FEDERAL SURVEYS OF INDUSTRIAL WASTE

Presented at the
Solid Wastes Management Association
International Waste Equipment and Technology Exposition
Los Angeles, June 20, 1975

U.S. ENVIRONMENTAL PROTECTION AGENCY

1976

FEDERAL SURVEYS OF INDUSTRIAL WASTE

by John P. Lehman*

All of you are intimately familiar with how trash and garbage, also known as municipal solid waste, is generated and collected, and most of you know how it is disposed of. You are able to quote facts on what is in municipal solid waste, how much is generated per person per day, and what disposal costs.

But what about industrial waste? This is an unfamiliar and uncharted area for most of us, because industrial waste usually has been handled by a private waste management system outside the traditional municipal solid waste management system. Out of sight and out of mind, so to speak.

How many of you can tell me what waste comes out the back gate of an industrial facility, and how much? And where it goes? And what it costs to take it there? And whether these wastes are hazardous?

---

*Mr. Lehman is Director, Hazardous Waste Management Division, Office of Solid Waste Management Programs, U.S. Environmental Protection Agency.

We all know that industry is cleaning up its industrial wastewater effluents to our rivers and streams, often using fairly sophisticated water treatment systems. And also, it is cleaning up the air going out factory stacks, again using scrubbers and precipitators of reasonably advanced design. What happens to the pollutants we spend so much energy and money to remove from industrial effluents? What is in those sludges, and filter aids, and dust bags? How much waste is there? Where does it go? How much does it cost to dispose of? And are the disposal methods acceptable to our society?

There are many such questions, and precious few answers. About four years ago, EPA ventured out in this uncharted area to fulfill a Congressional mandate to study hazardous waste practices in this country. The results were unsettling. We found that about ten percent of all industrial waste is potentially hazardous, and that most of it is disposed of on the land, generally in an inadequate fashion. Also, we estimated that industrial and hazardous waste generation is growing at a rate of five to ten percent per year. This early work whetted our desire for more knowledge about industrial waste in general, and hazardous waste in particular. Last year we launched new

studies in these two areas. In what follows, I'll report our progress and findings to date.

Industrial Waste Study

In mid-1974, we conducted a six-months-long, in-house study of industrial residues. We gathered and evaluated all available information concerning industrial waste; no new information was generated.

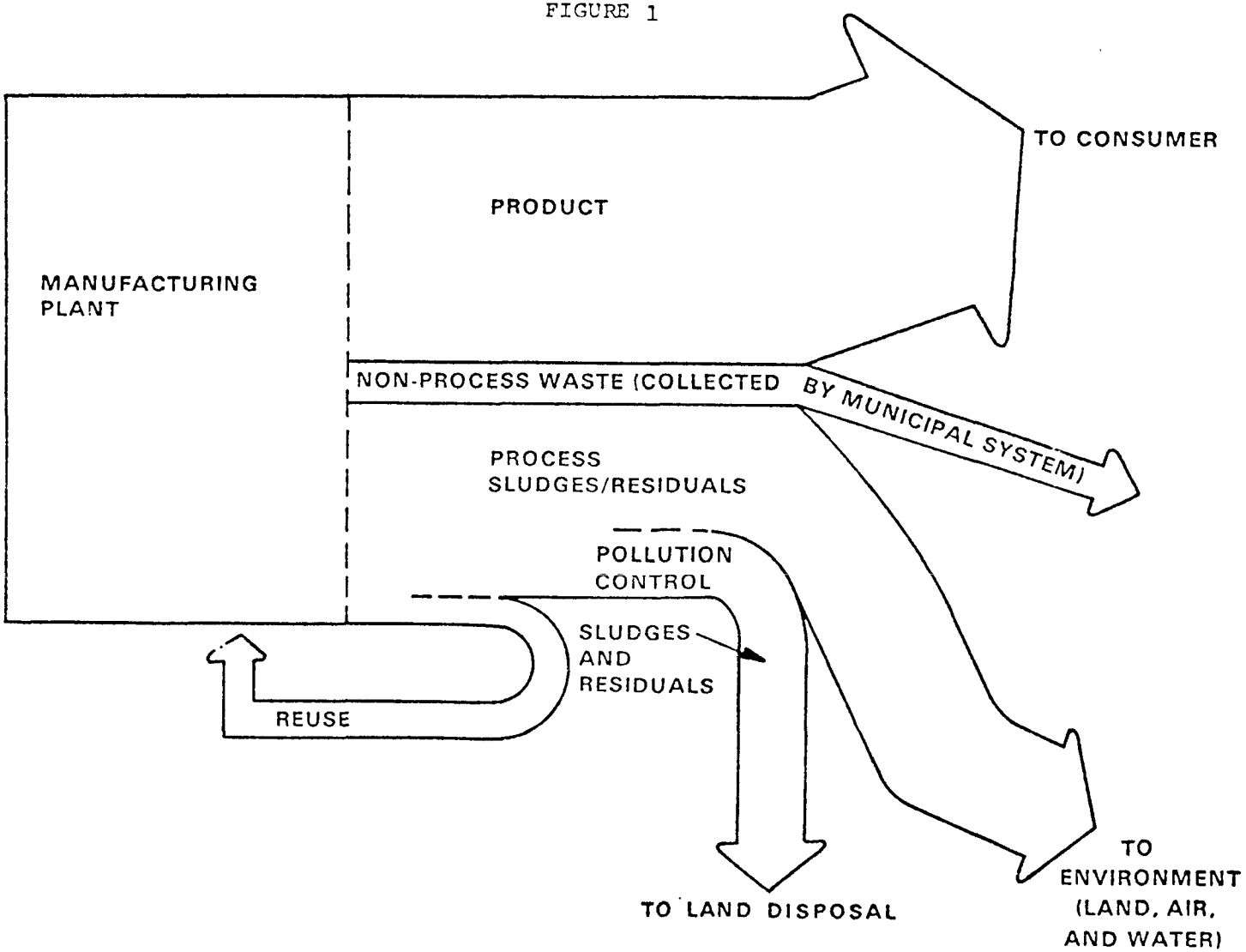
Before quoting facts and figures, let me define some terms concerning industry process outputs (Figure 1). The main output is the product, of course. There is some non-process waste, such as office paper and cafeteria waste, which is usually collected by a municipal system; we count that as "municipal" solid waste. The main waste source is the manufacturing process itself. In our thinking, there are three process-related residual streams:

