BACKGROUND DOCUMENT FOR SOLVENTS TO SUPPORT 40 CFR PART 268, LAND DISPOSAL RESTRICTIONS

VOLUME III

SOLVENT WASTE VOLUMES AND CHARACTERISTICS, REQUIRED TREATMENT AND RECYCLING CAPACITY, AND AVAILABLE TREATMENT AND RECYCLING CAPACITY

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PART A

EXECUTIVE SUMMARY

This volume of the background document discusses the volume of hazardous waste solvents affected by the land disposal restrictions and identifies the unused capacity of alternative treatment and recycling technologies for these solvents. Specifically, the following items are presented:

1. The volumes and characteristics of waste solvents affected by the land disposal restrictions,
2. An evaluation of required treatment and recycling capacity,
3. An assessment of available treatment and recycling capacity, and
4. A comparison of capacity requirements with available treatment and recycling capacity.

Data from the RIA (Regulatory Impact Analysis) Mail Survey performed in 1981 were used to quantify and characterize the solvent wastes affected by the land disposal restrictions set forth in the 1984 Hazardous and Solid Waste Amendments (HSWAs). From the questionnaire information, it was estimated that 214 million gallons of solvent wastes will require alternative treatment and recycling capacity. The 1984 HSWAs also require the proper disposal of wastes generated by what are known as Small Quantity Generators (SQGs). Solvent wastes generated by the SQGs will result in an additional 7.8 million gallons, bringing the total quantity to 222 million gallons. Additional demand for treatment capacity may also result from increased activities under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The extent to which this will occur, however, is unknown at this time.

Respondents to the RIA Mail Survey were requested to provide a short physical description of their waste. This information is important because it allows the evaluation of the various treatment and recycling technologies with respect to the physical and chemical characteristics of the waste solvent. Using the survey data, the 222 million gallons of solvent waste have been divided into the following groups:

1. Solvent-water mixtures,
2. Organic liquids,
3. Organic sludges and solids, and
4. Inorganic sludges and solids.

Each waste group was further divided into halogenated and non-halogenated organic groups using the reported hazardous waste codes (i.e., F001 through F005).

Solvent-water mixtures are characterized as predominately water with less than one percent total organic carbon. Conversely, organic liquids have organic concentrations greater than one percent. Both waste groups are also considered to have suspended solids contents less than one percent.

The majority of the organic sludges and solids are reported to be residues from solvent reclamation and recycling practices. As such, this waste stream frequently contains total organic concentrations greater than one percent. Inorganic sludges and solids are characterized as treatment sludges and filter cakes, which have high solids content. This latter waste group is also assumed to include soils contaminated with solvent constituents.

Given the physical and chemical characteristics of these groups, the appropriate alternative treatment and recycling technologies are treatment in tanks (biological treatment, carbon and resin adsorption, steam and air stripping, and chemical oxidation), incineration, fuel substitution, or distillation for solvent recovery.

The physical and chemical characteristics of the waste groups were compared with the restrictive waste characteristics for each of the above treatment and recycling technologies. Based on this comparison, each of the technologies is applicable to different waste groups, as shown below:

Waste Stream	Appropriate Treatment and Recycling Technologies
1. Solvent-water mixtures	Treatment in tanks
2. Halogenated organic liquids	Distillation Incineration
3. Organic sludges and solids	Incineration
4. Inorganic sludges and solids	Incineration

Fuel substitution is an appropriate technology for nonhalogenated organic liquids and nonhalogenated organic sludges and solids; however, the Agency is unable to predict the unused available capacity for this technology. Consequently, fuel substitution is not included in the comparison of capacity requirements with available treatment and recycling capacity.

When the volume of solvent waste (million gallons per year) is compared to the available treatment and recycling capacity, several shortages of capacity are identified, as shown below:

Treatment or Recovery Technology	Waste Quantity Requiring Alternative Capacity	Unused Capacity
Distillation	8.6	22
Incineration	29.1	<25.6
Treatment in tanks	185	<112

These data show a significant shortfall in tank treatment capacity for treating the solvent-water mixtures and a shortfall of incineration capacity for the total volume of solvent waste requiring incineration. If incineration capacity is not required immediately for the 6.7 million gallons of inorganic sludges and solids, enough incineration capacity is available to treat the remaining 22.4 million gallons of solvent wastes requiring incineration. It could be concluded that insufficient treatment and recycling capacity currently exist to manage solvent-water mixtures and inorganic sludges and solids.

PART B

VOLUME OF WASTE SOLVENTS AFFECTED BY THE LAND DISPOSAL RESTRICTIONS

This part of the background document presents an overview of waste solvent generation rates and management practices. The data and information presented here are used in Part C to assess treatment and recycling capacity needs for waste solvents restricted from land disposal by this rulemaking.

1. SUMMARY OF DATA GATHERING METHODOLOGY

Data concerning the volume of waste solvents generated each year and the manner in which these wastes are currently being managed were obtained from an industry survey. The survey and resulting data base are officially known as the National Survey of Hazardous Waste Generators and Treatment, Storage, and Disposal Facilities Regulated under RCRA in 1981 (2). It is more commonly referred to as the RIA (Regulatory Impact Analysis) Mail Survey. The latter term will be used throughout the remainder of this document.

During the survey, questionnaires were mailed to a statistically selected population of facilities regulated under RCRA in 1981. Questionnaire recipients were generators of hazardous waste and facilities which either treated, stored, or disposed of hazardous waste. This latter category of facilities, called TSD facilities, are those facilities that conduct either commercial or private treatment, storage, or disposal operations. The questionnaire received by the TSD facilities requested data and information on the volumes and types of wastes managed. Specific wastes were identified by the TSD facilities using the conventional EPA hazardous waste codes established in 40 CFR Part 261.

Approximately 11,000 questionnaires were mailed; the response rate was 94 percent. All responses received were screened prior to inclusion in the data base to ensure that reported wastes were hazardous under the RCRA definition, and that they were treated, stored, or disposed in processes regulated under RCRA.

Valuable data concerning types of wastes generated as well as land disposal practices were obtained from the survey. The resulting RIA Mail Survey data base has previously undergone extensive evaluation (1,2). This data base provides the basis for the information and data presented in this section concerning waste volumes and current land disposal practices.

2. LAND DISPOSAL PRACTICES

Land disposal is defined under RCRA as any placement of hazardous waste into or on the land. Therefore, storage and treatment of hazardous waste in or on the land is also considered land disposal. Land disposal methods can be divided into numerous categories. Four of these methods are addressed in detail in this document: storage and disposal in landfills; disposal in waste piles; treatment and disposal by land treatment; and treatment, storage, and disposal in surface impoundments. Utilization of salt dome formations, salt bed formations, and underground mines and caves are additional methods of land disposal that are affected by this rulemaking. Currently there is insufficient information to document the volumes of waste solvents disposed by these three methods; therefore, they are not addressed in the analysis of volumes and alternative treatment capacity. Underground injection, another form of land disposal, will be covered under a separate rulemaking; thus it is not considered further in this analysis.

The quantities of waste solvents managed by each of the four land disposal methods affected by this rulemaking were estimated using RIA Mail Survey data. The survey requested treatment, storage, and disposal facilities to provide information on the type and quantity of each hazardous waste managed at that facility, as well as the method of management. The solvent waste codes include the waste codes F001, F002, F003, F004, F005; and wastes coded by individual constituent codes (i.e., U and P codes). These individual constituent codes are listed in Volume I of this background document. The data obtained on wastes reflecting these waste codes were tabulated and assigned statistical weights. They were then used to project national estimates of waste volumes (2).

Table B-1 presents the volumes of waste solvents currently land disposed by each of the four methods: landfill, land treatment, waste pile, and surface impoundment. Surface impoundments are further divided into four management techniques. These present a special case, which is discussed separately below. The estimates in Table B-1 differ slightly from those developed previously for EPA (1) for the following reasons:

1. Disposal through deep well injection is no longer included,
2. Treatment, storage, and disposal using surface impoundments is now included, and
3. Disposal in waste piles is now included.

Table B-1 also presents estimates of the volume of waste solvents currently treated, stored, or disposed of in surface

TABLE B-1

VOLUME OF WASTE SOLVENTS
CURRENTLY LAND DISPOSED

(Million gallons per year)

Waste Disposition	Volume	Percent of Total
Landfill	32.1	2.7
Land treatment	0.001	<1
Waste pile	0.743	<1
Treatment only in surface impoundments	389	32
Storage only in surface impoundments	318	27
Disposal in surface impoundments	8.79	<1
Treatment and storage in surface impoundments	452	38
TOTAL	1,200	100

Source: RIA Mail Survey

impoundments. Four scenarios were considered when evaluating the quantity of waste solvents that are managed in surface impoundments:

1. Storage in surface impoundments,
2. Treatment in surface impoundments,
3. Concurrent storage and treatment in surface impoundments, and
4. Disposal in surface impoundments.

Data from the RIA Mail Survey were used to estimate the volume of waste solvents currently being managed by each of these methods, as well as the volume of those waste solvents that will require alternate treatment or recycling capacity. The use of questionnaire data concerning each of these methods is discussed below.

About 8.79 million gallons of waste solvents are disposed in surface impoundments each year. Disposal in surface impoundments is considered land disposal, which is restricted by this rulemaking. Consequently, all of this waste will require alternate treatment, recycling, or disposal by alternative methods to land disposal as a result of this rulemaking.

