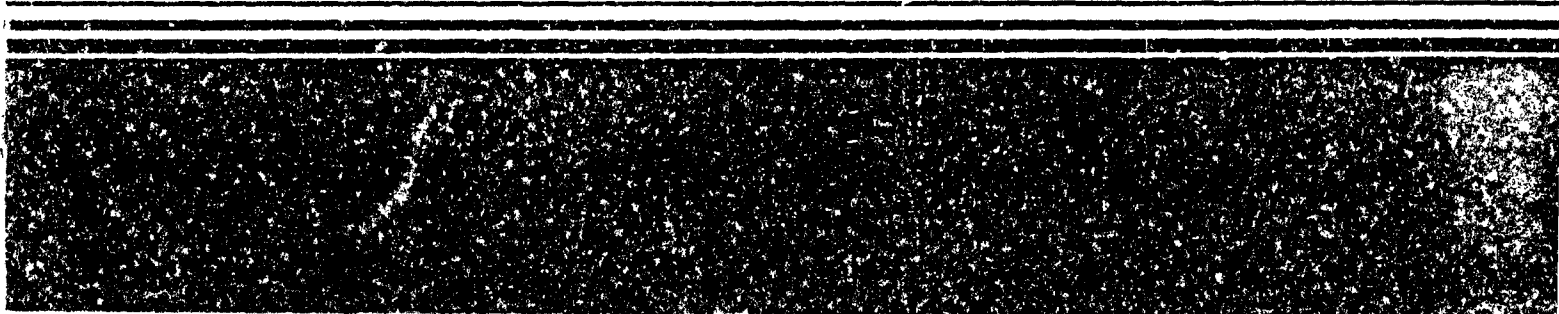

Solid Waste



Petitions to Delist Hazardous Wastes

A Guidance Manual



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PETITIONS TO DELIST HAZARDOUS WASTES:
A GUIDANCE MANUAL

April 1985

Prepared for:

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Office of Solid Waste and Emergency Response
U.S. Environmental Protection Agency

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1.0 INTRODUCTION

1.1 Purpose of This Manual

Under Part 261 of the hazardous waste regulations, the Environmental Protection Agency has listed approximately 90 industrial waste streams as hazardous.* These wastes were listed because they typically and frequently exhibit one or more of the characteristics of hazardous wastes, or they typically and frequently contain certain specific constituents that are known to be toxic or otherwise hazardous at levels of regulatory concern. A waste stream from any facility which qualifies as one of the streams listed in Subpart D of the regulations is regulated as hazardous; the Agency does not need to show for any particular plant that the hazardous constituents are actually present.

EPA has recognized, however, that a listed waste from a particular facility may not actually be hazardous. This could be the case if the waste (a) does not exhibit the characteristics or contain the constituents for which it was originally listed, or (b) because it contains these constituents at relatively low concentrations, or (c) although the waste contains the listed constituents, they are present in an immobile form.** These situations could occur, for example, if a facility uses different processes or raw materials than were assumed when the regulations were written. The regulations (in Sections 260.20 and 260.22), therefore, contain a procedure for anyone to petition the Agency to exclude, or "delist," such waste streams from regulation.†

The purpose of this manual is to assist persons who generate or manage listed wastes to submit delisting petitions. Due to the need to ensure that hazardous wastes do not reach the environment, the delisting procedure requires you to submit infor-

*The Agency also has listed approximately 360 commercial chemical products as hazardous when they are discarded or intended for discard.

**The delisting criteria were recently modified by the Hazardous and Solid Waste Amendments of 1984 to require the Agency to consider any factors (including additional constituents) other than those for which the waste was listed, if there is a reasonable basis to believe that such factors could cause the waste to be hazardous.

†References to Section numbers in this manual are current as of March of 1985. Amendments to the delisting procedures after this date may result in the renumbering of some Sections.

mation on the processes and chemicals used, the results of tests for hazardous constituents and hazardous waste characteristics, the waste management practices currently in effect, and other, related topics. Due to the large amount of information required, many petitions have contained errors and omissions. This manual is intended to address this need, and thus to avoid the costs and delays that have frequently resulted.

In the remainder of this Introduction, we address some topics that will help petitioners understand the background of the listing and delisting processes.

1.2 How Wastes are Listed as Hazardous

It is useful to understand how EPA lists wastes as hazardous, because that process forms the basis for the delisting procedure. Subpart B of Part 261 of the hazardous waste regulations directs EPA to list any waste as hazardous if it meets one or more of the following criteria:

1. It exhibits any one of four hazardous waste characteristics:

Ignitability
Corrosivity
Reactivity, or
Extraction Procedure (EP) toxicity.

(The definitions of these terms are given in Chapter 8 of this manual.)

2. It has been found to be fatal to humans in low doses; or, in the absence of human toxicity data, it has any of the following properties:
 - an oral LD₅₀ (rat) less than 50 mg/kg,
 - an inhalation LC₅₀ (rat) less than 2 mg/l, or
 - a dermal LD₅₀ (rabbit) less than 200 mg/kg;

or it has been found to otherwise cause or contribute to serious irreversible or incapacitating illness. Such a waste is called an acutely hazardous waste, and is subject to control at smaller quantities than other hazardous wastes.

3. It contains one or more of approximately 350 hazardous constituents listed in Appendix VIII of Part 261 unless, after considering certain relevant factors, the Administrator concludes that the waste cannot pose a substantial threat to human health or the environment when improperly

managed or disposed of. Many of these constituents have been shown to cause cancer, genetic mutation, or embryonic damage in humans or other animals.

Using these three criteria, EPA produced three lists of hazardous wastes, which are given in Subpart D of the regulations. The first two lists are based primarily on the third criterion (i.e., presence of hazardous constituents). The lists are:

1. Hazardous waste from non-specific sources. (Section 261.31) These consist mainly of spent solvents and electroplating wastes.
2. Hazardous waste from specific sources. (Section 261.32) These are mostly residues from manufacturing and wastewater treatment processes.

The third list contains specific commercial chemical products and is based on all three criteria: the four hazardous waste characteristics, the definition of "acutely" hazardous, and the presence of hazardous constituents. Specifically, it includes:

3. Discarded commercial chemical products, off-specification species, containers, and spill residues thereof. (Section 261.33) This list is divided into two parts: acute hazardous wastes and other hazardous wastes.

1.3 The Rationale for the Delisting Procedure

As we mentioned above, EPA included in its regulations (in Sections 260.20 and 260.22) a procedure for delisting a waste from an individual facility if it can be shown that the waste does not meet any of the criteria for which the waste was listed. Until recently, EPA required petitioners to demonstrate only that the waste was not hazardous based on the criteria used by the Administrator in listing it. Since the petitioner was not required to test for other hazardous properties, wastes containing hazardous constituents at significant levels still could be delisted. Likewise, wastes that exhibited one or more of the hazardous waste characteristics still could be delisted. In several cases, EPA found that wastewater treatment sludges from electroplating operations, although non-hazardous by virtue of their low heavy metal content, contained high concentrations of several toxic solvents.

The delisting procedures (as revised by the recently enacted Hazardous and Solid Waste Amendments of 1984, Section 222) require you to provide a more comprehensive description of the waste so that EPA can judge whether factors other than those for which the waste was originally listed may cause the waste to be hazardous. To characterize the waste adequately, four additional types of information should be provided:

1A. A complete listing of raw materials, intermediate products, by-products and final products, divided into three separate lists:

- all those materials that are used or produced in the processes at the plant or facility generating the waste;
- of those materials identified above, those that are discharged into or likely to be present in the waste, as well as the approximate quantities used or produced; and
- of those materials identified above, those that you do not believe are discharged into or likely to be present in the waste, and the basis for this belief;

or

1B. Representative analytical data for all hazardous waste constituents (as listed in Part 261, Appendix VIII) that are likely to be present in the waste at significant levels. For all other hazardous constituents in Appendix VIII, provide your rationale for why they are not expected to be present at significant levels;

and all of the following:

2. Test results on representative samples showing whether the waste exhibits any of the four hazardous waste characteristics (as given in Subpart C of Part 261). Alternatively, if you can explain why the waste cannot exhibit one or more of the four characteristics, you may submit your rationale in lieu of test results for those characteristics.
3. Test results on representative samples for total organic carbon (TOC).
4. Test results on representative samples for total oil and grease.*

In addition, we shall collect ground-water monitoring data, if available, from the states and regional offices for consideration in our petition review process.

While this may seem like a lot of information for us to request, it is justified by the seriousness of the harm that could result if wastes that are still hazardous are delisted and escape into the environment.

*Data on total oil and grease have been requested of petitioners since before the passage of the RCRA amendments of 1984. We list these items here for completeness.

