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state program implementation guide: hazardous waste surveys

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STATE PROGRAM IMPLEMENTATION GUIDE:

HAZARDOUS WASTE SURVEYS

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U.S. ENVIRONMENTAL PROTECTION AGENCY

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STATE PROGRAM IMPLEMENTATION GUIDE: HAZARDOUS WASTE SURVEYS

Introduction

In its Report to Congress: Disposal of Hazardous Wastes[1] the U.S. Environmental Protection Agency (EPA) estimated that approximately 10 million tons of non-radioactive hazardous wastes are generated annually and that hazardous waste generation will increase at an annual rate of 5 to 10 percent. As a first step in managing this ever increasing hazardous waste problem, EPA recommends that each State conduct a Statewide hazardous waste survey to establish an information base.

In the short term this information base will serve to demonstrate the magnitude of the hazardous waste problem, document the need for legislation and regulation, and identify the hazardous waste sources and sinks which should be regulated. In the long term the information base will serve as an indicator of the effectiveness of a State's hazardous waste management program. A good survey will also help establish surveillance priorities and enforcement actions. A survey should therefore be designed to be a planning tool as well as a tool to coordinate State agency operations.

A comprehensive survey should include facilities which generate hazardous wastes, facilities which receive hazardous wastes for storage, treatment and final disposal, and the collectors and haulers who transport hazardous wastes. The objective of the survey is to establish a Statewide mass balance of hazardous wastes (i.e., the hazardous waste generated, plus the hazardous waste transported into the State should equal the hazardous waste which is disposed of within the State, plus the hazardous waste treated, plus the hazardous waste stored, plus the hazardous waste transported out of the State). If a comprehensive survey is made, a system of checks and balances will be established.

Surveying only one portion of the hazardous waste life cycle will not define the total problem. As an example, if a survey were to include only those landfill sites which accept hazardous wastes, the survey would miss hazardous wastes which are stored or disposed of at the generators' sites. In some cases this could be a substantial quantity of waste. Furthermore, some haulers could be dumping their loads along back roads or in sewers. A comprehensive survey would help highlight these problems.

Authority to Request Data

In a few States, legislation has been enacted to specifically regulate hazardous wastes. Pursuant to that legislation, formal reporting, registration, or permit systems are being implemented. The data from these systems can provide the information necessary for a hazardous waste survey. These systems generally require periodic reporting and therefore provide an automatic means to update the hazardous waste survey. In some other States the solid waste management legislation is broad enough to include wastes other than municipal solid wastes (i.e., hazardous wastes). In these cases, reporting, registration, or permit systems can also be used to gather data.

If existing waste management legislation is not broad enough to require information from generators, collectors and haulers, and disposal facilities, it may be possible to use information gathering authority provided in other legislation (e.g., air pollution control legislation or water pollution control legislation). States can and have required generators to provide hazardous waste information with their water discharge permit applications. This approach requires coordination with and the cooperation of other State environmental programs. Additionally, this approach may cause some hazardous waste generators (e.g., pesticide applicators) to be excluded from the survey because they are not considered a point source of air or water pollution. Even if other legal authority cannot be used, air emission inventories and water discharge permit applications are good lists of potential generators with which to begin a survey.

In situations where a response is mandatory, the data gathered should be fairly reliable and nearly complete. Many States, however, will not be able to use any existing information gathering authority to conduct a hazardous waste survey. In these cases, the States will need to rely upon the good faith of the industries which they are surveying. States which have conducted hazardous waste surveys by mail and without data gathering authority have received less than 50% response to their inquiries. Telephone follow-up to the mailings has increased the response to as much as 70%. Other States without data gathering authority have conducted on-site interviews with potential generators with a much higher success rate (greater than 90%). Therefore, the on-site interview is the best approach to assure maximum coverage of hazardous waste sources and also to minimize poor quality data. Even when industries respond, the reliability of the data may be suspect. Part of the problem is the reluctance of industry to provide data which eventually may be used to formulate regulations. The best

response to this problem is that it is far better to establish regulations using sound data than to establish regulations using inaccurate data.

Hazardous Waste Definition

Another part of the problem is that there is no single definition of "hazardous wastes," although the Office of Solid Waste Management Programs (OSWMP) of EPA is developing one, along with a model to determine which wastes are hazardous. The following definition can serve as a definition of hazardous waste in the interim: A hazardous waste is "any waste or combination of wastes which pose a substantial present or potential hazard to human health or living organisms because such wastes are non-degradable or persistent in nature, or because they can be lethal, or because they may otherwise cause or tend to cause detrimental cumulative effects."

Various agencies and organizations have used varying criteria to define hazardous substances. Appendix A is a list of seventeen criteria systems used to define hazardous substances and materials, a table showing the types of criteria used by each system, and a table showing example criteria. Appendix B is a partial list of substances which, if present in a waste stream, could cause a waste stream to be classified as hazardous. As mentioned earlier, the model or criteria to be used in determining what is hazardous are under development by OSWMP, but, for purposes of a State hazardous waste survey, all wastes which are "potentially" hazardous should be included. Hazardous wastes can be solid, liquid, or contained gases or any combination of the three including sludges and slurries. A waste stream is an air or water pollution problem only if it is emitted into the air or discharged into water. If it is destined for disposal on the land (burial or ponding), it is potentially a hazardous waste. The control of air and/or water pollutants often results in the creation of a hazardous waste problem (e.g., the disposal of metallic fines from a fabric filter and the disposal of a sludge from a water treatment process are potential hazardous waste problems).

Survey Procedure (On-Site)

Each facility which generates or receives a hazardous waste should be visited and operating personnel at each facility should be interviewed, if at all possible. Greater depth and increased accuracy of the information received and better response rates can be achieved by visiting each generator and disposal facility. Firsthand knowledge of hazardous waste problems gained during interviews will be of lasting benefit to the State hazardous waste program. There

will undoubtedly be a great deal of hesitation by many States to undertake a hazardous waste survey simply because such a survey would appear to quickly exhaust the resources of a fledgling hazardous waste management program. Most State environmental programs have field personnel (in regions or districts) who can assist in conducting a survey. These individuals, with minimal training, could conduct approximately 20 interviews per month. The key to this approach is that each individual who conducts an interview must receive basic training for the task. In addition to the basic training, interviewers should review the technical literature[2-5] before each interview to familiarize themselves with the types of processes and wastes which they are likely to encounter during the interview.

Before actually beginning interviews, the proper groundwork should be laid by identifying potential generators and disposal facilities, developing interview forms, and soliciting the cooperation of other organizations (e.g., trade associations, local health departments, other State agencies, etc.).

