BNL 51065

A PRELIMINARY ASSESSMENT OF THE PROSPECTS FOR USE OF REFUSE-DERIVED FUEL IN MARYLAND

W. C. METZ, J. SHYER, AND K. EDGECOMB

FEBRUARY 1979

DIVISION OF REGIONAL STUDIES
NATIONAL CENTER FOR ANALYSIS OF ENERGY SYSTEMS
DEPARTMENT OF ENERGY AND ENVIRONMENT

BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK 11973

BNL 51065

A PRELIMINARY ASSESSMENT OF THE PROSPECTS FOR USE OF REFUSE-DERIVED FUEL IN MARYLAND

W.C. Metz, J. Shyer*, and K. Edgecomb**

February 1979

*Princeton Center for Environmental Studies

**Bruce Terris Associates

Research Supported by the
REGIONAL ASSESSMENT DIVISION
OFFICE OF TECHNOLOGY IMPACTS
U.S. DEPARTMENT OF ENERGY

DIVISION OF REGIONAL STUDIES
NATIONAL CENTER FOR ANALYSIS OF ENERGY SYSTEMS

B R O O K H A V E N N A T I O N A L L A B O R A T O R Y
A S S O C I A T E D U N I V E R S I T I E S, I N C.

Under Contract No. EY-76-C-02-0016 with the
UNITED STATES DEPARTMENT OF ENERGY

Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

ACKNOWLEDGEMENTS

We are indebted to many officials of Maryland State Agencies, particularly William W. Reinhardt, Maryland Energy Policy Office; Cliff Willey, Maryland Environmental Service; Richard S. Nietubiez, Power Plant Siting Program; Ronald Nelson, Community Health Programs; Douglas John, Division of Solid Waste; George P. Ferreri, Air Quality Programs; William K. Bonta, Division of Program Planning and Analysis; and Donald Andrew, Division of Engineering. Dr. Harvey Alter, Director of Research Programs, National Center for Resource Recovery, Inc. also gave freely of his time when requests for information were made. David Morell and Grace Singer, of the Princeton University Center for Environmental Studies, provided valuable advice and guidance. Finally we are indebted to Mary Bruck and Adele Hough, who prepared the manuscript and exhibited their usual patience and competence.

We also acknowledge the guidance and support of Dr. A. Katz, of the Regional Assessment Division of the U.S. Department of Energy, who served as the sponsoring agency's project monitor.

None of the above, however bear any responsibility for the accuracy of material presented, or for any judgments expressed, which remain solely with the authors.

CHAPTER I

EXECUTIVE SUMMARY

The energy potential of municipal refuse has been recognized for some time, and R&D efforts to develop the necessary technology are now coming to fruition. Perhaps the major reason for the interest in recapturing the energy content is the fact that it simultaneously provides a solution to the problem of environmentally acceptable disposal of such wastes, which, especially in urban areas, is becoming increasingly difficult in light of increasing land use and public pressures.

A number of technologies for recovering the energy of municipal waste are at hand. Yet at the same time, numerous impediments, -- legal, institutional, environmental, and even finding a suitable market for the recovered energy -- have impeded rapid development of this energy source. This assessment, therefore, focuses on the deployment problems of one such technology in one location, namely that of refuse derived fuel production in the State of Maryland. This choice is dictated by the fact that Maryland is already a national leader in the implementation of refuse-to-energy projects, with two major projects in place, and by the fact that refuse derived fuel (or RDF) is one of the technologies that is currently regarded as having the best prospects for widespread implementation.

The problems currently faced by the two projects in Maryland well illustrate the issues to be faced by the energy planner. The pyrolysis plant in Baltimore City has experienced a number of technical problems in becoming fully operational, with air emissions one of the principal points of contention. On the other hand, the resource recovery plant in Baltimore County, which is functioning very well from a technical standpoint, has experienced problems in developing a satisfactory long term market for the RDF it produces. Yet from the standpoint of having a suitable density of waste generation, the potential for a number of additional RDF projects in Maryland is clearly present, which gives added impetus to grappling with the institutional, legal and fuel user problems.

By 1980, the residential and commercial/institutional sectors in Maryland are estimated to generate an estimated 2.9 million tons of municipal solid waste, which when transformed into RDF, could replace some 132 million gallons of #6 fuel oil or 1.4 x 109 kwh of electricity per year, about 5% of the state's 1975 electric sales. Seventy percent of this refuse energy resource is available within the four highly urbanized political jurisdictions of Baltimore County, Montgomery County, Prince George's County and Baltimore City.

With the exception of the refuse being received at Baltimore City's pyrolysis plant and Baltimore County's New Texas resource recovery facility, all of Maryland's refuse is currently being landfilled. For reasons of land availability and low daily tonnages, more than half of Maryland's counties should continue their present practice of sanitary landfilling municipal solid waste (14 counties produce less than 10 percent of the state's refuse). But the remaining counties could find that resource recovery and RDF production offers a cost effective alternative method of municipal solid waste disposal. In order to justify this alternative, however, a number of incentives must be present, including a scarcity of acceptable land for future sanitary landfills; very high costs for locating and developing a new replacement sanitary landfill; and/or rapidly rising costs associated with the continued operation of a landfill within the realm of local, state and federal laws (especially the Resource Recovery and Conservation Act). Four steps are identified in this report as key to the successful deployment of RDF use. Although the specifics are elaborated in the context of Maryland, in outline they are applicable to all of the urbanized Northeastern states.

The first step in achieving increased RDF production and use in the state lies in securing a steady, interruption free flow of a predictable, daily tonnage and content of municipal solid waste. Residential refuse makes up 50 to 80 percent of a county's municipal solid waste depending upon the degree of urbanization. Counties already have the statutory right to collect or have collected all residential refuse within its boundaries; yet few exercise that right. In order to optimize RDF production and usage in the State of Maryland, control over the disposal of commercial/institutional refuse must also be sought through legislation.

The second step is to locate a local long-term user of the RDF product. At the present time there appear to be very few companies or utilities in Maryland who have facilities to use RDF as a supplementary fuel for steam generation. Unless oil costs escalate sufficiently in comparison with coal to induce an industry or utility to modify or purchase new boilers (or EPA, under the Energy Supply and Environmental Coordination Act of 1974, orders the conversion of existing boilers to coal), the use of RDF as a supplemental fuel may be limited. RDF, though, could be burned as the sole fuel in a boiler producing steam to generate electricity, and sold to area utilities.

Additional constraints to RDF use may occur as a result of the forthcoming revisions to the Maryland State Implementation Plan, developed under the guidelines of the 1977 Amendments to the Clean Air Act of 1970. However, more emission testing is needed on RDF burning prior to the implementation of siting restrictions. Concern over water quality problems need not be an impediment to RDF production and appropriate facility design and technology adjustments can alleviate most potential sources of trouble. Social constraints to transfer station and resource recovery facility locations can also be ameliorated with proper public relations and public evaluation.

A third step is the securing of adequate financing. Financing for a resource recovery facility is facilitated by a county or counties having a committed refuse supply and long-term RDF use contracts as mentioned in steps one and two above. While project funding can come from private and public sources, the use of Maryland Environmental Service (MES) funds and bonding ability may be preferable. MES, though, under the grant/loan program created by the 1974 Resource Recovery Act, is now limited to $5M, 20% of project costs and requires state ownership, where previously 50% was available. MES revenue bonds, however, are available without upper limit.

RDF in Maryland has the potential of becoming a significant contribution to the State's energy supply, possibly providing five percent of its electricity needs. This indigenous fuel could replace some imported oil and coal, enhancing, to some degree, supply security. The most promising course of action appears to be production of electricity by RDF-fired power plants, though industrial use of RDF should still be sought. Present county inaction in undertaking RDF production and electrical generation is due to numerous preceived difficulties and a lack of effective State leadership. Thus, the fourth step to increasing RDF production and use requires a coordinated effort by Maryland state agencies, a number of legislative changes, and a continuing dialogue between county, industry, utility and state officials.

Chapter II

MARYLAND'S MUNICIPAL SOLID WASTE PROBLEM

2.0 Introduction

The State of Maryland, and to a far greater extent each of the 24 county level political jurisdictions, shown on Figure 1, are facing an ever increasing municipal solid waste problem. Municipal solid waste is defined as "those obsolete products discarded by domestic, commercial and municipal consumers which would normally be deposited at municipal refuse disposal areas"[1] and usually encompasses household and commercial (but not industrial) refuse, as well as refuse from alleys, streets, trees, landscaping, parks, beaches, and catch basins.[2]

There are three major factors contributing to the disposal problem of municipal solid waste: 1) recent federal, state and local regulations, 2) population growth with its attendant urbanization, and 3) the difficulty of selecting new, publicly acceptable sanitary landfill sites. Thus, an ever-increasing volume of municipal refuse is having to be placed in an ever-decreasing number of acceptable sanitary landfill sites.

An alternative to the present wasteful practice of sanitary landfilling municipal refuse is to process it for its recoverable resources and energy content. In an evaluation of the usefulness of Maryland's municipal solid waste a first step is to identify the characteristics of that waste stream. The purpose of this chapter is to describe each of the major components of Maryland's municipal solid waste stream: 1) volume, composition and location; 2) collection methods used; 3) present and long-range disposal methods; and 4) regulations and ordinances.

2.1 Volume, Composition and Location

A determination of the present tonnage, and more specifically of the lbs/person/day of municipal solid waste for each of the 24 county jurisdictions, is at best a speculative exercise. Very few counties maintain scales at their refuse facilities to record load weights, and of those that do weigh refuse, records are often imcomplete, and usually without any indication as to whether the refuse is residential, commercial or industrial in origin. In

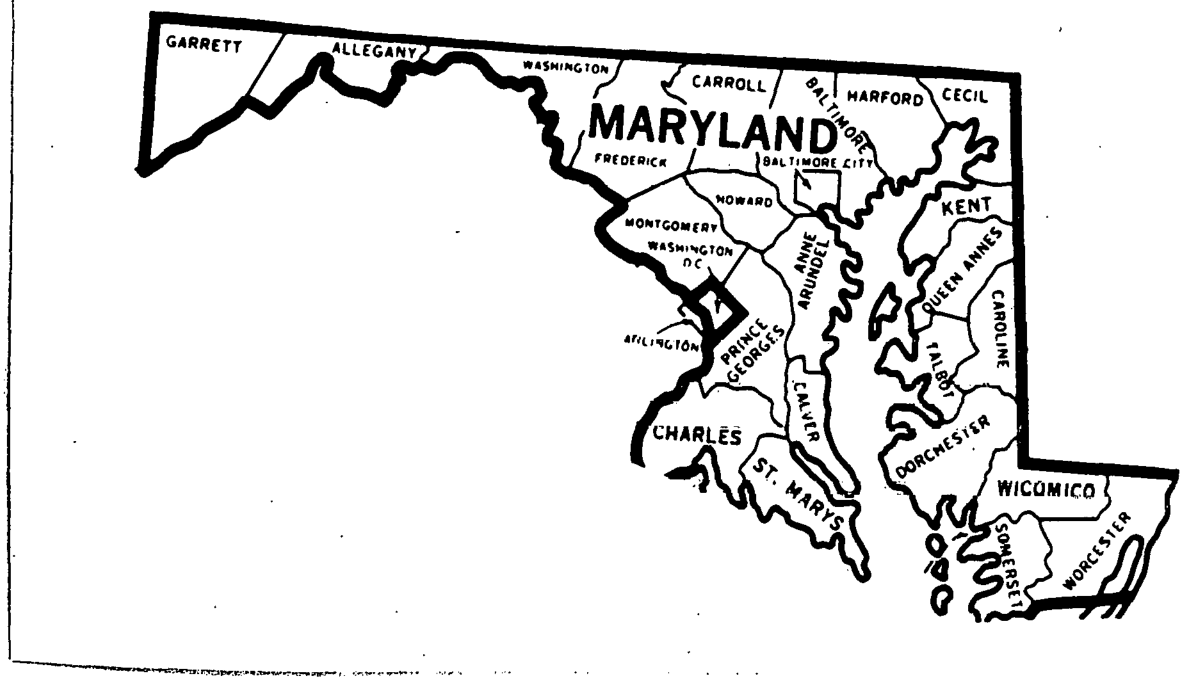

FIGURE 1: Political Jurisdictions in Maryland.

many instances a county's refuse data is the result of estimations based on the capacity of trucks, extrapolations from weights derived from several sample collection routes, the multiplication of county population figures by a literature derived lbs/person/day number, or of assumptions by county officials and their consultants. Tonnage breakdowns by specific refuse categories (i.e. residential, commercial, industrial, bulky items, litter, etc.) or even for the general municipal solid waste category are not kept in any Maryland county on an annual basis, let alone on a daily basis.

A county's volume of municipal solid wastes is related not only to population, but also to the degree of urbanization (an urban population includes all persons living in places of 2,500 inhabitants or more) and the quantity of commercial development present. Moreover, there is a recognized relationship between refuse generation and family income; in Baltimore City, for example, net municipal solid waste generation rates were aggregated in one study to three income levels (low income - 2.0 lbs/person/day, middle income - 3.0 lbs/person/day, and high income - 2.5 lbs/person/day).[3] Solid waste generation rates are also a function of urbanization; in West Germany it has been reported that municipal solid waste is generated at a rate of 0.6 lbs/person/day in municipalities of 2000 or less, 1.1 lbs/person/day in municipalities of 5-20,000 and 1.6 in municipalities of over one million inhabitants.[4] As we shall see below, the functional dependence on urbanization also holds very well for the State of Maryland. The explanation is not hard to find: rural and suburban residents often raise produce, compost their organic refuse, are more likely to reuse items, incinerate personal refuse,(e.g. newspaper in fireplaces) and send less refuse to a landfill because of the lack of the convenience of curbside refuse collection. There is also a greater abundance of commercial activity per person in urban areas than rural areas, and thus a higher rate of commercial refuse generation per person.

There is considerable variation in estimates of national average lbs/person/day numbers for the generic municipal solid waste category, as well as for residential, commercial and residential/commercial categories. The National Center for Resource Recovery estimated, after an extensive national survey in 1973, that municipal solid waste production in the U.S. averages 3.0 lbs/person/day, with residential and commercial refuse accounting for 2.64 lb of the total.[5] Gordian Associates, in a 1974 EPA report, used a figure of 3.6 lbs/person/day for a U.S. municipal solid waste generation average.[6] In a 1975 EPA report, Resource Recovery and Waste Reduction, 3.52 lbs/person/day was given as the national average for municipal solid waste.[7]

There is considerable variation among estimates of daily municipal refuse generation. A 1975 study estimated a statewide average of 2.5 lb/cap/day.[8] Table 1 indicates some of the other estimates reported in the State.

Using actual weighed municipal solid waste data from five Maryland counties, a regression analysis was performed matching the degree of urbanization to the lbs/person/day of municipal solid waste generation. According to Parker

Table 1

ESTIMATES OF PER CAPITA REFUSE GENERATION
(lb/capita/day, adjusted to 1970)

	Residential	Commercial
Baltimore City[a]	2.30	1.00
Baltimore County[a]	2.40	0.80
Anne Arundel[a]	2.00	1.10
Prince George's[b]	2.00	1.10
Harford[c]	2.20	1.33
Talbot[d]	3.04	0.80
Queen Anne's[d]	3.05	1.10
Calvert[e]	3.00	3.00
St. Mary's[e]	3.00	2.10

[a] Maryland Environmental Service, note 9; 1975 estimates.

[b] 1970 estimate based on an extrapolation of 1968 data; see note 10.

[c] Note 11.

[d] Based on 1968 Community Description Reports, interviews and consultant survey - see notes 12 and 13.

[e] Based on an extrapolation from data in Mecklenburg County, North Carolina - see note 14.

Andrews of the Anne Arundel County Department of Public Works, Anne Arundel produced approximately 235,800 tons of municipal solid waste in 1976. Montgomery County produced around 365,000 tons of municipal solid waste, including some industrial waste, in 1976. Prince George's County generated approximately 445,700 tons of municipal solid waste in 1976. Baltimore County, according to Maryland Environmental Service, recorded approximately 520,000 tons of municipal solid waste and Baltimore City produced approximately 675,000 tons during 1977. In the municipal solid waste tonnage estimates for Baltimore County and Baltimore City the commercial/industrial tonnages were reduced by one third to account for industrial, demolition, construction and non-processable wastes. Figure 2 shows the regression results for the State of Maryland.[15]

The generation rates for residential and commercial/institutional include litter collections, recreation facility refuse, and community clean-ups. No industrial, street sweeping, bulk trash, sewage solids, agricultural, pathological, vehicular, hazardous, fly ash or construction and demolition wastes are included in the municipal solid waste definition. County volumes of municipal solid waste estimated to be generated in 1980 are shown in Table 2. They were determined using 1980 population figures,[16] the 1970 urban/rural percentages, and the lbs/person/day generation rates extrapolated from the regression analysis. The geographical locations of the estimated 1980 municipal solid waste volumes within the State of Maryland are shown in Figure 3.