1.4 The Guidance Manual: Contents and Organization

This manual is intended to be a complete guide on how to satisfy the delisting petition requirements. It is intended to be used by plant managers, operators, and engineers. In order to keep it concise, we have not described the details of the various waste testing procedures. Most of the necessary information may be found in the following EPA publication:

"Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," U.S. EPA Office of Solid Waste and Emergency Response, Publication SW-846 (second edition), July 1982.

This document and its supplements and revisions are available from the Government Printing Office. (Its order number is 055-002-81001-2.) You need to acquire it, however, only if you plan to do the waste sampling and testing yourself.

Many of the required procedures -- particularly those relating to the sampling and analysis of wastes -- are complex and must be performed by qualified personnel. While some facilities may have the required staff in house, others may need help from consultants or commercial testing laboratories. If you decide to get outside help, you should make sure that the consultant or laboratory is familiar with the procedures in the publication cited above.

The rest of this manual is divided into the following sections:

- 2.0 The Elements of the Delisting Procedure
- 3.0 Administrative Information and Summary
- 4.0 Processes and Materials
- 5.0 The Waste Stream
- 6.0 Selecting Constituents for which to Test
- 7.0 Sampling the Waste Stream
- 8.0 Waste Analysis Methods
- 9.0 Presentation of Analytical Data

Appendices are also provided on the following subjects:

- A. Optional Petition Form
- B. Delisting Procedures (Section 260.22)
- C. State Hazardous Waste Agencies
- D. Hazardous Waste Characteristics (Sections 261.21, 261.22, 261.23, 261.24)
- E. Listed Waste Streams (Sections 261.31, 261.32, 261.33)
- F. Hazardous Constituents (Part 261, Appendix VIII)
- G. Use of a Random Number Table
- H. Price Ranges for Hazardous Waste Test Procedures
- I. Examples of Petitions for Organic wastes and Inorganic wastes
- J. Test Methods Not Available in Other References

The optional petition form in Appendix A is intended to assist you in reporting the required information. You may substitute your own reporting format as appropriate, provided that it is clear and complete. In particular, facilities having special petitioning requirements as described in Section 4.3 will need to adapt the optional form to suit their needs.

A summary of the information required in most petitions is given below.

Administrative Information:

Name, Address, Contact Person, Telephone Number,
RCRA ID number
Statement of Interest.
Description of Proposed Action
Certification Statement

Detailed Description of the Manufacturing Process
(Including Schematic Diagrams)

Waste Stream Information:

EPA Hazardous Waste Number
Description of the Waste
Estimate of Average and Maximum Monthly and Yearly
Quantities Generated
Waste Management Information: Current and Proposed

Sampling and Testing Information:

Name and Address of Laboratories Used
Names and Qualifications of Persons Performing the
Sampling and Analysis
Dates of Sampling and Analysis
Names and Model Numbers of the Testing Equipment Used
Detailed Description of Methods Used to Obtain
Representative Samples
Description of Sample Handling and Preparation
Description of Chain of Custody Procedures
A Statement and Evaluation of the Representativeness of
the Samples
Identification or Description of the Tests Performed
Quality Control and Quality Assurance Measures Taken

Data on Representative Samples for the Listed Constituents
and a Discussion of Why the Waste is Non-Hazardous

Data to Determine Whether Other Hazardous Constituents May Reasonably be Present:

Listing of All Raw Materials Used in the Process Generating the Waste; of Those Materials, a Listing of Those Expected to be Present in the Waste as well as Approximate Quantities Used or Produced; and of Those Materials Used in the Process, a Listing of Those Not Expected in the Waste and the Basis for this Judgment; or

Representative Test Data for All Hazardous Constituents Expected in the Waste and an Explanation of Why Those Not Tested For can be Excluded

Data on Representative Samples for Total Organic Carbon (TOC)

Data on Representative Samples for Oil and Grease

Data on Representative Samples for the Hazardous Waste Characteristics

2.0 THE ELEMENTS OF THE DELISTING PROCESS

This section summarizes the delisting process. There are three major steps:

- A. You submit the petition.
- B. The Agency reviews the petition. If it is incomplete, we request the missing information. When all of the information is complete, we review the petition and make a tentative decision whether to grant or deny the request.
- C. We then publish a proposed decision in the Federal Register and request comments. If there are no comments, and if no new significant information comes to light, the Agency then publishes a final decision. If new facts are brought forward, the Agency re-evaluates its tentative (proposed) decision.

Below, we describe your responsibilities in each of these steps, and what you should expect from us.

2.1 Submitting the Petition

Before you submit a petition, there are several preliminary issues that you should consider.

Determining why your waste is hazardous. You should review the reasons why your waste was determined to be hazardous. The regulations issued on May 19, 1980 required all generators of solid waste to determine whether their waste was hazardous (Section 262.11). Hazardous wastes were defined as those that are either: (a) listed in Subpart D of Part 261 or (b) exhibit one of the four characteristics (ignitability, corrosivity, reactivity, or EP toxicity) described in Subpart C of Part 261. If your waste was listed, then it is possible that it can be delisted (assuming the appropriate conditions are met). If it exhibits one of the four characteristics, however, it cannot be delisted and there is no point in submitting a delisting petition.

Determining whom to petition. Both the Federal government and the individual State governments have jurisdiction over hazardous wastes. In general, States whose hazardous waste programs have been authorized by EPA to make delisting decisions can process petitions without EPA review. (Note that delisting by a

State does not exempt the waste from the Federal hazardous waste program or from regulation in other States.) Under the new RCRA amendments, however, States will need to have their delisting programs re-authorized to reflect the changes required by the amendments in order to continue to delist wastes. These changes include the consideration of "other factors" (including additional constituents) in evaluating the hazardousness of the waste and the requirement for notice and comment. Therefore, you should contact either the Federal Regional Office or the State hazardous waste agency to determine who administers the delisting program for your State. A list of Regional delisting contacts and State hazardous waste agencies is included in Appendix C.

Content of the petition. The elements of the petition are as follows:

- A. Administrative information and summary
- B. Description of the manufacturing processes, including schematic diagrams
- C. Description of the waste stream and management methods
- D. The rationale for selecting the hazardous constituents for testing
- E. Development of the sampling plan
- F. Selection of waste analysis methods
- G. Presentation of analytical data

The following chapters describe in detail what you are to report within each topic heading. In addition, two Appendixes are provided to assist you in writing your petition:

- Appendix A presents a form that you may use as a guide. You may adapt it or use your own format if you wish, provided that the submission is complete and clear.
- Appendix I gives examples, drawn from petitions received by EPA in the past, that illustrate the content and level of detail that we look for.

Petitions are to be submitted to:

The Administrator
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

A copy of the petition should also be submitted to:

Chief, Waste Identification Branch
Office of Solid Waste (WH-562B)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

2.2 Review of the Petition

The petition review process is represented schematically in Exhibit 2.1. Petitions that are received are logged in and filed with the Public Docket and with the Waste Identification Branch of the Office of Solid Waste. A person from the delisting staff is assigned to review the petition and to handle correspondence with the petitioner. Notices of all petitions received are periodically published in the Federal Register.

We then conduct an initial review to determine:

- Whether the waste is eligible for exclusion, i.e., that it is a currently listed waste and
- Whether the petition is complete and the analytical data are representative of the waste stream.