Each generator, disposal facility, etc., which is to be surveyed, should be contacted to make an appointment and to briefly discuss the reasons for making the survey. The location of the facility should be verified during the conversation.

Potential Generators

Several States have used Standard Industrial Classification (SIC) codes to identify groups of hazardous waste generators and have found them to be inadequate. (SIC codes are established by the Office of Management and Budget and are published in the Standard Industrial Classification Manual.[6]) The manual and codes do not identify individual facilities or potential generators. They are not as descriptive and inclusive as is necessary for a complete hazardous waste survey. The electroplating industry can be used to illustrate the problem. Approximately two-thirds of the electroplating shops in the United States are "captive shops" and are not listed under the SIC code for the electroplating industry. Therefore, if a hazardous waste survey of the electroplating industry focused only on those electroplating shops which could be identified by the SIC codes, many electroplating waste streams would be omitted.

Manufacturing directories, which may also be based on SIC codes, do identify specific facilities but do not include all of the industries which are potential generators of hazardous waste. Pesticide applicators, utilities (railroads, electric utilities, etc.), mining operations,

and Federal and State facilities are examples of potential generators which are not usually included in manufacturing directory listings. Manufacturing directories can also be out of date or incomplete. It is therefore recommended that other listings (e.g., air pollution emission inventories, water discharge permit applications, State Department of Agriculture listings, State Department of Labor listings, Occupational Safety and Health Administration listings, etc.) be reviewed to expand upon the basic SIC code and manufacturing directory listings. Addresses and telephone numbers for potential generators can be obtained from the aforementioned listings as well as from telephone directories and trade association directories.

The hazardous waste practices assessment studies for thirteen industries which are being conducted by OSWMP are planned for completion between early 1975 and early 1976 (Table 1). These industries were selected for study because previous studies indicated that they generate large quanities of potentially hazardous wastes.

The OSWMP studies include a characterization of the industries studied; a characterization of the wastes from each industry which pose a potential health or environmental hazard upon final disposal; a description of three levels of treatment and disposal technology for each potentially hazardous waste stream; and, a cost analysis of each of the three levels of treatment and disposal.

More specifically, the industry characterizations include general information about each industry such as plant location distribution (by State), the age distribution of plants, the size distribution of plants (by numbers of employees) and the products produced (see Tables 2 and 3 for examples). The waste characterizations will provide a schematic, quantitative process flow diagram and mass balance indicating raw materials, products and sources of wastes to air, water, and land for a typical plant (see Figure 1 for an example). The waste characterizations also include a detailed description of each potentially hazardous waste stream from a typical plant.

The three treatment and disposal technology levels which are discussed are: the level of technology currently employed by the typical plant; the best technology currently employed; and, the technology necessary to provide adequate health and environmental protection. The cost analysis for each of the levels of technology includes estimates of capital, operating, and energy costs for each of the potentially hazardous waste streams identified (see Tables 4 and 5 for examples). These studies, although extremely useful to States, will not obviate the need for States to

conduct their own surveys, since they do not provide specific information about individual generators, haulers, or disposal facilities.

The Survey Data Collection Guide

A survey data collection guide should be developed and used by all interviewers to insure that they are requesting and gathering similar data during their interviews. Development of the data collection guide is one of the keys to a successful survey because the types and format of the questions included in the guide will dictate the quantity, quality, and usefulness of the data which is gathered. An individual experienced in conducting surveys and designing survey forms should be consulted for this aspect of the program.

Data should be gathered for a base year (e.g., calendar year 1974), so the information will be on a comparable basis with respect to time. Appendix C is an outline of topics which are considered appropriate for an hazardous waste survey.

Much of the information described in Appendix C can be obtained from air pollution, water discharge permit applications, or other State records. If information is available from these or other sources, it should not be requested again in the survey interview. Some of the information may be considered confidential or proprietary, and therefore it will be difficult to obtain without adequate authority. The main objective of the survey is to learn about the life cycle of hazardous wastes. If specific information concerning hazardous wastes is not available, hazardous waste generation rates can be estimated by using waste generation factors. Waste generation factors usually require data relating to a facility's production capacity (e.g., 0.324 kg of waste per 1000 kg of product). Comparisons can also be made with similar facilities of known size, production capacity, and generation rates to estimate hazardous waste generation.

Various approaches can be taken in developing a data collection guide. Specific guides can be developed for each industry (i.e., electroplating, battery manufacturing, etc.) or a single survey guide can be developed to survey the various phases of the hazardous waste life-cycle (i.e., generation, transporation, treatment, disposal, etc.) The advantage of the latter type of guide is that it is not limited to a single industry (i.e., electroplating, etc.) Each State should tailor the data collection guide to its individual needs.

TABLE 1

OSWMP HAZARDOUS WASTE PRACTICES ASSESSMENT
STUDIES FOR THIRTEEN INDUSTRIES

Industry Name	SIC Code	Scheduled Completion
1. Metals mining	1020;1031; 1092;1094; 1099	Second Quarter 1975
2. Industrial inorganic chemicals	281	First Quarter 1975
3. Pharmaceuticals	283	Second Quarter 1975
4. Paint and allied products	285	Second Quarter 1975
5. Organic chemicals, pesticides and explosives	286;2879; 2892	Third Quarter 1975
6. Petroleum refining	291	First Quarter 1975
7. Primary metals	331;3321; 3322;3324;333; 3341;3399	Second Quarter 1975
8. Electroplating	3471	Second Quarter 1975
9. Primary and storage batteries	3691;3692	First Quarter 1975
10. Textile mill products	223;226	First Quarter 1976
11. Rubber and plastics	282;301;302; 303;304;306	First Quarter 1976
12. Leather tanning	331	First Quarter 1976
13. Machinery, except electrical	355;357	First Quarter 1976