Projections for municipal solid wastes in 1980 and later are often estimated on population growth, which appears sound, and a percentage growth in the lbs/person/day of municipal solid wastes, which can contain inaccuracies. Generation rates in urban areas, where most residences and commercial establishments receive scheduled refuse collections, are not expected to increase much above their current levels, due to consumer pressure against excess packaging, spiraling costs of throwaway items, rising cost of refuse collection and disposal, a pervading attitude of conservation resulting from energy concerns and possible local, state and federal legislation banning no-return containers. But the less urbanized counties may witness an increase in a per capita generation rate as more residences and commercial establishments receive scheduled collections or a greater dispersion of green boxes,

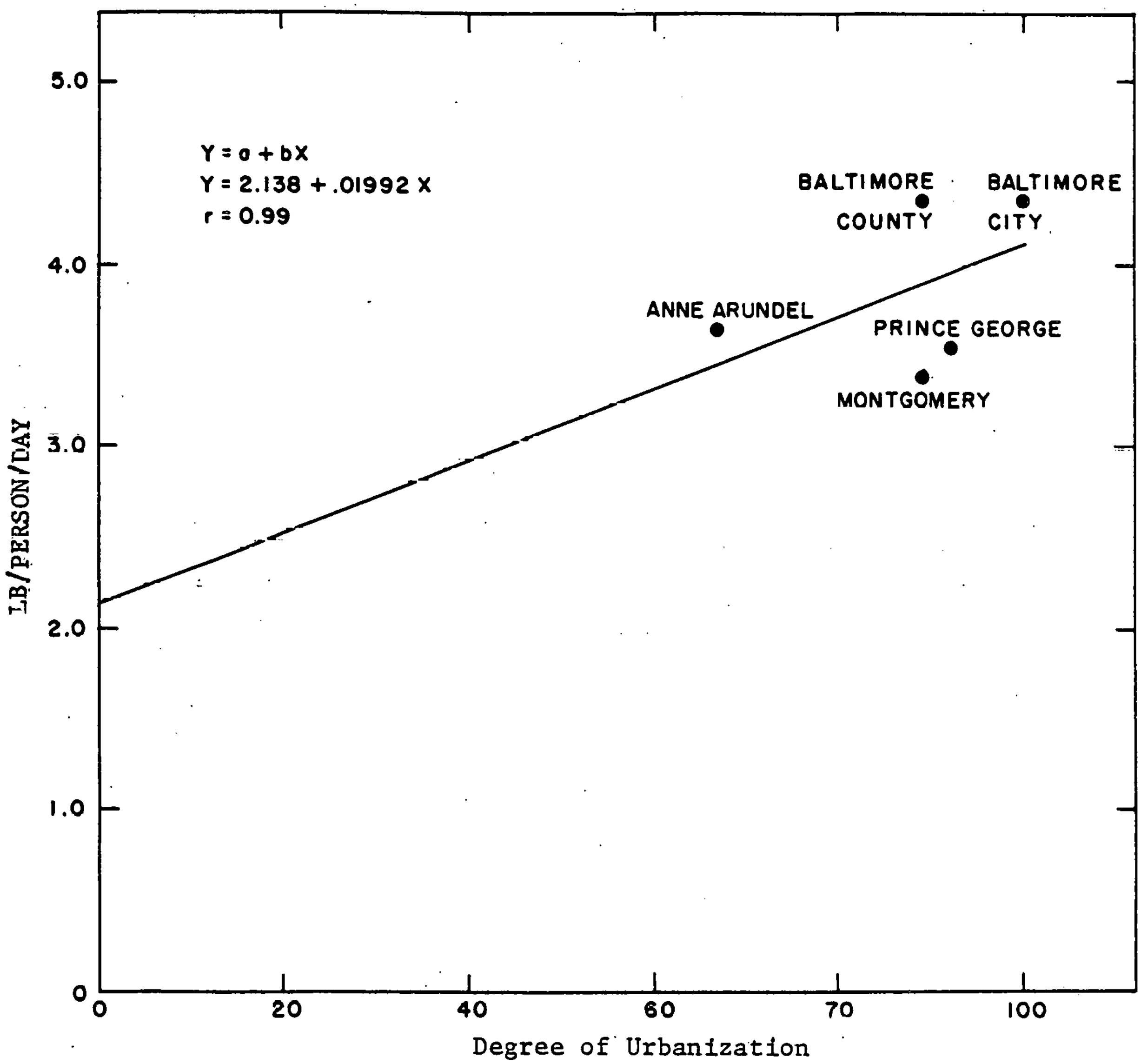

FIGURE 2: Relationship Between Urbanization and Refuse Generation Rate.

landfills, and transfer stations facilitate refuse depositions. The 2.0 percent annual increase projected for municipal solid wastes in several counties[17,18,19] is not expected to occur. Significant changes in county municipal solid waste generation rates will occur only if there is a change in the management of a county's refuse.

Table 2

LOCATION AND VOLUME OF MARYLAND'S MUNICIPAL SOLID WASTE

County	1980[b] Population	1970 Urban%	lb/cap/day[a]	Total, 10^3 tons/yr
Allegany	83,076	52.6	3.2	49
Anne Arundel	395,349	67.3	3.5	253
Baltimore	671,163	88.6	3.9	478
Calvert	34,500	-	2.1	13
Caroline	24,051	-	2.1	9
Carroll	90,019	10.4	2.4	39
Cecil	59,081	19.9	2.5	27
Charles	71,913	16.0	2.5	33
Dorchester	29,308	39.4	2.9	16
Frederick	100,379	32.0	2.8	51
Garrett	24,308	-	2.1	9
Harford	149,714	51.8	3.2	87
Howard	135,369	34.8	2.8	69
Kent	17,156	21.5	2.6	8
Montgomery	614,795	89.2	3.9	438
Prince George's	712,845	92.3	4.0	520
Queen Anne's	23,095	-	2.1	9
St. Mary's	55,195	19.3	2.5	25
Somerset	19,767	16.2	2.5	9
Talbot	26,871	28.8	2.7	13
Washington	114,823	40.4	2.9	61
Wicomico	63,091	28.1	2.7	31
Worcester	28,265	14.6	2.4	12
Baltimore City	828,821	100.0	4.1	620
	4,373,476	76.6	3.7	2,879

[a]Based on the regression equation (lb/cap/day) = 2.13 + 0.01992 (% urbanized), for which, in the base of Maryland data, R^2 = .99.

[b]Based on Reference 25.

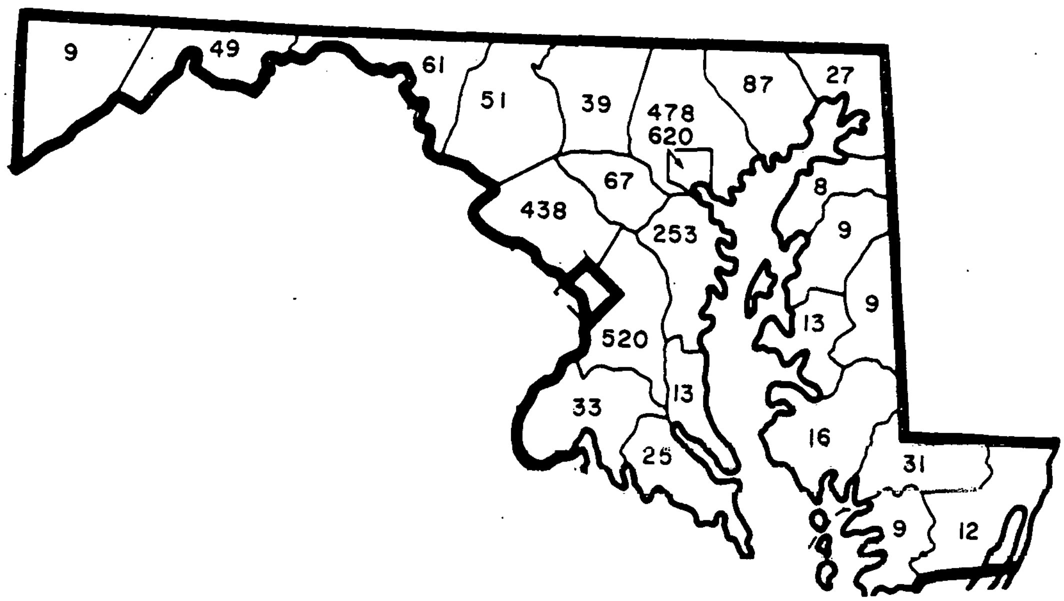

FIGURE 3: 1980 Waste Generation by County, in 10^3 Tons

Predicting the municipal solid waste composition of each of Maryland's 24 county/city jurisdictions would be unduly speculative. Residential refuse composition is determined by city, suburban and rural origin; area per capita income; percentage of homes tied into a sewerage system; type of refuse collection system; median age of residents; and ecological awareness of residents. Commercial/institutional refuse can differ between counties as a result of number, type and size of schools (including colleges), medical facilities, prison facilities, office buildings, wholesale and retail stores, professional services, and governmental offices. Maryland municipal solid waste composition differs from U.S. averages and other states because of variations in ferrous, aluminum and glass beverage containers; climatic differences; types of commercial enterprises present; variations in population density, age and income distribution; and the overall quality of life.

Examples of municipal solid waste composition on a national level are presented in Table 3. Maryland and its county residential solid waste compositions are shown in Table 4, and we note some significant differences in some categories.

The composition of municipal solid waste will change over the next few decades. One estimation of this change is shown in Table 3 for a year 2000 scenario. Plastics can be expected to rise markedly, so will paper, while metal, glass and garbage will probably decline.

2.2 Modes of Municipal Solid Waste Collection

There are three forms of municipal solid waste collection operating arrangements in Maryland's counties: 1) municipal collection (either using municipal employees or a municipally contracted private collector), 2) private collection at residences, commercial establishments and institutions who opt for service and 3) individual transport of refuse by personal, business or institutional vehicles to a "green box", landfill or transfer station. Variations in the rate of municipal soild waste generation is thus in some degree dependant on variations in collection practices. A sample of counties is discussed in this section to show the variety of collection procedures.

Only in Baltimore City and Baltimore County is 100 percent of residential refuse collected by city/county employees or designated contractors. Apartment complexes are not included in the residential collections. Commercial refuse is collected by private haulers licensed by the city or county.

Anne Arundel County (1974) offers all of its citizens a solid waste collection service through various collection contractors. However, not all citizens choose to participate in the solid waste collection service provided by the County. The County's Division of Solid Waste is operated as a utility, total funding for the solid waste collection and disposal is derived from user fees. One block of 1,800 residential units in the County contracted in 1974 with a private collector for twice-weekly, backdoor service at $10.00 more per year than the twice-weekly, curbside County service. The City of Annapolis provides refuse collection as a municipal service.[28]

Twenty-seven out of twenty-eight municipalities in Prince George's County (1976) provide municipal solid waste collection for 100 percent of

Table 3

NATIONAL MUNICIPAL SOLID WASTE COMPOSITIONS
(Percent by Total Weight)

Category	EPA[20]	NCRR[21]	Jackson[22] 1970	Jackson[22] 2000
Paper	39.6	43.0	38.0	55.0
Garbage	13.3	(other)	20.0	6.0
Glass	10.3	10.0	12.0	7.0
Plastics	4.1	2.0	2.0	13.0
Metals	9.9	9.0	10.0	5.0
Yard Wastes	14.1	(other)	12.0	12.0
Rubber, Leather, Textiles	4.3	5.0	-	-
Other	5.1	33.0	6.0	6.0
	100.0	100.0	100.0	100.0

Table 4

STATE OF MARYLAND AND COUNTY RESIDENTIAL SOLID WASTE COMPOSITIONS
(Percent by Total Weight)

Category	State of[23] Maryland	City of[24] Baltimore	Baltimore[25] Region	Baltimore[26] County	Howard[27] County
Paper	47.0-53.0	34.5	50.0	47.0	66.9
Garbage	11.0-13.0	11.7	11.0	11.0	0.55
Glass	8.0-16.0	19.9	10.0	13.0	7.3
Plastics & Rubber	4.0-11.0	5.9	5.0	5.0	-
Metals	8.0	7.7	8.0	8.0	5.1
Yard Wastes	6.0	10.0	6.0	6.0	7.8
Wood	4.0	1.1	4.0	4.0	-
Textiles & Leather	-	4.9	1.0	1.0	-
Other	-	4.3	5.0	5.0	12.35
	100.0	100.0	100.0	100.0	100.0

their residential housing units (and in some instances commercial housing units). Nine of these municipal services are performed on a contract basis with private collectors. Beginning in 1968 the County government initiated County refuse collection to certain developed areas in accordance with a suburban Areas Ordinance. The County refuse collection is provided by contracts with private refuse collection contractors who are awarded the contracts based on a lowest reasonable bid basis. In 1977 the County had 52 contracts involving 21 private refuse collection contractors to provide refuse collection services to 52,000 households. Performance bonds must be posted on all contracts. The County's contract area can be expanded to include additional areas, if, at a public hearing on a specific area's inclusion, 50 percent of the homeowners ratify the proposal. County residents remaining outside the municipal or County contract collection areas either use private contractors (the majority of commercial housing units so doing) or deliver their own refuse to the landfill.[29]

Of the twelve municipalities in Frederick County (1976), three provide their own municipal collection force, and the remaining nine municipalities contract with one of seven private collectors operating in the County. As of 1976, there were no concrete figures as to how much solid waste is collected by the individual haulers or how many homes and businesses have private pickup service. Approximately fifty percent of the county's population has private collection service available to it on an individual contract basis after discounting those served by municipalities. Freelancing by private collectors leads to route duplication, a common inefficiency.[30]

In 1978, all residential and commercial refuse collection in Washington County was carried out by private contract haulers, with the exception of the Town of Hancock which utilizes municipal employees. All other municipalities in the county execute contracts with private collectors and County non-municipal residents contract on an individual basis with a hauler.

The number of competitive contract haulers has been reduced in the past several years because one hauler has been able to dominate the urban collections. There are three "green box" locations in the county, which were established in 1974 in critical dumping areas to accept residential refuse from area inhabitants, previously often discarded in illegal roadside dumps.[31]

Howard County (1978) provides all residential units within its boundaries twice weekly collection of residential solid waste. These wastes are collected on a ten zone basis by four private collectors under contract, with the County at a fixed fee rate per residential unit. Eight of the collection zones refer to physical areas and include single or multiple family residences. The ninth zone includes all apartment units and government office buildings throughout the County, and the tenth zone encompasses all the residential and commercial buildings along Main Street in Ellicott City.[32]

In Queen Anne's County (1974) three of eight incorporated towns have made arrangements with private haulers for the collection of refuse. The remaining towns have no such agreements, allowing individuals to make their own arrangements. For the portion of Queen Anne's population not residing in the towns, collection service is accomplished either by private contractors or on an individual informal basis. Because there is no required registration for private haulers the number of private haulers is unknown. Furthermore, collection vehicles are not required to meet any minimum local standards related to leakage, littering or vector control.[33]

In St. Mary's County (1974), only the municipality of Leonardtown has municipal collection, the remainder of the County is handled by private haulers, except for the Patuxent River Naval Air Station. Private haulers, per County ordinance, obtain a license for $100 to use the County landfill. There are six licensed private haulers and all apparently are unwilling to divulge their routes and number of pickups. An estimated 60 percent of the County's households haul their own household wastes to the County landfill.[34]

Caroline County (1975) presently operates a "green box" collection system utilizing 39 collection sites. Two private haulers, under contract with the County, provide the equipment and the service. The purpose of the system is to provide readily accessible locations for residents to deposit their refuse. Due to several misuse and monitoring problems, the number of collection sites will be dropped to no more than nine, with all parts of the County within five miles of a site and 75 percent of the population within three miles of a site.[35]

Municipal solid waste processing in Maryland's counties ranges from total systematic collections to a haphazard variety. Most municipalities within the State provide residential refuse collection either by their own employees or through a contract with a private hauler. For the most part, with the exception of Anne Arundel, Baltimore City, Baltimore, Howard, Montgomery and Prince George's Counties, the rural or unincorporated residents are left to fend for themselves with regard to refuse collection. Collection costs can be placed in a county tax rate on assessed valuation, placed as a separate charge on a municipality's sewer and water bill, or sent as a separate bill to a resident's domicile on a monthly, quarterly or yearly basis. Residential collection can range in price from $30 to $100 a year depending on whether the collection is curbside, backyard and once or more times a week, as well as a variety of other differences in private hauler's costs.

Each county, under statutory authority of the State of Maryland (Section SV, Article 25) possesses the right to collect or have collected all residential refuse within its boundaries. Apparently, few counties wish to exercise that right.

2.3 Present and Long-Term Municipal Solid Waste Disposal Methods

In 1966-1967 Maryland still had 127 burning dumps. Now there are 5, and those will disappear in a few years.[36] The loss of burning dumps has meant a tremendous increase in the solid waste volume which has to be landfilled, since a ton of compacted refuse required 3.3 cubic yards of space and cover material, while when burned it yields a half cubic yard of residual. Closing of apartment, commercial, industrial and municipal/county incinerators in many counties has also increased the volume of refuse, as has the closing of illegal dumps. In order to dispose of 50,000 tons of municipal solid waste, compacted to 1,200 lbs/cubic yard (compaction by heavy equipment can range from 800 to 1400 lbs/cubic yard) in the prescribed sanitary landfill method with a 25 percent cover allowance, a requirement of 13 acres, 6.5 acres or 4.3 acres would be necessary if the landfill had a depth of 10 feet, 20 feet, and 30 feet respectively.[37]

While some previous burning dumps and open dumps have become sanitary landfills, many have been closed. By 1980 there will be less than 50 county/municipal and a half dozen private sanitary landfills in the State of Maryland. A few previous dumps will become locations for green boxes, to make refuse disposal more accessible for area residents, and transfer stations in order to lower haul costs to fewer landfills. Overall, refuse is being funneled to one or two landfills per county, or, in more rural counties upwards of three or four.