A number of respondents reported that they were storing waste solvents in surface impoundments. Storage implies a temporary placement of wastes in the surface impoundment, while disposal implies a permanent containment. Waste solvents stored in surface impoundments are eventually treated or recycled, or they are routed to permanent disposal in other surface impoundments or by other means. Thus, the volumes of waste solvents reported as being stored in surface impoundments were not included in the estimates of volumes requiring alternate disposal. This was done to avoid counting them twice: once when they are stored and again when they are finally disposed.

In addition to the waste solvents stored in surface impoundments, 841 million gallons of waste solvents per year are estimated to be treated, or treated and stored concurrently, in surface impoundments. Under RCRA, surface impoundments may continue to receive hazardous wastes if the surface impoundments are used for treatment. These surface impoundments, however, must meet certain design and operating criteria (see RCRA Section 3005 (j)(11)(A) and (B)). According to RCRA, any surface impoundment that continues to receive banned solvent waste must be equipped with double liners, leachate collection systems, and ground water monitoring systems. Because of these stipulations, it is anticipated that a portion of the impoundments not meeting these design criteria will no longer receive hazardous waste because of the expense of achieving these criteria. It is estimated that as a result of the land disposal restrictions, 20.5 percent of the volume of solvents currently treated in surface impoundments will no longer be placed in surface impoundments and will require management by alternate treatment or recycling methods. This assumption is consistent with the findings of the Regulatory Impact Analysis supporting this rulemaking (3).

Based on the analysis given above, the total volume of waste solvent that will compete for alternative treatment and recycling capacity is presented in Table B-2.

3. IDENTIFICATION OF WASTE SOLVENT PHYSICAL AND CHEMICAL CHARACTERISTICS

In order to assess the treatment capacity requirements that will result from the land disposal restrictions, it is necessary to identify the physical and chemical form of the 214 million gallons of waste solvents land disposed annually. Without this information, it is not possible to identify which treatment technologies are applicable to a given waste stream. For example, solids contaminated with solvents are not amenable to reclamation by distillation; the high solids level would plug or foul the system.

Data contained in the RIA Mail Survey were used to accomplish this task. The questionnaires provided a space for each respondent to provide a written description of each waste, in addition to its RCRA waste code. This information has been included in the data base, and it forms the basis for identifying the quantities of solvent wastes generated and managed by physical and chemical form. The descriptions of the wastes were analyzed and condensed into the physical and chemical codes shown in Table B-3. All codes were further identified as either inorganic solids, inorganic sludges, inorganic fluids (solvent-water mixtures), organic fluids, organic sludges and solids, or miscellaneous.

The hazardous waste codes reported by the respondents can be used to identify the quantity of waste that is halogenated (i.e., containing bromine, chlorine, fluorine, or iodine). This information is important because halogen content influences the treatability of the waste and could preclude the use of a given treatment technology. Waste solvents reported as F001 and F002 (as well as the corresponding P and U waste codes) are halogenated wastes because the constituents for which they are listed are halogenated (see 40 CFR Part 461, Appendix VII). Similarly, waste solvents reported as F003, F004, and F005 (or as the related P and U wastes) are nonhalogenated wastes. Given this information, the total volume of solvent waste affected by the

TABLE B-2

VOLUME OF WASTE SOLVENTS AFFECTED
BY LAND DISPOSAL RESTRICTIONS

(Million gallons per year)

Waste Disposition	Volume
Landfill	32.1
Land treatment	0.001
Waste pile	0.743
Treatment only in surface impoundments	79.8
Storage only in surface impoundments	0
Disposal in surface impoundments	8.79
Treatment and storage in surface impoundments	92.8
	214

TABLE B-3

CODES FOR PHYSICAL DESCRIPTIONS OF WASTE STREAMS

INORGANIC SOLIDS	101.	Contaminated Dirt
	102.	Fly Ash
	193.	Baghouse or APCD Dust
	104.	Bottom Ash or Slag
	105.	Spent Carbon
	106.	Spent Adsorbents (NOS)
	107.	Spent Filter Aids
	108.	Polymerized Solids
	109.	Spent Catalysts
	110.	Off-Specification Solid Chemicals
	111.	Waste NaOH or KOH
	112.	Metal Fines
	113.	Asbestos
INORGANIC SLUDGES	200.	Inorganic Sludge (NOS)
	201.	Metal Hydroxide Sludge
	202.	Wastewater Treatment Sludge
	203.	Biotreatment Sludge
	204.	Cooling Tower Sludge
	205.	Lagoon/Pond Sludge
	206.	Filter Cakes
	207.	APCD Sludge
	208.	Sludge from Electroplating
SOLVENT-WATER MIXTURES	300.	Aqueous Solution (NOS)
	301.	Wastewater (NOS)
	302.	Process Water
	303.	Wash/Rinse Water
	304.	Cooling Tower Blowdown
	305.	Lagoon/Pond Water
	306.	Incinerator Scrubber Waters
	307.	Caustic Scrubber/Petroleum Refinery
	308.	Waste Acid
	309.	Waste Caustic Solutions
	310.	Concentrated Chemical Solutions
	311.	Waste Acidic Solution
	312.	Acid and Base
	313.	Chromic Acid Waste

NOS = Not Otherwise Specified

TABLE B-3 (Continued)

CODES FOR PHYSICAL DESCRIPTIONS OF WASTE STREAMS

ORGANIC FLUIDS	400.	Organic Liquid (NOS)
	401.	Spent Solvents
	402.	Light Ends
	403.	Hydraulic Oils
	404.	Cutting Oils
	405.	Transformer Oils
	406.	Waste Oils (NOS)
	407.	Oil/Water Emulsion
	408.	Waste Paint
	409.	Paint Thinner
	410.	Off-Specification Liquids/Solvents
	411.	Coatings (laquer, varnish, epoxy)
ORGANIC SLUDGES/SOLIDS	500.	Organic Sludge (NOS)
	501.	Heavy Ends
	502.	Still Bottoms/Residues
	503.	Tars
	504.	Oily Sludge
	505.	Paint Sludge
	506.	Tank Bottoms
	510.	Solid Organic Chemicals
MISCELLANEOUS	000.	Unknown/Undescribed
	601.	Lab Packs
	602.	Lab Wastes
	603.	Liquids (NOS)
	604.	Resins (form unspecified)
	605.	Paint Stripper
	606.	Sludge (NOS)
	610.	Empty Containers
	611.	Gas
	612.	Organic Waste (NOS)

NOS = Not Otherwise Specified

land disposal restrictions as presented in Table B-2 can be divided into waste groups. This distribution is shown in Table B-4.

In order to properly evaluate the capacity requirements for alternative treatment and recycling, it is necessary to distribute into waste groups the wastes that are reported in the survey, but that are not identified by physical form, the so called miscellaneous or unidentified waste. The following methodology and assumptions were used to assign the unidentified waste to waste groups:

1. Unidentified waste was assumed to be divided into waste groups in the same proportions as the characterized waste.

2. The unidentified waste distributed into waste groups (inorganic sludges and solids, organic liquids, and organic sludges and solids) was then divided into halogenated and nonhalogenated wastes. The division was performed by assuming that the unidentified wastes follow the same ratio of halogenated to nonhalogenated wastes given for other wastes in Table B-4. Approximately 37 percent (5.54/14.8) of the unidentified wastes were reported to be halogenated; thus for each waste group in Table B-5, 37 percent of the total amount was assumed to be halogenated and 63 percent was assumed to be nonhalogenated.

Given these assumptions, the waste that appeared as unidentified in Table B-4 can be divided into waste groups, as shown in Table B-5.

Table B-6 then presents the total estimated volumes of spent solvents that are affected by the land disposal restrictions by waste group. The characteristics of these waste groups are discussed in greater detail below.

a. Solvent-Water Mixtures

From the survey data it is apparent that three facilities with large-volume aqueous waste streams account for 94 percent of the total volume of solvent-water mixtures subject to this analysis. It is assumed that these three waste streams adequately represent all F001 through F005 solvent-water mixtures that are currently land disposed. The RIA Mail Survey characterizes these three waste streams as 99 percent water. The sum of the other constituents (including solids) in these waste streams must therefore be less than one percent. According to the RIA Mail Survey, 98 percent of the solvent-water mixtures (and 85

TABLE B-4

REPORTED PHYSICAL FORM OF WASTE SOLVENTS AFFECTED BY LAND DISPOSAL RESTRICTIONS

(Million gallons per year)

Waste Form	Halogenated	Nonhalogenated	Total
Unknown	5.54	9.3	14.8
Inorganic Sludges	6.14	0.103	6.25
Solvent-Water Mixtures	0	173	173
Organic Liquids	7.39	6.28	13.7
Organic Sludges/Solids	4.89	1.90	6.78
Total	24.0	190	214

Source: RIA Mail Survey

TABLE B-5

DISTRIBUTION OF UNIDENTIFIED SOLVENT WASTES
INTO WASTE GROUPS

(Million gallons per year)

Waste Form	Halogenated	Nonhalogenated	Total
Inorganic Sludges/Solids	0.19	0.32	0.5
Solvent-Water Mixtures	0	12.8	12.8
Organic Liquids	0.37	0.63	1.0
Organic Sludges/Solids	0.19	0.32	0.5
Total	0.75	14.07	14.8

TABLE B-6

ESTIMATED VOLUME OF SOLVENTS AFFECTED BY LAND DISPOSAL RESTRICTIONS BY WASTE GROUP

(Million gallons per year)

Waste Form	Halogenated	Nonhalogenated	Total
Inorganic Sludges and Solids	6.33	0.423	6.75
Solvent-Water Mixtures	0	186	186
Organic Liquids	7.76	6.91	14.7
Organic Sludges/Solids	5.08	2.22	7.28
Total	19.2	196	215

percent of all solvent wastes) land disposed annually are managed in surface impoundments. Additional data from the Industry Studies Data Base (ISDB) characterize all waste streams containing the constituents of F001 through F005 wastes that are placed in surface impoundments as averaging 0.3 percent (3,000 mg/l) total solvent (4). Based on these data it is assumed that all solvent-water mixtures contain less than one percent (10,000 mg/l) total organic constituents and less than one percent total suspended solids.

b. Organic Liquids

Because solvent-water mixtures contain less than one percent total organic constituents, organic liquids are assumed to have greater than one percent total organics. It also appears to be a reasonable assumption that organic liquids are low in suspended solids (less than one percent). If this were not the case, they would have been reported in the RIA Mail Survey as organic sludges.