TABLE 2
Product Category - 3691 Storage Batteries

REGION/STATE	TOTAL	PLANT SIZE							PLANT AGE				PROCESS TYPE		
		A	B	C	D	E	F	G	H	I	J	K	L	M	N
IV ALABAMA	2	1	0	1	0	0	0	0	1	1	0	0			
X ALASKA	1	1	0	0	0	0	0	0	0	1	0	0			
IX ARIZONA	1	1	0	0	0	0	0	0	0	1	0	0			
VI ARKANSAS	1	0	1	0	0	0	0	0	0	0	1	0			
IX CALIFORNIA	39	21	4	4	9	1	0	0	5	30	4	0			
VIII COLORADO	5	1	0	3	1	0	0	0	1	3	1	0			
I CONNECTICUT	3	2	0	0	1	0	0	0	0	2	1	0			
III DELAWARE	1	0	0	0	0	1	0	0	0	1	0	0			
IV FLORIDA	11	5	1	3	1	0	1	0	1	9	1	0			
IV GEORGIA	7	1	0	3	2	1	0	0	0	7	0	0			
IX HAWAII	0	0	0	0	0	0	0	0	0	0	0	0			
X IDAHO	0	0	0	0	0	0	0	0	0	0	0	0			
V ILLINOIS	10	4	1	1	2	2	0	0	2	6	2	0			
V INDIANA	8	2	1	0	2	3	0	0	0	7	1	0			
VII IOWA	4	2	1	1	0	0	0	0	1	3	0	0			
VII KANSAS	3	0	1	0	1	0	1	0	0	3	0	0			
IV KENTUCKY	4	3	0	0	0	0	1	0	2	2	0	0			
VI LOUISIANA	2	1	1	0	0	0	0	0	0	2	0	0			
I MAINE	0	0	0	0	0	0	0	0	0	0	0	0			
III MARYLAND	1	1	0	0	0	0	0	0	0	1	0	0			
I MASSACHUSETTS	6	2	1	3	0	0	0	0	1	3	2	0			
V MICHIGAN	8	6	0	1	0	1	0	0	1	4	3	0			
V MINNESOTA	5	2	1	0	1	1	0	0	0	5	0	0			
IV MISSISSIPPI	2	0	1	0	1	0	0	0	0	2	0	0			
VII MISSOURI	7	2	2	0	1	2	0	0	1	5	1	0			
VIII MONTANA	0	0	0	0	0	0	0	0	0	0	0	0			
VII NEBRASKA	2	1	0	1	0	0	0	0	1	1	0	0			
IX NEVADA	0	0	0	0	0	0	0	0	0	0	0	0			
I NEW HAMPSHIRE	0	0	0	0	0	0	0	0	0	0	0	0			
II NEW JERSEY	6	2	0	0	1	2	1	0	0	4	2	0			
VI NEW MEXICO	1	1	0	0	0	0	0	0	0	1	0	0			
II NEW YORK	4	4	1	0	1	0	0	0	2	4	0	0			
IV NORTH CAROLINA	3	0	1	0	1	1	0	0	0	2	0	1			
VIII NORTH DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0			
V OHIO	6	2	2	0	1	0	1	0	1	4	0	1			
VI OKLAHOMA	2	1	0	0	1	0	0	0	1	1	0	0			
X OREGON	9	4	1	2	2	0	0	0	1	8	0	0			
III PENNSYLVANIA	15	5	2	1	2	4	1	0	1	12	1	1			
I RHODE ISLAND	2	0	1	0	0	1	0	0	0	2	0	0			
IV SOUTH CAROLINA	2	0	0	0	1	1	0	0	0	2	0	0			
VIII SOUTH DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0			
IV TENNESSEE	6	4	0	0	2	0	0	0	0	6	0	0			
VI TEXAS	18	11	0	1	3	2	1	0	3	14	0	1			
VIII UTAH	0	0	0	0	0	0	0	0	0	0	0	0			
I VERMONT	1	0	0	0	0	1	0	0	0	1	0	0			
III VIRGINIA	2	0	0	0	2	0	0	0	0	2	0	0			
X WASHINGTON	3	3	0	0	0	0	0	0	1	2	0	0			
III WEST VIRGINIA	0	0	0	0	0	0	0	0	0	0	0	0			
V WISCONSIN	4	2	0	1	0	0	1	0	0	2	1	1			
VIII WYOMING	0	0	0	0	0	0	0	0	0	0	0	0			
TOTAL US	219	98	24	26	39	24	8	0	27	166	21	5	202	10	8

KEY FOR SIZES

A	LESS THAN	20	
B	BETWEEN	20 and	50
C	BETWEEN	50 and	100
D	BETWEEN	100 and	250
E	BETWEEN	250 and	500
F	BETWEEN	500 and	1000
G	GREATER THAN	1000	

KEY FOR AGES

H	LESS THAN	5	
I	BETWEEN	5 and	30
J	BETWEEN	30 and	50
K	GREATER THAN	50	

KEY FOR PROCESSES & PRODUCTION

L	LEAD ACID
M	NICKEL CADMIUM
N	OTHER

A STATE BY STATE LISTING OF PROCESS TYPES CANNOT BE GIVEN TO AVOID DISCLOSURE OF INDIVIDUAL PLANTS

REGION	TOTAL	PLANT SIZE							PLANT AGE				PROCESS TYPE		
		A	B	C	D	E	F	G	H	I	J	K	L	M	N
REGION 1	12	4	2	3	1	2	0	0	1	8	3	0			
REGION 2	12	6	1	0	2	2	1	0	2	8	2	0			
REGION 3	19	6	2	1	4	5	1	0	1	16	1	1			
REGION 4	37	14	3	7	8	3	2	0	4	31	1	1			
REGION 5	41	18	5	3	6	7	2	0	4	28	7	2			
REGION 6	24	14	2	1	4	2	1	0	4	18	1	1			
REGION 7	16	5	4	2	2	2	1	0	3	12	1	0			
REGION 8	5	1	0	3	1	0	0	0	1	3	1	0			
REGION 9	40	22	4	4	9	1	0	0	5	31	4	0			
REGION 10	13	8	1	2	2	0	0	0	2	11	0	0			
TOTAL US	219	98	24	26	39	24	8	0	27	166	21	5	202	10	8

A REGIONAL LISTING OF PROCESS TYPES CANNOT BE GIVEN TO AVOID DISCLOSURE OF INDIVIDUAL PLANTS

TABLE 3

SIC 3691, DISTRIBUTION OF ANNUAL PRODUCTION, LEAD-ACID, NICKEL-CADMIUM AND OTHER (1972, Production in Metric Tons)