As old sanitary landfills fill up faster, municipalities/counties will have to search for new sites. Selecting new landfill sites is becoming ever more difficult as environmentally sensitive land areas are deleted from siting consideration. These include wetlands, floodplains, permafrost lands, critical terrestrial habitats, sole source aquifer recharge areas, high water table lands, and areas of other conflicting (zoning) land use. State laws, such as the one which prohibits landfills from being situated within a half mile of a hospital (changed from one mile when it was realized that all of Baltimore City was encompassed in the exclusion area), eliminate additional areas. The passionate, vocal opposition of local citizens in areas where a potential landfill may be sited raises the issues of water pollution, truck traffic, odors, rodents and other vectors, bacteria, noise and declining property values. Included in local opposition tactics are law suits, petitions, political pressures, demonstrations, public hearings, testimony and media campaigns. Montgomery County is spending approximately two million dollars to site and provide backup environmental data for a new landfill. Howard County with the Alpha Ridge tract and Baltimore County with the northwestern transfer station are engaged in siting controversies. While the use of citizen siting panels may assist in the siting process, they are not a panacea for siting controversies.

Costs for operating a sanitary landfill continue to rise, not only as a consequence of inflation, but as a result of increasing state and federal laws and regulations. In Maryland sanitary landfill operating expenses are often paid for by municipalities/counties out of their general funds. Some revenue is generated by a sanitary landfill through tipping fees and permits, but few facilities pay their own way. Howard County's 1976-1977 (fiscal year) solid waste disposal costs (administrative and technical) were $678,605. Revenues from permits and disposal charges were $206,342.[38] Washington County's operating budget for fiscal year 1977-1978, for its three landfills, is estimated to be $419,311. Since all individuals and private haulers use the landfills free, the only revenue derived is from the landfill caretaker's efforts at recycling (no figures available).[39] St. Mary's County had a landfill operations budget of $55,443, which in 1972-73 jumped to $96,786, funded by general funds with revenue coming only from a half dozen $100 private collector landfill user permits.[40] Anne Arundel County in 1974 established a disposal charge for commercial haulers only at its County landfills of $4.00 per ton at facilities with scales, and $1.00 per cubic yard at facilities without scales. This has since increased to $5.00 per ton at all sites raising $110,200 in 1974 fiscal year.[41] In the case of the municipality of Rosemont (1975 population 269) in Frederick County, a payment of $1000 a year is made to the municipality of Brunswick for the use of that municipality's landfill. The municipally contracted private collector then charges $.75 per weekly pickup per household to reimburse the municipality of Rosemont.[42] Only in Anne Arundel, which has made solid waste collection and disposal a utility, is municipal solid waste disposal paying its way. Whether there are license fees, permits, or tipping fees, some of which run as high as $16 a ton, most municipal solid waste disposal expenses are budgeted against general public works, sanitation, or highway department funds.

As the cost of landfill operation continues to increase, many landfill owners are raising fees in order to acquire compactors, shredders and balers with which to decrease refuse cubic yard space usage. Stretching existing landfill space at even higher costs now appears much more desirable to many municipalities/counties than going through the process of acquiring and developing new landfills. In some instances many of the older, small landfills may be closed and turned into transfer stations supporting the large, efficient landfills.

The number of private landfills, military and industrial not included, is declining as acquisition, development and operation costs increase. Under the new Resource Conservation and Recovery Act's stringent regulations there will be a lessening of motivation by private entrepreneurs to open landfills.

Still, if a developer can acquire land for potential landfill which is in compliance with local zoning and health laws, and gain inclusion in a county solid waste plan and thereby earn a landfill permit, despite opposition from county councils, committees and local groups, he can operate a landfill profitably. Private landfills exist, at present, only in Baltimore City, Baltimore County, Anne Arundel County, Harford County, and Kent County.

2.4 Municipal Solid Waste Regulations and Ordinances

The enactment of most local, state and federal regulations concerning disposal practices for municipal solid waste has occurred over little more than a decade. There will be a continuation of this trend over the next few years as disposal, economic and envirommental issues are advanced with greater frequency by the public. Municipal solid waste collection has not been the focus of many regulations.

The Maryland Department of Health and Mental Hygiene regulates air pollution and generally prohibits open burning, except for household trash, where no provision is made for public collection of refuse. The Division of Solid Wastes (within this Department) has issued instructions for procedures for approval of sanitary landfills which apply to counties, municipalities, firms and individuals who desire to operate landfills.

County regulations and ordinances vary tremendously among the 24 political units. Some counties, such as Frederick, have no regulations pertaining to on-site storage of solid waste, supervision of the work, performance of private refuse collectors or the establishment of new solid waste disposal systems and facilities. Other counties, such as Prince George's County, have enacted solid waste ordinances and regulations to control and regulate the collection, transport, and disposal of solid wastes within their counties. A few counties, such as Caroline County, have enacted solid waste ordinances in response to specific problems such as illegal dumping, unauthorized use of trash collection facilities and messy conditions around "green boxes".

Several counties prohibit the transport of refuse from neighboring or adjacent municipalities or counties to any county disposal facilities. This is extremely hard to police, as long as private refuse hauling vehicles have the appropriate county identification, and the caretaker cannot be certain that the refuse was collected across the county line.

Counties do have the authority to have all residential refuse collected, either by county employees, municipalities or by contract haulers. If the county does the collection it can determine the refuse destination, while it would have no real control over municipally collected refuse. Private refuse haulers could be given the opportunity to bid for collection contracts given with collection points and a refuse disposal location carefully detailed. Commercial refuse, at this point, cannot be regulated, for counties cannot authorize collection and cannot determine disposal location on a regular basis.

Each county has zoning ordinances. The effect of zoning rules on the siting of government-owned and privately-owned sanitary landfills varies strongly among the counties. Just the nature of a county's land use and degree of ubanization can cause the number of potential landfill sites to vary amongst counties. Sites are especially scarce in heavily urbanized Baltimore City and Montgomery County, while in Washington County, where 47 percent of the land area is zoned agricultural (which allows landfill operations as an exception, subject to public hearings), they are plentiful. However, areas which may be zoned to allow landfills, may actually be infeasible for landfills due to geological and topographical features, along with inadequate road networks and excessive hauling. Anne Arundel County recently unsuccessfully tried to zone out private landfills by first allowing them only in industrially zoned areas, then removing private landfills from the permissible category totally.

Locations zoned for landfill, transfer station and resource recovery uses, when they do exist, are not always the most economical sites. While economically preferable locations are those closest to populated urban areas where most of the refuse is generated, publicly acceptable sites are usually those that are farthest from any residential areas.

NOTES

CHAPTER II

1. National Center for Resource Recovery, Inc., "Municipal Solid Waste - Its Volume, Composition, and Value," *NCRR Bulletin*, Volume III, Number 2, Spring 1973, p. 4.

2. Bechtel Corporation, *Fuel From Municipal Refuse For Utilities*, prepared for Electric Power Research Institute, March 1975, p. 1-1.

3. R. H. Forste and T. R. Siegler, *Planning Solid Residuals Management in The Baltimore Area*, Maryland Environmental Service, Annapolis, Maryland, June 1976.

4. Conversation with Dr. Harvey Alter, Director of Research Programs, National Center for Resource Recovery, Inc., 1211 Connecticut Avenue, N. W., Washington, D. C., July 27, 1978.

5. Note 1, *supra*, p. 4.

6. Note 2, *supra*, p. 1-4.

7. C. R. Willey, "Municipal Solid Wastes As A Supplemental Energy Source For Maryland," Maryland Environmental Service, March 1977.

8. W. A. Miles, "Solid Waste Classifications and Generation Rates," Division of Solid Waste, Maryland Department of Health and Mental Hygiene, April 24, 1975.

9. Note 3, *supra*, p. 72.

10. Prince George's County, "Fiscal Year 1977-1986 Comprehensive Ten-Year Solid Wastes Management Plan," July 6, 1976.

11. R. F. Weston, Inc., "Solid Waste Management Plan for Harford County," October 1973.

12. Nassaux-Hemsley, Inc., "Talbot County Solid Wastes Management Plan," January 1974.

13. Nassaux-Hemsley, Inc., "Queen Anne's County Solid Wastes Management Plan," January 1974.

14. Henningson, Durham and Richardson, Inc., "Solid Waste Management Plan for St. Mary's County, Maryland," December 1973.

15. Note 7, *supra*, and interview with Cliff Willey, Maryland Environmental Service, October 25, November 17, and December 9, 1978.

16. Maryland Department of State Planning, "Population Projections to 2000," May 1975.

17. Greene Associates, Inc., "A Countywide Solid Waste Management Plan for Anne Arundel County," June 1974.

18. R. F. Weston, Inc., "Solid Waste Management Plan for Baltimore County," January 1974.

19. R. F. Weston, Inc., "Solid Waste Management Plan for Baltimore City," January 1974.

20. Note 7, supra.

21. Note 1, supra.

22. F. R. Jackson, Energy From Solid Waste, Noyes Data Corporation, Park Ridge, New Jersey, 1974, p. 6.

23. Frederick County Planning Commission, "Frederick County Solid Waste Management Plan, 1977," August 1977.

24. Note 3, supra.

25. Note 19, supra.

26. Note 18, supra.

27. Howard County, Department of Public Works, "Solid Waste Management Plan, 1978."

28. Note 17, supra.

29. Note 10, supra.

30. Note 23, supra.

31. C. Wiederhold, "Washington County Solid Waste Management Plan, 1978 Review," March 14, 1978.

32. Note 27, supra.

33. Note 13, supra.

34. Note 14, supra.

35. Caroline County Planning Office, "Caroline County Solid Waste Management Plan, 1978 Annual Review," March 1978.

36. Conversion with Douglas John, Division of Solid Waste, Environmental Health Administration, Department of Health and Mental Hygiene, 201 W. Preston Street, Baltimore, Maryland, July 26, 1978.

37. Note 23, _supra_.

38. Note 27, _supra_.

39. Note 31, _supra_.

40. Note 14, _supra_.

41. Note 17, _supra_.

42. Note 23, _supra_.

CHAPTER III

GENERIC SOCIAL AND LEGAL CONSTRAINTS TO RDF PRODUCTION

3.0 Introduction

Many previous research papers[1] have addressed the issues which are commonly referred to as the "institutional barriers" to RDF production, and a discussion of these issues here would be of little additional value. Answers to questions of financing, marketing recovered resources, selecting a system design and other issues are to be found in the existing literature on refuse-derived fuels, or from the several national organizations which regularly deal with these topics.[2]

There are two issues which have been virtually ignored by previous researchers, however, and these are the questions that can be referred to as the social and legal constraints to RDF production. Both of these issues are discussed in this chapter.

3.1 Social Constraints

Social constraint issues are often overlooked by planners until it is too late. Yet the issues are viewed as vitally important by citizen groups and the general public in areas where RDF facilities are to be sited. These concerns include: truck traffic; noise from operations; rats, vermin and disease; dust and odors; and unsightly appearance of facilities.

Each of these issues is addressed in this section. On the basis of information provided by the operators of existing RDF facilities throughout the country[3] suggestions are made for dealing with these problems at new RDF installations in Maryland and elsewhere. In general, it is important that social questions be addressed at the earliest possible opportunity in the planning process, since many of the problems discussed here can be avoided if simple, early efforts toward amelioration are undertaken by the operators of a facility.

Truck Traffic: The first of the social constraints relates to truck traffic, including these problems:

- Increased traffic congestion on residential roadways
- Increased danger to pedestrians and children

- Spillage from collection vehicles
- Noise and odors from operations

Solid waste planners agree that truck operations, and the possible harmful effects associated with those operations, are resisted more vigorously by local residents than any other aspect of garbage handling. The siting of RDF transfer stations in or near residential neighborhoods is often an essential link in acquiring sufficient low cost municipal solid waste to make a central resource recovery plant economical. But transfer stations also bring increased traffic, as standard garbage trucks and private/commercial vehicles deliver their loads to the facility and large trailer trucks carry compacted refuse from the station to the processing plant.

In a guide to local planners, EPA recognizes the difficulty of siting transfer stations:

> The major disadvantage of setting up a transfer station is the problem of public opposition...while many people will recognize the need for a facility, very few will allow it to be built near their homes.[4]

Residents fear, in particular, the road congestion, danger to pedestrians, and noise and odors that may be associated with truck operations. In order to site necessary RDF facilities, officials need to take all available steps to overcome citizen fears and to reduce the impact of refuse transport on local communities. Experience at existing facilities is encouraging in this area. Operators have learned that, through careful planning, truck traffic need not become a nuisance for residents. And they have identified specific steps which can be taken to reduce the likelihood of citizen opposition.

The first and most important step is siting. New RDF facilities and their associated transfer stations should be placed as near to major arterial roadways as possible. Direct-access ramps should route trucks quickly on and off the highway so that travel through local streets becomes unnecessary. Residential garbage collectors, after making their rounds or filling their truck, should drive to the nearest facility by highway, actually reducing congestion on local streets. Using these principles as guidelines, the Connecticut Resource Recovery Authority has planned and constructed six transfer stations in its statewide collection network. Charles Kurker, Director of Solid Waste

Management Programs for the state, reports that citizen resistance to the facilities has been minimized as a result.[5]

A second and compatible siting procedure for RDF facilities used by some operators is to site new installations on existing public works lands. In some cases, modernization and improvement of the existing physical plant will be necessary and should be greeted with favorable public response. Existing public works lands are likely to be sited near major roadways and therefore usually will not require costly ramp construction for trucks. Area residents, already accustomed to refuse or other operations at the site, will normally not object to the construction of needed resource recovery facilities.

The environmental degradation associated with truck traffic--in the form of visual, noise and air pollution; odors; and spillage during collection--is a set of problems which must be solved through improvement in technology and operations. At the outset it should be noted that most local patterns of garbage collection are unlikely to change as a result of RDF production, and environmental problems associated with truck transport will remain as they were prior to resource recovery within the local community. Those same problems will tend to be more severe near transfer stations and processing facilities--the sites at which large numbers of trucks must congregate during designated periods of the day.

At Saugus, Massachusetts, where the nation's most successful waterwall incineration project is now in full-scale production, operator Bob Foster said that the problem of truck operations has largely solved itself by "fostering better equipment on the part of the operator."[6] Communities serviced by Saugus have purchased new garbage collection vehicles which tend to be quieter and cleaner than the models they replaced.

All of the operators contacted reported that spillage from trucks is no longer a serious problem. The large trailers which carry compacted refuse from transfer points to the associated processing plant are fully enclosed and tightly sealed, making spillage virtually impossible. Local waste collection trucks may lose a few shreds of refuse on the way to a transfer station, but are designed to be clean when properly operated. Sanitation workers must be supervised and directed to carefully inspect all points at which the truck stops in order to assure that refuse is not left behind on streets or sidewalks.

In many cases the construction of a new RDF facility which includes transfer stations and processing operations will greatly increase truck traffic in an entire region. The possible air pollution impacts associated with this increased traffic deserve the early attention of planners and control authorities.

Noise From Operations: The second of the social constraints relates to noise from the operations, including these problems:

- Noise from collection and handling is objectionable
- Noise from shredders and other operations requires control
- Siting to reduce noise impact
- Sound isolation and barriers

The collection, compacting, shredding and processing of municipal solid waste is a noisy business. Complaints from citizens regarding waste processing are more likely to center on noisy vehicles and plants than any other operational aspect--perhaps because refuse collection must occur in their immediate neighborhood and often begins in the early hours of the morning. It is a mistake to assume that the noise pollution associated with resource recovery must be accepted without hope of improvement, however. The operators indicated that advances are being made in noise suppression at all new RDF facilities.

As noted in the preceding section, advances in vehicle design have reduced the noise produced by garbage trucks to a point at which most residents no longer find it objectionable. The noise of collection can be further reduced by routing trucks on major roadways whenever possible, by designing collection runs in such a way that trucks need not climb very steep grades (truck engines are noisiest in low gear), and by discouraging the use of metal garbage cans. In any event, the noise of collection under a system of resource recovery will not exceed that of trucks in any other conventional waste handling and disposal system.

Within the RDF plant itself, there are some large pieces of machinery which produce a high level of noise. A simple solution to this problem is to site the plant at a distance from the nearest homes sufficient to allow the noise to dissipate in the atmosphere. At Milwaukee, St. Louis, Ames and other RDF facilities, the plant operations have been confined to existing industrial areas where noise is not a critical consideration. As a result of this kind of careful siting, noise complaints by local citizenry can be virtually eliminated. Often it is possible to site needed transfer stations in industrial areas as well, largely eliminating noise as a factor in RDF development.