According to the survey, over 80 percent of the 14.7 million gallons of organic liquids that are land disposed annually are described as "spent solvents." By definition, all wastes listed in 40 CFR Part 261.31 as F001, F002, F003, F004, and F005 are "spent solvents." However, it is EPA's judgement that solvent wastes identified as "spent solvents" in the survey are actually used, highly concentrated waste solvents resulting from certain industrial applications.

For example, metal degreasing is a common means of generating a concentrated spent solvent. Industrial grade metal degreasing solvents such as 1,1,1-trichloroethane contain less than 100 mg/l water and less than 10 mg/l non-volatile residue. As metal degreasing operations proceed, solvent vapors are contained within the system by contacting the vapors with cooling coils so that the vapor is condensed and returned to the system. At the same time, atmospheric moisture also condenses on the cooling coils. Quite frequently, water that may accumulate in the solvent during degreasing is removed by gravity separation in a quiescent tank. If the water concentration is allowed to increase in the solvent during degreasing, the chlorinated hydrocarbons begin to hydrolyze and form hydrochloric acid. As this occurs, the effectiveness of the solvent is reduced and a corrosive mixture is produced. Hydrolysis is prevented by incorporating chemical additives into the solvent that react with the water (13).

Consequently, spent solvents from modern degreasing operations contain a high percentage of solvent contaminated with oil and grease removed from the metal parts. The water accumulation in the spent solvent from modern units is negligible.

In older units that do not remove water, water will accumulate in the system and can reach concentrations as great as 80 percent (1). Even so, the solvent content is still reported to be above 10 percent, in addition to 5 percent oil.

c. Organic Sludges and Solids

The majority of this waste is reported to be heavy ends, still bottoms, or residues from distillation units used to reclaim spent solvents, all of which are high in solids content. Data from the ISDB show that these wastes contain significant quantities of solvents (4). As shown in Table B-7, the solvent concentration is generally reported to be above one percent. For many of the solvent constituents, the mean concentration is above 10 percent and ranges up to 50 percent. Based on this information, all organic sludges and solids are assumed to have solids and total organic contents greater than one percent.

d. Inorganic Sludges and Solids

Inorganic sludges and solids reported in the survey include those wastes listed in Table B-3 as numbers 100 through 208. The majority of these wastes are treatment sludges and filter cakes, which have high solids contents. Based on these descriptors, all of the inorganic sludges and solids are assumed to have a solids content greater than one percent and total organic content less than one percent.

The inorganic sludges and solids waste group also includes soils contaminated with solvents. According to RCRA, any contaminated soil resulting from the spill of a listed hazardous waste (e.g., F001 through F005) must also be managed as a listed hazardous waste. Contaminated soils may contain greater than one percent organics; however, it was assumed that the respondents to the RIA Mail Survey reported any soil contaminated with solvents as an inorganic solid.

4. OTHER CAPACITY REQUIREMENTS

a. Small Quantity Generators

The discussions above present estimates of the quantities of solvent wastes that will be affected by the land disposal restrictions proposed by this rulemaking. To fully evaluate treatment and recycling capacity requirements, other wastes that will compete for alternative capacity with solvent waste restricted from land disposal must be identified and included in

TABLE B-7

MEAN SOLVENT CONCENTRATIONS
OF DISTILLATION RESIDUES
(Percent)

Constituent	Heavy Ends: Number of Reported Values	Heavy Ends: Mean Concentration	Distillation Residues: Number of Reported Values	Distillation Residues: Mean Concentration
carbon disulfide	4	53	-	-
methyl isobutyl ketone	2	30	1	30
toluene	32	27	23	30
acetone	9	25	6	23
n-butyl alcohol	12	23	8	22
isobutanol	5	22	4	20
ethyl acetate	4	18	3	22
xylene	7	13	5	10
ethylbenzene(s)	14	11	6	15
chlorobenzene	17	11	14	10
methanol	14	11	8	3
tetrachloroethylene	26	8	12	4
methylene chloride	14	6	9	0.2
carbon tetrachloride	19	6	8	5
trichloroethylene	22	4	14	4
1,2-dichlorobenzene	8	2	6	3
cyclohexanone	6	1	4	3
1,1,1-trichloroethane	12	0.3	-	-
trichlorofluoromethane	2	-	2	-

Source: Science Applications International Corporation. Industry Studies Data Base. Prepared for the U.S. EPA, Office of Solid Waste. 1985.

the analysis. This will include those wastes, for which new requirements are proposed, generated by what are known as Small Quantity Generators (SQGs) (see generally 50 FR 31278). Prior to the Hazardous and Solid Waste Amendments (HSWAs) of 1984, wastes generated by SQGs were not subject to most RCRA requirements. The amendments, however, now require that certain SQGs manage their wastes as hazardous where appropriate. The final regulations pertaining to these SQGs will result in an additional demand for alternative capacity that must be accounted for here. As shown in Table B-8, approximately 7.8 million gallons per year of spent solvent waste are attributable to SQGs.

The volume of waste generated by SQGs predicted to require treatment and recycling as a result of the HSWAs was derived from the National Small Quantity Generators Survey, conducted for the U.S. EPA (5). Of the waste types reported to be generated by the respondents to the survey, three were determined to be solvent wastes that will require treatment and recycling capacity: spent solvent wastes, solvent still bottoms, and dry cleaning filtration residues. The volume of each of these waste types generated by SQGs is presented in Table B-8. The majority of the waste (75 percent) was reported to be spent solvent wastes. Twenty percent is dry cleaning filtration residues, and the remaining 5 percent was reported to be still bottoms. The amount of spent solvent wastes predicted to require treatment and recycling capacity was derived by adding the volumes of each of these three waste types to obtain 7.8 million gallons per year.

As indicated previously, the physical and chemical characteristics of a waste stream determine the appropriate treatment and recycling technologies applicable to that waste stream. Thus, it is necessary to segregate the SQG waste into the physical groupings described previously for the waste solvents so that capacity limitations can be fully evaluated. The SQG waste has been segregated into waste groups using the following methodology and assumptions:

1. The SQG spent solvent waste is assumed to be an organic liquid (i.e., the total organic content is greater than one percent).

2. The solvent still bottoms and dry cleaning filtration residues are assumed to be organic sludges and solids.

3. The ratio of halogenated to nonhalogenated spent solvent from the SQGs is assumed to be the same as the ratio for the 13.7 million gallons of organic liquid currently land disposed annually, as presented in Table B-4.

TABLE B-8

SMALL QUANTITY GENERATOR (SQG) WASTES PREDICTED TO REQUIRE TREATMENT AND RECYCLING AFTER IMPLEMENTATION OF PROPOSED SQG REGULATIONS

(Million gallons per year)

Waste Group	Quantity Requiring Treatment and Recycling
SQG Spent Solvent Wastes	5.9
SQG Solvent Still Bottoms	0.3
SQG Dry Cleaning Filtration Residues	1.6
Total SQG Wastes	7.8

Source: ABT Associates. National Small Quantity Generators Survey. Prepared for the EPA, Office of Solid Waste. 1985.

Thus, 54 percent (7.39/13.7) of the 5.9 million gallons is assumed to be halogenated organic liquids.

4. The ratio of halogenated to nonhalogenated sludges for the SQGs is assumed to be the same as for the 6.8 million gallons of organic sludges currently land disposed annually, as presented in Table B-4. Using this assumption, 72 (4.9/6.8) percent of the 1.87 million gallons are halogenated organic sludges.

With the above methodology and assumptions, the volume of waste attributable to SQGs by waste group is presented in Table B-9. These data can then be aggregated with the data in Table B-6 to determine the total volume of waste that will compete for alternative capacity. A summation of these data is presented in Table B-10. Treatment and recycling requirements for SQG wastes is discussed in Part C. This volume of waste is evaluated against existing alternative capacity in Part E of this volume.

b. CERCLA Waste

It is also possible that wastes resulting from the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) could result in additional competition with waste solvents and other RCRA wastes for alternative capacity. There are insufficient data, however, to accurately estimate the treatment and recycling methods appropriate to either past or future CERCLA waste. Further, the Agency at this time does not have the information necessary to determine to what extent future CERCLA activities will increase the current demand for treatment and recycling capacity. As a result, it is assumed for the purpose of this proposal that the alternative capacity (e.g., incineration capacity) required by CERCLA wastes will remain constant. If the necessary information becomes available prior to final promulgation, the additional capacity needs of CERCLA wastes will be considered in this analysis.