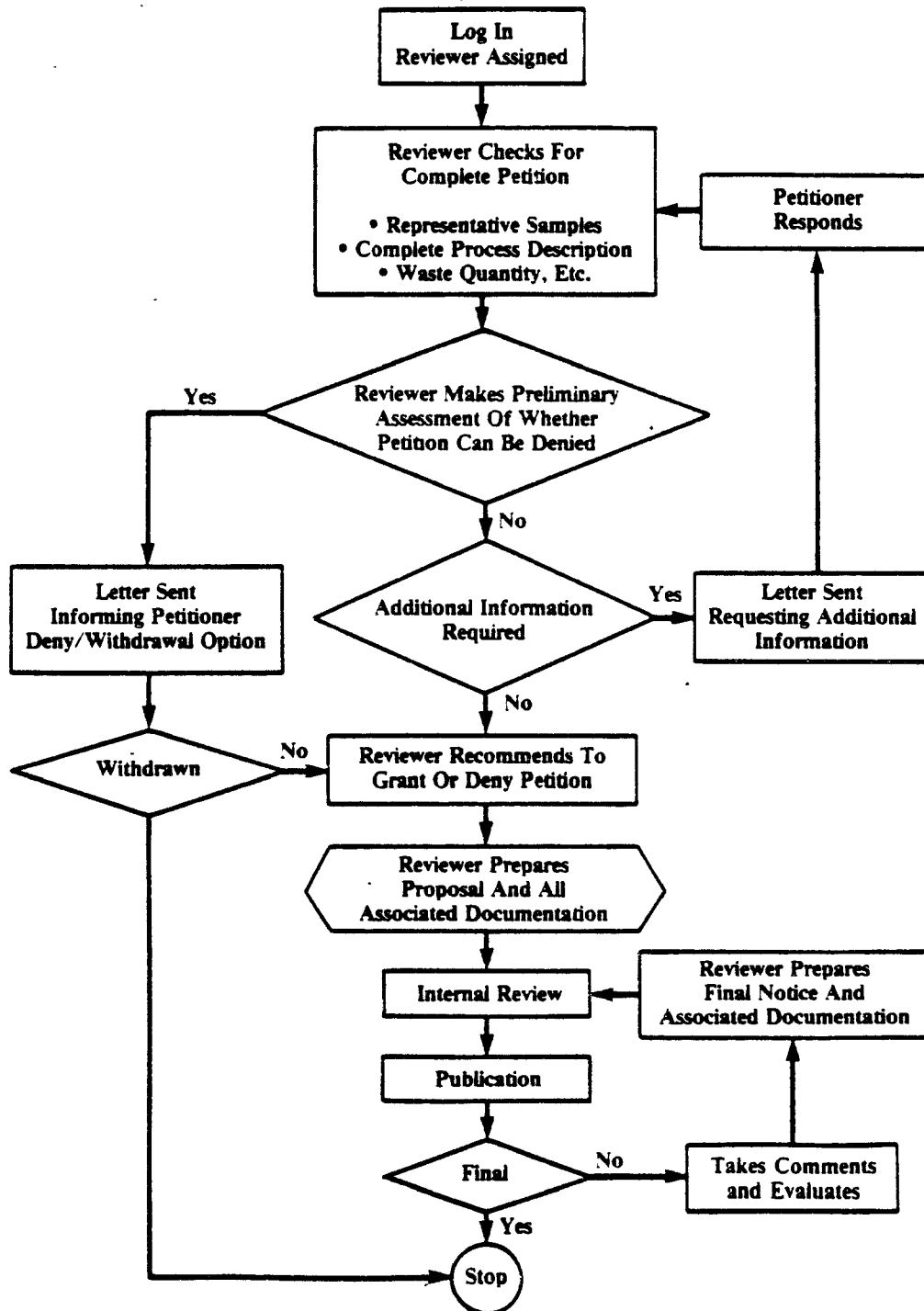
If the information submitted is judged to be incomplete, additional data are requested. Once a petition is judged to be complete, the reviewer makes a tentative decision to grant or deny the petition. If the tentative decision is to deny it, then you are notified of this by letter and you are offered the opportunity to withdraw the petition. If you decline to withdraw it, a draft Federal Register notice is prepared that proposes to deny the petition. If, however, the decision is to grant the petition, a draft Federal Register notice is prepared announcing that decision. We also may recommend that the petition be granted on condition that certain measures (for example, monitoring) be instituted.

The draft notices are then sent to a workgroup consisting of representatives from OSW and other Offices within EPA. The workgroup carefully evaluates the quality and representativeness of the supporting data, and submits comments to OSW. When all of the comments raised by the workgroup have been addressed, the notice is sent to the Office of the General Counsel for its concurrence. If that Office concurs, the final recommendation is sent to the Assistant Administrator for Solid Waste and Emergency Response for his final review and decision.

2.3 Decision to Grant or Deny

The Assistant Administrator decides whether to approve the Office's recommendation. A notice of his proposed decision is published in the Federal Register, along with a request for comments on the action. When the comment period closes, the Office reviews the information received in response to the Notice, and the proposed decision is again reviewed by the workgroup and the

EXHIBIT 2.1: PETITION REVIEW PROCESS



process described above is repeated. The Assistant Administrator then makes a final decision, which is published in the Federal Register as a final rule.

3.0 ADMINISTRATIVE INFORMATION AND SUMMARY

In this section, we describe the administrative information that you are required to provide in your petition. We also suggest you provide a summary of the technical information; this will assist us in our review. The material in this section corresponds to Section A of the optional petition form in Appendix A.

The following information should be included at the beginning of your petition. Items that are required by the regulations are indicated by the appropriate Section number. The other items are not required, but make it easier for us to review the petition.

- o The name and address of the individual or firm submitting the petition. (Section 260.20(b)(1))
- o The name, address, and RCRA identification number of the specific facility to which the petition applies. (Section 260.22(i)(4))
- o The names, titles and telephone numbers of people to contact for additional information.
- o A brief description of the requested delisting action and a summary of your justification for the action (Section 260.20(b)(2), (3), and (4)). (A detailed justification, along with supporting data, should be furnished in later parts of the petition.)
- o The following statement signed by you, as generator of the waste, or by your authorized representative (Section 260.22(i)(12)):

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

An "authorized representative" is a person responsible for the overall operation of a facility or an operational unit (for example, a plant manager, superintendent, or person of equivalent responsibility). Consultants or other outside parties may not sign the certification statement.

4.0 PRODUCTION PROCESSES

This section requests information on the manufacturing operations or other processes which generate the waste. We require you to submit sufficient information for us to determine what hazardous waste characteristics and toxic constituents may be present in the waste. You must submit a description of the manufacturing or other process that generates the waste. You may choose either to furnish a list of raw materials or to test for Appendix VIII constituents; these options are described in greater detail below. Special data requirements for petroleum refineries and multiple waste treatment facilities are also described.

This chapter corresponds to Section B of the optional petition form in Appendix A. (Facilities having special petition requirements should adapt the optional petition form as appropriate.)

4.1 General Process Information

Please provide a description of the manufacturing processes or other operations that produce the listed waste. Examples may include, as appropriate, the following items:

- Descriptions of production lines and major items of equipment. Also describe the stages of the typical operating cycle (e.g., startup, steady-state operation, cleaning and maintenance) on a daily, weekly, or other basis as appropriate.
- A description of any surface and equipment preparation, cleaning, degreasing, coating or painting processes used in the facility that you have not included in the description of the production lines.
- A schematic diagram of all manufacturing processes, surface preparation, cleaning, and other operations that may provide influent to the waste stream.

You do not need to provide an exhaustive description of the process. Rather, you need only provide sufficient information to allow us to understand your process, how and where the waste is formed, and how the toxic constituents may end up in the waste.

The regulatory requirement for the information requested in this section may be found in Section 260.22(i)(5).

4.2 Assessment of Hazardousness

You may use either of the two approaches described below to provide information on those constituents that may be present in the waste.

Approach A:

Please provide the following information:

- Test results on representative samples for the following:
 - The specific hazardous constituents for which the waste was listed (i.e., total concentration of each listed constituent found in Appendix VII of Part 261);
 - The four hazardous waste characteristics;*
 - Appropriate leachate tests for the EP toxic metals, nickel, and cyanide;
 - Total concentrations of the EP toxic metals and nickel;
 - Total organic carbon (TOC); and
 - Total oil and grease.
- A list of all materials used in the manufacturing or other operations that produce the waste. To the extent possible, use the chemical name rather than the generic name (e.g., "sodium hydroxide" instead of "caustic cleaner"). Specify the approximate quantities used annually. Examples of materials to be included are:

- Raw materials
- Intermediate products
- By-products
- Products
- Oils and hydraulic fluids
- Surface preparation materials (solvents, acids, cleaners, surface preparation agents, paints, etc.)

*Note that you may provide an explanation of why the waste does not exhibit a particular characteristic, in lieu of testing for that characteristic.

- An indication of which materials on the above list are either discharged into the waste or are likely to be present in the waste. For each material so indicated, provide an estimate of the amount that enters the waste stream annually. (Please specify kilograms, pounds, or similar units.) For any of these materials that is specified only in terms of a generic or trade name, please furnish a Materials Safety Data Sheet.
- From the above list of all materials that are used or produced at the plant or facility, an indication of which ones are not discharged into or likely to be present in the waste. Also give the basis for this belief.
- Your assessment of the likelihood that these processes, operations, or feed materials might produce a waste stream that is not included in this petition. Include considerations such as startup and shutdown operations, maintenance, spills, leaks, and other accidents.