In the event that facilities must be located near residential areas, engineering and design steps can easily be taken to reduce noise output. At the highly advanced Chicago, Illinois fluff RDF plant, noise has been controlled by enclosing all machinery operations within a high-mass concrete structure. Shredders and other heavy equipment are placed on special base pads which tend to absorb vibration and prevent sounds from leaving the building. Within the facility, all workers and visitors don specially designed headphones which block out interior noise and provide FM radio communication with the plant's central control room. As a result of these measures, neither the plant's workers nor its neighbors have complained about the noise output of the machinery.[7]

Taking all factors into consideration, it now seems that noise levels associated with RDF processing can be controlled with relative ease, and should not block future development of resource recovery facilities at properly selected sites.

Rats, Vermin and Disease: The third social constraint relates to rats, vermin and disease, including these problems:

- Rats in garbage may be transported to facilities
- Refuse storage provides ideal conditions for rats
- Rats may leave plants to infest nearby communities
- Refuse may carry or promote disease

All of the operators reported that their facilities maintained a careful and reliable program of rodent and insect control. The operators know that rats are nearly always to be found in the vicinity of refuse, that rodents reproduce quickly under favorable conditions, and that nearby residents fear infestation of their homes as a result of waste processing operations.

Opponents of new RDF facilities often argue that rats will be brought to the plant by the refuse collection trucks, where they will multiply and become a threat to the community. Rats do, in fact, arrive at plants in the garbage stream. However, their lives within the facilities are usually very short.

Under normal conditions, refuse is conveyed to the shredder in an RDF plant soon after it is unloaded onto the tipping floor or into a receiving bin. In the shredder the animals are destroyed and become an indistinguishable part of the fuel product. Accordingly, the rat problem is, in most cases, controlled by the RDF process itself.

In the event that some of the rats evade the shredders and survive, all facilities maintain active pest control programs to kill them before they can multiply. In one facility an exterminator lays out bait boxes every other week. Several plants spread chemical poisons daily. Inspection crews on regular rounds (sometimes as often as once a day) search out rodents and order increased chemical control when necessary. In most of the facilities the tipping floor and receiving area are washed down daily with industrial cleaners, depriving the rats of sustenance and preventing the spread of disease.

As a result of these procedures, rodents are effectively controlled; the operators have not received complaints of rats traveling to nearby residences or businesses. Emil Nigro of the Chicago Bureau of Sanitation feels that concern among citizens about rodent infestation is "reasonable", and that an effective program of chemical control is an "absolutely essential element" of any RDF facility.[8]

As with all toxic and possibly hazardous substances, pest control chemicals must be carefully monitored to avoid inadvertant contamination of soil or water supplies.

The question of disease is also one with which the operators are concerned. Disease vectors can be transported in garbage and might pose a threat to workers who come into continued contact with refuse during processing. Pathological wastes (as from hospitals and disease research institutions) normally are subjected to special disinfectant treatment and do not become part of the municipal solid waste stream. The danger of disease spread from conventional residential garbage is small, particularly where control procedures and general cleanliness practices are initiated at RDF plants.

Frequently, the buildings which house refuse processing equipment are kept under pressure, and all air in the building is exchanged and filtered on a continuing basis. Workers are provided with nose and mouth guards to prevent infection, and are advised to avoid direct physical contact with the garbage in the plant. Disease vectors at RDF plants are "no worse a problem than with other refuse operations", says St. Louis Refuse Commissioner Jim Shea.[9] Proper control measures reduce the likelihood of a disease outbreak nearly to zero, as long as garbage is moved expeditiously through the processing lines in the plant.

Dust and Odors: The fourth social constraint relates to dust and odor, including these problems:

- Machinery in processing plants releases dust
- Odors from a plant may be objectionable
- Control measures for dust and odors

Within an RDF production plant refuse undergoes a number of processes which tend to release dust into the atmosphere. The massive shredders used to crush and tear the waste into small pieces are probably the major contributors to the airborne particulate problem, but magnetic separators, air classifiers, conveyor belts and storage systems all cast some dust into the air during operation. Virtually any machine process which moves the garbage will release dust, and that very broad description includes nearly all operational features of RDF production.

The operators admit that citizen objections to dust in the atmosphere near resource recovery plants have in some cases been justified. The particles are objectionable when inhaled, may cause irritation of the eyes and throat, reduce visibility in the immediate vicinity of the plant, and are a nuisance when they enter nearby homes. Siting the facilities far enough from residential areas to minimize exposure has been one common method of handling the problem. In the new generation of RDF plants there have been efforts to incorporate complex and costly dust control measures which reduce the amount of dust released to the atmosphere by collecting and redirecting the particles. This method of control is clearly preferable to reliance on site distance only, since it prevents the dust from reaching the atmosphere where it may be dispersed, and minimizes the exposure of workers to potential particulate hazards within the plant building. Appropriate siting and control technology, used together, provide the best protection from air quality degradation associated with RDF operations.

Nearly all new RDF processing facilities are equipped with "baghouses" to filter the internal air of the building. These ventilation machines take in air from the dustier portions of the plant, remove the particulate matter, and release the clean exhaust to the external atmosphere. In some cases water is sprayed on the refuse during processing to reduce the formation and release of dust particles. All machinery should be completely enclosed within the plant building to facilitate dust control.

The new RDF plant in Chicago includes a model dust control system that is both effective and profitable:

> Dusty air is drawn from various places in the plant by a number of dust hoods such as those located over the coarse shredder feed conveyer, conveyors entering and leaving the coarse shredder, and the combustible refuse cyclones. The dusty air is taken to a series of cyclones and baghouses located behind the plant. Once cleaned, the air is discharged to the atmosphere while the dust is carried back into the plant and delivered with the supplementary fuel to the Commonwealth Edison Plant.[10]

According to plant officials, the dust increases the combustibility and reduces the moisture content of the RDF fuel product, and is therefore a valuable element of the production process. The atmosphere around the facility is virtually dust-free, and has brought no complaints from citizens.[11]

In general, odors associated with refuse processing are easier to control than dust. This is due, in part, to the fact that the compacting, shredding and classifying of refuse seems to produce a final product that is nearly devoid of any objectionable odor. It is only the garbage entering the plant at the tipping floor or receiving bin that tends to harbor unpleasant odors.

Rapid processing of incoming refuse, together with a program of daily cleaning of the receiving area of the plant will prevent odor problems from arising. The need for efficient movement of refuse increases in warm weather, when odors quickly proliferate. Chemical deodorant sprays are available for use in those instances when standard procedures fail to eliminate odor problems--but these are seen as unnecessary during all but "extended, very warm periods."[12] In general, odors will not leave the immediate vicinity of the plant if all receiving and processing operations are contained within the internal area of the plant building, and if a normal degree of cleanliness is maintained.

As with other potentially objectionable aspects of RDF production, citizen resistance to odor problems can be reduced by carefully siting the facility at a reasonable distance from residential developments.

Unsightly Appearance of Facilities: The last of the social constraints involves the unsightly appearance of facilities, including these issues:

- Careful site selection
- Architectural design
- Barriers, screens and landscaping

In the eyes of some community residents, refuse-derived fuel facilities--no matter how necessary or effective--are little more than glorified city dumps. The problem is that public works buildings, and especially those designed to handle municipal refuse, are usually very unattractive structures. For this reason RDF systems are often opposed by the communities in which they are to be located, and encounter significant developmental problems.

Clearly, the answer to this problem is to assure that questons of facility appearance are addressed early in the design stage of any new project. Many problems of appearance can be overcome by siting the facilities (either transfer stations or central processing plants) in areas where their appearance will actually improve the overall surroundings--as, for example, on the site of a former dump or landfill, or on ground occupied by an older, uglier public works structure. If area residents view the new structure as an improvement over the former use of the land they are unlikely to oppose the siting.

While this appreach might be termed "passive", there are also active steps that can be taken to improve the appearance of facilities. Architects can be directed to produce pleasant exterior designs which will not conflict with or interrupt the prevailing building patterns of surrounding areas, and the designs can be submitted to local residents for review prior to construction. This method was followed in the creation of six transfer stations for the Connecticut Resource Recovery Authority, and the Director of the program reports that the towns have "dressed up the facilities to suit the local areas."[13] A disadvantage of this approach is price--the Connecticut transfer stations cost an average $850,000 apiece.[14] Transfer station costs are a function of land prices, facility size, equipment, type, landscaping and access expense.

A cheaper and equally effective method to reduce the obtrusiveness of RDF facilities has been used in some other cities and is nearly universally applicable. These operators site their facilities at an adequate distance from nearby thoroughfares and then erect visual barriers to hide the buildings from sight. The barriers are inexpensive--and serve a dual purpose of blocking some of the noise that may be associated with refuse processing facilities.

In some cases it will be advisable to combine all three appearance enhancement approaches when designing new facilities. The construction and operation of the plant will be made easier if local residents are shown that the operators are attempting to be good neighbors from the very beginning of the planning process.

Mitigation by Communication and Education: All of the operators interviewed agreed that active communication between facility operators and the general public can prevent problems from occurring, or can diminish their severity once they have developed. "Public education" as to the benefits of RDF programs is often an important tool in overcoming citizen resistance to new facilities.

Communication with the citizenry normally takes three forms: direct appearance of public officials at meetings organized by citizen groups, presentation of information about a facility at "town meetings" called by the operator, and plant tours conducted by the operator for school groups and other organizations. The first approach is essential in areas where conflict over the issues discussed in this section of the paper have already arisen. The latter two methods provide a valuable ongoing mechanism by which the operator can build interest in and support for his present and future activities.

The success of programs of public education is most evident in the City of Chicago, where Emil Nigro reports that citizens have used the development of new transfer stations in their communities to enhance the appearance of nearby areas. He asserts that the public is "conservation oriented" and has favored the RDF project from the outset. And, what is perhaps the best sign of all, the facility's Speakers Bureau has been overbooked since the day the project opened.[15]

3.2 Legal Constraints

The legal constraints to RDF production lie in the ability of a proposed resource recovery facility to secure a steady flow of a predictable tonnage of municipal solid waste. An assured daily quantity is necessary in a project receiving financial backing, being built for optimum capacity and guaranteeing the RDF user a daily uninterrupted quantity of RDF. There are several philosophies as to the method of achieving a steady refuse flow.

One philosophy emphasizes the free market system, stating that if the facility is what it is supposed to be (an economical method of refuse disposal) then refuse collectors will naturally deposit refuse at the facility rather than at a more expensive landfill. The Ohio chapter of the National Solid Waste Management Association (NSWMA) has filed suit against the City of Akron, Ohio for passing an ordinance making refuse hauling licenses contingent upon private haulers agreeing to take collected waste to the city-owned resource recovery facility. NSWMA feels that it is clearly unconstitutional for a governmental body to pass legislation which attempts to seize control of the waste stream and/or direct it to a pre-determined site--when such legislation is for economic reasons rather than in compliance with a state's/community's police power to protect the public health, safety and welfare of the inhabitants. Further, it is felt that the regulation amounts to confiscation of "abandoned" (State of California legal interpretation) property which has value to the collector, and threatens investments in alternate sites by eliminating the disposal business from facilities previously licensed by the state's Environmental Protection Department. Akron is also charged with violating the Sherman Anti-Trust Act by eliminating competition.[16]

In a supporting case, a Michigan circuit court struck down the ordinances of municipalities which had been amended (concededly to ensure financial stability of the municipal refuse operations) to provide that all wastes collected within their boundaries be deposited at municipal disposal sites. The court held that the ordinances were not reasonably related to the health and welfare of the public. In another case in which a county attempted to confine wastes to particular disposal sites within the county to ensure economic viability of the county sites, the Minnesota Supreme Court held in part that "the ordinance in question is clearly an attempt to regulate intrastate commerce by creating artificial barriers at county lines. The attempt...is improper and invalid."[17]

A method which tilts the free market disposal of refuse is the subsidy. It includes the reduction of the tipping fee to an artificially low or non-existent basis, thereby making a facility the most attractive disposal site for all private haulers. In Dayton, Ohio disposal facilities have a zero tipping fee, the local government preferring instead a user charge, whereby each homeowner and business is assessed a monthly charge for refuse disposal. At the Saugus, Massachusetts facility community-contracted private companies deposit refuse free at the facility; each community is then billed an appropriate fee for the tonnage its collectors deposit. In Albany, New York plans call for a projected tipping fee of $2.50 per ton which would make the use of the disposal facility a far more attractive option than a landfill averaging $4-8 a ton.[18,19]

Legal questions exist as to a collector's right to sort through the refuse prior to delivering it to a resource recovery facility. If a collector extracts must of the paper in the refuse it collects or passes the material through a resource recovery operation prior to delivery to the stated resource recovery facility then much of the value would be extracted.

Another method which is used to control refuse disposal is state legislation under the constitutional basis of police powers in protecting the public health, safety and welfare. This avoids any anti-trust problems. An indirect method of controlling the location of refuse disposal can be seen in the Delaware Solid Waste Authority's adoption and implementation of stringent environmental landfill requirements which are foreseen to close all but one landfill in each of the three counties. Those three landfills will be operated by the state with a resource recovery facility constructed at each site. Refuse, though, could be lost by being landfilled out-of-state. The Michigan legislature is in the process of passing legislation to strengthen the authority of the Resource Recovery Commission to require that landfills meet stringent state requirements, thereby making resource recovery a more viable option. A further indirect refuse control measure was enacted in Rhode Island where the Rhode Island Solid Waste Corporation (a quasi-public entity) gains control of the refuse from any community which cannot be disposed of within that community's own boundaries.[20]

Direct control of refuse disposal by state legislation is also a possibility. The State of Maryland has enabling legislation which allows counties to collect or have collected residential refuse where, were it not collected, it might prove to be "injurious to the health and comfort of the inhabitants of the county." The Michigan legislature is passing a bill mandating that localities have control over the flow of residential wastes. In Wisconsin a court-tested law has given the responsibility and ownership of solid waste to the Wisconsin Solid Waste Recycling Authority (not to cities and counties). By having the right to determine where garbage is delivered once it is picked up the Authority can establish regional resource recovery facilities. The law is in the interest of public health and revenue bond selling; regional tipping fees are set by the state Public Service Commission. In Hawaii, a new state statute will provide powers to departments of public works of political subdivisions to designate facilities or areas where refuse is to be disposed of in the "best public interest," slightly different than public health, safety and welfare.[21,22,23]

Financial pressure can be placed on a community in the delivery of refuse to a resource recovery facility. When the Massachusetts State Bureau of Solid Waste Disposal issues general obligation bonds to aid in building a resource recovery facility it obtains a contractual "deliver or pay" agreement with communities involved to provide that a certain minimum of refuse be delivered or communities pay a penalty. The Connecticut Resource Recovery Authority also demands that long-term contracts for the delivery of refuse be made by cooperating communities prior to the issuing of bonds for a resource recovery facility. Occasionally a problem can arise (as in Ames, Iowa) where a township cancelled its refuse supply contract upon learning it could landfill its refuse for $800 yearly rather than spend ten times that in using the Ames resource recovery facility.[24,25,26]

Knowing what options are available for the control of refuse disposal is extremely important for a community and state. Learning from the experiences of others' attempts, legal challenges and the reasons for approval or failure, allows a community and/or state to seek a method which suits its particular situation. Such knowledge can gain a community or state a very good chance of withstanding legal challenges to its progress.

In the event that communities are obligated to sign long-term contracts assuring the constant, uninterrupted supply of municipal solid waste to a resource facility, careful review of the legal issues is important. There appears to be much ambiguity, contradictory opinion and, in some instances, traditional community contracting practice which contravenes the letter of the law. The National Center for Resource Recovery has published an article on contract problems.[27] It is very important for a community, state and private enterprise to ascertain all the legal implications of a long-term supply contract.

NOTES TO CHAPTER III

1. A particularly useful handbook for planners is Decision-Makers Guide in Solid Waste Management published in 1976 by the Office of Solid Waste Management Programs of the U.S. Environmental Protection Agency.

2. National Center for Resource Recovery, Inc., 1211 Connecticut Ave., NW Washington, DC 20036 and National Solid Wastes Management Association, 1120 Connecticut Ave., NW Washington, DC 20036.

3. Including Baltimore, St. Louis, Ames (Iowa), Chicago, Milwaukee, Saugus (Mass.), and Bridgeport (Conn.). Where a specific facility or city is not indicated, statements made in this chapter represent the general experience of the operators of the set of RDF plants at the locations listed above.

4. U.S. Environmental Protection Agency, Decision-Makers Guide in Solid Waste Management, publication #SW-500 (Washington, DC. US Government Printing Office, 1976), p. 74.

5. Charles Kurker, Director of Solid Waste Management Programs, State of Connecticut, in a telephone interview with John Shyer, Center for Environmental Studies, Princeton University, Princeton, NJ, August 1978.

6. Bob Foster, Saugus Massachusetts Waterwall Incinerator Project, in a telephone interview with John Shyer, Center for Environmental Studies, Princeton, NJ, August 1978.

7. Emil Nigro, Supervising Engineer, Chicago RDF plant, in a telephone interview with John Shyer, Center for Environmental Studies, Princeton University, Princeton, N.J. August 1978.

8. Ibid.

9. Jim Shea, Refuse Commissioner, City of St. Louis, in a telephone interview with John Shyer, Center for Environmental Studies, Princeton University, Princeton, New Jersey, August 1978.

10. City of Chicago, Department of Public Works, "The Southwest Supplementary Fuel Processing Facility: A Municipal Refuse Disposal System to Convert Waste into Electrical Energy," Updated, p. 2.