REGION/STATE	Lead Acid	Nickel-Cadmium	Other
IV Alabama	10,848	0	0
X Alaska	537	0	0
IX Arizona	534	0	0
VI Arkansas	1,740	0	0
IX California	150,622	0	11.4
VIII Colorado	1,407	Combined with Iowa	90.8
I Connecticut	9,666	0	0
III Delaware	17,798	0	0
IV Florida	22,682	Combined with Texas	59
IV Georgia	46,206	0	0
IX Hawaii	0	0	0
X Idaho	0	0	0
V Illinois	67,086	0	0
V Indiana	97,702	0	0
VII Iowa	5,499	283.3	0
VII Kansas	35,037	0	0
IV Kentucky	31,776	0	0
VI Louisiana	2,277	0	0
I Maine	0	0	0
III Maryland	535	0	0
I Massachusetts	9,257	Combined with N.J. & N.Y.	0
V Michigan	49,042	0	0
V Minnesota	21,611	Combined with Ohio	0
IV Mississippi	10,333	0	0
VII Missouri	13,146	0	0
VIII Montana	0	0	0
VII Nebraska	3,759	0	0
IX Nevada	0	0	0
I New Hampshire	0	0	0
II New Jersey	64,447	Combined with Mass. & N.Y.	0
VI New Mexico	[illegible]	[illegible]	[illegible]
II New York	3,887	646.9	0
IV North Carolina	14,477	0	99.9
VIII North Dakota	0	0	0
V Ohio	11,943	1,161.8	0
VI Oklahoma	9,129	0	0
X Oregon	25,610	0	11.4
III Pennsylvania	133,124	0	4.5
I Rhode Island	1,740	0	32.7
IV South Carolina	30,075	0	0
VIII South Dakota	0	0	0
IV Tennessee	19,332	0	0
VI Texas	93,191	1,913.6	0
VIII Utah	0	0	0
I Vermont	18,282	0	0
III Virginia	17,185	0	0
X Washington	1,610	0	0
III West Virginia	0	0	0
V Wisconsin	21,936	0	0
VIII Wyoming	0	0	0
TOTAL	1,081,187	4,005.6	309.7
Region I	38,945	Combined with Region II	32.7
II	68,334	646.9	0
III	168,645	0	4.5
IV	185,730	Combined with Region VI	158.9
V	269,320	1,161.8	0
VI	106,874	1,913.6	0
VII	57,441	Combined with Region VIII	0
VIII	6,981	283.3	90.9
IX	151,159	0	11.4
X	27,757	0	0

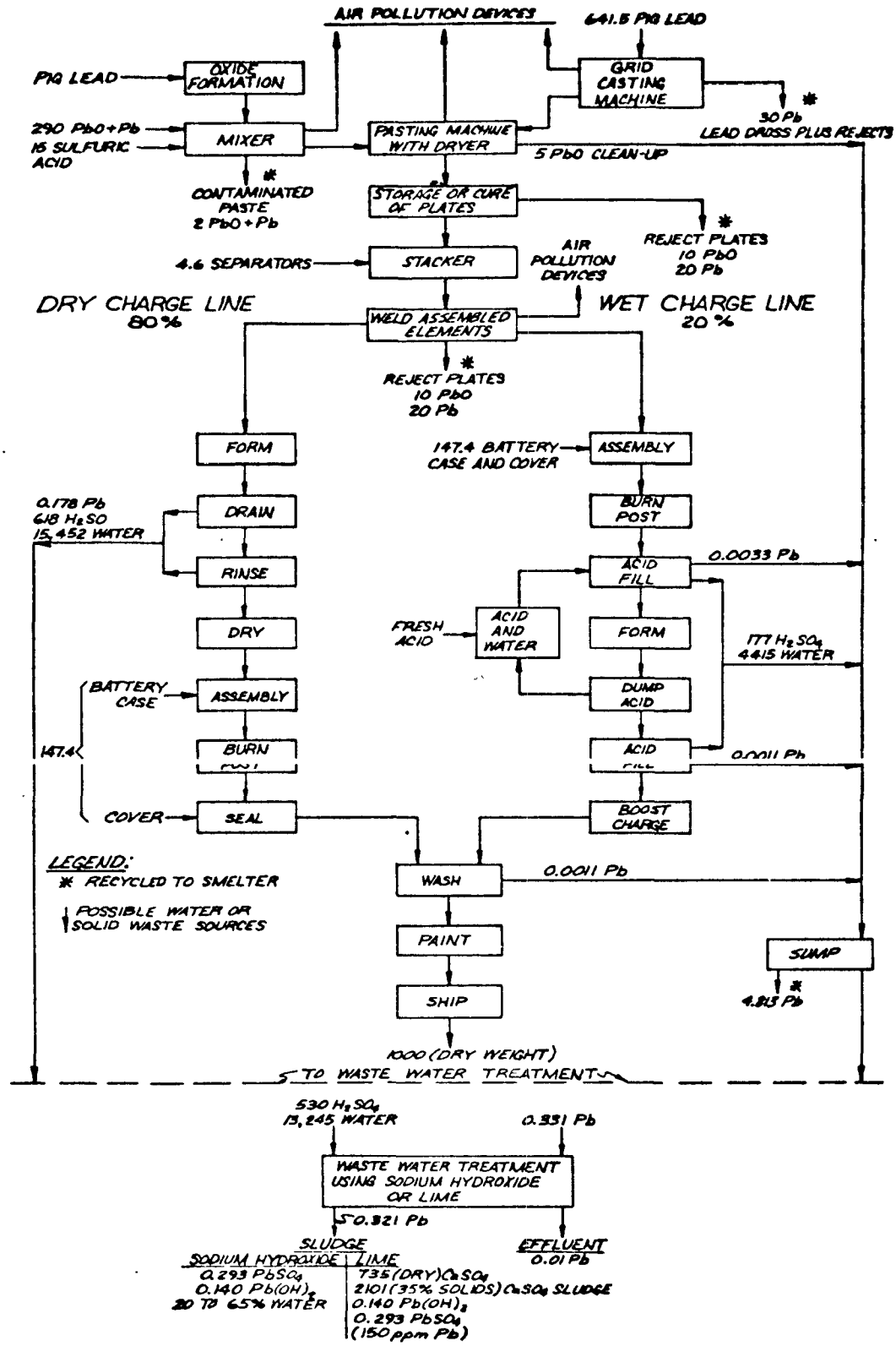

FIGURE 1 Major Production Operations in Lead-Acid Storage Battery Manufacture

TABLE 4 Lead Acid Battery Typical Plant Costs
For Treatment and Disposal

	Production Rate	Location	Process
Typical Plant:	8,200 kkg/yr	Eastern U.S.	Dry and Wet Charge

Identification of Waste Stream:	Composition	Form	Amount to Treatment/Disposal
Lime Wastewater Treatment Sludge	Calcium Sulfate Water 150 ppm Lead	Sludge (35% Solids)	2,100 kg/kkg product or 17,290 kkg/year

	Dollars (1973)			
T/D Level	Level I	Level II	Level III	
Technology	1	1	1	2
Investment Costs:				
Land	1,770	1,770	1,770	1,770
Other	19,750	100,000	19,750	29,750
Total Investment	21,520	101,770	21,520	31,520
Annual Costs:				
Cost of Capital	5,210	21,480	5,210	7,200
Operating Costs	18,460	18,860	18,460	28,460
Energy & Power	1,000	1,000	1,000	1,000
Contractor			66,778	
Total Annual Costs	26,840	43,110	91,448	36,660
Cost/kkg of product	3.27	5.26	11.15	4.47
Cost/kkg of waste	1.55	2.49	5.29	2.12

Treatment/Disposal Technology

- Level I — Simple land storage (On-site)
- Level II — Land storage with leachate collection and treatment (On-site)
- Level III(1) — Chemical fixation and landfill (Cost assumed to be $3.86/kkg for fixation.)
- Level III(2) — Approved landfill.