Approach B:

If you decline to furnish the information requested in Approach A above, then you should furnish the following information instead:

- Test results on representative samples for the following:
 - The specific hazardous constituents for which the waste was listed (i.e., total concentration of each constituent found in Appendix VII of Part 261);
 - All other constituents listed in Appendix VIII of Part 261 that are likely to be present in the waste at significant levels;
 - The four hazardous waste characteristics;
 - Appropriate leachate tests for EP toxic metals, nickel, and cyanide;
 - Total organic carbon; and
 - Total oil and grease.
- For those constituents listed in Appendix VIII of Part 261 that the petitioner does not expect to find (and thus does not analyze for), an explanation of why this is reasonable. Your explanation may be presented on a substance-by-substance basis or for a group of substances. If the Agency does not find your explanation satisfactory, we shall either ask that you analyze for the additional constituents or ask that a better explanation be provided.

4.3 Special Procedures for Certain Industries

Certain industries generate wastes whose constituents vary widely, and for which raw materials data cannot generally be provided. Therefore, we require petitioners in these industries to perform testing for certain constituents that we feel can reasonably be expected to be present in the waste streams. Also, we request additional information on manufacturing and waste treatment processes beyond that which was requested in Section 4.1 above. The industries covered by these special procedures are Petroleum Refining and Multiple Waste Treatment (i.e., commercial offsite waste treatment facilities that accept waste from a variety of generators).

Petroleum Refining Wastes

In lieu of Approaches A or B above, please furnish the following information:

- Test results on a representative number of samples for each of the following:
 - The four hazardous waste characteristics. If your waste contains greater than 1 percent oil and grease, use both the extraction procedure from Section 261.24 and the extraction procedure for oily waste when testing for EP toxicity. (The oily waste procedure is required for all wastes that have an oil and grease content greater than 1 percent.)
 - Total organic carbon (if total oil and grease is less than 1 percent).
 - Total oil and grease.
 - Weight of the solid residue remaining after Step 9 of the EP toxicity test for oily waste.
 - Total concentrations of EP toxic metals in the waste.
 - Total concentration of each of the constituents shown in Exhibit 4.1 (some of these will already have been included in the tests for EP toxic metals).
- Your assessment of the likelihood that these processes, operations, or feed materials might produce a waste stream that is not included in this petition. Include considerations such as startup and shutdown operations, maintenance, spills, leaks, and other accidents.

EXHIBIT 4.1: CONSTITUENTS OF PETROLEUM REFINING WASTES

1. Metals

Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Lead
Mercury
Nickel
Selenium
Vanadium

2. Volatiles

Benzene
Carbon disulfide
Chlorobenzene
Chloroform
1,2-Dichloroethane
1,4-Dioxane
Ethyl benzene
Ethylene dibromide
Methyl ethyl ketone
Styrene
Toluene
Xylene

3. Semivolatile Base/Neutral
Extractable Compounds

Anthracene
Benzo(a)anthracene

Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Bis(2-ethylhexyl) phthalate
Butyl benzyl phthalate
Chrysene
Dibenz(a,h)acridine
Dibenz(a,h)anthracene
Dichlorobenzenes
Diethyl phthalate
7,12-Dimethylbenz(a)anthracene
Dimethyl phthalate
Di(n)butyl phthalate
Di(n)octyl phthalate
Fluoranthene
Indene
Methyl chrysene
1-Methyl naphthalene
Naphthalene
Phenanthrene
Pyrene
Pyridine
Quinoline

4. Semivolatile Acid-Extractable
Compounds

Benzenethiol
Cresols
2,4-Dimethylphenol
2,4-Dinitrophenol
4-Nitrophenol
Phenol

Wastes from Multiple Waste Treatment Facilities

Multiple Waste Treatment Facilities (MWTFs) typically receive large numbers of individual waste shipments having a wide variety of compositions. Therefore, MWTFs cannot describe adequately the "raw materials" for the treatment process or use a mass balance to demonstrate the presence or absence of a constituent in the treatment residue. In addition, it is more difficult for them to demonstrate that waste samples are representative.

Due to the differences between this hazardous waste category and others, we have specified a more rigorous sampling and testing strategy than is otherwise required. In addition, petitioners must submit a plan for testing each batch of treated sludge before it is disposed of, for as long as the facility is in operation. This plan is referred to as the "contingency plan" and is described in more detail below.

In lieu of Approaches A or B, please submit the following information:

- A description of your procedure for prescreening clients and wastes;
- Test results, on a representative number of samples (but no fewer than eight) taken over a two-month period, for each of the following:
 - The four hazardous waste characteristics. For the EP toxicity test, use the extraction procedure for oily wastes in addition to the extraction procedure in Section 261.24 as appropriate.
 - Total concentrations of the EP toxic metals and nickel.
 - Appropriate leachate tests for the EP toxic metals, nickel, and cyanide.
 - Total organic carbon. •
 - Total oil and grease.
 - Long-term stability, using the Multiple Extraction Procedure (see SW-846). This test is required only for stabilized wastes, and only four samples are required if these will be representative.
 - Cyanide: total, free, and leachable.
 - Appendix VIII constituents. Test for all constituents that can reasonably be expected to be present in the treatment residue. At a minimum, these should include the 129 Priority Pollutants.

- The percentage of the total number of waste types received during the year that are represented by the wastes sampled and tested for in this petition.
- For those Appendix VIII constituents for which you do not analyze, your basis for not analyzing them (i.e., why it is reasonable that these constituents are not expected to be present in the treatment residue at significant levels).
- Your contingency plan for continuous testing of the treated sludge. The following tests will be required for each batch of treatment residue that is disposed of:
 - Appropriate leachate tests for the EP toxic metals,
 - Representative organic toxicants as determined from the test results for Appendix VIII constituents, and
 - General screening tests such as TOX and TOC.

In addition, composite samples must be tested periodically for the 129 Priority Pollutants. Monthly composites must be tested for base-neutral compounds, and biweekly composites must be tested for volatiles. Contact the delisting staff of the Waste Identification Branch for guidance in developing this plan.

5.0 THE WASTE STREAM

In this section, you are asked to describe the waste stream that you request be delisted and to give its hazardous waste number. The regulatory requirement for this information is found in Section 260.22(i)(6). You also are asked for information on how the waste is managed, and how it will be managed if your petition is granted. The material in this section corresponds to Section C of the optional petition form in Appendix A.

5.1 Description of the Waste Stream

The lists of regulated wastes are found in Sections 261.31, 261.32, and 261.33. From those lists, please furnish the following information regarding the waste that is the subject of your petition:

- Its EPA hazardous waste number. If several wastes are combined or mixed, please provide the hazardous waste numbers for all listed wastes.
- Its common name (e.g., electroplating sludges, spent xylene, dissolved air flotation (DAF) float from the petroleum refining industry).
- Its physical form (i.e., aqueous stream, sludge, dry solid; for sludges, please indicate the percentage of solids).

From your operating records, please estimate the following amounts:

- Average amount generated monthly
- Maximum amount generated monthly
- Average amount generated annually
- Maximum amount generated annually

Please state clearly the units of measurement. Avoid using vague units (such as "truckloads" or "barrels").

- Examples: kilograms, pounds, English tons, metric tons, gallons

In addition, please specify which of these descriptions applies to the waste stream:

- It is presently being generated.
- It will be generated in the future.
- It has been generated in the past and is presently being treated or stored on-site.

5.2 Description of Waste Management Methods

Briefly describe how you treat or dispose of the waste at present. Include the following items:

- A paragraph describing the waste management techniques currently used (e.g., landfill, lime treatment, etc.) Please indicate whether the waste is managed on-site or off-site.
- A schematic flow diagram (if appropriate) of the waste treatment system, showing the processes, equipment, and storage methods used.
- The names and locations of any commercial treatment, storage, or disposal facilities that are used.

Describe, in a paragraph, the following as appropriate:

- How you treated or disposed of the waste before November 19, 1980 (when EPA's Hazardous Waste Management System became effective), and
- How you will treat or dispose of it if your delisting petition is granted.

6.0 SELECTING CONSTITUENTS FOR WHICH TO TEST

This chapter is intended to guide you in determining the constituents for which you should test. The actual sampling and testing procedures are described in the following chapters. The material in this chapter corresponds to Section D of the optional petition form in Appendix A.

6.1 General Considerations

As we have already stated in previous chapters, the revised delisting procedures suggest that you submit either:

1A. A complete listing of raw materials, intermediate products, by-products and final products, divided into three separate lists:

- all those materials that are used or produced in the processes at the plant or facility generating the waste;
- of those materials identified above, those that are discharged into or likely to be present in the waste, as well as the approximate quantities used or produced; and
- of those materials identified above, those that you do not believe are discharged into or likely to be present in the waste, and the basis for this belief (Approach A);

or

B. Representative analytical data for all constituents listed in Appendix VIII of Part 261 that are likely to be present in the waste at significant levels, as well as your basis for not analyzing for the other Appendix VIII toxic constituents (Approach B).