11. Interview with E. Nigro, August 1978.

12. Interview with B. Foster, August 1978.

13. Interview with C. Kurker, August 1978.

14. Ibid.

15. Interview with E. Nigro, August 1978.

16. Information Concepts, Inc., "Recovery Engineering News", May 1978.

17. "Who Shall Own the Garbage", The American City and County, Vol. 93, No. 2, February 1978.

18. R. L. Chrismon, "State Initative in Resource Recovery," NCRR Bulletin, Vol. 8, No. 3, Spring 1978.

19. Note 17, supra.

20. Note 18, supra.

21. Ibid.

22. "State Resource Recovery Authorities", NCRR Bulletin, Vol. 4, No. 2, Spring 1974.

23. Note 17, supra.

24. Note 18, supra.

25. G. E. Easterbrook, "The Acid Test for Bridgeport," Water Age, Vol. 9, No. 5, May 1978.

26. Information Concepts, Inc., "Recovery Engineering News," January 1978.

27. "Contract Restrictions... An Important Consideration," NCRR Bulletin, Vol. 5, No. 1, Winter 1975.

CHAPTER IV

THE PROBLEMS OF RDF TECHNOLOGY DEPLOYMENT

4.0 Introduction

The potential for the production and use of refuse-derived fuel (RDF) in the State of Maryland is to be described in this chapter. Information contained in Chapter II, Maryland's Municipal Solid Waste Situation, and Chapter III, Generic Social and Legal Constraints and Solutions to RDF Production, will be incorporated in this examination. The six major sections to this chapter are: 1) County and State RDF Energy Potential; 2) Institutional Barriers to RDF Production and Use in Maryland; 3) Maryland Permitting Requirements for New RDF Production and Use Facilities; 4) Water Quality Issues of RDF Production and Use in Maryland; 5) Air Quality Issues of RDF Production and Use in Maryland; and 6) Recommendations for Initiating RDF Production and Use in Maryland.

4.1 County and State RDF Energy Potential

It is estimated that by 1980 (Table 2) approximately 2.9 million tons of municipal solid waste (residential and commercial/institutional) will be generated on an annual basis in Maryland. Eighty percent of this municipal solid waste will be generated by Anne Arundel County, Baltimore County, Montgomery County, Prince George's County and Baltimore City. This will be at a rate of approximately 7,500 tons per day (306 collection days). The remaining 19 counties will produce only 20 percent of the state's municipal solid waste.

Municipal solid waste has an estimate energy content of 4,500 Btu's per pound in its unprocessed state. Shredding and air classifying municipal solid waste in order to extract the inert components, metals and minerals (20 percent) leaves a refuse-derived fuel having approximately 5,500 Btu's per pound and a moisture and ash content of 25 and 20 percent, respectively.[1] When trommeling is introduced the heating value, as witnessed at the MES/ Baltimore County Solid Waste Reclamation and Disposal Facility, can be raised to approximately 6,500 Btu's per pound and the moisture and ash content dropped to 15 and 10 percent, respectively. This additional process step results in an overall material yield of about 65%.[2]

RDF fuel when burned as a sole fuel in a semi-suspension fired, field-erected boiler, similar to the Akron, Ohio 1000 ton per day facility, is expected to maintain an 80 percent combustion efficiency at maximum load. In packaged systems, generally of the starved-air, rotary kiln, augered-bed or basket-grate type, combustion efficiencies of as high as 90 percent have been reported.[3] In this report, however, we use the value of 80% combustion efficiency (relative to that of fuel oil combustion, which approaches 99% in modern utility equipment*).

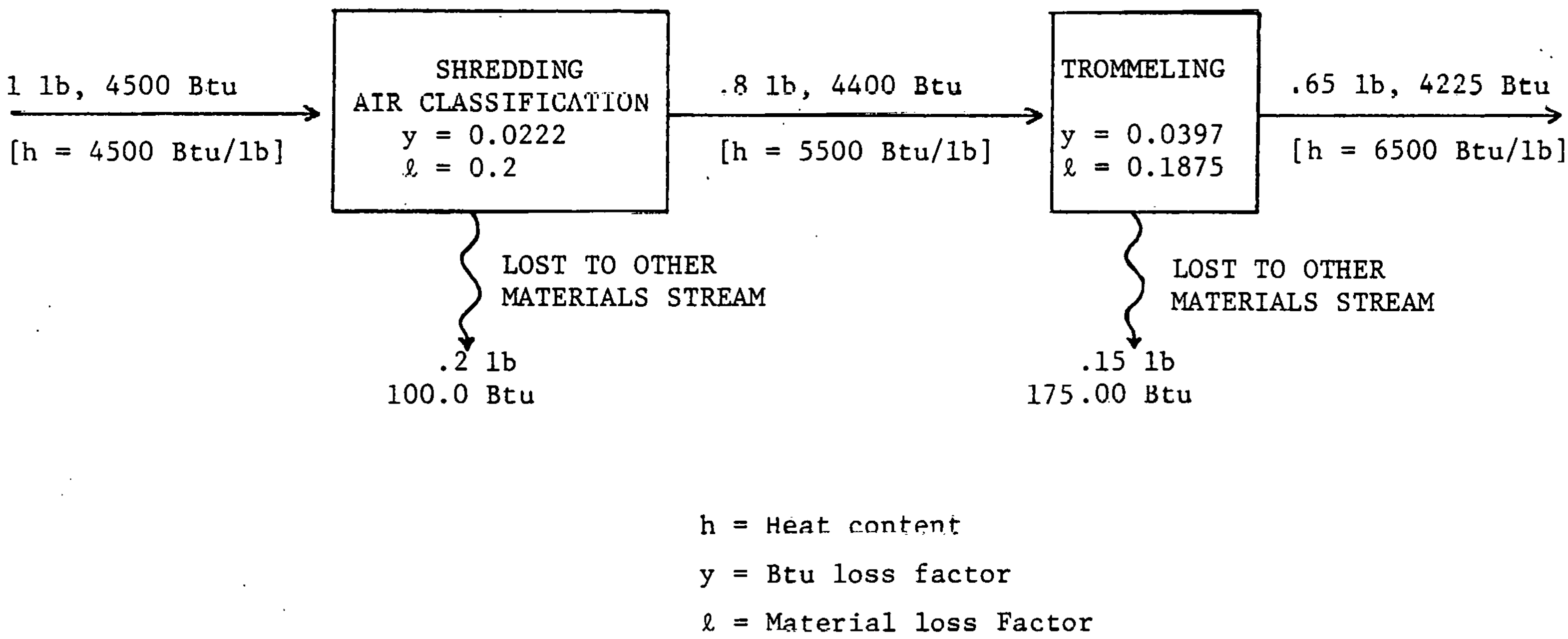

FIGURE 4: Energy and Material Balance Through an RDF Plant

*This is to be contrasted with overall thermal efficiency, which captures Btu equivalent of electric output per Btu of fuel input, which is in the order of 33% for conventional steam electric cycles.

The Btu potential of municipal refuse can be determined by the following equation:

$$Q = \underset{\left[\frac{tons}{yr}\right]}{x} \quad \underset{[\quad]}{(1 - y)} \quad \underset{\left[\frac{Btu}{lb}\right]}{H_r} \quad \underset{\left[\frac{lb}{ton}\right]}{2000} \quad \underset{[\quad]}{e'}$$

where x = material input, in tons/yr

y = Btu loss factor ($o \leq y \geq 1$)

H_r = Energy content of raw refuse, Btu/lb

e' = Efficiency of combustion, relative to that of fuel oil or pulverized coal in a modern boiler

For example, for shredding and air classified RDF, for which y = 0.022, and assuming H_r = 4500 Btu/lb and a total Maryland Refuse of 2.9×10^6 tons/yr, we have a potential fuel oil equivalent of

$$2.9 \times 10^{9} \cdot (1 - 0.022) \cdot 4500 \cdot 2000 \cdot 0.8 = 20.42 \times 10^{12} \text{Btu/yr}$$

It should be noted that the term $(1-y) \cdot H_r$ in the above equation is equivalent to $(1-\ell)\, H^*$, where ℓ is the material loss factor, and H^* the heat value of the RDF. This equivalence is readily identified on Figure 4. This 20.42×10^{12} Btu is equivalent to about 136 million gallons or 3.22 million barrels of #6 fuel oil.

Under the assumptions that 70 percent of the municipal solid waste in Maryland, namely that from Baltimore County, Montgomery County, Prince George's County and Baltimore City, would all be economically transportable to recovery facilities; that the refuse can be legally committed to resource recovery facilities on a steady basis; and that the RDF is burned in sole source, electric generating steam power plants, then 1.4×10^9 kilowatt hours of electricity could be generated from refuse in 1980. This would be equivalent to 5.2 percent of the State of Maryland's total 1975 electric sales

(27.4×10^9 Kwh), and implies replacement of 95 million gallons of #6 fuel oil, in turn equivalent to 13.7 percent of the 693.4 million gallons of residual oil used for the generation of electricity in Maryland in 1975.[4]

Utility requirements for the processing of a ton of raw refuse at a resource recovery plant have been estimated at 19.2 Kwh and 0.8 gallons of fuel oil.[5] When these requirements are compared with the energy potential of a ton of refuse which is 641 Kwh of electricity or 45.5 gallons of fuel oil, then the applicable conversion loss is approximately 5 percent.

4.2 Institutional Barriers to RDF Production and Use in Maryland

While municipal solid waste is being produced throughout the entire state of Maryland, there are large portions of the State where, for a variety of reasons, it currently appears infeasible to produce and use RDF. A primary reason for the production of RDF is to provide a cost effective alternative method of municipal solid waste disposal. In order to make RDF a viable alternative, there usually must be a scarcity of nearby acceptable land for future sanitary landfills, high costs associated with locating and developing a new replacement sanitary landfill, and/or rapidly rising costs of operation (often due to government environmental and solid waste management laws). In a few instances RDF production may be initiated by a community for environmental and energy conservation reasons, even though it is not fully cost effective. In the vast majority of cases the generation of steam/electricity and the recovery of resources would be considered by-products of refuse disposal and would not be the motivating factor for RDF production and use. If a national or Maryland bottle bill is enacted similar to the one in Maine or Vermont (where 90 percent of the soft drink containers and 80 percent of beer containers are returned), there should not be much effect on a Maryland resource recovery facility. An important consideration in determining the validity of a resource recovery facility is that the statutory basis for state and local control of refuse disposal is based on the police power of protecting public health, safety and welfare, not on economic issues or energy production.

More than half of Maryland's counties should continue their present practice of sanitary landfilling raw municipal solid waste because of low daily tonnages and the availability of low cost landfill sites.

On the other hand, Baltimore City, Baltimore County, Montgomery County and Prince George's County each are expected to generate more than 400,000 tons of municipal solid waste annually by 1980. Anne Arundel County in 1980 will probably generate almost 253,000 tons with possible augmentation from the several large federal facilities situated within that county. Harford County (87,000 tons/year), Howard County (69,000 tons/year), Washington County (61,000 tons/year) and Frederick County (51,000 tons/year) would all be viable partners in an intercounty compact based on daily tonnages and adjacency to large counties.

4.2.1 Securing a flow of municipal solid waste

The first step in the production and use of RDF in Maryland lies in securing a steady, uninterrupted flow of a predictable, daily tonnage of municipal solid waste. Resource recovery facilities should be built for optimum capacity and the RDF user guaranteed a daily supply of a specified quantity of RDF. Therefore, some form of control must be maintained over the disposal of municipal solid waste, residential and commercial/institutional.

Presently, under the authority of State of Maryland legislation (Section SV, Article 2.5), each county can require that all residential refuse be collected either by county/municipal employees or by private collectors under contract to the local governments. The rationale for this authority is based on the assumption that the lack of collection may be injurious to the health and comfort of the inhabitants of the county. At this point, counties have control over residential refuse collection and ultimately residential refuse disposal by virtue of contracts with private haulers where disposal locations are specified (a resource recovery facility or transfer station) or by having county/municipal employees dump it at specified locations themselves. Daily deliverance of residential refuse can thus be assured at a county resource recovery facility. (Section 2.2 discusses the many modes of municipal solid waste collection presently practiced in Maryland.) Some counties do achieve 100 percent collection of residential refuse. No county has control over any commercial/institutional refuse at this time.

Residential refuse makes up from 50 to 80 percent of the municipal solid waste of a county depending upon its degree of urbanization. In order to optimize RDF production and usage in the State of Maryland, control over the disposal of commercial/institutional refuse should be sought, though RDF production and use can be feasible using only residential refuse. Many refuse disposal control methods are described in Section 3.2. A possibility would be to pass a state law similar to the present residential collection law basing the act on a demonstratable case concerning public health and "best public interest" (reducing: landfilling, foreign oil imports, and utility costs). However, implementation of a commercial refuse pickup law could pose problems by virtue of the organization necessary for the wide variation in commercial pickup frequencies, container sizes and types, customer demands, and seasonality of volumes. An alternate method of commercial refuse control may be through an avowed subsidy program of resource recovery facilities (described in Section 3.2), thereby desciplining the market. Objections will be raised if disposal control starts at the pickup point, disallowing initial collector sorting.

As residential and commercial/institutional refuse collection in counties achieves 100 percent, the per capita amount of refuse for disposal may increase, since an individual responsible for his own disposal would probably have incentive to minimize his generation (by recycling, composting, etc.). Moreover, illegal roadside dumps will lose much of their reason for existence and there will be generally less reason for litter, unsanitary conditions, and trash strewn alleys. On the other hand, there may well be some complaints by those who are forced to pay for and receive the collection service when their use of the service may be negligible. Rates throughout a county for collection service will vary according to the number of pickups per mile and the haul distance to a transfer station or resource recovery site unless an average rate is used for the entire county.

4.2.2 Long-term users of RDF in Maryland

The second step is to determine if there is a local long-term user of the RDF product. At the present time there appear to be very few companies or utilities in Maryland who can use RDF as a supplementary fuel for steam and electric generation in existing boiler facilities.[6] Most of the electric power plants in Maryland, and especially those in the Baltimore region which were originally designed for coal, have now been converted into oil-fired peaking units. Because of a lack of experience and a guarantee of reliability the Baltimore Gas and Electric Company is hesitant to burn RDF with oil, but if the Crane 1 and 2, Wagner 1 and 2, and/or Brandon 1 and 2 units are converted to coal uder the ESECA legislation, RDF could be burned as a supplemental fuel. Potomac Edison Power Company could modify its Dickerson 1, 2, and 3 units, which are already burning coal, but because they are peaking units, they would need expensive modification, require long-term RDF contracts, for a fuel savings which would not be significant. No action is presently contemplated. The proposed Dickerson 4 plant, a base load 850 Mw unit designed to accept RDF, continues to be postponed in light of recent load growth developments. Under MES estimates of a 10 percent Btu substitution of municipal solid waste fuel at the Dickerson 4 facility, there would be a need of 2260 tons/day of refuse or 1582 tons/day of RDF, almost 30 percent of Maryland's refuse. The feasibility of using RDF as a supplemental fuel at the City of Hagerstown's municipally owned power plant is being studied as a means of enhancing fuel economy. Issues under study include air emission standards, base load operational possibilities, capturing a higher fraction of the available refuse, the economics of resource recovery and landfilling, and possible contractual obligations.[7]

A feasible alternative to burning RDF as a supplemental fuel in an existing or new utility boiler is to fire it at 100 percent in a county or regional electric generating facility. MES has two ways to provide capital. One is through its revenue bonds. The other is through its Grant/Loan Program, as authorized by the 1974 Maryland Resource Recovery Act, which provides for up to 20% State Funding, but not to exceed $5M. This will not harm a county's bonding capacity or credit rating. The county (under the Public Utilities Service mandate regarding intra-state generation and with the involvement of the Maryland Power Plant Siting Program) could finance an electric generation facility with short term notes without initial cost to a utility. In the case of Hempstead, New York facility, the electric generation equipment, which fully meets utility specifications, from the boilers' steam line to the transmission line tie-in will be sold to an area utility once the plant is operational, thereby allowing the county to repay its short term loans.[8] According to MES, capital expenditures for a 1,600 tons/day plant designed with semi-suspension boilers and a 60 Mw power plant to generate electricity six days a week, 16 hours a day would involve in 1975 dollars, $14.9M for materials recovery, $1.8M for RDF storage and materials handling, $34.8M for steam generation equipment and $11.4M for electricity generation equipment; debt service, operations and maintenance, landfill costs, recovered materials, and steam prices not included.[9] Agreements would be necessary with the utilities to operate the facility on a regular basis so that the refuse does not have to be stored for more than two days.

State institutions in Maryland for the most part have oil-fired heating units, a variable seasonal demand and, in general, a small, year-round steam demand. In 1973-74 Maryland State facilities consumed 31.9 million gallons of fuel oil. As the price of oil rises or new equipment is needed, however, it may be feasible to purchase new boilers and use RDF in pellet form with or without coal. The University of Maryland in College Park, Prince George's County, has been studying the use of 100 percent RDF in a new boiler to both augment and replace oil-fired capacity, but there would be fluctuations in steam need due to seasonal variations and school schedules. A solution to the seasonal irregularities is to pelletize the RDF using any one of several existing methods and treat it is so that long-term storage would be possible. Pelletized RDF has been test burned at the Maryland Correctional Institution's (MCI) stoker-grate coal-fired boiler and a public school boiler, where the burning characteristics of the coal appeared to improve. Demand for steam in non-electricity generating uses has a less dramatic seasonal variation which also might be solved by pelletized RDF if the pellets can withstand a minimum of 6 months storage with no health hazard or decomposition.