TABLE 5 Lead Acid Battery Typical Plant Costs
For Treatment and Disposal

	Production Rate	Location	Process
Typical Plant:	8,200 kkg/yr	Eastern U.S.	Dry and Wet Charge

Identification of Waste Stream:	Composition	Form	Amount to Treatment/Disposal
Caustic Soda Waste-water Treatment Sludge	Lead Hydroxide Lead Sulfate, and Water	Sludge (80% Solids)	0.5 kg/kkg product or 4.46 kkg/yr

Dollars (1973)

T/D Level	Level I		Level II		Level III	
Technology	1	2	1	2	1	2
Investment Costs:						
Land						
Other	1,000					
Total Investment	1,000	0	0	0	0	0
Annual Costs:						
Cost of Capital	200					
Operating Costs	1,000					
Energy & Power	200					
Contractor		<500	<500		1,000	
Total Annual Costs	1,400	<500	<500	0	1,000	0
Cost/kkg of product	0.17	<0.10	<0.10	0	0.12	0
Cost/kkg of waste	314	<112	<112	0	224	0

Treatment/Disposal Technology

- Level I(1) — Simple landfill (On-site)
- Level I(2) — Simple landfill (Off-site contractor)
- Level II(1) — Simple landfill (Off-site)
- Level II(2) — Reclaim of lead
- Level III(1) — Secured landfill (Based on outside contractor costs)
- Level III(2) — Reclaim of lead

Data Storage, Handling, and Display

The data gathered during the survey should be reviewed for completeness and accuracy and then stored so that it is readily available and usable. The data will probably first be used to produce a survey report describing hazardous waste management practices in the State. Topics which would probably be of interest for a hazardous waste survey report include the types, quantities, and distribution of hazardous wastes within the State; the types, numbers, capacities, and distribution of treatment and disposal facilities which handle hazardous wastes in the State; and the flow of hazardous wastes into and out of the State. In order to standardize hazardous waste reporting, quantities of hazardous waste should be reported on a dry weight basis. An estimate of the weight of the water portion of hazardous waste should also be given. Projections of future hazardous waste generation based on growth projections for the State's population and industry are also appropriate. Appendix D is a partial list of States and other jurisdictions which have completed hazardous waste surveys and have published reports.

The hazardous waste survey will probably be subject to refinement as the hazardous waste management program matures. As an example, if a permit or registration system is implemented, hazardous waste generation and disposal data should become more readily available and more accurate. From time to time it will probably be necessary to produce new or supplementary survey reports to describe the status of the program. The data storage and handling system should be flexible to permit the development of summary reports, to track the progress of the overall program, and to track the progress of individual facilities.

Some States may wish to use existing automatic data processing resources to store and manipulate the data gathered during the survey. Many States, however, will not have the necessary resources to develop a computerized data retrieval system and will prefer to use a manual storage system. These States should design data collection guides which will allow for conversion to automated data processing systems in the future. Either approach is sufficient, as long as the objectives of the program and the survey are satisfied.

The data gathered from hazardous waste sources and sinks will probably be in English units. The data should be converted to metric units and used and stored in that form to conform with the national trend to convert to the metric system. Appendix F is a table of conversion factors to assist in the conversion to metric units.

Other Topics

The cost of a hazardous waste survey will vary from State to State depending upon a number of factors. Some of those factors include the number of potential waste sources and sinks, the complexity of the sources and sinks, and the amount of travel required to obtain data. OSWMP estimates that it will cost the typical State $100 per generator plant site, treatment site, or disposal site to gather and store hazardous waste data and to publish a survey report. This cost includes supervision, clerical, printing costs and other overhead costs as well as the actual data gathering costs.

Most medium to large companies require visitors to sign releases from responsibility in the event of injury to the visitor. State employees should make inquiries to determine if it is their State's policy to permit employees to sign such releases. The Attorney General's office is usually responsible for questions of this nature and should be contacted before visits are initiated.

Most companies will provide required safety equipment (e.g., safety shoes, safety glasses, hard hat, etc.) for plant tours by visitors. State employees should, however, obtain and be prepared to use their own safety equipment when making plant inspections.

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3. Trade directories of the world. Queens Village, New York, Croner Publications, Inc., 1971. 1 v. (loose-leaf).

Appendix A: Criteria Systems for Defining Hazardous Substances and Materials

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3. Hazardous substances; definitions and procedural and interpretive regulations. Code of Federal Regulations, Title 21 (Food and Drugs), Pt. 191: 10-59, 1973.

4. (a) Public Health Service Drinking Water Standards; revised 1962. Public Health Service Publication No. 956. Washington, U.S. Government Printing Office, 1969. 61 p.

   (b) Drinking water standards; prepared by the EPA Advisory Committee on the Revision and Application of the Drinking Water Standards as recommended to the Administrator, Environmental Protection Agency. Washington, U.S. Environmental Protection Agency, Sept. 20, 1973. 28 p., app. (Unpublished report.)

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TABLE 6

SUMMARY OF CRITERIA FOR
HAZARDOUS SUBSTANCE CLASSIFICATION SYSTEMS

System	Criteria											
	Toxicological	Flammability	Explosive	Corrosive	Reactivity	Oxidizing material	Radioactive	Irritant	Strong sensitizer	Bioconcentration	Carcinogenic, mutagenic, or teratogenic	Sufficient quantity
Department of the Army	X											
Department of the Navy	X	X	X	X	X	X	X					
FDA - Title 21, CFR, Part 191	X	X		X			X	X	X			X
Drinking Water Standards	X									X	X	
FWPCA - Sec. 307 (a)	X									X	X	X
FWPCA - Sec. 311	X											X
Clean Air Act - Sec. 112	X							X			X	
Ocean Dumping - Title 40, CFR, Part 227	X									X	X	X
DOT - Title 49, CFR, Parts 100-199	X	X	X	X		X	X	X				X
State of California List	X	X	X	X				X	X			
National Academy of Sciences	X	X			X							
Booz-Allen Applied Research, Inc.	X	X	X		X							X
Battelle Memorial Institute	X	X	X		X	X	X	X		X	X	
TRW Systems Group	X	X	X	X			X			X		X
NIOSH - Toxic Substances List	X										X	
Pesticides - Title 40, CFR, Part 162	X	X								X	X	