If you have elected to take Approach A, then you need to test a representative number of samples of the waste for the following:

- The specific hazardous constituents for which the waste was listed (i.e., total concentration of each listed constituent found in Appendix VII of Part 261);

- The four hazardous waste characteristics;
- Appropriate leachate tests for the EP toxic metals, nickel, and cyanide;
- Total concentrations of the EP toxic metals and nickel;
- Total organic carbon (TOC); and
- Total oil and grease.

After examining the data on raw materials, we may request further analytical testing for those constituents that are likely to be present in the waste at levels of regulatory concern. The relevant test procedures are discussed in Chapter 8 of this manual.

If you have chosen this option, you may omit the rest of this chapter.

If you have chosen Approach B, then you should perform all of the tests specified above -- i.e., listed Appendix VII constituents, total oil and grease, TOC, and hazardous waste characteristics -- on representative samples of the waste. You must also test representative samples for all Appendix VIII constituents that may "reasonably be expected" to be present in the waste, whether or not they were used as a basis for listing. In the remainder of this chapter, we describe engineering analysis methods that can assist you in determining which constituents are likely to be in the waste.

Note that in selecting constituents for testing, you must specifically consider each item on the list in Appendix VIII of Part 261, and either test for its presence or state why it is not likely to be present. This subject is discussed further in Section 6.3 below.

6.2 Engineering Analysis to Determine What is Likely to be Present in the Waste

The list of likely hazardous constituents usually can be reduced to a reasonable number by specifying the chemicals going into a process, the products coming out, and an understanding of the chemical and physical attributes of the process. This type of approach involves:

- A mass balance to allow calculation of the total amount of constituents in the wastes, and
- An examination of the chemical reactions occurring in the process to identify other likely constituents in the waste stream.

A mass balance for the process will show what raw materials are used, their use rates, and whether they are likely to be present in the waste at significant concentrations. For example, consider a process involving the production of aniline by the reduction of nitrobenzene. Based on plant data, for each 100 lb of nitrobenzene used, 72 lb of aniline is formed, which indicates that 5 lb of nitrobenzene is lost in the process per 100 lb used. Furthermore, it is known that 2000 gal of wastewater results from the production of each 72 lb of aniline. Therefore, one can estimate that the maximum concentration of nitrobenzene in the wastewater is about 300 ppm, assuming that all of the nitrobenzene is in the wastewater. Based on this calculation, the generator would likely test the wastewater treatment sludge for nitrobenzene.

The area of by-products is the most difficult to consider, because expert chemical judgment (supported by appropriate examples from the literature) must be applied to predict the types and relative amounts of by-products expected from a reaction. Unfortunately, demonstrating that a chemical reaction does not actually produce traces of hazardous substances also can be inconclusive. For example, any reaction involving chlorinated phenols might produce some chlorinated dibenzodioxins, which are considered to be hazardous at trace levels, although it is not a very probable reaction in most circumstances. In such cases, you should include the substance as a constituent for testing.

The more detail that is provided by the engineering analysis, the more likely our reviewers are to accept your judgment on which constituents are likely to be present. For example, if a reactant is described as "technical benzene," questions about the presence of toluene and other aromatics (and their by-products) in the waste stream may be raised. On the other hand, identification of the reactant as "90% benzene, 9% toluene, 1% xylenes and less than 10 ppm sulfur" limits the likely composition of the waste stream.

You may not wish to disclose some items of process information, even under the protection of the confidential business information (CBI) restrictions. In such cases, a greater burden is placed on the analytical chemist as discussed below. Every attempt should be made to exclude possibilities from consideration even when the process itself cannot be discussed. For example, if none of the starting materials, solvents, or catalysts contain halogens, the waste stream probably does not contain halogenated constituents.

In some instances -- for example, chemical mixtures used in maintenance, cleanup, and other non-process applications -- it may not be possible to construct a mass balance. In such cases, you should list the known constituents in each mixture and estimate the amounts disposed of based on usage rates.

6.3 Supporting Your Selection of Constituents

In your petition, you should describe how you selected the constituents for which you will test. In addition, we shall require you to give your basis for not analyzing any particular constituent or group of constituents listed in Appendix VIII of Part 261. You should state, for each hazardous waste constituent (or group of constituents) for which you do not test, why you do not believe it may "reasonably be expected to be present in the waste." Substances on the list that may be found in your industry's wastes (although not in your particular facility's wastes) should be addressed individually. The remaining constituents may be addressed as a group by stating that your facility neither uses nor produces any of the substances in question, nor any chemicals that could form the substances in question.

The mass balance approach described above can be quite useful for eliminating or identifying those constituents that are present or absent from the waste. If you use this approach, however, you should describe how it affected your choice of constituents.

7.0 SAMPLING THE WASTE STREAM

Your delisting petition must be supported by analytical data for samples of the waste in question. It is particularly important for you to demonstrate in the petition that the samples are representative of the waste and that their integrity was preserved until the required analyses were performed. Specific reporting procedures are described in Chapter 9 of this manual. The specific regulatory requirement for this information may be found in Section 260.22(h).

Information to evaluate whether the collected samples are representative of the waste is inadequate or totally lacking in many delisting petitions. A simple statement that the samples are representative is not sufficient for the Agency to conclude that the waste has, in fact, been adequately characterized. In order for us to make a finding of representativeness, you must provide a detailed rationale as to why the samples that were collected do represent the waste's composition as it varies in time and space. This rationale should be based in part on considerations of how the waste-generating process itself varies.

This chapter of the manual summarizes the elements that must be considered in the development of a good sampling program. (A detailed discussion of sampling methods may be found in EPA Publication SW-846.) In the first section (7.1), the concept of representative sampling is discussed, especially with respect to heterogeneous wastes. Two basic strategies for obtaining representative samples of heterogeneous waste are described: time composite sampling and two-dimensional random sampling. In Section 7.2, the most common sampling equipment is briefly described. In Section 7.3, sampling techniques are described for process discharges, drums, landfills, lagoons, and waste piles. In each case, specific techniques are presented for obtaining representative samples, and suitable equipment from Section 7.2 is suggested. Section 7.4 discusses sample handling and storage, as well as documentation of the sampling effort. Finally, Section 7.5 describes how your sampling effort should be documented in the petition. The material in this manual corresponds to Section E of the optional petition form in Appendix A.

Sampling is a complex procedure and the representativeness of the sample is critical to the acceptability of your petition. Therefore, we strongly recommend that you contact the delisting staff of the Waste Identification Branch for guidance before you actually draw the samples.

7.1 Representative Sampling

The waste to be sampled may be homogeneous, or it may vary in time or space. The selection of a sampling strategy depends on what type of variability the waste exhibits.

Time Variability

Time variability is most often encountered when point discharges are sampled, such as flow from pipes. Time composite sampling usually is used in such cases. In this method, a number of grab samples of equal volume are taken at regular time intervals. These intervals must adequately characterize the variations in process flow over time. The individual samples then are combined into a series of composite samples, which are analyzed for the various constituents.

You must collect and analyze enough composite samples to characterize the variability of the waste stream over time. The frequency of collection and the number of samples to be taken from a production process depend on the process and its operating schedule, and on the schedule of variation of the waste composition, if that is known. The greater the variability, the more composite samples must be taken. The volume of waste required also must be determined beforehand, and usually is dictated by the analyses to be performed and the homogeneity of the waste material. For example, a one-liter daily composite could consist of five 200-ml samples taken at two-hour intervals throughout the day; a weekly composite could consist of seven samples taken on seven consecutive days and then combined. The schedule for a composite sample is process-dependent and should be decided upon by someone who is familiar with the process and who understands the need for a representative sample.

Spatial Variability

Spatial variability within a container, pile, landfill, or lagoon may be vertical or horizontal. Contained wastes have a much greater tendency to vary in a vertical rather than a horizontal direction because of (1) the settling of solids and the denser phases of liquids and (2) variations in the composition of the waste as it entered the container.

It is necessary to characterize the waste's variability in both the horizontal and vertical dimensions. This usually means collecting a complete vertical sample of the waste at each of several randomly selected points on a horizontal grid. Appropriate methods for accomplishing this are described in Section 7.3. The number of samples to be taken will vary with the size of the containment area and the degree of spatial variability. A minimum of four samples should be drawn from each storage location

or container, even if the waste appears to be homogeneous. In many cases, however, more than four samples will be required to adequately characterize the waste. (Drums form a partial exception to this rule, as described below; one sample per drum will usually suffice.)