Many of the State and Federal facilities in Maryland dispose of their refuse in on site sanitary landfills. Only a few contract for refuse pickup with disposal taking place in county landfills. As with the State facilities, the steam needs of Federal facilities also vary widely between seasons. This can possibly lead to the burning of 100 percent unprocessed municipal solid waste of their own plus some county refuse during peak needs, and landfilling of some waste when demand slackens. The use of internally generated municipal solid waste as a fuel is currently being examined by the Department of Defense for several Federal facilities in Maryland.

One hundred million gallons of #2 and #6 oil were used in 1974 by a total of 12 Maryland industries, with Bethlehem Steel using half of that amount.[11] Kelley-Springfield uses approximately 250 tons/day of coal, but the facility's location in Allegany County places it near easily available coal and away from major refuse generation centers.

Present reasons for industry's limited use of RDF can be attributed to several factors which can be surmounted with proper handling. First, because fuel costs are usually only a small proportion of production costs (possible exceptions are a few energy intensive industries) and uninterrupted production of steam/power is essential, industry has no present incentive to experiment or assume risks. Second, when an industry is an oil user the assurances of "no problems", "uninterruptable supply" and "fill the need" must be proven before a company will undertake a reconfiguration of its boilers or purchase new boilers with ash handling, in order to install RDF-firing equipment and suitable air pollution controls. Third, in the case of the coal user, there still are concerns over: the dependability of supplemental or sole RDF use, firing techniques to give even heating, and air pollution control which is more difficult with RDF. Fourth, industry is skeptical, though not as much as before, about signing long-term supply contracts for RDF with one or more county/municipal governments even with the promise of financial penalties for non-deliverance. Unless induced by much higher fuel costs, impending oil embargoes and natural gas curtailments, or given committments of federal and state fiscal incentives, industry will only continue to "discuss" RDF.

An exception to industry's avoidance of RDF is coming from the cement industry. Three major Maryland cement manufacturers use 250, 275 and 720 tons/day of coal. MES has been conducting tests at the Lehigh Portland Cement facility in order to determine the feasibility of RDF use as a supplemental fuel. Although the tests have proved positive, there has been weak industry incentive to sign contracts and enter into a fueling method which involve extra effort and expense. Benefits will have to be explained to potential industry users and uncertainties reduced.

Central heating and cooling systems, outside of the one in Baltimore City and the several state and federal facility systems, are almost non-existent in the private sector. The steam demand in these systems is seasonally variable and presently handled by oil-fired power plants. The Baltimore Pyrolysis facility will supply steam to city steam customers; additional suppliers are not needed.

Even after the state and counties have solved the problems of the command of a steady supply of municipal solid waste and assure its delivery to resource recovery facilities, siting transfer stations and resource recovery facilities, and producing RDF there may be a difficulty in convincing utilities, industries and governments to use it. While some political persuasion may be brought to bear and institutional barriers lessened, the economic rationale must be viable. RDF production, and more importantly its use, are essential in the debate on whether or not to build a resource recovery facility. RDF sales must account for at least half of the facility's product sales. The facility's existence should be the result of refuse disposal problems (physical and fiscal), not product profits. But when a resource recovery facility is built, RDF use is the cornerstone to economic viability.

4.3 Ambient Air Quality Issues

The purpose of this section is to determine whether permitting regulations within the State of Maryland would hinder the production and use of RDF. A review has been made of the existing rules and procedures within the State as they affect transfer stations, resource recovery plants and RDF user facilities. A more detailed discussion of the specific water and air quality issues are presented in Sections 4.4 and 4.5, respectively.

From all available information, it seems that the permitting of new transfer stations and resource recovery facilities within Maryland would not be difficult. Don Andrew, of Maryland's Environmental Health Administration, Air Quality Program, believes that such facilities would require permits only to the extent that they release "fugitive dust" into the atmosphere.[12] New installations would need to be equipped with baghouses and odor control systems to prevent escape of dust and odors to the surrounding atmosphere. Since nearly all new facilities are designed with control capability at this time, it would seem that permits could be easily obtained.

More serious problems may be encountered at facilities which are designed to burn the RDF to produce steam and/or electricity, however. Any new plant of this kind would be treated in the same manner that other potentially polluting installations are handled: it would require a "permit to construct" showing that "advances in the technology of air pollution control developed for the kind and amount of emissions" produced by the facility were included in the design.[13] Later, the facility would require a "permit to operate" demonstrating that the emissions control equipment had been shown to be effective,[14] and would have to invite public comment on its proposals in a manner stipulated by the Air Quality Programs. Copies of all relevant materials are normally made available to the public during the permitting process.[15]

RDF use may encounter hazardous waste regulations both under the federal Resource Conservation and Recovery Act and Maryland's Natural Resources Article 8-1413.2. As of now the production of ash over 2,000 tons per month is designated a Class VI hazardous waste by Maryland requiring special treatment during disposal.

According to Andrew, the siting of new RDF-burning installations in nonattainment areas of Maryland would be difficult because of the strict requirements imposed under EPA regulations (described in Section 4.5). However, EPA has exempted plants that burn municipal solid wast from its emission offset policy, and thus new resource recovery facilities can be built, under the policy, even if they cause or contribute to violations of ambient air quality standards. In such cases, facility owners must obtain all "available" emission offsets -- corresponding reductions in air pollution emissions from existing sources in the same area.

Unlike other new air polluting sources, resource recovery facilities will not be prohibited if available offsets do not result in "a positive net air quality benefit" in the affected area and "reasonable progress toward attainment" of the applicable ambient air quality standard. EPA does require, however, that owners make continuing good-faith efforts to obtain additional offsets as they become available.

Special Maryland statutes which regulate the location of new solid fuel fired utility boiler installations below 250 X 10^6btu/hr could also inhibit RDF development.[16] As a result of these restrictions in urban areas, the development of RDF-firing capacity is thought to be limited to the more rural areas of the state.[17] Whether it is economically feasible to site RDF facilities at a distance from urban areas is a question that must be addressed by state and county planners on a case by case basis in their review of area refuse generation tonnages, landfill disposal costs, haulage costs, RDF user location, and other siting factors.

Permitting requirments are presently under review by federal and state officials with an attitude of removing the permitting barriers to siting. This may come from regulation changes or requirements for additional technology to mitigate potential problems.

4.4 Water Quality Issues

The issue of water quality degradation resulting from RDF production and burning in Maryland is one for which virtually no data is currently available. Municipal solid waste (MSW) can contain elements which might pose a threat to drinking water were they to enter the aquifer of a community, but it is unclear whether any process associated with RDF production and use would be likely to contribute directly to water contaimination. In the normal RDF production chain--collection of refuse from private homes and communities, transport to a transfer station for compacting and loading, transport to the RDF plant for shredding and resource recovery, and transport to a boiler for burning and final landfill--there would seem to be few points at which exposure to natural water would be possible.

Transfer stations and resource recovery facilities are designed to entrap all water which might have come in contact with the refuse. Tipping floors and receiving bins are usually enclosed to keep out rain water. Daily sanitizing of the tipping floors, packer truck loading areas and resource recovery receiving areas diminishes the water pollution potential.

In the resource recovery process certain glass recovery processes demand the use of large quantities of water, some needing as much as 65 thousand gallons per ton of refuse. The amount of water used in ferrous and non-ferrous metal cleaning, if necessary, is relatively insignificant, as is the water occasionally used in the shredder or receiving area cleanup. Recycled water is suitable for all aspects of resource recovery except for final froth floatation in the froth floatation glass recovery process. A dry recovery process is used at the Baltimore County resource recovery facility. Waste water can be pumped into a thickener, a settling pond and filtration system and/or sewer.[18]

There is the possibility that water used in boilers for ash quenching and stack scrubbers of facilities which burn RDF with coal might contain larger amounts of some substances than water used in the same facilities when coal alone is burned. Pollution studies conducted at the EPA demonstration plant in St. Louis showed marginal increases for total dissolved soliids (TDS), biological oxygen demand (BOD), dissolved oxygen, and suspended solids in the facility's effluent pond.[19] Increases for some chemical compounds were also noted. However, the significance of these findings is questionable since the testing program was limited and yielded results for only one facility.

In considering the possible water quality impacts of RDF utilization it is worthwhile to recall that the same refuse used in RDF production would normally be landfilled if resource recovery operations were not present. Herein lies a significant point: the end result of RDF burning is an ash (removed from the floor of the boiler and from pollution control equipment) which is easier to landfill, without fear of contamination than raw refuse which commonly produces leachate problems when placed in the ground. A recent report by the State of Maryland indicates that more than half of the existing landfills in the state are experiencing leachate problems ranging from moderate to severe at this time.[20] The following description is typical of the landfill sites at which leachate hazards have been found:

> Black seeps with a strong leachate odor exist in the area of the completed fill. Black ponded water surrounds the end of the older fill. In the newer fill area, a discharge from a sediment pond flows directly into a nearby stream.[21]

While it is reasonably easy to build filtration devices to remove chemical substances from the effluent of an RDF plant, it is very difficult to control leachate problems of the kind described above. Since RDF use can reduce the amount of municipal refuse that needs to be landfilled by as much as ninety percent and produces a relatively inert final product from RDF processing and burning, it would seem to be beneficial for water quality.

Thus, water quality degradation should not present an impediment to resource recovery and RDF use in Maryland. It appears that facility design and technological adjustments can alleviate such potential sources of trouble.

4.5 Legal Air Quality Issues

Introduction: This section will focus on the effects of the Maryland State Implementation Plan (SIP), as required by the Clean Air Act of 1970 and amended in 1977 on RDF production and use in Maryland. A full discussion of the Federal Clean Air Act of 1970 and the 1977 Amendments and their effect on Maryland's RDF production and use potential is given in the Appendix to this report.

The processing of municipal solid waste into RDF involves the shredding and preparation of a light aggregate of paper and plastics. The primary air quality impact is dust. Emissions from the Cockeysville, Maryland processing facility are controlled by a baghouse with a 99.9% collection efficiency sufficient to meet Maryland's .03 grams per standard cubic foot of dry exhaust gas (gr/SCFD) emissions limitation.[22]

While the basic pollutants emitted in RDF combustion are known (suspended particulates, hydrogen chloride, sulfur oxides, nitrogen oxides, carbon monoxide, hydrocarbons, and certain trace metals in gaseous form), the volumes and proportions of pollutants have been found to vary due to geographical origin and seasonal fluctuation of the refuse. In addition to the changes in pollutant make-up caused by variations in RDF composition, the differences in RDF processing techniques and user facilities also have strong effects. It is known that when RDF is cofired with coal, the result, as compared with 100 percent coal, is higher particulate and carbon monoxide emissions, but lower sulfur dioxide and nitrogen oxide emissions; the degree of variation is only partially due to the percent of coal used and its characteristics. When using refuse or RDF in a pyrolysis plant the amount and characteristics of the particulate matter is the problem.

The Maryland State Implementation Plan: The Maryland State Implementation Plan (SIP) is intended to implement the Clean Air Act of 1970 and 1977 Amendments. The construction, modification, and operation of almost every stationary source is regulated by the states pursuant to their state implementation plans. The Clean Air Act, as amended by the 1977 Amendments, requires states to submit new SIPs by January 1, 1979, to incorporate the changes made in the 1977 Amendments. (Section 42 U.S.C. 7410 (a)(2)(D) provides that the SIP must include a permit program to implement the provisions dealing with the prevention of significant deterioration (PSD) and nonattainment (defined in the Appendix.) In addition, the state SIP must include:

> "a permit or equivalent program for any major emitting facility, within such region as necessary to assure (i) that the national ambient air quality standards are achieved and maintained and (ii) a procedure, meeting the requirements of paragraph (4), for review (prior to construction or modification) of the location of new sources to which a standard of performance will apply."[23]

The states must therefore have the authority to refuse to permit the construction of a new source or the modification of an existing source if (1) the source would be likely to interfere with the attainment or maintenance of an ambient air quality standard or a PSD increment or (2) if the new source or modification would violate a new source performance standard.

Air quality control in Maryland is governed by Article 43 of the Annotated Code of Maryland and by statewide and regional regulations promulgated by the Department of Health and Mental Hygiene. The statute and regulations are incorporated as part of the SIP and designed to permit the state to identify sources and detect violations of the emission standards.

The Annotated Code of Maryland, Article 43, Section 693(a), (b), established six air quality control regions and authorized the Department of Health to establish air quality standards. Effective July 1, 1979, the ambient air quality standards for the six regulated pollutants will be identical to the national ambient air quality standards. The Department of Health also set emission limitations for a variety of categories of sources emitting each pollutant. The emission limitations vary depending upon the location of the source. The four air quality control regions (AQCR) other than Metropolitan Baltimore and Metropolitan Washington D.C. are covered by one set of standards (COMAR 10.18.02, .06, and .07) and the two large metropolitan areas by another (COMAR 10.18.04 and 10.18.05).

The emission limitations of special interest for RDF use are those for visible emissions and particulates. Outside the two major metropolitan areas, an existing installation and any subsequent modification (i.e., one constructed before January 17, 1972) is permitted according to section .02(c) of COMAR 10.18.02, .03, .06, and .07, to have visible emissions no darker than that designated as No. 1 on the Ringelmann Smoke Chart or greater than 20 percent opacity. In the Baltimore and Washington areas and for new installations in other parts of the state, no visible emissions are permitted according to section .02(A) of COMAR 10.18.04 and .05, and section .02(B) of COMAR 10.18.06 and .07.

Determination of the applicable emission limitation for particulate matter is complicated by the fact that the standard applied will depend upon whether the facility is characterized as an incinerator or as solid fuel burning equipment.[24] While a pyrolysis plant or a waterwall incinerator might be classified as an incinerator, it seems likely that a boiler which burned RDF in suspension would be classified as solid fuel burning equipment. On that assumption, the emission limitation for new solid fuel burning equipment in the four non-metropolitan AQCRs (COMAR 10.18.02, .03, .06. and .07, and section .03(B)(2), Table 2) and for new and existing solid fuel burning equipment in the Baltimore and Washington metropolitan areas (COMAR 10.18.04 and subsection .03(B)(3), Table 2) is .03 gr/SCFD.

Representatives of Maryland's Air Quality Programs stated that a facility burning RDF as a supplement to coal would have to have extremely good electrostatic precipitators and still would probably not meet a no visible emissions and .03 grain loading standard. However, some industry sources believe that a precipitator designed specifically for RDF use might well meet such a standard. Nevertheless, RDF use in outlying counties, in existing sources where the particulate standard is not as stringent and where the visible emissions standard for existing and modified sources is 20 percent opacity, appears to pose fewest problems. However, the haul cost penalties might affect overall viability of RDF use.

Data for the St. Louis plant indicate that at lower boiler loads (up to 120 MW) a mixture of coal and RDF, with RDF averaging about 10 percent, resulted in a grain loading of less than .1 gr/SCFD.[25] At 140 MW, emissions increased to almost .3 gr/SCFD due to a loss of precipitator efficiency at these higher boiler loads. Each of these levels exceeds new source performance standards for incinerators (.08 gr) and fossil fuel fired steam generators (.1 $lb/10^6$ Btu) and also exceeds the 0.03 grain loading standard under Maryland law. However, it must be noted that the loss in precipitator efficiency at 140 MW was due in large measure to operation in excess of the 125 MW design, thereby exceeding design air velocities. Moreover, the precipitators were not assigned to meet .3 even for burning coal. In any event, given this admittedly limited experience with RDF, it would seem that if any RDF facilities can be located in metropolitan areas the most appropriate facilities for experimentation would be ones with relatively new equipment, and efficient precipitators specially modified to work efficiently with RDF.

NOTES TO CHAPTER IV

1. Bechtel Corporation, Fuel From Municipal Refuse for Utilities, prepared for Electric Power Research Institute, March 1975, pp. 2-30.

2. C. R. Willey, "Municipal Solid Wastes as a Supplemental Energy Source for Maryland," Maryland Environmental Service, March 1977.

3. National Center for Resource Recovery, Inc., Refuse-Derived Fuel and Densified Refuse-Derived Fuel, June 1978, p. 17.

4. US DOE, EIA, Federal Energy Data System, Statistical Summary, U.S.G.P.O., February 1978, p. 211.

5. T. A. Phillips, An Economic Evaluation of a Process to Separate Raw Urban Refuse into its Metal, Mineral, and Energy Components, Bureau of Mines Information Circular 8732, College Park, MD, 1977, p. 15.

6. Note 2, supra.

7. Ibid.

8. Dr. Harvey Alter, National Center for Resource Recovery, interview with William Metz, Brookhaven National Laboratory, July 26, 1978.

9. Note 2, supra.

10. C. R. Willey, "Energy From Waste", Maryland Environmental Service, Annapolis, MD, June 1978.

11. Energy Policy Office via MES, Note 2.

12. Don Andrew, Head of Engineering, Maryland's Air Quality Programs, in a telephone interview with John Shyer, Center for Environmental Studies, Princeton University, Princeton, NJ, July 1978.