(1) Process sludges and residuals;

(2) Air and water pollution control sludges and residuals, and

INDUSTRY PROCESS OUTPUTS

FIGURE 1



(3) Wastes reused in the basic process (termed "home scrap") or recycled in the secondary materials market.

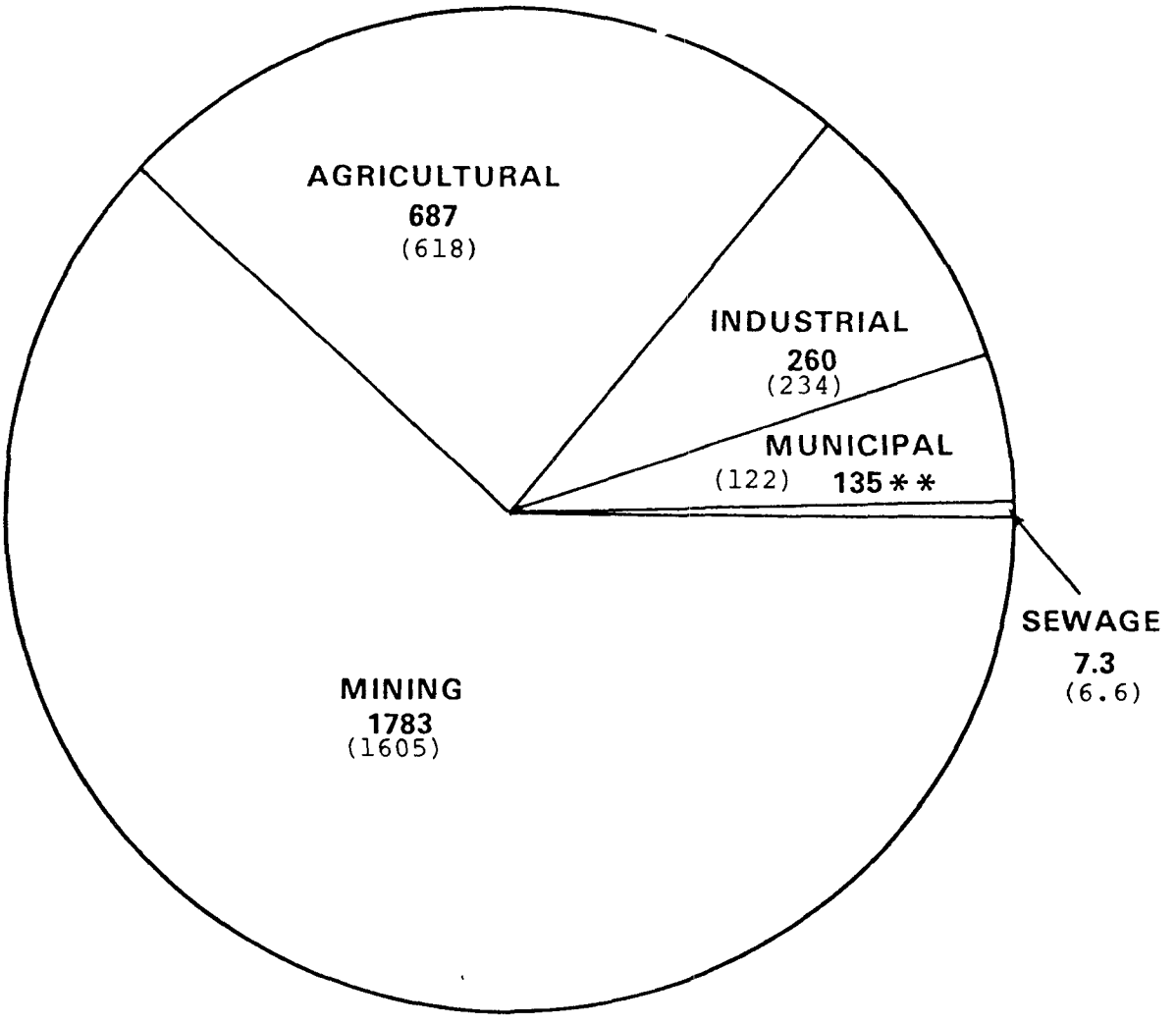
In EPA's studies, we try to track all three, but when we say "industrial waste," we refer only to the first two, that is, non-recycled process and pollution control residues.