An Example

To illustrate the application of the above principles, we consider the case of an electroplating line that generates sludge continuously from rinsing operations (Waste No. F006). Once every six weeks, however, the plating baths themselves are dumped into the waste stream. The waste is held in a tank with a residence time of about two days, and neutralized before being discharged to a surface impoundment via a pipe. The plating process used in the plant was implemented two years ago, prior to which a different process was used.

First, let us assume that the delisting petition applies only to the currently discharged waste stream. On the basis of the above information, the Agency would expect the generator to sample the waste stream over at least a six-week period. In particular, samples should be taken during the two days in which the plating baths themselves are resident in the sludge, to demonstrate the variability of the neutralized sludge due to discharge of the plating baths.

If the petition includes the sludge stored in the surface impoundment in addition to the current discharge, then the generator must take representative samples of the sludge in the impoundment as well. Because the waste-generating process was changed two years ago, there will most likely be vertical non-homogeneity in the stored sludge. Therefore, full-core samples of the impounded sludge would be necessary. In addition, it is likely that horizontal variability will occur in the impoundment because the sludge is discharged into it at a fixed point. Therefore, samples should be collected at randomly spaced points on a horizontal grid.

7.2 Sampling Equipment

This section contains a brief description of the most common sampling devices: dippers, weighted bottles, COLIWASAs, thieves, triers, and augers. Detailed descriptions and directions for obtaining or constructing the equipment can be found in EPA Publication No. SW-846, "Test Methods for Evaluating Solid Waste," second edition.

Dipper

A dipper consists of a glass or nonreactive plastic beaker clamped to the end of a pole, which serves as the handle (see Figure 7.1). It is used to sample flowing liquids and slurries. The dipper can be varied in size depending on the flow rate of the waste stream.

Weighted Bottle

This sampling device consists of a glass or nonreactive plastic bottle with an attached sinker or weight, stopper, and a line which is used to lower, raise, and open the bottle. It is used to sample liquids and slurries. Figure 7.2 depicts a weighted bottle sampler.

COLIWASA

A COLIWASA (composite liquid waste sampler) is a glass, plastic, or metal tube with an end closure that can be opened and closed while the tube is submerged (see Figure 7.3). This sampling device is useful for free-flowing liquids and slurries contained in drums, shallow open-top tanks, pits, and similar containers. It is especially useful for sampling wastes that consist of several immiscible liquid phases. The COLIWASA is lowered into the waste at a rate slow enough to permit the level of liquid inside and outside the sampler to remain the same. When the sampler hits the bottom, the stopper is closed. In this manner, a sample is obtained that is representative of the entire depth of the waste.

Thief

A thief consists of two slotted concentric tubes usually made of stainless steel or brass (see Figure 7.4). The outer tube has a conical pointed top which permits the sampler to penetrate the material being sampled. The inner tube is rotated to open and close the sampler. A thief is used to sample dry granules or powdered wastes whose particle diameter is less than one-third the width of the slots. A thief is available at laboratory supply stores.

Trier

A trier consists of a tube cut in half lengthwise with a sharpened tip that allows the sampler to cut into sticky solids and loose soil (see Figure 7.5). The trier is then rotated to cut a core of the waste. A trier samples moist or sticky solids having a particle diameter less than one-half the diameter of the trier. Triers can be found at laboratory supply stores, or they can be fabricated.

FIGURE 7.1: DIPPER SAMPLER

(Source: Test Methods for Evaluating Solid Wastes, 2nd Edition,
U.S. EPA, SW-846, July 1982)

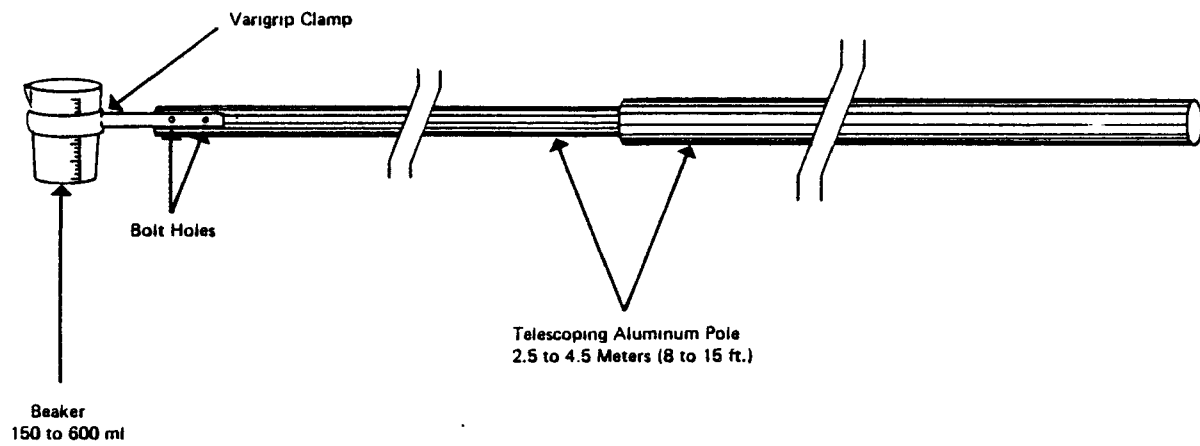


FIGURE 7.2: WEIGHTED BOTTLE SAMPLER

(Source: Test Methods for Evaluating Solid Wastes, 2nd Edition,
U.S. EPA, SW-846, July 1982)

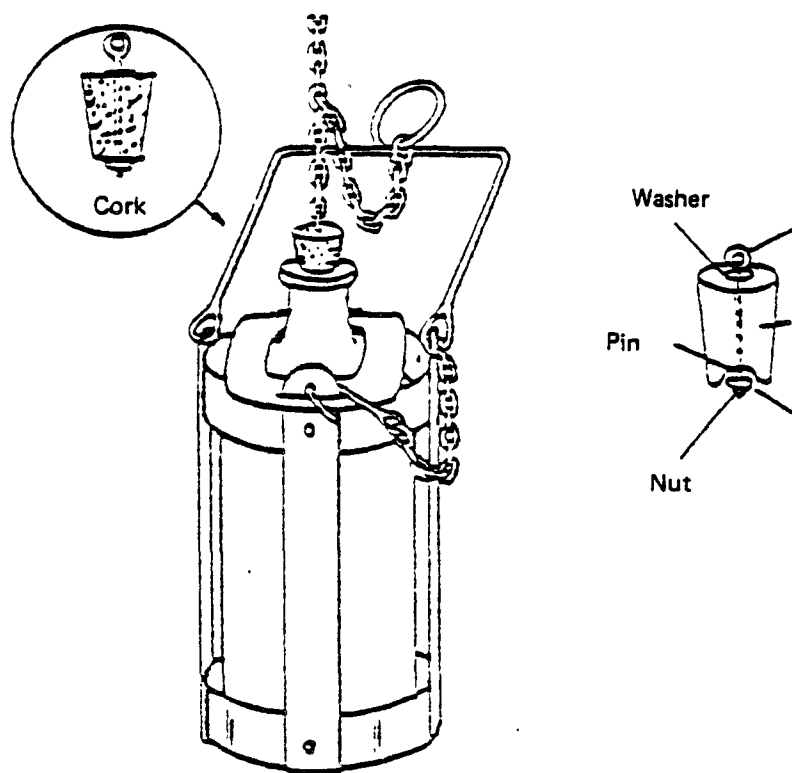


FIGURE 7.3: COMPOSITE LIQUID WASTE SAMPLER

(Source: Test Methods for Evaluating Solid Wastes, 2nd Edition,
U.S. EPA, SW-846, July 1982)