TABLE B-9

DISTRIBUTION OF SMALL QUANTITY GENERATOR
WASTE INTO WASTE GROUPS

(Million gallons per year)

Waste Form	Halogenated	Nonhalogenated	Total
Organic Liquids	3.1	2.8	5.9
Organic Sludges	1.3	0.6	1.9
Total	4.4	3.4	7.8

TABLE B-10

TOTAL QUANTITY OF SPENT SOLVENTS REQUIRING TREATMENT AND RECYCLING CAPACITY

(Million gallons per year)[a]

Waste Form	Halogenated	Nonhalogenated	Total
Solvent-Water Mixtures	0	186	186
Organic Liquids	10.9	9.7	20.6
Organic Sludges	6.4	2.8	9.2
Inorganic Sludges	6.3	0.4	6.7
Total	23.6	199	223

[a]The volumes presented here are a summation of the volume of solvent waste currently land disposed (Table B-6) and the volume of waste attributable to small quantity generators (Table B-9).

PART C

EVALUATION OF REQUIRED TREATMENT AND RECYCLING CAPACITY

The waste groups affected by this rulemaking were identified and characterized in detail in Part B. The appropriate alternative treatment or recycling technologies (BDAT) for each waste group were presented in Volume II of this document. This section presents an analysis of the alternative treatment and recycling capacity that will be required by the solvent waste groups banned from land disposal by this rulemaking.

Given a particular waste type, there are several treatment and recycling options available to a hazardous waste generator that can be used as an alternative to land disposal. Therefore, it is impossible to predict precisely what treatment technologies any of the numerous generators will choose as an alternative to land disposal. The factors that will influence which treatment or recycling technology is selected are both technical and economic. The cost of applying a specific technology to a waste are facility-specific, depending on the characteristics and volume of the waste generated, and the proximity of commercial treatment and recycling facilities. As a result, the analysis given here will consider economics only implicitly, in that the capacity of technologies currently available to treat hazardous wastes is influenced by the relative economic feasibility. This evaluation will primarily consider the technical feasibility of applying available technologies to specific waste groups.

In the discussions that follow, the waste groups have been assigned to a given treatment or recycling technology based on the information presented in Part B of this volume, and in Volume II of this document. Information obtained from the ISDB is also used to select appropriate treatment technologies for the waste groups.

1. SOLVENT-WATER MIXTURES

As discussed in Part B, solvent-water mixtures are aqueous mixtures containing less than one percent total organic content by weight. An estimated 186 million gallons of solvent-water mixtures land disposed each year will be affected by the land disposal restrictions and will require alternative management.

Based on the characteristics described in Part B, solvent-water mixtures are amenable to one or more of the following wastewater treatment technologies described in Volume II of this document: biological treatment, carbon and resin adsorption, steam and air stripping, chemical oxidation, or some combination of these methods. In addition, incineration is a treatment option for solvent-water mixtures. As discussed in Volume II, each of these technologies can achieve BDAT levels for some waste streams.

Because of the low total organic content, solvent-water mixtures are not amenable to fuel substitution or reclamation. Data obtained from the ISDB, presented in Table C-1, demonstrate that mean solvent concentrations for reclamation are approximately 40 percent (4). Similarly, the low organic content indicates that the heat value of this waste is inadequate for fuel substitution. This is also demonstrated in Table C-1 which shows that the mean solvent concentration of wastes used as fuel substitutes is 37 percent. The most viable treatment options for solvent-water mixtures are incineration and wastewater treatment in tanks[1]; these are discussed below in greater detail.

a. Incineration

Data from the ISDB, shown in Table C-1, demonstrate that even waste streams of very low heat value can be destroyed using incineration technology. Additional data from the Regulatory Impact Analysis for the Incinerator Regulations show that wastes containing 0.1 to 80 percent solvent have been destroyed using incineration technology (6). A summary of these data is presented in Figures C-1 and C-2. These figures present graphically the heat value, in Btus per pound, of incinerated RCRA wastes. In Figure C-1, the data are presented by waste code. Waste codes F001, F003, F005, D001, and mixed codes are represented. The data points available for waste codes F002 and F004 were too few in number to be considered statistically significant. The figures indicate that wastes of widely varying heat content are incinerated. Ignitable wastes (coded D001) in particular have a mean heat value of only 6,900 Btu/lb.

b. Wastewater Treatment

As stated previously, the solvent-water waste group identified in the RIA questionnaire information is predominantly water (over 99 percent). As discussed in Volume II, the most viable option for managing solvent-water mixtures is some form of wastewater treatment.

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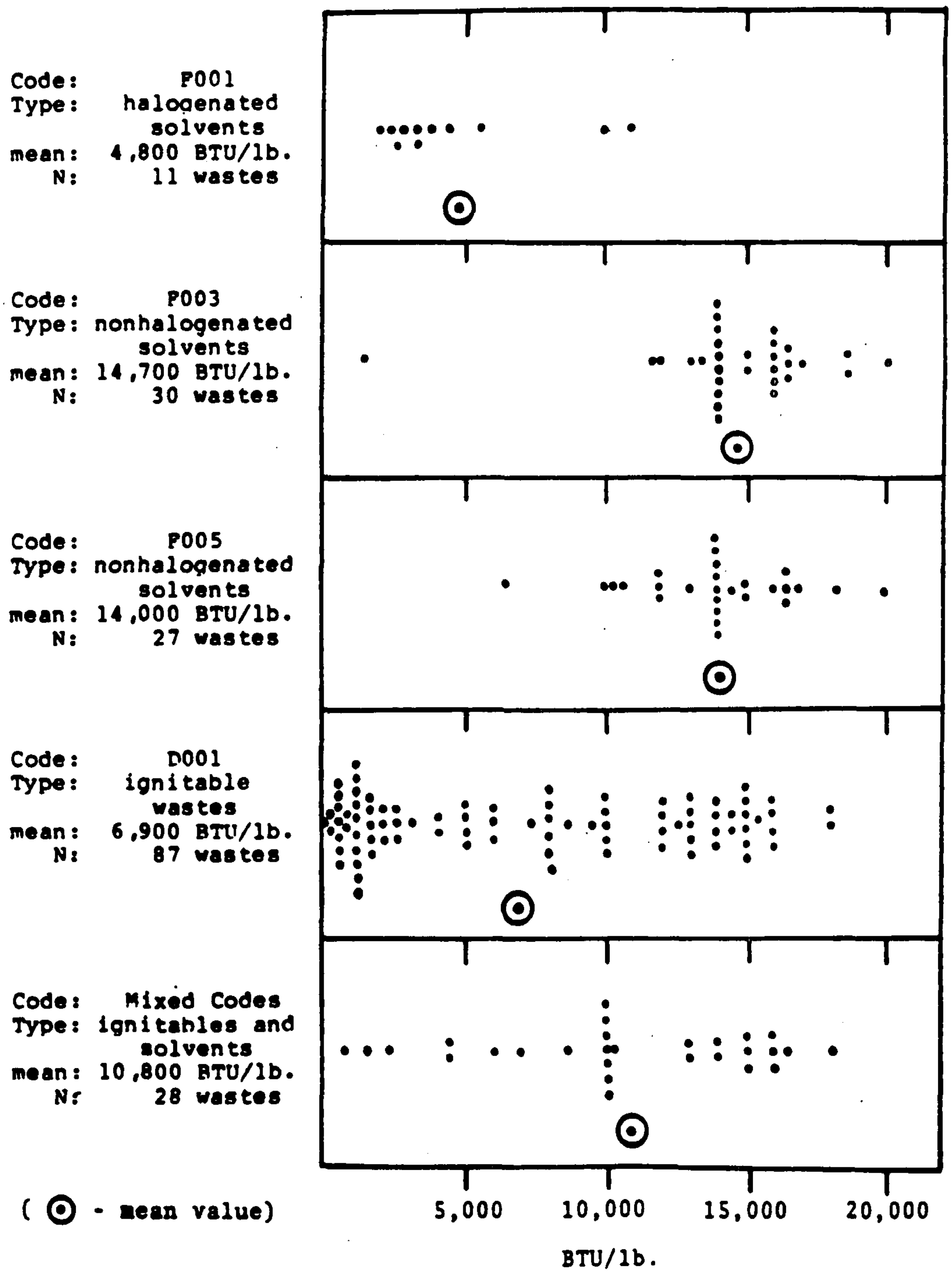
[1]All wastewater treatment methods are defined generically as tank treatment.