13. State of Maryland, Regulations Governing the Control of Air Pollution in the State of Maryland, as ammended December 16, 1977, Sec. 11 I.1.

14. Ibid., Sec., 11 I.2.

15. Ibid., Sec. 11 J.3(b).

16. These rules state that no utility boiler installation producing less than 250 million Btu/hour can be sited in any urban area of Maryland.

17. Note 12, supra.

18. Note 5, supra.

19. Midwest Research Institute, St. Louis Demonstration Project Final Report, (Kansas City, MO: MRI Environmental Systems Section, 1977), pp. XXV and 51ff.

20. State of Maryland, Water Resources Administration "A Field Investigation of Sanitary Landfills in Maryland", March 17, 1978, p. 1.

21. _Ibid._, p. 245.

22. Maryland Department of Health, Bureau of Air Quality and Noise Control, premise file.

23. 42 U.S.C. 7420(a)(2)(D).

24. At a meeting with representatives from the Bureau of Air Quality and Noise Control of the Maryland Department of Health in July 1978 this was raised as the threshold question in an examination of the legal restraints on RDF use.

25. Note 23, _supra_.

CHAPTER V

SOME PRELIMINARY CONCLUSIONS

In general, we reiterate that the best prospects for implementing RDF or other resource recovery facilities is in those counties where the problems of disposal by sanitary landfilling methods are becoming acute for either fiscal or land availability reasons. Attempted stimulation of resource recovery facilities in counties where the physical or fiscal problems of refuse disposal are not sufficiently acute will be likely prove unsuccessful.

The State of Maryland can encourage RDF production and use in those counties where conditions are favorable by reducing certain institutional barriers and social constraints. This could involve passing new State legislation, undertaking further studies, applying pressure to local governments and industries, adjusting the MES charter, offering interdepartmental assistance to county governments, and making additional financial commitments to resource recovery. A number of specific points emerge from our preliminary study:

Air Quality Issues

Many of the air quality restraints on the use of refuse-derived fuels in Maryland will depend upon the position of EPA on a number of important issues, upon the impending revisions to the Maryland State Implementation Plan, and plans to implement the new nonattainment and prevention of significant deterioration provisions of the 1977 amendments to the Clean Air Act (as discussed in the Appendix). These revisions are presently being planned by the State of Maryland for submission to EPA in 1979.

More significant uncertainties remain about the nature and composition of the refuse and the emissions it will generate. Research will be needed into control technology designed to work efficiently with RDF. Unique problems might arise with reference to emissions of trace metals, and pathogens. Although there are no standards for safe levels of such emissions under the Clean Air Act, special precautions may be necessary.

RDF is generally an urban resource because of the availability of large concentrations of refuse from these areas. Since urban communities are also the most likely to experience air quality nonattainment problems, special precautions will be required to assure that the result is not further deterioration in the already overburdened urban environmental setting, especially in the case of particulates. It remains to be seen whether current emission trade-off and PSD policies will be adequate in this regard. At this early stage of development of RDF, when many uncertainties about its environmental impact exist, it would seem prudent to use closely monitored pilot studies in Maryland and elsewhere to gain more definitive data on the full air quality costs of this important resource before its widespread use is advocated.

Refuse Control

As has been stated (section 4.2.1), a primary factor in developing resource recovery is having a known, assured quantity of refuse. Counties have the backing of a state law to operate or contract for residential refuse collection; legislation allowing them to do the same with commercial/institutional refuse probably is needed as well. These two laws would allow credible assurances of a definite refuse supply to be given to financial backers and industrial partners, and allow facilities to be designed and constructed for optimum capacity, which in turn maximizes economies of scale in both capital and operating costs.

Characteristics and Volume of Maryland Solid Waste

The volume and characteristics of a county's municipal solid waste must be known before the resource recovery facility is designed. Few counties have this information on the residential and commercial/institutional refuse collected or disposed of within their jurisdictions. Counties, possibly with MES or other state agency assistance, need to weigh refuse (even if only periodically), know refuse origins and know the characteristics of the refuse from residential and commercial units. Facility design requires at the very minimum knowledge of the fractional composition of paper, plastics, ferrous metal, non-ferrous metal, garbage, wood, leather, textiles, garden wastes and inert materials; with additional knowledge on seasonal variations and the frequency of daily and weekly surges. The economic viability of recovering ferrous and non-ferrous metals and glass must also be made prior to recovery system investment.

RDF Users

Given county authority to collect residential and commercial/institutional refuse and known volume and characteristics of refuse, (or estimates based on reasonable sampling program) identification of potential RDF user is the next step. If the user is to be a utility, industry or state/federal facility then it is preferable, of course, that the RDF be used within the county in which it is generated in order to minimize inter-county refuse and ash movement. Territoriality is an important issue among Maryland's counties. Any program of marketing RDF to customers in adjacent counties on long-term contracts may warrant state judicial attention, for the county in which the RDF was being hauled would be excluded from marketing its future RDF to that particular client. While states cannot block the movement of refuse across state lines it is uncertain whether counties can or cannot pass ordinances with regard to county lines. Counties can build their own boilers and steam generators, but, again, territoriality is an issue. Some counties may not have feasible locations for a power plant or would require new connecting transmission lines to be built through another county.

Siting

In conjunction with identifying the RDF user siting of the resource recovery facility, transfer stations, residual landfill and ultimate user (existing or planned) must be addressed.

Potential power plant sites are subject to the usual issues of transmission line adjacency (138 Kv or 69 Kv for the likely size of RDF fired feneraters), water needs, air quality permitting ability, geology, land use compatibility, major refuse locations, resource recovery facility location and transportation aspects of refuse and RDF. Location of the RDF facility should be based on a full locational analysis, balancing refuse and RDF haul distances, and constrained by the set of feasible sites. A landfill needs to be located near the resource recovery facility to take the unrecoverables. Transfer stations often have to be placed in locations of least community resistance, but should be situated in accordance with the economics of haul distances between collector vehicles and the resource recovery facility. Collection routes can be arranged so that the collection trucks travel toward transfer station and resource recovery facilities rather than the reverse. This interrelationship in facility sitings and collection routes needs to be investigated by MES so that a more complete picture of RDF costs and implementation problems is known.

Financing

Financing a resource recovery facility, and possibly steam and electric generation facilities can follow both private and public routes. The most advantageous method would be to use the bonding ability of MES, whose revenue bonds would be available without upper limit. The MES loan/grant program, as authorized by the 1974 Resource Recovery Act, however, currently provides only up to 20% state funding, with an upper limit of $5M, and in addition requires State ownership. Certainly increasing the MES share, and making State ownership conditions less stringent, would provide worthwhile additional incentives. Assistance in the funding of county steam and electric generation facilities is also granted within the MES charter, and the necessary details should be resolved. One additional issue is the ability of a county to pay a penalty to an RDF user in the event of refuse or RDF product shortfall, a problem that will likely arise in negotiations with potential users, and which should therefore be clarified in advance.

Conclusion

RDF use in Maryland is on the verge of becoming a reality. MES has conducted much basic research and experimentation in resource recovery at the Baltimore County facility. Several counties have considered the idea of RDF production and use, but inaction is due to the perceived difficulties and the lack of a real State effort to assist counties in project completion. A coordinated effort by Maryland state agencies, the introduction of necessary legislative changes, developing a sense of priority and a continuing dialogue with county officials, industry, utilities and State citizenry may well remedy the current stagnation in RDF production and use efforts. The desired result would be the use of a presently wasted resource, refuse, an inherently satisfactory and environmentally sound solution to municipal refuse and a small, but nevertheless significant lessening of the state dependence on oil.

APPENDIX

This Appendix focuses on the effects of the Clean Air Act of 1970 and the 1977 Amendments on RDF production and use in Maryland. The emphasis here is on the cofiring of RDF and coal to facilitate the fullest discussion of the 1977 Amendments, and not to prejudge the most advantageous use of RDF.

The Clean Air Act of 1970 and the 1977 Amendments

The Clean Air Act of 1970 required the administrator of EPA to establish national primary and secondary ambient air quality standards (NAAQS) for any pollutant which causes any adverse effect to public health or welfare. EPA has designated six such pollutants: particulates, sulfur dioxide, carbon monoxide, nitrogen oxide, photo-chemical oxidants, and hydrocarbons. States were required to submit State Implementation Plans (SIP) by May 30, 1972, designed to bring each state's air quality within the national primary standards by 1975, and within the secondary standards within a reasonable time thereafter. Extensions to 1977 were granted by EPA under certain conditions. The Clean Air Act, as amended by the 1977 Amendments, requires states to submit new SIPs by January 1, 1979 to incorporate the changes made in the 1977 Amendments. States were permitted to submit plans more stringent than necessary to comply with the national standards (discussed in Section 4.5).

The 1977 Amendments to the Clean Air Act will have the most significant impact upon the future use of RDF and the siting of new RDF facilities. Three major sections of the amended law must be considered in some detail in order to evaluate the foreseeable legal constraints on the future use of RDF as an energy source. These are: 1) new source preformance standards, 2) provisions for non-attainment areas, and 3) provisions for the prevention of the significant deterioration of air quality.

The Source Performance Standards (NSPS) (42 U.S.C. 7411)

EPA was required by the 1970 Act to set new source performance standards (NSPS) for emissions from new or modified sources which the Administrator determined might contribute significantly to air pollution at levels threatening the public health and welfare. Regardless of the location of a significant new or modified source, the state must conduct a preconstruction review to ensure that emissions will not violate the NSPS.

The 1977 Amendments provide that the standards set by EPA are subject to the following requirement: the "standard of performance shall reflect the degree of emission limitation and the percentage reduction achievable through application of the best technological system of continuous emission reduction which (taking into consideration the cost of achieving such emission reduction, and any non air quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated."[1] The section applies to new sources within the industrial categories specified by EPA. The Administrator is required to include a category of sources if, in his judgment, it cuases or contributes significantly to air pollution which might endanger the public health or welfare.

The statute exempts a conversion to coal pursuant to an order under the Energy Supply and Environmental Coordination Act of 1974 (ESECA) from the definition of a modification and hence from the definition of a new source. Maryland has several power plants presently burning oil which may be affected by this provision. It seems logical to predict that those plants would be most likely to include further modifications permitting the use of RDF as a supplemental fuel when they make the necessary modifications to burn coal, even though (subject to some qualifications to be explored) the further modifications necessary to permit the source to burn RDF could constitute a major modification potentially ringing the source within the preview of the new source performance standard.

The next question is whether certain types of RDF facilities fall within any of the new source categories established by EPA. Some personnel in Maryland's Air Quality Programs see a serious definitional problem in trying to fit RDF facilities within one of the existing categories.

Two categories are pertinent: 1) large incinerators and 2) fossil fuel fired steam generators. The EPA definition of an incinerator is very broad under 40 C.F.R. 60.51: "any furnace used in the process of burning solid waste for the purpose of reducing the volume of the waste by removing combustable matter." An RDF facility would be burning solid waste not to reduce its mass, but rather to recover the energy available for use. It can be argued that the reduction of the amount of waste is largely only a beneficial side effect, though the production of RDF may be the result of landfill costs and economic benefit. Given our focus on facilities which burn processed RDF either as the only fuel or as a supplement to coal, it would seem that the EPA definition of incinerators does not include RDF. However, EPA's interpretation will be required in an individual situation when the question arises.

EPA's definition of a fossil fuel fired steam generator under 40 C.F.R. 60.41 is "a furnace or boiler used in the process of burning fossil fuel for the purpose of producing steam by heat transfer." EPA further defines fossil fuel under 40 C.F.R. 60.41 as "natural gas, petroleum, coal, and any form of solid, liquid, or gaseous fuel derived from such materials for the purpose of creating useful heat." Since RDF does not fall within the definition of a fossil fuel, it would seem unlikely that plants buning RDF alone could be characterized as falling within the category of fossil fuel fired steam generators. Moreover, the modification of an existing coal-burning plant to complete or partial RDF, would similarly not appear to be covered because the modification was to allow use of a non-fossil fuel and less of a fossil fuel. EPA's regulation 40 C.F.R. 60.40 states that:

> any change to an existing fossil-fuel steam generating unit to accommodate the use of combustible materials, other than fossil fuels as defined in this subpart, shall not bring that unit under the applicability of this subpart.

While the language of the EPA regulations appears to exclude from either of these new source categories, a new plant burning entirely RDF or an existing coal burning plant coverting to the use of RDF, EPA may decide to include such future new sources or modifications within one of these existing categories. It is conceivable, for instance, that EPA might decide that an RDF burning plant is an incinerator because it reduces the volume of waste before it is burned even though its purpose is mainly to produce energy. EPA could also decide that a modification of a coal burning plant partially to RDF came within the category of fossil fuel fired steam generators since most of the fuel consumed was coal even though the modification decreased use of coal.

If RDF begins to be used widely, EPA might also create a new category for sources burning RDF either entirely or in conjunction with coal. EPA is required under 42 U.S.C. 7411 to establish NSPSs for all categories of sources that might contribute significantly to air pollution which threatens public health and welfare. However, under regulation 42 U.S.C. 7411(a)(2) the NSPS standards do not apply to sources which have commenced construction before the NSPS has been proposed.

The study done for the Department of Energy (Institutional Barriers) assumes that the St. Louis test plant would not fall under the federal new source performance standards as it was constructed prior to April 1971, the date on which EPA issued the NSPS for fossil fuel fired steam generators.[2] EPA's regulation 40 C.F.R. 60.14 clearly states, however, that a preexisting facility can become subject to the new source performance standards through a modification which results in increased emissions:

> (a) * * * Upon modification, an existing facility shall become an affected facility for each pollutant to which a standard applies and for which there is an increase in the emission rate to the atmosphere.

A conversion of an existing facility to the use of RDF might quality as such a modification if there is an increase in particulate emissions or if modifications are required, especially to the precipitators.[3]

A study conducted for the Department of Energy has indicated that the only test results on cofiring of a modern utility boiler, the one in St. Louis, exceeded federal new source performance standards for both large incinerators and fossil fuel fired steam generators.[4] Furthermore, the use of RDF reduced the collection efficiency of the electrostatic precipitator at higher boiler loads.[5] Consequently, the issue of whether RDF is covered by either of these two categories appears extremely important.

In addition, when RDF is used in a particular industrial boiler, it will have to comply with the NSPS for that industrial category if such a category has been established. For instance, a cement plant would have to conform to the new source performance standards for that category if the plant were modified to utilize RDF as a supplemental fuel.

As a practical matter, the safest route for a facility that is considering a switch to RDF in conjunction with coal is to obtain an early determination from EPA or the state as to whether that modification would bring the source within one of the categories of sources for which new source performance standards have been set.

If EPA does not include RDF facilities within a NSPS, the NSPS review process would not be applicable. The state would still be required, however, to determine that the new source or modification would not interfere with attainment and maintenance of the ambient air quality standards pursuant to 42. U.S.C. 7410.

Nonattainment Areas (42 U.S.C. 7501, et seq.)

In December 1976, the EPA issued an Interpretative Ruling, 41 F.R. 55524, which required emission offsets for new sources that sought to locate in a nonattainment area. The emission offset meant that another source in the same area had to reduce emissions by an amount which would more than offset the emissions expected from the new source. This policy was adopted by the agency to avoid the statute's apparent requirement that no new sources could be built in nonattainment areas (usually urban) until the national ambient standards were met.

In amending the Clean Air Act in 1977, Congress adopted the concept of emission offset. The statute (42 U.S.C. 7410 (a)(2)(I) provides that "After June 30, 1979, no major stationary sources shall be constructed or modified in any nonattainment area * * * if the emissions from such facility will cause or contribute to concentrations of any pollutant for which national ambient air quality standard is exceeded in such area unless, at the time of application for a permit for such construction or modification, (the state implementation) plan meets requirements of Part D of this subchapter (relating to nonattainment areas)."

EPA is now in the process of revising its interpretative ruling to incorporate the changes necessitated by the 1977 Amendments. The ruling, once it is promulgated in final form, will govern the period prior to a state's submission of a revised SIP for EPA approval and it will continue in effect in states where SIPs are not approved by EPA. The new emission offset ruling is available only in draft form, but it will be discussed here because it may have important ramifications for RDF use in Maryland and elsewhere.

In order to determine the applicability of this provision to the siting of RDF facilities in a nonattainment area of Maryland, a number of definitions are involved. First, a major stationary source is defined in the Act (42 U.S.C. 7602) as a facility that has the potential (without emission controls) to emit 100 tons per year of a regulated pollutant. The new draft ruling modifies this definition to exempt sources whose allowable emissions under the SIP or the NSPS are less than 50 tons per year of the pollutant. Small industrial boilers would probably be exempted by this definition and therefore would not be required to obtain an emission offset before being built in a nonattainment area.[6] On the other hand, a large electric utility boiler would undoubtedly fall within the definition of a major stationary source.