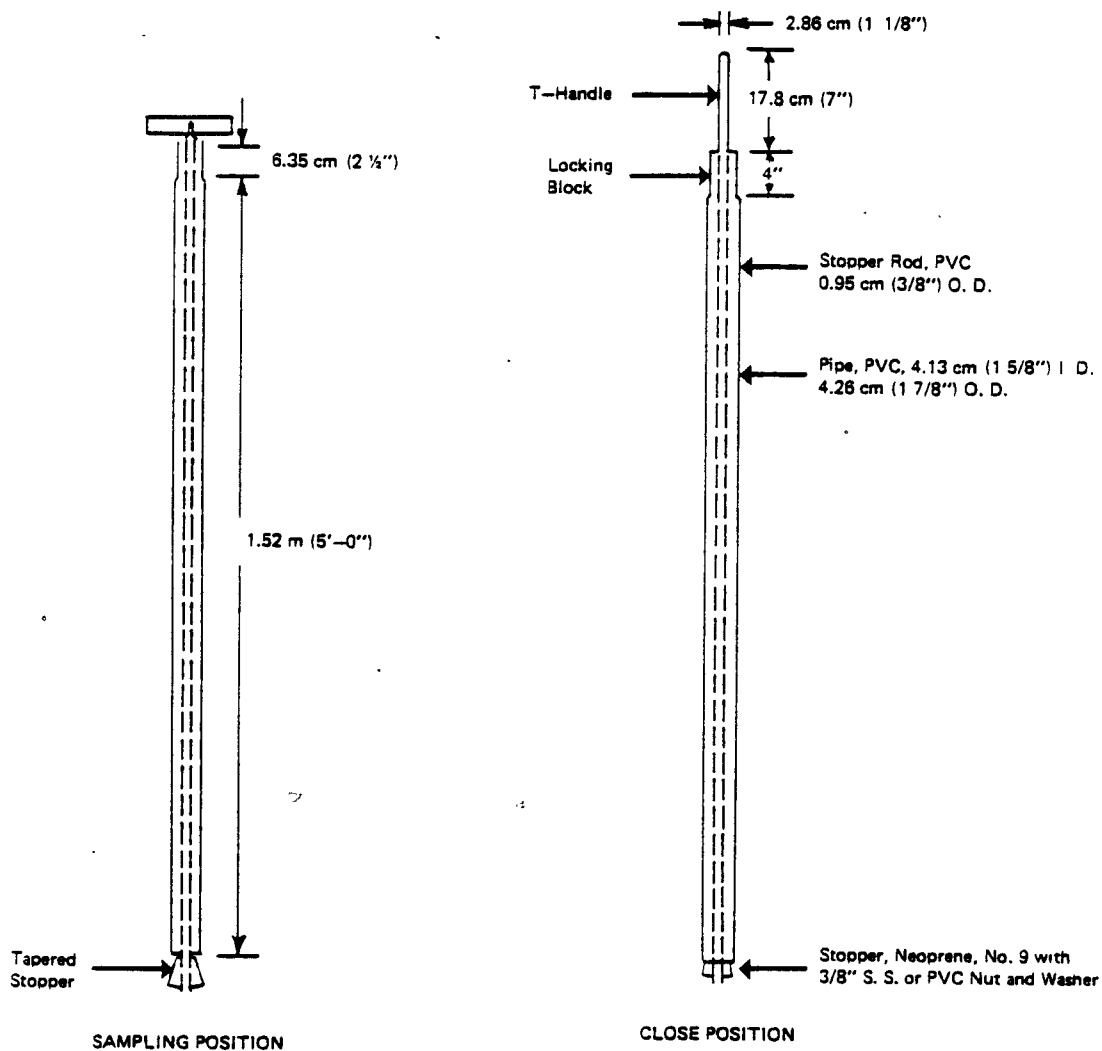


FIGURE 7.4: THIEF SAMPLER

(Source: Test Methods for Evaluating Solid Wastes, 2nd Edition,
U.S. EPA, SW-846, July 1982)

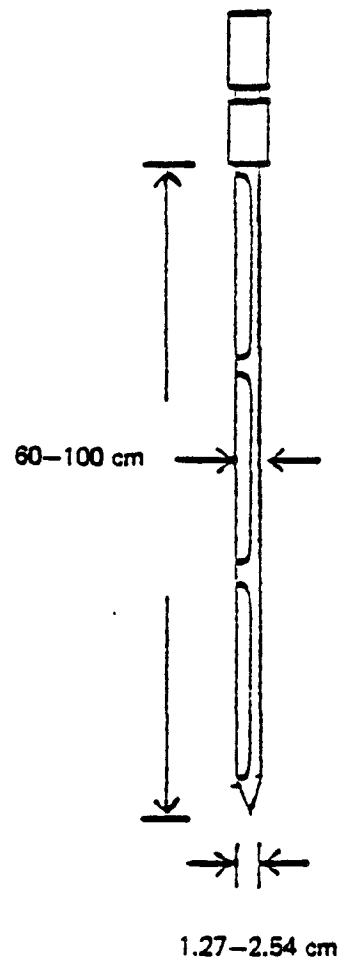
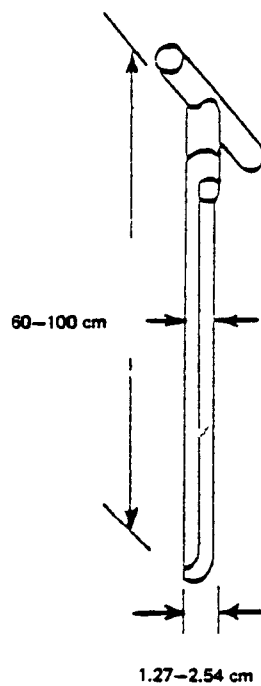
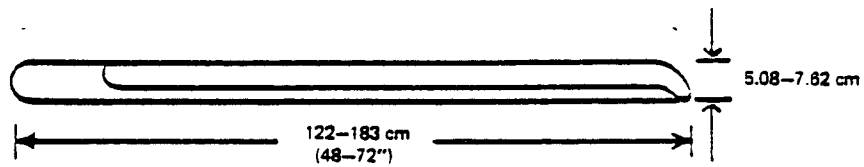


FIGURE 7.5: SAMPLING TRIERS

(Source: Test Methods for Evaluating Solid Wastes, 2nd Edition,
U.S. EPA, SW-846, July 1982)



Auger

An auger consists of sharpened spiral blades attached to a hard metal central shaft. Augers sample hard or packed solid wastes or soil. They are available at hardware stores or laboratory supply stores.

7.3 Sampling Techniques for Specific Forms of Waste

In this section, sampling techniques are presented for various sampling situations: sampling from pipes and other process discharges; drums; landfills; lagoons; and waste piles. We also describe an approach for taking samples at multiple waste treatment facilities.

The variety of physical forms of waste and the uniqueness of each sampling situation necessitates a flexible approach to acquiring samples. The procedures discussed here are believed to represent the best approaches to sampling different forms of waste; however, the technique that you select should be devised in each case by a person familiar with the process and with general principles of sampling.

Pipes and Other Process Discharges

Representative samples from pipes and other process discharges are best obtained through time composite sampling, which was described in section 7.1 of this chapter. Composite sampling may be performed through the use of automatic compositers, or it may be done manually. This discussion assumes that manual sampling is performed.

There are two general types of process discharges: liquid or slurry discharges, and solid or semi-solid discharges. Liquids or slurries generally will be sampled from pipes, valves, or sluiceways. Solid process discharges are often sampled from conveyor belts or filter presses.

For slurry and liquid discharges, a dipper-type sampler should be used. The dipper can be easily constructed out of materials on hand at the plant. The dipper bucket should be of an appropriate non-reactive material, similar to the sample containers. The size of the bucket used should increase with increasing stream flow rate. A dipper should be used to sample only one waste stream and it should be cleaned after each sample is collected.

Each time a grab sample is taken, the dipper is first rinsed in the sampled stream. Then the dipper is passed in one sweeping motion through the discharge stream so that the dipper is filled

in one pass. Do not sample from the edge of the stream only. If the cross-sectional area of the stream is large in comparison with the size of the dipper, more than one pass may be necessary to sweep the entire cross-sectional area of the stream. Each grab sample should be emptied into the composite container and the entire contents mixed well.

Solid or semi-solid discharges on a belt should be sampled with a scoop or a shovel. The shovel should be chosen or fabricated to match the width and general contour of the belt as closely as possible. The grab samples can be taken at any convenient point along the belt, as long as the entire width of the belt is sampled. Any fines or liquid present on the belt at the sampling point should be included in the sample.

Another common type of solid discharge is filter cake. If samples are taken as the material is produced, then a trowel or shovel may be useful, depending on the type of filter. Care should be taken so that the entire waste stream is represented by the sample.

In each case, the frequency of sampling and the number of individual grab samples that are combined to form a composite depends on the variability of the waste over time and on the time span which the sample is to represent. For sampling point discharges as they are generated, samples can be taken every hour for eight to 24 hours, depending on the process schedule, and combined to form a daily composite. As an alternative, samples can be taken daily for a week, and the daily samples combined into a weekly composite. Again, the sampling period and number of samples will vary for each petitioner. Therefore, it is important that whoever takes the sample be familiar with the spatial and temporal variability of the waste stream.

Often solid discharges, such as filter cakes, fall from the press or plate-and-frame filter into a hopper or storage area. In this case, a more long-term composite may be obtained by sampling the material after it has accumulated for a period of time. For example, filter cake can be allowed to accumulate in a hopper for 24 hours, and then random core samples can be taken using a simple two-dimensional random sampling strategy. (If separation of the waste -- such as by the expression of liquids -- appears to have occurred in the storage container, mix the waste well before drawing the samples.) The samples would be combined to form a 24-hour composite. The process would be repeated enough times to obtain the number of samples required for analysis. Sampling filter cake from a hopper would require the use of a thief or a trier, depending on the water content of the material. In each case, the composite should be mixed until it is homogeneous before sub-samples are split for analysis.