TABLE C-1

WASTE SOLVENT MANAGEMENT PRACTICES FROM THE INDUSTRY STUDIES DATA BASE[a]

Waste Management Technique	Number of Reported Waste Streams	Quantity of Wastes (Million gallons per year)	Mean Total Solvent Concentration[b] (Percent)
Fuel Substitution for Industrial Boilers	61	61.2	37
Discharge to Surface Waters	108	2,580	0.31
Discharge to POTW	93	341	1.2
Treated at a Commercial Facility (TSDF)	16	165	26
Incineration	157	36.0	28
Landfill	91	39.8	7.4
Stored or Treated in On-Site Tanks[c]	120	1,590	0.71
Reclamation	136	413	40
Surface Impoundments	101	2,130	0.30
Injection Well	61	442	5.6

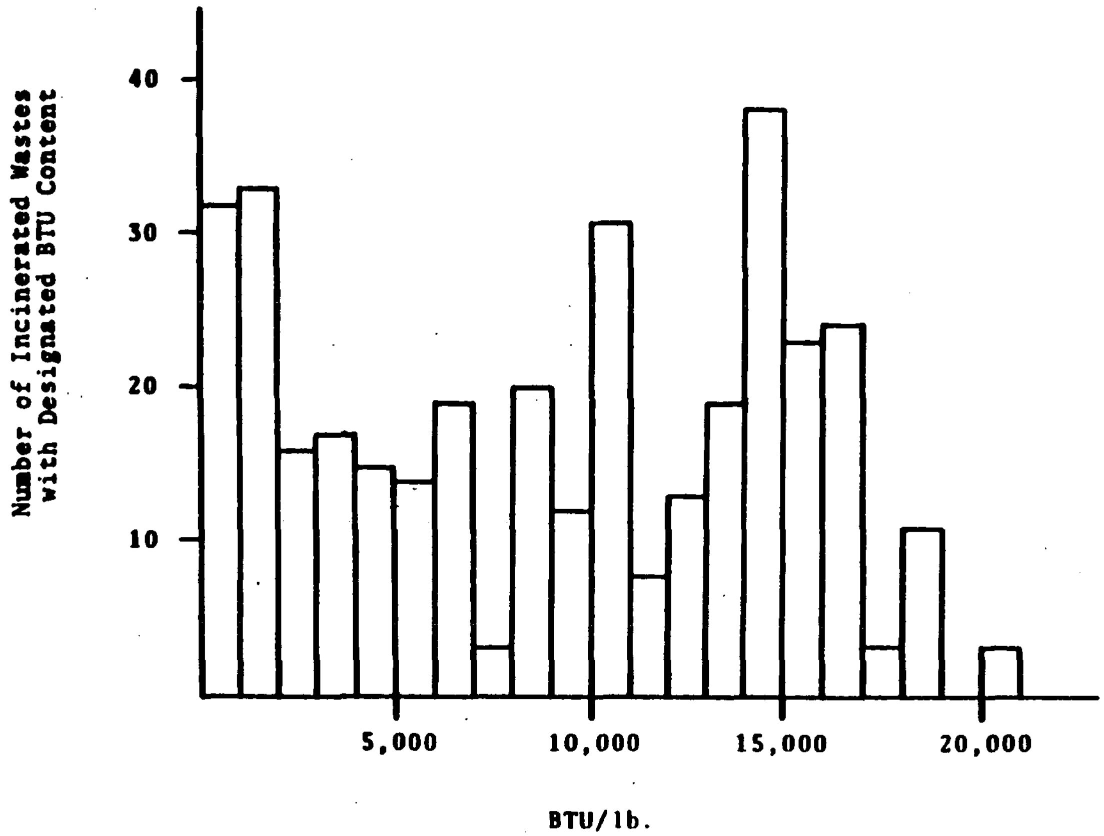
[a]Compilation of data for wastes containing the solvent constituents of F001, F002, F003, F004, and F005 waste codes.
[b]All concentrations are prior to any treatment.
[c]May include some double counting of waste streams discharged to surface waters.



Source: Supporting Documentation for the RCRA Incineration Regulations, PB-86-110293. 1984.

FIGURE C-1

DISTRIBUTION OF Btu CONTENT BY WASTE CODES
FOR 183 INCINERATED RCRA WASTES



Source: <u>Supporting Documentation for the RCRA Incineration Regulations</u>, PB-86-110293. 1984.

FIGURE C-2

DISTRIBUTION OF Btu CONTENT FOR 354 INCINERATED RCRA WASTES

This is also supported by ISDB information which shows that solvent waste streams discharged as wastewaters (i.e., to surface waters and POTWs) have mean solvent concentrations of approximately one percent or less. A summary of these data is presented in Table C-1.

The demonstrated wastewater treatment technologies for solvent water mixtures are biological treatment, steam and air stripping, and carbon adsorption. As discussed in Volume II, biological treatment, steam and air stripping, and carbon adsorption are demonstrated technologies for many solvent wastes. Other technologies such as chemical oxidation and resin adsorption, are not widely demonstrated, but are capable of achieving BDAT treatment performance levels for some solvent wastes.

Solvent-water mixtures may be treated by many different combinations of wastewater treatment technologies sequenced in various process trains taking place in tanks. The choice of treatments will depend on specific waste characteristics and economic factors. There are currently insufficient data to determine precisely the volumes of wastes that would require any of these specific wastewater treatment technologies. Because these data are currently unavailable, it is impossible to determine the future capacity needs for these specific wastewater treatment technologies. For the purpose of determining capacity needs in this document, the solvent-water mixtures of less than one percent total organics are grouped into one treatability group of wastes, all of which require some form of wastewater treatment occurring in tanks.

2. ORGANIC LIQUIDS

As discussed above, organic liquids (as opposed to solvent-water mixtures) are defined in this analysis as those liquids having a total organic concentration greater than one percent. From the RIA questionnaire information, over 80 percent of the 13.7 million gallons identified as organic liquids are described as spent solvents. Such waste streams are amenable to various management practices such as distillation for solvent recovery and reuse, destruction through incineration, and destruction through fuel substitution. Furthermore, it is demonstrated that these treatment technologies have been utilized to manage spent solvents. Each technology is discussed in greater detail below.

a. Distillation

Distillation is a suitable method of separation for volatile liquid organics and for aqueous solutions containing volatile liquid organics. The boiling points of the components of the mixture must be separated by 20°C to 30°C. Substances with low boiling points are more economical to distill because less heat is required. In addition, mixtures of substances with vastly different volatilities are easier to separate by distillation than are mixtures of substances with similar volatilities.

Within these constraints, the primary reason more of the 13.7 million gallons of spent solvents classified as organic liquids are not recovered through distillation appears to be economics. Given the past options for managing spent solvents, land disposal in most situations is less costly than recovering solvents through distillation. The economic cut-off centers on the concentration and mixtures of solvents in the waste liquid. As noted above, because of the heat input required for distillation, waste streams currently reclaimed by distillation generally contain solvent concentrations sufficient to offset the recovery cost. From the ISDB, it appears the mean concentration of solvent wastes reclaimed through distillation is 40 percent. Further evaluation of the data shows a range of 0.4 percent to 98 percent. At the lower concentration range, it is likely that the waste stream is being reclaimed to recover other constituents that are present at much higher concentrations. Nonetheless, current and future regulatory and economic incentives will make distillation a more attractive alternative for the management of organic liquids.

A second reason that distillation is not currently more widely used is the practice of commingling different solvents. In cases where there is no economic incentive to distill and recover waste solvents, generators often commingle several different solvents. When solvents are commingled, their recovery becomes much more difficult. Commingled solvents preclude the use of the relatively simple and inexpensive binary distillation units. The single equilibrium stage provided by these units does not allow for the separation and recovery of more than two compounds, normally water and one solvent. More complicated and expensive fractional distillation columns are required to accomplish the separation and recovery of multiple solvents from a single waste stream.

Greater volumes of solvent waste may be recovered by distillation if the waste management practices of generators are altered to prevent commingling. For example, if waste solvents 1,1,1-trichloroethane and trichloroethylene are mixed together in a waste stream, pot distillation, commonly used to reclaim a single solvent constituent, cannot be used to recover the individual solvents. Furthermore, although recovered 1,1,1-trichloroethane or trichloroethylene alone may be sold for over $2.00 per gallon, a recovered mixture of these solvents has little or no resale value.