In order to put industrial residuals into appropriate perspective, we must look at the relative contribution of all sources to the total waste stream (Figure 2). Although mining wastes greatly overshadow all other sources, they are largely composed of overburden which, while representing a major materials handling problem, appear not to represent as widespread an environmental problem as manufacturing wastes. Crop and feedlot wastes represent almost all of the agricultural waste production. The potential for reuse and natural degradation of crop and feedlot wastes diminish their relative significance.

The true magnitude of the industrial waste situation is now beginning to come into focus, and the picture we see is alarming. Not many people appreciate the fact that industry produces about 260 million dry tons of waste per year which is almost twice as much waste each year as is generated by residential and

FIGURE 2

ESTIMATED INDUSTRIAL VERSUS OTHER RESIDUALS * (DRY WEIGHT IN MILLION TONS PER YEAR)



* DATA REPRESENTS VALUES FROM 1970-1974.

** REPRESENTS VALUE "AS GENERATED" I.E. WITH MOISTURE.

( ) METRIC TONS

commercial sources. Further, industry generates about 35 times more waste than do the sewage treatment plants; yet one hears a lot more talk about the sewage sludge problem than the industrial sludge problem.

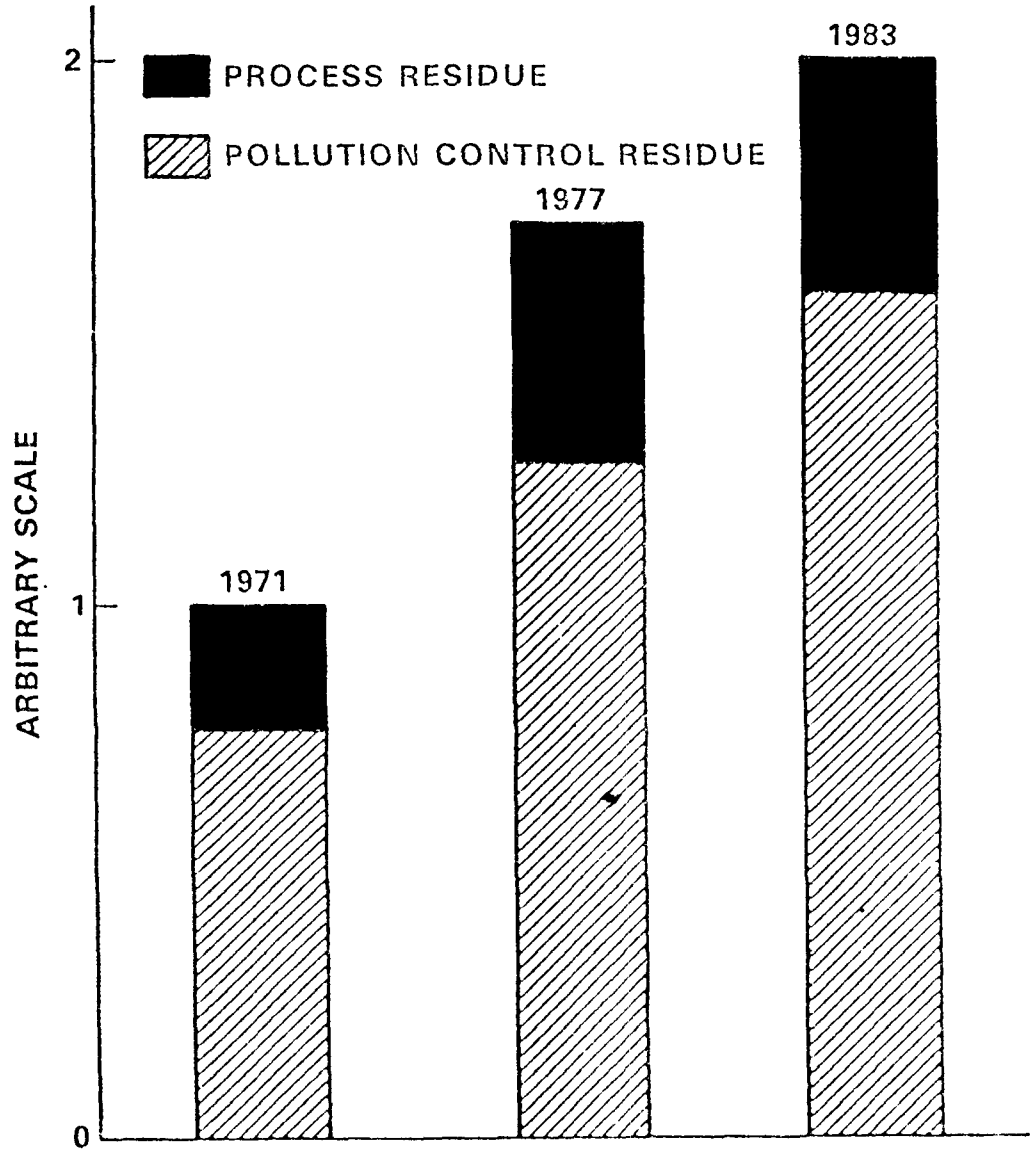
The industrial waste figures include about 40 million tons per year of residuals from the electric power utility industry (bottom ash, fly ash, and captured particulates). Sulfur oxide scrubbers are not yet widely used, so there are only small amounts of SO_x scrubber sludges being generated at present.