TABLE 7

ACUTE TOXICITY AND FLAMMABILITY CRITERIA

	HIGHLY TOXIC SUBSTANCES†						FLAMMABILITY‡			
SYSTEM	ORAL LD_{50} mg/kg	INHALATION LC_{50} (dust or mist) micrograms per liter	INHALATION LC_{50} (gas or vapor) ppm	DERMAL LD_{50} mg/kg	AQUATIC LIFE LC_{50} mg/l	AQUATIC FLORA IL_m ppm	EXTREMELY Flammable	HIGHLY FLAMMABLE	FLAMMABLE	COMBUSTIBLE
Title 15, USC., Sec. 1261	50	2,000	200	200			$F_p \leq 20°F$		$20°F < F_p \leq 80°F$	$80°F < F_p \leq 150°F$
FDA-Title 21, CFR, Part 191	50	2,000	200	200			$F_p \leq 20°F$		$20°F < F_p \leq 80°F$	
DOT Title 49, CFR, Parts 100-199	50	2,000	200	200					$F_p \leq 100°F$	$100°F < F_p \leq 200°F$
Pesticides-Title 40, CFR, Part 162	50	2,000	200	200			$F_p \leq 20°F$*		$20°F < F_p \leq 80°F$*	
NIOSH-Toxic Substances List	5,000**	2,000**		2,800*						
FWPCA-Sec. 307(a)***	50	2,000	200	200	10					
Sec. 311(b)(2)(A)	50	2,000	200	200	500	100				
California State List	50	2,000	200	200			$F_p \leq 20°F$		$20°F < F_p \leq 80°F$	
National Academy of Sciences	5 to 50		50 to 200	20 to 200	1		$F_p \leq 100°F$ $B_p \leq 100°F$	$F_p \leq 100°F$ $B_p > 100°F$		
Battelle Memorial Institute	50	2,000	200	200	1,000	1,000	$F_p < 73°F$ $B_p \leq 100°F$			
Booz-Allen Applied Research, Inc.	50	5,000(man) 2,000(ecology)			100		$F_p < 100°F$ $B_p < 100°F$			

†Oral LD_{50}, Inhalation LC_{50}, Dermal LD_{50} are defined in Federal Hazardous Substances Labeling Act section; aquatic life LC_{50} and aquatic flora IL_m are defined in sections dealing with Sec. 307(a) and Sec. 311(b)(2)(A) of FWPCA, respectively. Unless otherwise indicated, substances having toxicities less than or equal to the amount indicated are classified as highly toxic

‡F_p: flash point; B_p: boiling point

*Proposed standard

**LCLo, LC_{50}, LDLo, or LD_{50}: no time limit for tests given, see NIOSH section.

***Currently under revision.

Appendix B: An Example List of Hazardous Substances*

This list of substances was issued as an advanced notice of proposed rulemaking under authority of section 311 and section 501 of the Federal Water Pollution Control Act as amended (33 U.S.C. 1251 et seq.).* Its inclusion is for illustrative purposes only and does not necessarily represent endorsement or approval by OSWMP for use in determining those wastes which are hazardous.

acetaldehyde
acetic acid
acetic anhydride
acetone cyanodrin
actyl bromide
actyl chloride
acrolein
acrylonitrile
adiponitrile
aldrin
allyl alcohol
allyl chloride
aluminum sulfate
ammonia
ammonium acetate
ammonium benzoate
ammonium bicarbonate
ammonium bisulfite
ammonium bromide
ammonium carbamate
ammonium carbonate
ammonium chloride
ammonium citrate, dibasic
ammonium ferrocyanide
ammonium fluoborate
ammonium formate
ammonium gluconate
ammonium hydroxide
ammonium hypophosphite
ammonium iodide
ammonium molybdate
ammonium nitrate
ammonium oxalate
ammonium pentaborate
ammonium persulfate
ammonium silicofluoride
ammonium sulfamate
ammonium sulfate
ammonium sulfide
ammonium sulfite
ammonium tartrate
ammonium thiocyanate
ammonium thiosulfate
amyl acetate
aniline
antimony pentachloride
antimony pentafluoride
antimony potassium tartrate
antimony tribromide
antimony trichloride
antimony trifluoride
antimony triiodide
antimony trioxide
arsenic acid
arsenic disulfide
arsenic pentaoxide
arsenic tribromide
arsenic trichloride
arsenic trifluoride
arsenic triiodide
arsenic trioxide
arsenic trisulfide
cacodylic acid
calcium arsenate
calcium arsenite
potassium arsenate
potassium arsenite
sodium arsenate
sodium arsenite
sodium cacodylate
benzene
benzoic acid
benzonitrile
benzoyl chloride
benzyl chloride
beryllium chloride
beryllium fluoride
beryllium hydroxide
beryllium nitrate
beryllium phosphate
beryllium sulfate
boric acid
brucine
butyl acetate
butylamine
butyric acid
cadmium acetate
cadmium bromide
cadmium chloride
cadmium fluoborate
cadmium nitrate
cadmium sulfate
calcium carbide
calcium hydroxide
calcium hypochlorite
calcium oxide
captan
carbaryl
carbon disulfide
catechol
chlordane
chlorine
chlorobenzene
chloroform
chlorosulfonic acid
ammonium bichromate
ammonium chromate
calcium chromate
chromic acetate

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* Source: Hazardous substances-spills, Sec. 311, Federal Water Pollution Control Act Amendments of 1972 (FWPCA). Federal Register, 39(164):30466-30471, Aug. 22, 1974.

chromic acid
chromic sulfate
chromous carbonate
chromous chloride
chromous oxalate
chromyl chloride
lithium bichromate
lithium chromate
potassium bichromate
potassium chromate
sodium bichromate
sodium chromate
strontium chromate
zinc bichromate
cobaltous acetate
cobaltous bromide
cobaltous chloride
cobaltous citrate
cobaltous fluoride
cobaltous formate
cobaltous iodide
cobaltous nitrate
cobaltous perchlorate
cobaltous succinate
cobaltous sulfamate
cobaltous sulfate
cupric acetate
cupric acetoarsenite
cupric acetylacetonate
cupric bromide
cupric chloride
cupric formate
cupric gluconate
cupric glycinate
cupric lactate
cupric nitrate
cupric oxalate
cupric subacetate
cupric sulfate
cupric sulfate, ammoniated
cupric tartrate
cuprous bromide
cuprous iodide
coumaphos
cresol
barium cyanide
calcium cyanide
hydrogen cyanide
potassium cyanide
sodium cyanide
zinc cyanide
cyanogen chloride
cyclohexane
2,4-D (acid)
2,4-D (ester)
dalapon
DDT
diazinon
dicamba
dichlobenil
dichlone
dichlorvos
dieldrin
diethylamine
dimethylamine
dinitrobenzene
dinitrophenol
diquat
disulfoton
diuron
dodecylbenzenesulfonic acid
dodecylbenzenesulfonic acid, calcium salt
dodecylbenzenesulfonic acid, isopropanolamine salt
dodecylbenzenesulfonic acid, sodium salt
dodecylbenzenesulfonic acid, triethanolamine salt
Dursban
endosulfan
endrin
thion
ethylbenzene
ethylenediamine-tetraacetic acid
aluminum fluoride
ammonium bifluoride
ammonium fluoride
hydrofluoric acid
lithium fluoride
phosphorus pentafluoride
sodium bifluoride
sodium fluoride
stannous fluoride
formaldehyde
formic acid
fumaric acid
furfural
guthion
heptachlor
hydrochloric acid
hydroquinone
hydroxylamine
ferric ammonium citrate
ferric ammonium oxalate
ferric chloride
ferric fluoride
ferric glycerophosphate
ferric nitrate
ferric phosphate
ferric sulfate
ferrous ammonium sulfate
ferrous chloride
ferrous oxalate
ferrous sulfate
isoprene
kelthane
lead acetate
lead arsenate
lead bromide
lead chloride
lead fluoborate
lead fluoride
lead iodide
lead nitrate
lead stearate
lead sulfate
lead sulfide
lead tetraacetate
lead thiocyanate
lead thiosulfate
lead tungstate
lindane
malathion
maleic acid
maleic anhydride
mercuric acetate
mercuric chloride

