

PLASTICS

Although the high weight percent of plastic(s) encountered should not have been surprising, the laboratory determination of its moisture and ash content was—at first. As discussed in the paper, it was concluded that the high values reported for these parameters and that for the soluble chlorides can be logically attributed to the residues from the material which had been in the plastic containers rather than as characteristic of the plastic.

OBW

Although the relative quantity of this category was small and the combustible weight fraction still smaller, it was included in the overall material and energy balance(s). However, the effect of quantification of the specific constituents therein would have been virtually indiscernible in the final material and energy balances. By reporting the information in the manner shown, attention was drawn to a category which could be troublesome and has usually been ignored by other investigators.

LABORATORY METHODOLOGY

The methods and procedures which were rigorously followed are the analytical standards recently developed through extensive “round robin” verification by ASTM-38.01 Energy, under the sponsorship of US-EPA-MERL-CINN.

In a sorting/sampling/analysis program of this magnitude, it is probable that if any bias was inadvertently introduced, it would be in the sorting and selection of laboratory samples rather than the laboratory methodology.

SORTING/SAMPLING TEAM

The “essential elements” of the sorting/sampling...
ing activity were described in the paper — the authors felt that in view of space limitations, the nitty-gritty data/findings would be of paramount interest to the reader.

A “detailed” description of the program including planning, team formation, equipment and supplies, scheduling of effort and narration of experiences could be the subject of a report unto itself. One might say that motivation and accomplishment can be attributed to “outstanding management and leadership”.

HEATING VALUE – MAF

Although the synthesized MAF values obtained were higher than expected, they were in the 9,000 to 10,000 Btu/lb range. The enigma of encountering higher caloric MAF values with materials having higher ash is still a puzzlement. The Hasselriis correlation equation (using ash % on a dry or as-discarded basis) does not satisfy the data from this investigation. However, some form of correlation equation of this sort would be a helpful tool and, therefore, should be pursued further, with validity corroborations made by those using the same laboratory analysis procedures.

CLOSURE

Although displaying the thermo-chemical data on a moisture and ash-free basis tends to display a more consistent character for waste materials (simplifying relative evaluations) the plant operator still must cope with the material and its variations, as it is received. Therefore, the designer/constructor/operator must define and account for the nature of the feedstock received and its probable variability in any undertaking.

The data presented by the authors is based on limited sampling (but much greater than most), taken during a short period, at a specific time of the year and at a specific location.

These data provide more information than previously available regarding the nature of the waste (and its variability) received at the CWCSA site. However, the characterization afforded thereby can only be considered indicative of what “might” be received routinely at this site and should not be arbitrarily applied elsewhere.