The industrial waste figures are for the current situation. When the Effluent Limitation Guidelines mandated by the Federal Water Pollution Control Act Amendments (FWPCA) go into force in 1977 and 1983, and as industry gears up to meet the Clean Air Act requirements, we estimate the industrial waste figures will jump dramatically in many industries.

To illustrate, we have estimated the combined total waste and the pollution control residual fraction for four major industries (Inorganic Chemicals, Paper, Steel, and Nonferrous Smelting/Refining) in 1971, 1977, and 1983 (Figure 3). The total waste increases by 70 percent in 1977 and by 100 percent in 1983.

FIGURE 3

PROJECTED GROWTH OF COMBINED WASTE QUANTITIES FOR FOUR REPRESENTATIVE INDUSTRIES (INORGANIC CHEMICALS, PAPER, STEEL, AND NON-FERROUS SMELTING)



A large part of the increase is due to the anticipated installation of pollution control equipment. Pollution control residuals account for about 75 percent of the total waste in these industries. While all industries may not have this degree of waste growth, the trend is unmistakable.

From this study we conclude that industrial waste is a major fraction of the total waste stream which has been overlooked for too long, and that EPA's air and water pollution control activities will, over the next decade, have a major impact on land disposal of wastes. Implications of these findings on EPA strategy, and on land use and energy policy, are being evaluated by a high-level policy group set up recently by Administrator Train.

These industrial waste quantity and growth estimates are somewhat staggering. But, an aspect causing even greater concern is that many of these wastes are potentially hazardous.

Hazardous Waste Surveys

While earlier industrial hazardous waste survey work in support of our Report to Congress was sufficient to highlight the importance of hazardous waste, these data were too general to support our technical assistance efforts or preparation of hazardous waste guidelines. Consequently, EPA decided to study specific industrial wastes on a national scale.

The basis for selection of an industry for study was the potential hazard of its wastes (Table 1) and production quantities as determined by our earlier overview studies.

A series of nine industrial hazardous waste practices studies was begun in February 1974, followed by another four just getting underway this year (Table 2). All are being done by contractors.

All associated industrial trade associations have been briefed on these studies, and in some cases the trade associations have been active participants, by mailing questionnaires, arranging facility visits, and the like.