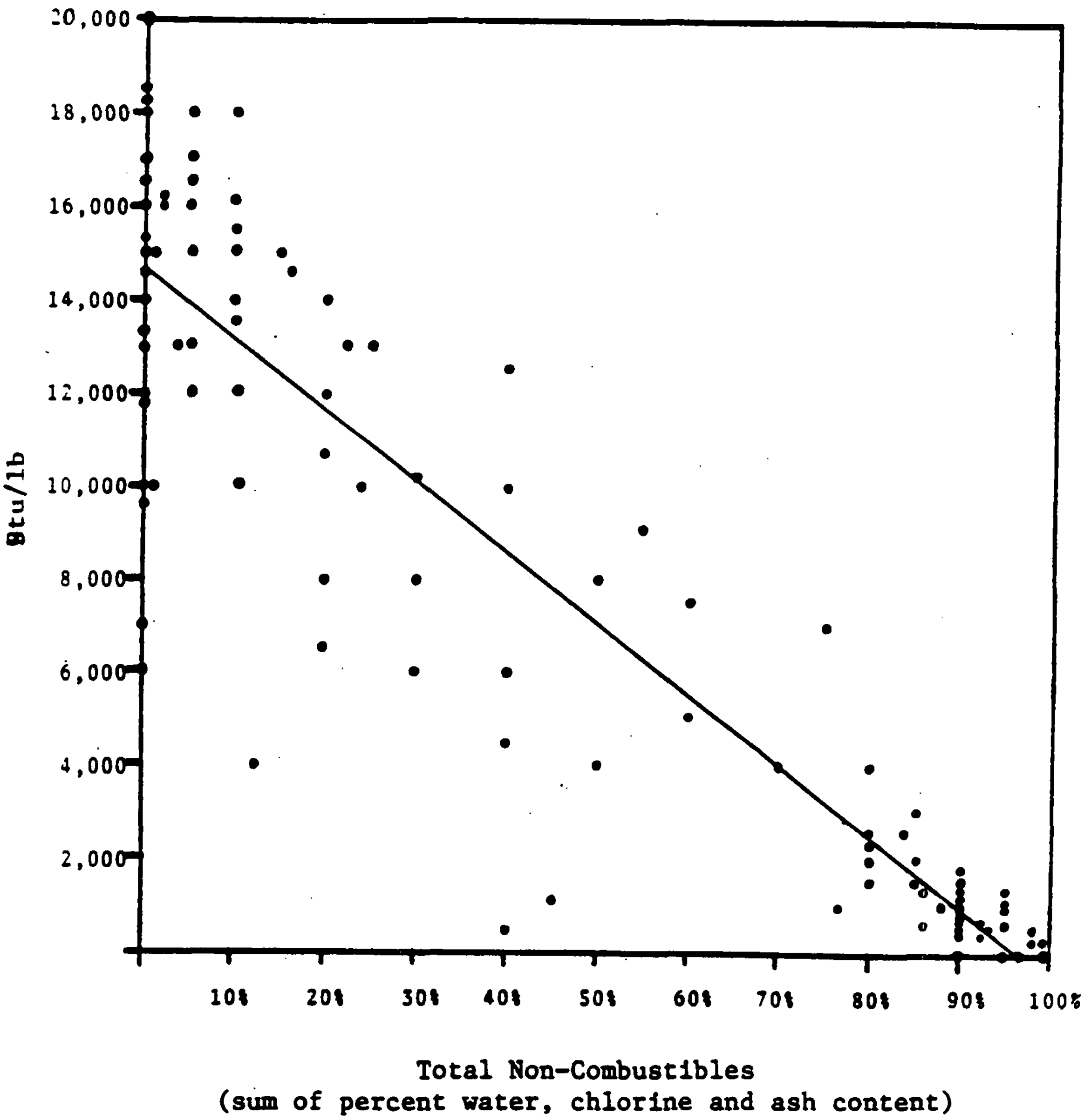
b. Fuel Substitution

A second alternative to land disposal for organic liquids is fuel substitution. For a waste stream to be useful as a fuel substitute, it must meet certain criteria for two important waste characteristics: heating value and halogen content. In order for a facility to utilize a waste solvent as an alternative fuel, it must contain sufficient heating value to offset the consumption of primary fuel. An EPA survey of industrial boilers, cement kilns, and aggregate kilns found that most facilities specify that wastes burned as fuel are acceptable when the heating value is between 10,000 and 18,000 Btu/lb (7). Analysis of data from the RIA for the Incinerator Regulations demonstrates that if the heating value of solvent waste incinerated was above 10,000 Btu/lb, the sum of the noncombustibles totalled less than 30 percent (Figures C-3 and C-4). Much of the 20.6 million gallons of organic liquid is characterized as used, highly concentrated spent solvent. It is anticipated that a significant portion of this waste stream will contain greater than 70 percent organics and meet the heating value criterion.

Examination of the ISDB reveals that the mean solvent concentration in wastes used as auxiliary fuels in industrial boilers is 37 percent. Solvent concentrations in the individual wastes range from 0.4 percent to 80.5 percent. At the lower end of this range, the waste stream is typically blended with other fuels so that the overall heat value is acceptable. This practice is more common when the waste solvent is used as a fuel substitute by the generator.

Not only will chlorine affect the heating value of a waste, but it may also contaminate the product (e.g., cement kilns) (8), reduce the particulate matter control efficiency of electrostatic precipitators (9), or it may present a corrosion problem for industrial boilers (12). As a result, the chlorine content of wastes used as fuel in these devices is often quite limited. For industrial boilers this limit is about three percent; for cement kilns it is five percent (7). Given these constraints, the nonhalogenated organic liquids are the preferred choice for fuel substitution. This is further evidenced by the fact that only two of the 61 waste streams reported in ISDB as being used as fuel in boilers were halogenated. Of the 20.6 million gallons of organic liquid wastes, 47 percent are reported to be nonhalogenated.

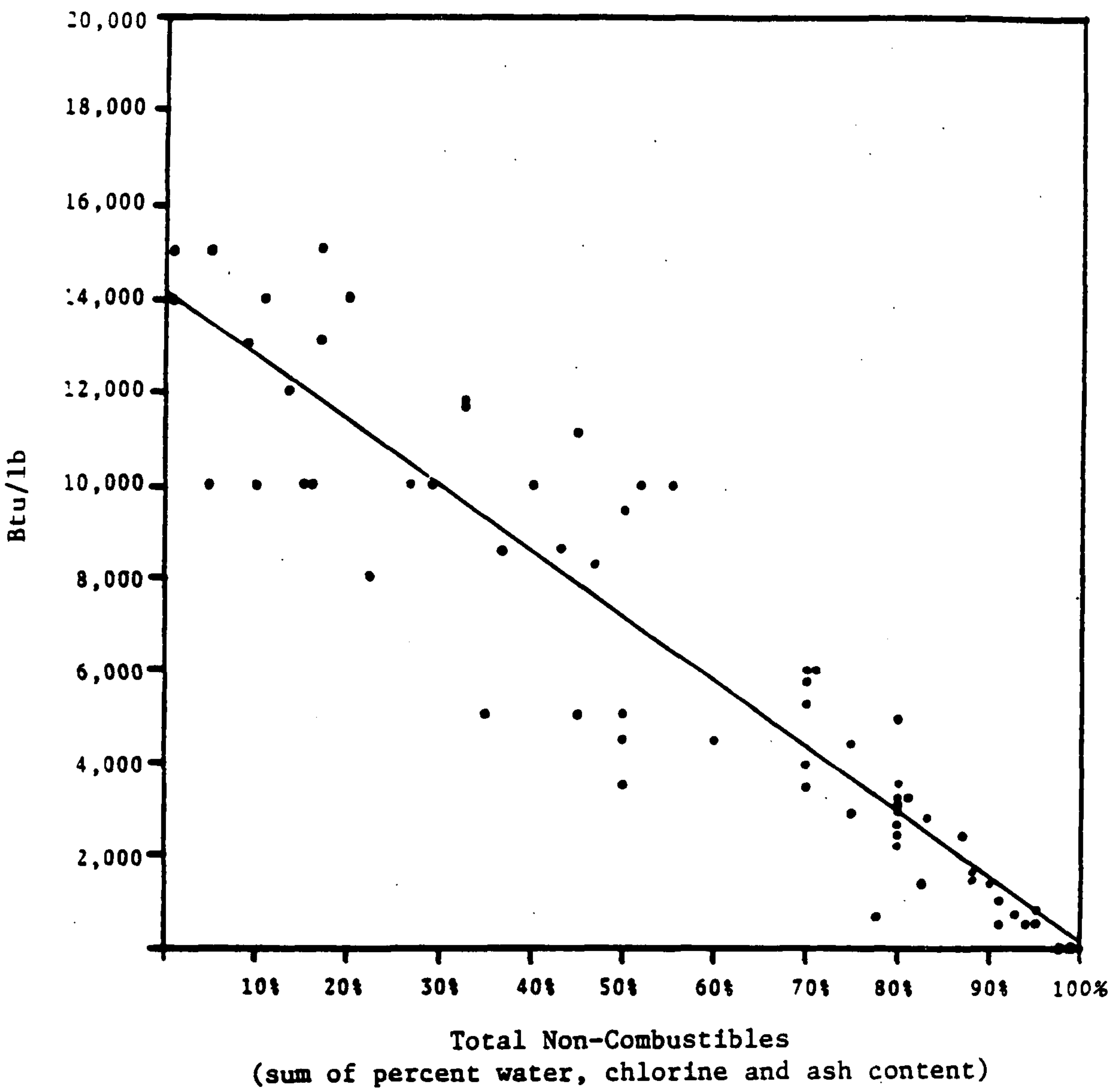
The remaining halogenated wastes could be used for fuel substitution provided the chlorine content is below three to five percent. However, because most organic liquids contain high concentrations of solvents, it is unlikely the chlorine content of the halogenated organic liquid wastes will meet this



Source: Supporting Documentation for the RCRA Incineration Regulations, PB-86-110293. 1984.

FIGURE C-3

DISTRIBUTION OF Btu CONTENT vs. TOTAL NON-COMBUSTIBLES FOR INCINERATED NONHALOGENATED SOLVENT WASTES



Source: Supporting Documentation for the RCRA Incineration Regulations, PB-86-110293. 1984.

FIGURE C-4

DISTRIBUTION OF Btu CONTENT vs. TOTAL NON-COMBUSTIBLES FOR INCINERATED HALOGENATED SOLVENT WASTES criterion. Therefore, it is assumed that none of the waste streams containing halogenated constituents will be used as fuel substitutes.

c. Incineration

As shown in Figures C-1 and C-2, the heat and noncombustible content of a given waste is not as restrictive a characteristic for incineration technology as it is for fuel substitution. In fact, approximately 31 facilities in the Incineration RIA report (6) destroyed wastes with a heat content less than 1,000 Btu/lb. Figure C-2 clearly illustrates that even low Btu, halogenated organic solvents are incinerated.