mercuric cyanide
mercuric iodide
mercuric nitrate
mercuric oxide
mercuric sulfate
mercuric thiocyanate
mercurous chloride
mercurous iodide
mercurous nitrate
methoxychlor
methyl mercaptan
methyl methacrylate
methyl parathion
mevinphos
molybdic trioxide
monoethylamine
monomethylamine
naled
naphthalene
naphthenic acid
nickel acetate
nickel ammonium sulfate
nickel bromide
nickel chloride
nickel fluoride
nickel formate
nickel hydroxide
nickel iodide
nickel nitrate
nickel perchlorate
nickel sulfate
nitric acid
nitrobenzene
nitrogen dioxide
nitrophenol
paraformaldehyde
parathion
pentachlorophenol
phenol
phosgene
phosphoric acid
phosphorus
phosphorus oxychloride
phosphorus pentasulfide
phosphorus trichloride
polychlorinated biphenyls
potassium hydroxide
potassium permanganate
propionic acid
propionic anhydride
propyl alcohol
Pyrethrins
pyrogallic acid
quinoline
resorcinol
selenic acid
selenium oxide
sodium selenite
sodium
sodium bisulfite
sodium borate
sodium hydrosulfide
sodium hydroxide
sodium hypochlorite
sodium methylate
sodium nitrite
sodium phosphate, dibasic
sodium phosphate, monobasic
sodium phosphate, tribasic
sodium silicate
sodium sulfide
strychnine
styrene
sulfuric acid
sulfuric monochloride
2,4,5-T (acid)
2,4,5-T (esters)
tannic acid
TDE
tetraethyl lead
tetraethyl pyrophosphate
toluene
toxaphene
trichlorfon
trichlorophenol
triethylamine
trimethylamine
uranium peroxide
uranyl acetate
uranyl nitrate
uranyl sulfate
vanadium oxytrichloride
vanadium pentoxide
vanadyl sulfate
vinyl acetate
xylene
xylenol
Zectran
zinc acetate
zinc ammonium chloride
zinc ammonium sulfate
zinc borate
zinc bromide
zinc carbonate
zinc chloride
zinc fluoride
zinc formate
zinc hydrosulfite
zinc nitrate
zinc permanganate
zinc phenolsulfonate
zinc phosphide
zinc potassium chromate
zinc propionate
zinc silicofluoride
zinc sulfate
zinc sulfate, monohydrate
zirconium acetate
zirconium ammonium fluoride
zirconium potassium fluoride
zircomium nitrate
zirconium oxychloride
zirconium sulfate
zirconium tetrachloride

Appendix C: Suggested Information to be Included in a Hazardous Waste Survey

I. General information (to be obtained for each facility).

A. The facility name, location, and owner.

B. The facility's mailing address.

C. The name and telephone number of the individual authorized to answer questions concerning the hazardous waste survey.

D. The name and telephone number of the individual responsible for the facility.

E. Time period for which data is representative (e.g., calendar year 1974).

F. SIC group name and four digit number.

1. Primary

2. Secondary

G. Number of employees and facility area (i.e., square feet).

H. A plat of the facility showing the location of on-site process waste storage, treatment, and disposal sites.

II. Waste characterization (applicable to generator, treatment, and incinerator facilities).

A. The types of process waste generated by specific processes.

B. The quantities (weight and volume basis) of process wastes generated in terms of an annual rate, an average hourly rate, and a maximum hourly rate. (In some cases hourly rates may be impossible to obtain or meaningless. The best alternative should be substituted.)

C. The composition (on a weight basis) of each process waste stream including "inerts" and hazardous constituents.

D. The process and quantity of products associated with each process waste stream.

E. Flow diagrams of each process showing product and waste streams (if available).

III. Storage methodology (applicable to generators, treatment, and disposal facilities and collectors and haulers).

A. Types and quantities of process waste stored.

B. Frequency of transfer from the storage area.

C. Methods used to store process waste (i.e., steel drums on pallets, railroad tank cars, stationary storage tanks, lagoons, etc.).

D. Methods used to transfer process waste to and from storage.

E. Procedures which have been implemented to prevent emergency situations.

F. Plans which have been prepared in the event of emergency situations.

IV. Transportation methodology (applicable to generator, storage, and treatment facilities and collectors and haulers).

A. Types and quantities (weight and volume basis) of process waste transported.

B. Destination of process wastes (i.e., landfill, dump, treatment facility, incinerator, sewer, roadside ditch, etc.).

C. Identify any special handling procedures.

D. Plans which have been prepared in the event of emergency situations (i.e, spillage clean-up procedures, accident procedures, etc.).

V. Treatment methodology (applicable to generator and treatment facilities).

A. Types and quantities of process waste treated.

B. Composition of process waste treated.

C. Chemical analysis capabilities.

D. Treatment methods and processes description (i.e., volume reduction, neutralization, detoxification, physio-chemical encapsulation, etc.).

E. Equipment used to Treat Wastes (i.e., setting tanks, filters, separators, etc.

F. Product and waste streams after treatment (see II. Waste characterization).

VI. Disposal methodology (applicable to generator, treatment, and disposal facilities).

A. Types, composition (weight basis) and quantity (weight and volume basis) of process wastes handled.

B. Land disposal.

1. Type of disposal (i.e., landfill, dump, lagoon, pond, etc.).

2. Design specifications.

a. Liner type (i.e., concrete, asphalt, clay, etc.) and thickness.

b. Leachate collection capability.

c. Depth of landfill, pond, dump, etc., and the distance from the surface to the water table.

d. Land site security (i.e. fences, warning signs, etc.).