TABLE 1

POTENTIALLY HAZARDOUS SUBSTANCES WITHIN INDUSTRIAL WASTE STREAMS

Industry	Hazardous substances										
	As	Cd	Chlorinated hydrocarbons*	Cr	Cu	Cyanides	Pb	Hg	Miscellaneous Organics+	Se	Zn
Mining and metallurgy	x	x		x	x	x	x	x		x	x
Paint and dye		x		x	x	x	x	x	x	x	
Pesticide	x		x			x	x	x	x		x
Electrical and electronic			x		x	x	x	x		x	
Electroplating and metal finishing		x		x	x	x					x
Chemical manufacturing			x	x	x			x	x		
Explosives	x				x		x	x	x		
Rubber and plastics			x			x		x	x		x
Battery		x					x	x			x
Pharmaceutical	x							x	x		
Textile				x	x				x		
Petroleum	x		x								
Leather				x			x		x		

*Including polychlorinated biphenyls.

+For example, acrolein, chloropicrin, dimethyl sulfate, dinitrobenzene, dinitrophenol, nitroaniline, and pentachlorophenol.

TABLE 2

LIST OF INDUSTRIAL HAZARDOUS WASTE STUDIES

Group I

Primary and Storage Batteries

Inorganic Chemicals

Organic Chemicals, Pesticides and Explosives

Electroplating

Metals Mining

Paint and Allied Products

Petroleum Refining

Pharmaceuticals

Primary Metals Smelting and Refining

Group II

Textile Mill Products

Rubber and Plastics

Leather Tanning and Finishing

Machinery, except Electrical

Industrial participation is on a voluntary basis and industrial cooperation has been very gratifying to date.

Objectives of the studies are to:

(1) Characterize each industry in terms of the number of plants, number of employees, location, production processes and rates, etc.

(2) Characterize the wastes generated by each process in each industry, both the total amount, and the potentially hazardous fraction.

(3) Define hazardous waste treatment and disposal methods in terms of industry average, current best practice, and environmentally acceptable methods, and

(4) Analyze the costs associated with treatment and disposal.

Results to Date

Only 6 of the 13 studies are now complete, so it is difficult to discuss results and perhaps dangerous to draw conclusions at this time. However, I will give you a snapshot of the results to date, and perhaps some trends will appear. It is important to note that we have attempted to standardize results by normalizing quantity data to a dry-weight basis. Since the majority of hazardous wastes are in liquid or sludge form, rather than solids, and it is often difficult to accurately determine the liquid fraction of wastes, this procedure can introduce some inaccuracies. On the other hand, it is important to know quantities on a wet basis as well, since that is the tonnage actually handled (and charged for) by the waste treatment industry. Consequently, in most data displays, we present both dry- and wet-basis data.

First, it is interesting to determine the fraction of an industry's total waste stream that is potentially hazardous. EPA left it to each contractor to devise criteria for "potential hazard" for each industry studied because: (1) it is difficult to define "hazard" in advance of knowing what the wastes are, their chemical composition, form and amounts; and (2) we are

still in the learning phase of this program and were interested in getting some independent thinking as to what constitutes a potential hazard, at what levels, etc. Many contractors used criteria corresponding to the National Academy of Sciences "moderately hazardous" rating* as the cutoff between "potentially hazardous" and other wastes.

We use the term "potentially hazardous" waste advisedly, since actual hazard to public health and the environment depends on the waste management methods employed. These are the wastes requiring special control in order to prevent future public health and environmental damages, both in the short term (acute) and the long term (chronic) effects sense.

The Industrial Hazardous Waste Practices Study results to date, from 6 of 13 industries, indicate the total of all industrial waste is 44 million metric tons per year, on a dry-weight basis, of which five million tons per year, or 12 percent is potentially hazardous (Table 3). This hazardous waste percentage compares to our earlier estimate of about ten percent.

*System for Evaluation of the Hazards of Bulk Water Transportation of Industrial Chemicals. National Academy of Sciences, Washington, D.C., 1974.

Table 3

INDUSTRIAL HAZARDOUS WASTE STUDIES

Waste Generation

Industry	Total Waste Amount (Millions of Metric Tons/Yr - Dry Basis) All-Industrial	Potentially Hazardous Wastes	Hazardous Constitutents
1. Batteries	-	0.005	0.0005
2. Inorganic Chemicals	40.00	2.000	0.064
3. Organic Chemicals, Pesticides & Explosives	2.25	2.200	0.840
4. Electroplating	-	-	-
5. Metals Mining	-	-	-
6. Paint & Allied Products	0.39	0.106	0.160
7. Petroleum Refining	0.70	0.674	0.124
8. Pharmaceuticals	0.25	0.062	0.003
9. Primary Metals Smelting and Refining	-	-	-
Total (to date)	43.59	5.047	1.048

Notes

1. - data not yet available
2. Four additional studies currently underway

The total industrial waste figure from six industries compares with our earlier estimate of 110 million tons per year for all industries, which was recently updated to 260 million tons per year, as noted above. Several of the industries not yet included in our figures are expected to be large contributors to the overall total and the hazardous waste fraction. Also, our earlier figures were on a wet basis. This leads us to believe that our earlier estimate of ten million tons per year (wet basis) for all hazardous waste was on the low side.