The next definitional question involves what constitutes a "modification." The present regulation (40 C.F.R. 52.01(d)) states that any change in the method of operation which increases the emission rate of any pollutant or results in the emission of any criteria pollutant not previously emitted is a modification. However, the regulations provide that switching to an alternative fuel would not be considered a modification if this was accomplished prior to December 21, 1976. In other words, if the plant were already designed to accommodate RDF but was not yet actually using it, the fuel switch would not be considered a modification. This exception has been retained in the draft revised ruling. This exception would not apply to most boilers in Maryland, however, because they are presently equipped to burn oil and would require modifications to burn coal, RDF, or some combination of the two. Such a change would therefore be a modification bringing the source within the requirements of the ruling. However, the draft regulations not yet issued by EPA state that conversion to an alternative fuel ordered by DOE pursuant to the Energy Supply and Environmental Coordination Act of 1974 (ESECA) will not be considered to be a modification. This would mean that an order to convert to coal, which is imminent for many of the power plants in Maryland, the facility would not be considered a modification necessitating an offset. However, when changes (to allow the use of RDF as a supplemental fuel) beyond those necessary for a conversion to coal are undertaken a modification has occurred.

EPA's new draft regulations contain two new exemptions from the emission offset requirements. The first exempts temporary emissions, such as those resulting from construction, and the second exempts "resource recovery projects burning municipal solid waste (as defined in Section 104 of the Resource Recovery and Conservation Act of 1976, P.L. 94-580)." There is no authority for the latter exemption in the Clean Air Act Amendments of 1977 and the decision was apparently made on the basis that EPA should, as a policy matter, encourage resource recovery projects because, it is felt, they result in overall environmental benefits. EPA has apparently made a determination that the negative air quality impacts of RDF use are less significant than the gains in other environmental areas, presumably solid waste disposal and water quality. Water quality would presumably improve with less reliance on landfills and their attendant runoff and leachate problems.

EPA's definition of a resource recovery project refers to the definition in the Resource Conservation and Recovery Act of 1976 (RCRA), 42 U.S.C. 6901-6987. The term resource recovery facility is defined (42 U.S.C. 6903 (24) as "any facility at which solid waste is processed for the purpose of extracting, converting to energy, or otherwise separating and preparing solid waste for reuse." A narrow interpretation of this statutory definition would appear to include a facility that took raw municipal solid waste and processed, separated or otherwise prepared it for conversion to energy or other reuse. It would not include the combustion of RDF either in conjunction with coal or alone at a facility which did not process the solid waste, but merely purchased the RDF from a processing plant for fuel. It might, however, include a facility which both processes RDF and uses it, such as an electric utility or an industrial plant that builds a processing plant on its premises and then uses the RDF for fuel.

EPA, however, may interpret this examination more broadly. An EPA official stated that a cofired boiler would also be included.[7] Thus, EPA might include within the definition any facility that converts municipal solid waste to energy whether the facility buys the waste preprocessed or not.

On the other hand, another EPA official responded much more cautiously that the determination would only be made by EPA on a case-by-case basis and that it would likely depend upon whether the purpose of the facility is to burn garbage or produce energy.[8] He therefore stated that if, for example, a standard municipal incinerator has a heat recovery unit which simply heated the building, it probably would not qualify. If, on the other hand, it ran the facility, heated the building, and heated an adjacent building, then perhaps it would qualify. A pyrolysis plant, according to this official, probably would qualify, but again, EPA would look at whether the purpose was to simply eliminate solid waste or to recover it for use as an energy source. This official also concluded that a cofired boiler using both coal and RDF might also qualify for this exemption, but indicated that there would likely be some cut-off point based on the ratio of coal to RDF, and suggested that if the boiler burned more than 50% RDF if might qualify as a new source.[7] The view that cofired plants may be exempt from the nonattainment provisions does not seem reasonable because of the possible abuse by sources that might decide to cofire coal and RDF simply to avoid regulation under the nonattainment provisions.

EPA's draft ruling makes clear that even for new sources and modifications which come within an exemption, the resulting increases in emissions will use up a part of the state's allocation for growth. The SIP may therefore have to require additional controls on existing sources in order to achieve the statutorily required "reasonable further progress" towards compliance with the NAAQS.

Since it is unclear whether resource recovery projects, and particularly cofired electric utility boilers, are covered by the nonattainment requirements, the effects of nonattainment coverage must be considered. First it must be determined whether the conversion to the use of RDF will "cause or contribute" to concentrations of any pollutant for which a national standard is not presently being met. It can be assumed that a boiler utilizing RDF in conjunction with coal will add to the concentration of TSP (total suspended particulates) in a nonattainment area if the source itself is located in the nonattainment area. If the source is located in a clean air area, the determination whether it will affect a nearby nonattainment area is a more difficult one and will depend on modelling of the individual situation.

The states will be required to address these problems in their revised SIPs due to EPA on January 1, 1979. The plan requirements are set forth in 42 U.S.C. 7501-7508. The revised SIP must provide for attainment of the NAAQS by December 31, 1982 (with possible extensions for photo chemical oxidants and carbon monoxide until 1987). In order to accomplish this, the states according to 42 U.S.C. 7502(b) must require: (1) the implementation of all reasonably available control measures as expeditiously as practicable; (2) reasonable further progress, including adoption of reasonably available control technology (RACT) for existing sources; (3) a current inventory of actual emissions from all sources for each nonattainment area to be revised periodically in order to determine whether the area will meet the 1982 deadline; (4) a quantification of emissions which will be allowed for new or modified stationary sources; (5) a permit requirement for construction and operation of new or modified stationary sources; (6) emission limitations and compliance schedules for attainment of the deadline; (7) an analysis of the air quality, health, welfare, economic, energy, and social effects of the plan provisions and the alternatives considered by the state.

The permit requirement (#5 above) and the growth allowance (#4 above) are of most immediate interest. Section (42 U.S.C. 7503) requires the permitting agency to make one of two determinations in order to permit the new source or modification: (1) that total allowable emissions from existing sources (to which RACT will apply), from new sources which are not major (and therefore do not need permits but which are counted for emissions purposes), and from the proposed facility will be sufficiently less than emissions allowed from existing sources (including implementation of RACT) to represent reasonable further progress toward attainment of the NAAQS by 1982; or (2) that the proposed new source or modification will not cause or contribute to emission levels which exceed the growth allowance for the area (see #4 abve).

This appears to give the states two alternative ways in which to structure their construction permit program for sources which will cause or contribute to concentrations of a pollutant in a nonattainment area. The state may provide for an emission offset which more than offsets not only the new major source or major modification but also any cumulative effects of smaller exempted sources constructed in the same year. Or, alternatively, the state may set up a growth bank and allow only those new sources which will not exceed the growth allowance.

In addition, in order to receive a permit, the source will be required to comply with the lowest achievable emission rate (LAER). The statute (42 U.S.C. 7501(3)) has defined LAER as the most stringent emission limitation contained in any state plan unless the applicant can prove this is not achievable, in which case the most stringent emission limitation ever achieved would apply. EPA is expected to provide guidance on what this standard means according to 42 U.S.C. 7508. Meanwhile, the effect of LAER for RDF use is uncertain because it is such a new fuel. As a practical matter, the standard may not be very restrictive since there are probably few, if any, emission limitations in state plans and the most stringent emission limitation ever achieved has little effect because of the newness of RDF. This should not, however, be viewed as a total benefit because the more emissions permitted for an RDF facility, the less remains available for new growth by other types of sources in the nonattainment, generally urban, area.

EPA has not issued any guidance to the states for the design of the new permit program which must be included in the states' SIP revisions of January 1, 1979. However, the essence of this permit program, as applied to RDF, is that a reduction in emissions must be found somewhere else which will more than offset the expected increase from a new RDF facility so that reasonable further progress toward attainment of the NAAQS by 1982 will result.

Maryland has six Air Quality Control Regions (AQCRs). Regions II (Central Maryland), IV (National Capital), V (Southern Maryland), and VI (Eastern Shore) have been designated by EPA as attainment areas for particulates. One election district in Region I (Cumberland-Keiper) and a portion of Region III (Metropolitan Baltimore), including parts of Baltimore City, Baltimore County, and Anne Arundel County, were designated nonattainment for this pollutant.

As a practical matter, it is difficult to predict whether RDF facilities will be permitted to locate in a nonattainment area such as the Baltimore Metropolitan Area. In part, this depends upon how far away from attainment an area is and whether economically feasible offsets are available. According to Maryland's 1977 Air Quality Data Report (pp. 16-21), almost every monitoring station in Baltimore City reported nonattainment for particulates; in some locations the annual arithmetic mean is almost twice the national primary standard. This would tend to make it unlikely that the state would permit a modification that would very likely result in increased particulate emissions even if an RDF plant could find offsets. It should be stressed that, even if resource recovery facilities and conversion to coal pursuant to ESECA are exempt from the offset requirements of the nonattainment regulations, these modifications will still result in greater concentrations of particulates and will therefore necessitate further reductions from existing sources in order to obtain reasonable further progress. It seems safe to predict that the Maryland Bureau of Air Quality and Noise Control would find itself under enormous pressure not to permit a resource recovery facility from existing sources which do not wish to be subjected to greater controls and from new sources which were proposing locations in the nonattainment area and will, as a result, be required to find offsets.

In conclusion, it appears that most uses of RDF would be exempted from the permitting program pursuant to the nonattainment provisions. Even if RDF facilities are exempt, however, the additional emissions would require further reductions from existing sources to mee the NAAQSs. It is therefore unlikely that such facilities will be allowed in nonattainment areas. This may pose siting constraints on effective RDF use in states like Maryland.

Prevention of Significant Deterioration (PSD), 42 U.S.C. 7470-7479

Section 42 U.S.C. 7471, 7407(d)(1) states that for those areas of the state where air quality complies with the NAAQSs or cannot be classified as nonattainment for the six regulated pollutants, the PSD requirements apply. In these areas, a permitting program will be necessary for the location of new or modified major stationary sources to ensure that the national standards are maintained and that pollution levels do not exceed the allowable incremental increases for sulfur dioxide and particulates (SO_2 and TSP). One of the stated purposes of the PSD requirements, 42 U.S.C. 7470, is to "assure that any decision to permit increased air pollution in any area to which this section applies is made only after careful evaluation of all the consequences of such decision and after adequate procedural opportunities for informed public participation in the decision making process." The PSD requirements allow in Class II areas--which are all the attainment areas in Maryland at least at the present time[10]--moderate increases in the concentration of sulfur dioxide or particulates over the baseline concentration (defined as the level of air quality existing on August 7, 1977, the date of enactment of the 1977 Amendments). However, the increase in concentration of any regulated pollutant cannot exceed the national primary or secondary standard.

Each state is required to submit to EPA a revision to its implementation plan by June 1979 containing a permit program to prevent significant deterioration. A permit must be obtained for any source which has been defined by EPA's regulations as a major new or modified stationary source.[11]

The Act's Section 42 U.S.C. 7475 requires that the SIP permit program contain the following requirements: (1) the permit must set forth emission limitations for the proposed facility, (2) the permit must be subject to public hearing and opportunity for written or oral comment, (3) the owner or operator must demonstrate that emissions from the facility will not cause or contribute to air pollution in excess of the allowable increment or the NAAQS, (4) best available control technology must be used, (5) an analysis must be made of air quality impacts projected to result from growth due to the location of the new source, and (6) the owner or operator must monitor the effects of the facility on air quality.

The PSD requirements must be examined to determine whether they might apply to an RDF facility. First, new or modified facilities within the 28 industrial source categories included within the definition of major stationary sources but which would emit or have the potential to emit an additional 100 tons of pollution, are covered by the permit process. The 28 categories include fossil fuel fired steam electric plants of more than 250 million BTUs/hour input, municipal incinerators capable of charging more than 250 tons of refuse a day, and fossil fuel boilers totalling more than 250 million BTUs/hour input. The municipal incinerator category would appear to include pyrolysis plants, but it is unclear whether cofired boilers fall within the fossil fuel fired boiler category. If a cofired boiler had the potential to emit less than 250 tons per year of any pollutant, or had allowable emissions of less than 50 tons a year, it would be exempt from the PSD requirements.

Second, concentrations of a pollutant attributable to increased emissions from stationary sources which have converted to an alternate fuel pursuant to the Energy Supply and Environmental Coordination Act of 1974 (ESECA) will not be counted in the state's determination of compliance with the allowable incremental increases.[12] This would mean that the conversion of an electric utility boiler from oil to coal would be exempt for purposes of determining incremental increases in the concentrations of TSP and SO_2. Nevertheless, the further modifications necessary to allow the burning of RDF in conjunction with coal, if they qualify as major modifications, would require a permit. The definition of a major modification exempts any fuel switches, "if prior to January 6, 1975, the source was capable of accommodating such fuel or material." Most electric utility boilers which are likely to be subject to an order to convert to coal under ESECA and which may decide to burn RDF as a supplemental fuel, would probably not come within the exemption because, as of January 1975, most such boilers in Maryland were burning oil. It appears, therefore that the conversion to coal would be exempt but the additional modifications required to burn RDF would have to comply with the PSD permit requirements.

Third, 42 U.S.C. 7475 (b) Provides that the owner or operator need not demonstrate that the source will not cause or contribute to a violation of the maximum allowable increase in a Class II area for the expansion or modification of a facility in existence on August 7, 1977, when the actual allowable emissions of air pollutants after compliance with best available control technology will be less than 50 tons per year. Sources which meet these criteria must still comply with the other permitting requirements.

It is impossible to speculate here whether the use of RDF in an existing facility would result in increased emission of less than 50 tons per year of particulates with the application of best available control technology. This determination would have to be made by the State Bureau of Air Quality and Noise Control on a case-by-case basis. However, it is unlikely that the conversion of an electric utility boiler to use of RDF in conjunction with coal would fall within this exemption.

If it has been determined that the PSD permitting requirements are applicable to a particular new source or modification, location becomes the central issue. Although it would appear from the language of the Clean Air Act that the proposed siting of the source in either a nonattainment area or an attainment area would determine whether the emission offset ruling or the prevention of significant deterioration regulations would apply, this is not necessarily the case. When EPA published these designations on March 3, 1978 (43 F.R. 8962, et seq.), it stated that "new sources, wherever they propose to locate must be reviewed for their impact on all nearby areas as well as that in which they would locate. If an area on which a new source would impact is designated differently than the one in which it is locating, the designation of the latter would not necessarily determine the rules to which the source would be subject." Furthermore, the EPA promulgation stated that "PSD rules apply in any area where at least one NAAQS is attained, and since virtually every area in the country shows attainment for at least one pollutant, the PSD review will be a requisite virtually everywhere."

It therefore seems likely that a proposed new source or modification must be examined to determine impacts on both attainment and nonattainment areas. Most of the State of Maryland is Class II for purposes of the PSD requirements. This means that the allowable incremental increase in TSP will be 19 micrograms per cubic meter. Moreover, if the area is just barely within the secondary national standards of 60 micrograms per cubic meter, which will be the case in many areas of Maryland, the second NAAQS will constitute the ceiling beyond which no further deterioration in air quality will be permitted and the full incremental increase will not be allowed. And, as we have noted, even if the increments are not violated, the state must, in locating RDF facilities, consider whether it desires to use up some of the area's growth allowance so that further industry will be prevented from locating there. Moreover, the state could also redesignate some areas to Class III - allowing some air degradation to the NAAQS - which would further affect RDF usage.

NOTES TO APPENDIX

1. 42 U.S.C. 7411 (a)(1).

2. Note 22, p. 171, note ***

3. The assumption that modifications will be required in a coal-burning plant in order to burn RDF as a supplement to coal is substantiated in the discussion in Institutional Barriers of costs of modifying existing controls. This Report states:

   Cost of Modifying Existing Control Equipment. This cost of modifying existing pollution-control-equipment relates mainly to supplemental RDF firing. It is difficult to generalize about the costs since they largely depend on the condition of the existing equipment and the site. For example, modification may involve the upgrading of a low-energy wet scrubber to a high-energy scrubber or electrostatic precipitator. Or, it may involve the restoration to service of a precipitator which has been in disuse in an oil-fired steam plant originally designed to fire coal. If the existing plant already has an electrostatic precipitator adequate for control of emissions from coal firing, upgrading the unit for supplemental refuse firing may involve adding additional collecting surface to the existing unit or extending the unit by adding a new unit. In this case, the cost may depend on the extent of the addition as well as whether the existing unit is a roof-or ground-level installation and whether the new unit is to be "piggy-back" on the old one.

4. Note 22, supra.

5. Note 22, p. 175.

6. Other laws, however, may restrict their location. See Section 4.5.3.

7. D. Kent Berry, Office of Air Quality Planning and Standards, EPA, Research Triangle Park, North Carolina, interview with Karen Edgecombe, Bruce Terris Associates, Washington, DC, September 1978.

8. David Sussman, Division of Solid Waste, Office of Water and Hazardous Materials, EPA, Washington, DC, September 1978.

9. As a practical matter, it is unlikely that a facility would burn more than 15 to 20 percent RDF in a cofired boiler because of the lower BTU content.

10. The state has the authority to change the classification of such areas to Class I (which would allow only extremely small pollution increases) or Class III (which would allow increases to the NAAQSs).

11. A major new stationary source is one which falls within one of the 28 industrial categories and which emits or has the potential to emit 100 tons per year of any of the criteria pollutants or one which is not within those specified categories but which emits or has the potential to emit 250 tons or more of a criteria pollutant and which has allowable emissions of 50 tons. A major modification is defined as any physical change or change in the method of operation which increases the potential emission rate of any pollutant by either 100 tons or more per year of one of the 28 source categories or by 250 tons or more per year for any stationary source and which has allowable emissions of 50 tons. 43 F.R. 26382.

12. 42 U.S.C. 7473(c)(1)(A).