As compared to solvent-water mixtures, organic liquids are more amenable to destruction through incineration because of their higher organic content. In many cases, their heat value is high enough so that little auxiliary fuel is required to maintain sufficient temperatures for complete destruction. The requirement for auxiliary fuel, of course, depends largely on such factors as the ash, chlorine, and water content of the waste as discussed above. In addition, because they are pumpable, organic liquids can be injected into an incinerator under highly turbulent conditions, promoting more complete combustion and destruction.

d. Summary of Capacity Requirements for Organic Liquids

In conclusion, the data indicate that organic liquid waste containing halogenated solvents are more likely to be distilled or incinerated than to be used as a fuel substitute. Therefore, in order to estimate the total quantity of organic liquid waste that is amenable to each alternative technology, EPA assumes that approximately half (when considering rounding of decimals) of all halogenated organic liquids will be incinerated and about half will be distilled. This yields 5.4 million gallons per year routed to distillation and 5.5 million gallons per year routed to incineration.

In the preceding discussion, it was shown that organic liquids containing nonhalogenated solvents are amenable to incineration and distillation treatment, or use as fuel substitutes. However, the available fuel substitution capacity is unknown, as explained in Part D. EPA is assuming that 6.5 million gallons of nonhalogenated organic liquids will be incinerated each year, and 3.2 million gallons will be distilled. The lower volume routed to distillation reflects the fact that nonhalogenated solvents have a lower purchase cost than halogenated solvents. As such, it is more economical to recycle halogenated solvents.

3. ORGANIC SLUDGES AND SOLIDS

As discussed in Part B, an estimated 7.3 million gallons of solvent contaminated organic sludges and solids are generated per year. These sludges and solids contain greater than one percent total organics and greater than one percent total solids. In addition, 1.9 million gallons of wastes generated by small quantity generators are organic sludges and will compete for alternative capacity with currently land disposed organic sludges. Also, 1.2 million gallons of still bottoms will be generated by distillation of the organic liquids discussed above. This generation rate for still bottoms is based upon data gathered through a survey of the Small Quantity Generators. These data indicate that approximately 14 percent of the input to distillation leaves as a residue (5).

Therefore, a total of 10.4 million gallons of organic sludges and solids require alternative capacity. Of this quantity, 7.2 million gallons are halogenated organics and 3.2 million gallons contain nonhalogenated constituents.

Data from the ISDB characterizing these wastes indicate that they are most amenable to incineration and fuel substitution. Both of these technologies are discussed below with respect to organic sludges and solids.

a. Fuel Substitution

The preceding discussion identified the critical waste characteristics that will limit the use of organic liquids as fuel substitutes. These same characteristics, as well as viscosity and solids content, will affect the applicability of organic sludges and solids to fuel substitution. The fuel handling systems for boilers and industrial kilns are capable of handling liquids (fuel oil) and/or granulated solids (coal). High viscosity sludges (greater than 23 stokes) are not pumpable and therefore not compatible with the liquid injection units used to feed fuel oil.

Viscosity, solids content, and heat content information is not available for the 10.4 million gallons of organic sludges and solids; therefore, it is not possible to predict the quantity of this material that will be used for fuel substitution. Using these waste materials for fuel substitution is nevertheless demonstrated. In a telephone survey performed for the Agency, 29 facilities operating solvent recovery operations were identified as using the residuals for fuel substitution (1). Further examination of these data show that the residuals containing nonhalogenated solvents are more likely to be used as fuel substitutes than the residuals containing halogenated solvents. As discussed above under organic liquids, it is assumed that halogenated solvent wastes will not be used for fuel substitution.

b. Incineration

Commercial incinerators are capable of destroying highly viscous, halogenated wastes. Furthermore, the fact that these wastes are used as auxiliary fuels indicates they have sufficient heat content to be incinerated with a minimum of auxiliary fuel.

Rotary kiln, fixed hearth, multiple hearth, and fluidized bed incinerators are capable of destroying viscous wastes that are not compatible with liquid injection units. In addition, commercial incinerators are refractory-lined to minimize corrosion due to halogens. Finally, commercial incinerators are not subject to product quality constraints as is the case with industrial furnaces and kilns.

For the purpose of determining treatment capacity, it is assumed that all of the 9.2 million gallons of organic sludges and solids will be incinerated. This is due to the fact that there are several factors limiting the use of organic sludges and solids as fuel substitutes. It is not possible to precisely predict how much of this quantity would be acceptable as a fuel substitute. Secondly, as explained in Part D, the available unused fuel substitution capacity is unknown.

4. INORGANIC SLUDGES AND SOLIDS

Part B explained that an estimated 6.7 million gallons of inorganic sludges and solids are currently land disposed. These wastes consist of soils contaminated with solvents and sludges and solids containing less than one percent total organics. These wastes are further characterized as having greater than one percent total solids. Although soils contain up to several percent organics, it is assumed the RIA Mail Survey respondents reported these soils as inorganic solids.

These inorganic sludges and solids contain concentrations of solvents too low and solid contents too high to allow these wastes to be distilled or reused as fuel. Consequently the only treatment option for the 6.7 million gallons of inorganic sludges and solids contaminated with solvents is destruction by incineration. As discussed previously, commercial incineration technology is capable of destroying highly viscous wastes containing halogenated, as well as nonhalogenated, constituents.

Furthermore, auxiliary fuels such as natural gas or other high heat content wastes can be used as a supplemental fuel source during incineration. Because this waste group has a low organic content, auxiliary fuels will be needed. Figures C-1 and C-2 demonstrate that low heat content wastes can be treated using incineration technology.

5. SUMMARY OF CAPACITY REQUIREMENTS

Waste solvents are comprised of four waste groups that will require alternate treatment or recycling capacity if banned from land disposal: solvent-water mixtures, organic liquids, organic sludges and solids, and inorganic sludges and solids. For each of these waste groups, the volume of solvent waste requiring treatment or recycle capacity for each of the following technologies was estimated: distillation, commercial incineration, fuel substitution, and wastewater treatment. The total volume of solvents wastes requiring treatment and recycling capacity is summarized in Table C-2; these quantities are distributed by treatment or recycle technology in Table C-3.

TABLE C-2

VOLUME OF SOLVENT WASTE REQUIRING TREATMENT AND RECYCLING CAPACITY

(Millions gallons per year)

Physical Form	Halogenated Solvents	Nonhalogenated Solvents	Total
Solvent-Water Mixtures	0	186	186
Organic Liquids	10.9	9.7	20.6
Organic Sludges	6.4	2.8	9.2
Inorganic Sludges	6.3	0.4	6.7
	23.6	199	223

TABLE C-3

SOLVENT WASTE TREATMENT AND RECYCLING DEMAND

(Million gallons per year)

Treatment or Recovery Technology	Waste Quantity Requiring Alternative Capacity
Distillation	
Halogenated Organic Liquids	5.4
Nonhalogenated Organic Liquids	3.2
Total Solvent Wastes	8.6
Incineration	
Halogenated Organic Liquids	5.5
Nonhalogenated Organic Liquids	6.5
Halogenated Organic Sludges	6.4
Nonhalogenated Organic Sludges and Solids	2.8
Halogenated Still Bottoms	0.8 (a)
Nonhalogenated Still Bottoms	0.4 (a)
Inorganic Sludges and Solids	6.7
Total Solvent Wastes	29.1
Wastewater Treatment	
Solvent-Water Mixtures	186
Total	223

(a) Still bottoms will be generated through distillation of the 5.4 million gallons of halogenated organic liquid and 3.2 million gallons of nonhalogenated organic liquid. Based on data collected in the SQG survey, 14 percent of the distillation input is removed as still bottoms (5). This factor is used to account for still bottoms that will be generated when the organic liquids are recycled.

PART D

ASSESSMENT OF AVAILABLE TREATMENT AND RECYCLING CAPACITY

Four basic management practices were identified as the best demonstrated available technologies for waste solvents. Each of these technologies is considered a viable option to land disposal of waste solvents:

1. Treatment in tanks,
2. Distillation for solvent recovery,
3. Incineration, or
4. Fuel substitution.

Treatment in tanks refers to biological treatment, carbon and resin adsorption, steam and air stripping, and chemical oxidation. The analysis of the unused capacity available for each of these methods is presented below.

The evaluation of available treatment and recycling capacity will not include private solvent treatment and recycling facilities. Data are not available to determine to what extent private facilities will manage additional solvent waste in the future. It is not known how many owner/operators of private treatment and recycling facilities also land disposed solvent waste that will be banned, nor is there information on the quantity of such land disposed waste. Thus, the analysis presented below includes only the capacity of commercial facilities.

Information was also unavailable concerning any treatment or recycling facilities that are in various stages of development (e.g., permitting, design, construction). Only existing, on-line facilities were included in this analysis.

1. TANK TREATMENT CAPACITY

Several sources of national tank treatment capacity were considered: (1) the RIA Mail Survey, (2) the RCRA Biennial Reports Data Base, and (3) the Hazardous Waste Data Management System (HWDMS). The Biennial Reports Data Base gives the total number of RCRA-regulated treatment facilities, but this data base does not identify the type of treatment, the waste treated, or the treatment capacity.