Turning now to the potentially hazardous portion of the industrial waste stream, we have accumulated sufficient data to indicate trends in hazardous waste characteristics, comparisons of current data with earlier estimates, hazardous waste growth projections associated with key target dates for compliance with the FWPCA Effluent Limitations Guidelines by 1977 and 1983, hazardous waste treatment and disposal technology and cost data, and the geographical distribution of hazardous waste generation.

Industrial hazardous waste characteristics, known from six industries to date, indicate that total amounts calculated on a wet basis are 12.8 million metric tons per year, compared to 5 million metric tons per year on a dry basis, or roughly 150

percent more tonnage wet than dry (Table 4). About 28 percent of hazardous wastes are in solid form and 72 percent are in liquid or sludge form. About 58 percent are organics vs. 42 percent inorganics.

Comparing these figures with earlier estimates on a wet basis, we see that, within the SIC codes studied in both cases, our earlier data on total hazardous waste amounts were low by factors ranging from 2 to 12, except for the batteries industry (Table 5). Earlier we estimated 90 percent of hazardous waste were in liquified or sludge form vs. 72 percent in our current studies. Earlier estimates indicated hazardous waste was 60 percent organic and 40 percent inorganic vs. 58 percent organic and 42 percent inorganic in current estimates to date.

To gauge the impact of the FWPCA Effluent Limitations Guidelines on hazardous waste sludge generation, we have projected hazardous waste amounts from 1974 to 1977 and 1983, when best practicable technology and best available technology levels are to be implemented (Table 6). Although the increase in hazardous waste generation varies from industry to industry, depending on the sensitivity of the process waste stream to waste water pollution control requirements, overall we predict a

TABLE 7

INDUSTRIAL HAZARDOUS WASTE STUDIES

Current Hazardous Waste Disposal Practices

Industry	Land Disposal			Treatment (Chemical, Thermal, Etc.)			Recovery	
	% Waste	Cost Range ($/Ton)	Avg.Cost ($/Ton)	% Waste	Cost Range ($/Ton)	Avg.Cost ($/Ton)	% Waste	Avg.Cost ($/Ton)
1. Batteries	89	1.1- 44	15	2	None Reported	4	9	-
2. Inorganic Chemicals	90	1.8- 80	18	5	7- 59	34	5	-
3. Organic Chemicals, Pesticides and Explosives	93	0.6-240	3	2	18-323	37	5	18
4. Electroplating	-	-	-	-	-	-	-	-
5. Metals Mining	-	-	-	-	-	-	-	-
6. Paint and Allied Products	88	3 -130	60		None Reported		12	23
7. Petroleum Refining	99+	0.9- 20	12	0.13	None Reported	34	.01	36
8. Pharmaceuticals	10	7 - 27	15	85	10-300	90	5	-
9. Primary Metals Smelting and Refining	-	-	-	-	-	-	-	-
Overall Weighted Average	92		11	4		49	4	19

Notes

1. - data not yet available
2. Four additional studies currently underway

TABLE 4

INDUSTRIAL HAZARDOUS WASTE STUDIES

Hazardous Waste Characteristics

Industry	Amount (Mill. Metric Tons/Yr.) Dry Basis	Wet Basis	% Solid	% Liquid or Sludge	% Organic	% Inorganic
1. Batteries	0.005	0.010	50	50	0	100
2. Inorganic Chemicals	2.000	3.400	60	40	0	100
3. Organic Chemicals, Pesticides and Explosives	2.200	7.333	30	70	99	1
4. Electroplating	-	-	-	-	-	-
5. Metals Mining	-	-	-	-	-	-
6. Paint and Allied Products	0.106	0.424	20	80	15	85
7. Petroleum Refining	0.674	1.440	46	54	99	1
8. Pharmaceuticals	0.062	0.200	31	69	90	10
9. Primary Metals Smelting and Refining	-	-	-	-	-	-
Total (to date)	5.047	12.807 Wtd. Avg.	28	72 Wtd. Avg.	58	42

Notes

1. - data not yet available
2. Four additional studies currently underway

TABLE 5

INDUSTRIAL HAZARDOUS WASTE STUDIES

Comparison to Earlier Hazardous Waste Data

Industry	SIC Codes	Amount (Mill. Metric Tons/Yr.-Wet Basis) Current Study	BNW Report*	% Variation
1. Batteries	3691, 3692	0.010	0.022	-100
2. Inorganic Chemicals	281	3.400	1.500	+127
3. Organic Chemicals, Pesticides and Explosives	2861, 2865, 2869 28694, 2879, 2892	7.333	3.500	+110
4. Electroplating	-	-	-	
5. Metals Mining	-	-	-	
6. Paint and Allied Products	285	0.424	0.035	+1100
7. Petroleum Refining	291	1.440	0.204	+600
8. Pharmaceuticals	283	0.200	Negligible	-
9. Primary Metals Smelting and Refining	-	-	-	-
Total (to date)		12.807	5.261	Wtd. Avg. +143

Notes

1. - data not yet available
2. Four additional studies currently underway

* Swift, W.H. Program for the management of hazardous wastes. v.1. [Richland, Wash.], Battelle Memorial Institute, Mar. 1, 1973. July 1973. 385 p.