3. Operating procedures.

a. Leachate collection and treatment procedures.

b. Number of wells used to monitor the groundwater.

c. Types of analysis performed on leachate and ground water samples.

d. Methods of burial (i.e., mixing hazardous waste with other wastes, containerization, etc.).

e. Methods used to identify and mark the location of hazardous wastes.

C. Incineration.

1. Types and rated capacity of incinerator.

2. Type and quantity of auxiliary fuel used.

3. Design specifications.

a. Burning temperatures.

b. Dwell-time of waste in incinerator.

c. Status of current air pollution permit.

4. Operating procedures.

a. Residue disposal practices.

b. Storage practices prior to burning.

D. Other disposal methods.

1. Ocean dumping.

2. Sale to reclaimer.

3. Well injection.

DATA COLLECTION GUIDE
FOR AN
INDUSTRIAL WASTE SURVEY

A. General information (to be obtained from each facility).

Facility name _____

Facility location _____

_____

Facility owner _____

Facility mailing address _____

_____

Facility manager _____ Telephone no. _____

Facility contact _____ Telephone no. _____

SIC group name and four digit number. Primary _____

Secondary _____

Time period for which data is representative _____

Number of employees _____ Facility area _____

Either obtain a plat of the facility showing the location of on-site process waste storage, treatment, and disposal from the facility personnel or sketch a diagram of the facility on the back of this page.

B. Waste characterization (applicable to generator, treatment, and incinerator facilities).

Process waste			
Process origin			
Quantity of waste			
Annual rate			
Average hourly rate			
Maximum hourly rate			
Waste stream composition (weight basis)			
Process products			
Quantity			

Attach flow diagrams of each process showing product and waste streams, if available.

C. Storage methodology (applicable to generators, treatment and disposal facilities, and collectors and haulers).

Process wastes stored			
Quantity			
Type of storage			
Frequency of transfer to the storage area			
Frequency of transfer from the storage area			
Methods of transfer to and from storage			
Safety procedures			
Emergency plans			

D. Transportation methodology (applicable to generator, storage, and treatment facilities and collectors and haulers).

Wastes transported			
Quantity			
Destination			
Waste composition			
Special handling procedures			
Emergency plans			

E. Treatment methodology (applicable to generator and treatment facilities).

Wastes treated			
Quantity			
Composition of wastes treated			
Treatment methods			
Equipment used to treat wastes			
Products			

Describe the wastes from the treatment facility using the waste characterization portion of the guide.

F. Disposal methodology (applicable to generator, treatment, and disposal facilities).

Land disposal

Waste			
Quantity			
Composition			
Type of disposal			
Liner type			
Thickness			
Leachate collection			
Depth of facility			
Distance to ground water			
Site security			
Leachate treatment			
Burial methods			
Types of leachate analysis			

Describe methods used to identify and mark the location of hazardous wastes.

F. Disposal methodology (continued)

Incineration

Wastes			
Quantity			
Composition			
Type of incinerator			
Rated capacity			
Auxiliary fuel used			
Quantity			
Design specifications			
Temperature			
Dwell-time			
Air pollution controls			
Air pollution permits			
Residue disposal			
Waste storage prior to incineration			

F. Desposal methodology (continued)

Other disposal methods

Wastes Quantity			
Ocean dumping			
Reclaimer			
Well injection			
Other			

Appendix D: Partial List of Published State Hazardous Waste Survey Reports

1. Hazardous waste disposal survey, 1974. California State Department of Public Health, Jan. 1972. 69 p.

2. Idaho solid waste management industrial survey report. Idaho Department of Environmental and Community Services, June 1973. 71 p., app.

3. Barr Engineering Company. Hazardous waste generation Twin Cities metropolitan area. Minneapolis, Metropolitan Inter-County Council, Minnesota Pollution Control Agency, (Oct. 1973). 1 v. (various pagings).

4. Hazardous waste management planning, 1972-73. State of Oregon, Department of Environmental Quality, Mar. 1974. 43 p., app.

5. A report on industrial and hazardous wastes. State of Washington, Department of Ecology, Dec. 1974. 90 p.

Appendix E: Checklist for an Industrial Waste Survey

I. Pre-survey.

A. Determine the type of authority, if any, which will be used to require a response.

B. Develop a data collection guide.

C. Obtain the cooperation of other State agencies, local agencies, trade associations, etc.

1. Existing permit applications.

2. Review other data.

D. Train survey personnel.

1. Procedures.

2. Process waste information and data sources.

3. Data collection guide.

E. Identify and list potential generators, haulers, treatment facilities, and disposal sites.

1. List by size

2. List by geographic distribution (e.g., counties).

F. Obtain existing information from other agencies.

II. Survey.

A. Call the sources and sinks for an appointment and to explain the purpose of the visit.

B. Review process information from the literature.

C. Interview source and sink personnel to obtain additional information and to verify existing data.

D. Request waste stream sampling data.

E. Return completed data collection guide to the central office for compilation.

III. Post-survey.

A. Check data collection guides for completeness and accuracy.

1. Complete industrial waste generation data using waste generation factors.

2. Compare with similar facilities and use "engineering judgement."

B. Tabulate quantities of wastes by waste type (i.e., chlorinated hydrocarbons, etc.) and geographic distribution.

C. Tabulate quantities of wastes by industry type (i.e., refining steel making, etc.) and geographic distribution.

D. Store raw data for future analysis and use.

Appendix F: English to Metric Conversion Table

Multiply English Units	by	to Obtain Metric Units
acres	0.405	hectares
acre-feet	1,233.5	cubic meters
British Thermal Unit	0.252	kilogram-calories
British Thermal Unit/pound	0.555	kilogram-calories/kilogram
cubic feet/minute	0.028	cubic meters/minute
cubic feet/second	1.7	cubic meters/minute
cubic feet	28.32	liters
cubic inches	16.39	cubic centimeters
degree Fahrenheit	0.555(^{o}F-32)	degree Centigrade
feet	0.3048	meters
gallon	3.785	liters
gallon/minute	0.0631	liters/second
horsepower	0.7457	killowatts
inches	2.54	centimeters
inches of mercury	0.3342	atmospheres
pounds	0.454	kilograms
million gallons/day	3,785	cubic meters/day
mile	1.609	kilometers
pounds/square inch gauge	(0.06805 psig +1)(1.0) *	atmospheres
square feet	0.0929	square meters
square inches	6.452	square centimeters
tons (short)	0.907	metric tons
yard	0.914	meters

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