HWDMS contains information from Part A and Part B of the RCRA treatment, storage, and disposal facility permit applications submitted to the EPA. Although the Part A applications list all of the waste codes managed, the capacities reported include all of the capacity that the interim status facility planned to have at an unspecified time in the future. This capacity is not an accurate indication of either actual design capacity or of unused capacity. Part B applications give actual design capacity; however, many currently regulated tank treatment facilities are operating under interim status and have not yet submitted Part B applications to EPA.

The RIA Mail Survey is the only source that provides design capacity, percent utilization, and waste codes for treated wastes at individual commercial facilities. In the case of tank treatment, however, the questionnaire was not designed to report the capacity available to treat waste by specific treatment methods. Consequently, all of the treatment capacity at tank treatment facilities must be grouped together. From these data, an estimated 112 million gallons per year of excess tank treatment capacity exist for solvent wastes. This excess capacity was derived from a reported planned design capacity of 170 million gallons per year and a reported capacity utilization of 34 percent.

Some of the facilities that treat solvents also treat other types of wastes, such as those containing metals. The total capacity given above includes the capacity available to treat these other wastes. Consequently, the RIA Mail Survey data provides a maximum unused capacity for treating solvent wastes. The actual unused capacity available to treat solvents is less than 112 million gallons because some of the calculated capacity is part of treatment systems designed to treat other types of wastes.

2. SOLVENT RECYCLING CAPACITY

An estimate of the commercial recycling capacity was obtained through a telephone survey of the members of the National Association of Solvent Recyclers (NASR) (1). According to NASR, their members represent 70 percent of the commercial recycling capacity available in the United States. Data and information on recycling capabilities were obtained from 31 of the 43 member facilities.

The telephone survey effort involved contacting each recycler and asking a series of questions concerning their operations. The following information requested during the survey was used here to determine recycling capacity:

1. The volumes and types of solvent managed by "F" hazardous waste designation,
2. The type of recycling process, and
3. The process capacity.

The data and information obtained from the 31 facilities were compiled by EPA region. Subsequently, the data were extrapolated proportionally to cover the remaining NASR firms and the remaining 30 percent of the nationwide recycling capacity.

The principal method of solvent recycling reported is distillation. From the telephone survey it is estimated that approximately 374 million gallons per year of commercial distillation capacity exist in the United States. It is also estimated that each year, approximately 150 million gallons of spent solvents undergo reclamation by commercial distillation. Thus, there exist about 224 million gallons per year of unused commercial distillation capacity.

An additional 278 million gallons of spent solvents are recycled by distillation in privately operated units. The majority of this amount is believed to be halogenated solvents, which, in general, have a higher resale value than nonhalogenated solvents.

3. INCINERATION CAPACITY

EPA calculated estimates of the total and unused commercial incineration capacity based on data and information from several sources. A summary of this information is presented below.

A telephone survey of commercial hazardous waste treatment facilities was performed in 1984 (10). This survey included five major firms operating nine commercial incinerators. Because the survey information is confidential, only summary information can be provided here. Based on answers from the five incinerator owner/operators, the total quantity of hazardous waste burned in 1984 was 239,000 metric tons. The reported total design capacity was 301,000 metric tons with a current capacity utilization of 80 percent. Assuming the waste had a weight similar to water, these estimates yield an unused capacity of 18.7 million gallons per year.

The telephone survey also allowed industry representatives to provide direct input regarding the interpretation of the data they provided. For example, incineration capacity is frequently discussed in terms of thermal input. In many cases, it was necessary to convert thermal input into a volume by assuming an average waste heat content.

A second, more complete estimate of incinerator capacity was determined using data obtained from several sources. This information was obtained from telephone contacts with commercial incinerators, site visit reports, the RIA Mail Survey, permit data, and the HWDMS. Most of this information is confidential.

Non-confidential information is provided in the Administrative Record supporting this rulemaking. As of November 1985, it was determined that there are 17 commercial incineration units in the United States operated by 11 firms. There have been more commercial incineration facilities in the United States, but they have ceased accepting hazardous waste or are no longer in operation.

The volume of waste incinerated and the thermal capacity of these facilities was uniformly converted using the following assumptions:

1. The average heat content for the incinerable waste is 8,000 Btu/lb (1),
2. The capacity utilization is 80 percent (1,10),
3. The average available operating time is 83 percent (7,270 hours/yr) (14), and
4. The average weight of the incinerable waste is that of water, 8.34 pounds per gallon (10).

Using the above conversion factors, the available capacity at these 17 facilities is estimated to be a maximum of 25.6 million gallons per year. This estimate is slightly higher than that calculated from Reference 10 because all operating incinerators are included.

Further data available in Reference 1 indicates that in 1984 the thermal capacity of the commercial incinerators was 986 million Btu per hour. Using the conversion factors listed above, 986 million Btu per hour converts to an unused commercial incineration capacity is 21.5 million gallons per year.

These three estimates of unused commercial incineration capacity, obtained from independent sources, appear consistent. For the purposes of evaluating capacity availability, the most current and complete estimate of 25.6 million gallons per year will be used.

4. FUEL SUBSTITUTION

From the RIA Mail Survey, it has been determined that at least 231 million gallons of hazardous waste are burned annually as fuel substitutes (7). In addition, approximately 159 million gallons of that quantity contain solvent constituents found in F001, F002, F003, F004, and F005 wastes (1). The majority of this 159 million gallons is reported to be ignitable waste (77 percent). Less than one percent is halogenated, and the remaining 23 percent is reported to be nonhalogenated. As discussed previously, halogenated wastes are not used extensively as fuel substitutes.

Because of the numerous high temperature industrial processes operated in the United States, there is a substantial potential for available capacity to destroy organic wastes by using these wastes as auxiliary fuel. For example, it is estimated that of the over 400,000 industrial boilers, approximately 5,500 are capable of destroying organic wastes (11).

An EPA survey of handlers and burners of used or waste oil and waste-derived fuel material identified 1400 boilers that use organic wastes as auxiliary fuels (7). These data indicate that there is substantial thermal capacity available for fuel substitution in industrial boilers. It is likely that the same situation exists for high temperature industrial kilns and furnaces. Nevertheless, the Agency is unable to predict the willingness of these facilities to accept hazardous wastes to offset fuel costs.

Further, it should be noted that EPA is considering regulations that could curtail fuel substitution practices. These regulations may require that industrial operations using hazardous wastes to co-fire boilers, furnaces, and kilns demonstrate and achieve destruction and removal efficiencies of 99.99 percent or greater. As discussed in Volume II of this document, various industrial boilers, industrial kilns, and industrial furnaces have demonstrated that this degree of destruction is achievable.

EPA is also considering additional limitations for particulate matter and hydrochloric acid emissions. These emission limits would be achievable through proper air pollution control or by reducing the mass feed of waste material into the operation. Because of these limitations, and because industrial facilities may not be willing to accept hazardous wastes, it is not possible to estimate the quantity of unused fuel substitution capacity.

PART E

COMPARISON OF CAPACITY REQUIREMENTS WITH AVAILABLE CAPACITY

In the previous sections, volume estimates of solvent waste that will be directed to specific types of alternative treatment and recycling technologies were presented. Estimates were also presented for the unused commercial capacity of these alternative treatment and recycling technologies. In this subpart, the required capacity is compared to the unused capacity in order to determine where capacity shortfalls exist. A summary of EPA's estimates of quantities of solvent wastes requiring treatment and recycling and the unused commercial capacity per technology is presented in Table E-1. It should be remembered that this analysis does not include any solvent wastes that may be currently disposed in salt-dome formations, salt bed formations, and underground mines and caves.

The Agency has concluded that based on the analysis of the data in Table E-1, sufficient unused commercial recycling capacity exists for all solvent wastes that will be distilled. This volume represents less than a four percent increase over the 159 million gallons of solvent waste currently reclaimed through distillation.

Table E-1 also demonstrates there is insufficient commercial incineration capacity. When capacity is insufficient to treat all of the waste groups requiring the same technology, EPA is proposing to utilize all of the available capacity by banning from land disposal the more toxic or concentrated waste first. In this case, inorganic sludges and solids may be considered the least toxic or concentrated waste among those requiring incineration. When the 6.7 million gallons of inorganic sludges and solids are subtracted from the estimates of required incineration capacity, the estimated available incineration capacity is adequate to handle the wastes containing the greater concentrations of solvents and total organics. These wastes are organic liquids, organic sludges, and still bottoms. Therefore, the Agency concludes that a shortfall in incinerator capacity exists for inorganic sludges and solids.

Current estimates of commercial wastewater treatment capacity also show a significant shortfall for treating the estimated 185 million gallons of solvent-water mixtures containing less than one percent (10,000 ppm) total solvent that are currently land disposed each year.

TABLE E-1

COMPARISON OF ALTERNATIVE TREATMENT AND RECYCLING DEMAND WITH UNUSED CAPACITY

(Million gallons per year)

Treatment or Recovery Technology	Waste Quantity Requiring Alternative Capacity	Unused Capacity
Distillation	8.6	224
Incineration[a]	29.1	25.6
Wastewater Treatment	185	<112

[a]When the inorganic sludges and solids are subtracted, the waste quantity requiring incineration is 22.4 million gallons.

PART F

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