TABLE 6

INDUSTRIAL HAZARDOUS WASTE STUDIES

Hazardous Waste Growth Projections

Industry	Amount (Mill. Metric Tons/Yr.) 1974 Dry	1974 Wet	1977 Dry	1977 Wet	1983 Dry	1983 Wet	% Growth '74-'83
1. Batteries	0.005	0.010	0.082	0.164	0.105	0.209	2000
2. Inorganic Chemicals	2.000	3.400	2.300	3.900	2.800	4.800	40
3. Organic Chemicals, Pesticides and Explosives	2.200	7.333	3.500	11.666	3.800	12.666	73
4. Electroplating	-	-	-	-	-	-	-
5. Metals Mining	-	-	-	-	-	-	-
6. Paint and Allied Products	0.106	0.424	0.122	0.488	0.167	0.668	58
7. Petroleum Refining	0.674	1.440	0.773	1.540	0.883	1.850	31
8. Pharmaceuticals	0.062	0.200	0.070	0.226	0.104	0.335	68
9. Primary Metals Smelting and Refining	-	-	-	-	-	-	-
Total (to date)	5.047	12.807	6.847	17.984	7.859	20.528	Avg. 56

Notes

1. - data not yet available
2. Four additional studies currently underway

hazardous waste growth of 56 percent over the next decade. This figure compares with our earlier estimated growth rate of 5 to 10 percent per year.

Current hazardous waste treatment and disposal practices and costs confirm earlier suspicions (Table 7). Over 92 percent of all hazardous waste is disposed of directly on land as opposed to 4 percent undergoing some form of treatment, and 4 percent being recycled in some fashion. The average cost figures illustrate why this is so: $11 per ton for land disposal vs. $49 per ton for treatment. Land disposal is by far the cheaper waste management option.

Similarly, distribution of hazardous waste generation follows expected patterns (Table 8). The highest percentage of hazardous waste is generated in EPA Region VI, followed by Regions IV and III. Each of these regions contains heavy concentrations of chemical and other industrial production. In our study reports, the hazardous waste generation distribution is further subdivided by total amount generated per industry by State. This information should be of great interest to State solid waste management authorities.

TABLE 8

INDUSTRIAL HAZARDOUS WASTE STUDIES

Hazardous Waste Distribution

Industry	Percent of Total Per EPA Region									
	I	II	III	IV	V	VI	VII	VIII	IX	X
1. Batteries	1.3	12.2	22.3	4.8	36.2	6.6	0.5	-	12.0	4.1
2. Inorganic Chemicals	0.4	5.2	16.3	15.5	8.4	45.4	1.6	-	3.3	3.9
3. Organic Chemicals, Pesticides and Explosives	0.1	3.6	15.0	21.5	2.7	54.6	1.0	0.1	1.2	0.2
4. Electroplating	-	-	-	-	-	-	-	-	-	-
5. Metals Mining	-	-	-	-	-	-	-	-	-	-
6. Paint and Allied Products	2.2	15.4	9.2	13.8	31.7	6.5	6.0	0.6	13.4	1.2
7. Petroleum Refining	0	5.0	7.2	3.5	18.0	43.0	3.5	3.8	13.0	3.0
8. Pharmaceuticals	55.4	*	9.7	7.7	20.6	**	0.2	**	0.2	6.2
9. Primary Metals Smelting and Refining	-	-	-	-	-	-	-	-	-	-
Overall Weighted Average	0.9	4.6	14.3	16.4	7.9	47.7	1.7	0.6	3.7	2.1

Notes

* Included in Region I
** Included in Region X
1. - data not yet available
2. Four additional studies currently underway

Cost Implications

Each industrial hazardous waste study defines specific technology levels and associated costs for each process waste stream. I refer you to each study report for details. In general terms, we have found that the cost required to move from current treatment and disposal practice to environmentally acceptable treatment and disposal for hazardous waste does not represent an unreasonably high cost burden on industry. For example, in the petroleum industry the cost of current hazardous waste treatment and disposal practice represents about one percent of refinery production costs while environmentally acceptable treatment and disposal methods for these wastes would be about three percent of refinery production costs. Please note that refinery production costs are only one element in the retail price of oil and gasoline. Other elements include exploration, drilling, transportation and marketing. Consequently, the cost impact to the industry and to the public of upgrading hazardous waste disposal practices will be significantly less than the above figures.

These patterns are followed in most industries we have studied; we are now performing more studies of the economic

impact on specific industries of improved waste management practices in order to confirm our earlier estimates.

Availability of Reports

Industrial Hazardous Waste Practices Study reports will be published by EPA and made available through the National Technical Information Service (NTIS) operated by the Department of Commerce. The first report of the series to be completed, "Assessment of Industrial Hazardous Waste Practices, Storage and Primary Batteries Industries," is at NTIS now and should be available for purchase shortly. Other reports in the series will follow in sequence. Most reports from the first group of studies will be available before year-end.

Value to Industry

EPA feels these hazardous waste studies are of considerable value to the industries studied. Strange as it may seem, many industrial facilities visited during the course of these surveys had no idea what was in their land-destined waste streams, or what the ultimate fate of these wastes was. As a result of these studies, many industries will, for the first time, have a much

clearer picture of the hazardous waste generation situation in that industry, along with suggested treatment and disposal technology options and associated cost information for upgrading hazardous waste management practices.

For the waste treatment and disposal industry, these studies pull together detailed information about the quantities, characteristics, and location of industrial hazardous waste. In the past, this type of information had to be purchased from marketing consultants. Close study and evaluation of these data should lead to new offers of service to industry, and should be a valuable aid in facility siting and construction decisions. Lastly, service bid pricing structures will be more easily and logically determined.

Future Efforts

"What is past is prologue" states the facade of our National Archives. Knowledge is often the precursor to action. Clearly, our industrial hazardous waste survey efforts to date are just the opening act of a drama yet to be revealed.

EPA's first order of business is to gain more facts. As I mentioned, our second series of industrial hazardous waste studies is just getting underway. When completed next year, these studies will clarify considerably the somewhat preliminary data I've presented here. We also recognize the need for new techniques to deal with the mounting hazardous waste management problem. Consequently, OSWMP has recently initiated programs to explore the major hazardous waste treatment and disposal options:

(1) Land Disposal. EPA recently awarded a major demonstration grant for a full-scale chemical waste landfill to the State of Minnesota.

(2) Incineration. Last fall EPA started a $1.5 million program to evaluate the effectiveness and costs of hazardous waste incineration.

(3) Chemical/Biological Treatment. A major effort to evaluate existing hazardous waste chemical/biological treatment methods and match them with industrial wastes is now in the contract procurement stage.

(4) Resource Recovery. Last on this list, but first in our priority, we have recently begun two studies of resource recovery potential from industrial hazardous waste. First, we will examine the concept of waste exchange between industries; one man's waste may be another man's raw material. Second, we will study the potential for energy recovery from industrial wastes, as part of the overall national effort to enhance energy conservation.

We believe these efforts will allow us to make better judgments as to future actions, and provide us with sharper tools for our technical assistance efforts to industry, State and local governments, and the public.

Conclusions

Bearing in mind that our industrial hazardous waste surveys are not yet completed, the following trends and conclusions can be drawn from the preliminary results presented here:

(1) Industrial waste is now generated at roughly twice the rate of municipal waste.

(2) Land-destined industrial waste amounts will jump dramatically in the next decade, due in great part to installation of air and water pollution control systems.

(3) About 12 percent of all industrial wastes can be classified as potentially hazardous to public health and the environment.

(4) About 72 percent of potentially hazardous waste is in liquid or sludge form.

(5) About 58 percent of potentially hazardous waste is organic; 42 percent is inorganic.

(6) Amounts of potentially hazardous waste generated will increase by about 56 percent in the next decade.

(7) Land disposal is the predominant hazardous waste management practice today.

(8) Only four percent of potentially hazardous waste is treated and four percent is recovered.

(9) Generation of potentially hazardous waste is concentrated, as expected, in the heavily industrialized Gulf Coast and mid-Atlantic regions.

(10) Upgrading hazardous waste treatment and disposal practice to environmentally acceptable standards will not represent an unreasonable cost burden to industry or the public.

EPA's future efforts will concentrate on improving our industrial waste data base and evaluating the major treatment and disposal options for hazardous waste management. We cannot alone bring about the necessary improvements to current industrial hazardous waste management practices. We urge the waste generation industry and the waste management industry to join with us in a cooperative effort to upgrade industrial waste management practices to better protect the public health and our environment.

Thank you very much.

µσll99
SW-545

☆ U S GOVERNMENT PRINTING OFFICE: 1976— 241-037/8