Drums

If the waste is contained in drums, then ideally each drum should be sampled. If there are too many drums for this to be practical, then a representative number of individual drums must be randomly selected. This is easily done by assigning a number to each drum consecutively and then using a random number table to choose the sample. A detailed method for selecting drums for sampling may be found in the following publication:

"Waste Analysis Plans: A Guidance Manual," U.S. EPA Office of Solid Waste, Publication EPA/530-SW-84-012, October 1984.

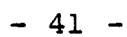
For each drum, a single sample that samples the entire depth of the drum along its axis is sufficient. Equipment used for sampling waste in drums includes weighted bottles (for heterogeneous wastes), COLIWASAs, thieves, and triers. COLIWASAs and weighted bottles are best suited to sampling liquids and slurries; if the sample is dry granules or a powder, a drum thief should be used. A trier should be used to sample moist or sticky solids.

Landfills

Wastes contained in landfills are primarily solids or moist solids. These wastes are best sampled using a two-dimensional random sampling strategy as described below. (The procedure is also illustrated in Figure 7.6).

- (1) On a diagram, divide the landfill to be sampled into sections of equal area. If the area is under 40,000 square feet, then it should be divided into four equal quadrants. If the area is over 40,000 square feet, then it should be divided into equal sections of not more than 10,000 square feet each.
- (2) Divide each quadrant or section into an imaginary 10x10 grid to get 100 squares (or rectangles) of equal size. Number the grid lines in each dimension from 1 to 9.
- (3) For each section, determine the number of sampling points necessary to characterize the waste. This number will depend on the degree of spatial variability within the landfill.
- (4) Select a two-digit number using a random number table. Repeat this procedure until you have one two-digit number for each sampling point in the section. (Random number tables are available in any introductory statistics text or handbook. Their use is explained in Appendix G.)
- (5) Locate the grid intersections whose coordinates correspond to each of the two-digit random numbers. These

The Figure shows a 30,000 sq ft landfill (150 ft x 200 ft) divided into four 7,500 sq ft quadrants.



intersections are the locations of the randomly selected sampling points.

- (6) Sample each selected grid point vertically along the entire distance from the top to the bottom of the landfill.
- (7) Combine the samples for each section and mix them well to form a homogeneous composite sample. Do not, however, combine samples from different sections.

For example, a landfill of 10,000 square feet would be divided into four quadrants of 2,500 square feet each. In each quadrant, a sufficient number of core samples would be taken and combined. The result would be four homogeneous composite samples, one from each quadrant. Similarly, a landfill of 60,000 square feet would be divided into six sections of 10,000 square feet each, yielding six homogeneous composite samples.

It is particularly important to obtain vertical samples along the entire depth, including the bottom. Hollow-stem augers combined with split-spoon samplers are frequently useful for sampling landfills. Triers or modified triers also may be used.

Lagoons

Lagoons are similar to landfills in that they cover a large area and stratification and settling are likely to occur. The same two-dimensional randomized sampling strategy therefore may be used. Again, it is important that each sample include material from the entire depth of the lagoon, including the bottom.* This can be done by using a COLIWASA.

Waste Piles

Ideally, waste piles should be divided into quadrants (in a similar fashion to landfills), and each quadrant sampled using a two-dimensional grid and random vertical core samples. Equipment commonly used to sample piles includes triers, and shovels.

Multiple Waste Treatment Facilities

The variety and number of incoming wastes accepted at multiple waste treatment facilities (MWWTFs) result in less control over the variability of constituent concentrations. Since inherent variability makes it difficult to collect representative

*Note that if the listed waste is a sludge (e.g., Waste No. F006), the liquid above the sludge, if any, need not be sampled.

samples, the MWTF petitioner has fewer options available to demonstrate the non-hazardousness of his waste. To obtain representative samples, the following guidelines are suggested:

- Analyze as many samples as necessary to represent variability in toxicant concentrations in the treatment residue generated annually. (The Agency believes that a minimum of eight weekly composite samples should be collected over a minimum period of two months.)
- Determine what percentage of waste treated annually is treated during the sampling period.
- Explain why the remaining percentage of the waste would not be expected to contain any hazardous constituents; different levels of these constituents; or different characteristics than the waste sampled.

7.4 Sample Handling, Storage, and Documentation

Samples collected must be handled, labeled, and stored so that sample integrity is preserved. In addition, proper documentation of sample collection, preservation, and custody is essential.

Handling and Storage

Containers. Samples should be collected and composited in glass, polytetrafluoroethylene (PTFE), or plastic containers with tight, screw-type lids. PTFE lid liners should be used if organic analyses are to be performed on the sample. Containers made of plastic other than PTFE should not be used if organic analyses are to be performed.

On-Site Preservation. Once a sample has been collected, steps must be taken to preserve the physical and chemical integrity of the sample during transport and analysis. Sample preservation and storage requirements vary according to the analysis to be performed. Therefore, it may be necessary to prepare more than one container of the waste material to accommodate the different analyses. Again, refer to EPA Publication SW-846 for detailed preservation procedures.

Identification and Labeling. Each container should be assigned a unique sample identification number. An indelible label should be secured to the container that identifies the sample. The label should contain the following information:

Sample identification number
Name of collector
Date and time of collection
Place of collection

The label should be filled out after the container is filled to avoid spilling the sample onto the label. Finally, the label should be completely covered with wide cellophane tape to ensure that the labels remain attached and dry throughout shipping and analysis.

Shipping. After the samples have been preserved, labeled, and sealed, they are ready for shipping. Samples should be shipped and analyzed as rapidly as possible to ensure that the most accurate and reliable data can be obtained.

There are four areas of concern: 1) protection of carriers and receivers, 2) preservation of samples, 3) rapid and efficient transit, and 4) compliance with DOT regulations.

Specific DOT requirements for the packaging of hazardous environmental laboratory samples can be found in 49 CFR 173.24 and 173.6. In general, these requirements state that hazardous samples must be packaged in such a way that under normal conditions of transportation, no significant release of hazardous materials to the environment will occur due to breakage, leakage, or reaction with packing materials.

The following recommendations are patterned after EPA-recommended procedures which are designed to comply with DOT regulations.

- Shipping containers must be designed such that they will withstand a four-foot drop on solid concrete in the position most likely to cause damage. A good example is a metal clad cooler lined with plastic. The container should be taped shut and the drain plug at the bottom secured to prevent leakage. The container should be marked "THIS END UP" in proper position.
- Glass containers must be packed in a shipping container in a manner that minimizes the possibility of breakage or leakage. Screw-type lids should be securely tightened. Large glass bottles should be separated by cushioning material. Containers should be sealed in plastic bags or packed in absorbent material in case breakage does occur.
- Plastic containers, though not requiring packaging to prevent breakage, are packed with a cushioning material to prevent leakage by puncture. Screw-type lids should be tightened securely.
- If the sample is to be analyzed for volatile organics, it should be packed in a cooler and maintained at 4°C.

Documentation

In addition to labels and seals, there are three types of documentation necessary to ensure the integrity of the sample: a chain-of-custody record, a field log book, and a sample analysis request sheet.

A chain-of-custody record should be filled out and should accompany every sample. The record should contain the following information: sample identification number, signature of collector, date and time of collection, place and address of collection, and waste type. A place also should be provided for the signature of each person who has the samples in their possession, along with the inclusive dates of possession.

In addition, all information pertinent to a field survey or sampling must be recorded in a log book. Entries in the log book should include the following items:

- Date and time of sampling
- Collector's name and affiliation
- Process sampled
- Type of waste (e.g., sludge, wastewater)
- Exact location of all sampling points (drawings may be helpful)
- Description of sampling methodology
- Number, volume, and appearance of samples
- Any field measurements made
- Field observations

Any deviations from the sample plan or any problems should be noted. In general, sufficient information should be recorded so that the sampling can be entirely reconstructed without reliance on the collector's memory.

Finally, a sample analysis request sheet should accompany the sample to the laboratory. The sheet should specify the following items:

- Sample identification number
- Description of sample
- Date
- Analyses to be performed
- On-site preservation

You should preserve all chain-of-custody documents, log books, and similar records in case a question arises regarding the sampling portion of your petition.

7.5 The Written Sampling Plan

A written sampling plan should be prepared for even the simplest sampling efforts. This will ensure that proper planning has taken place and that planned procedures are followed. The sampling plan also will serve as the basis for demonstrating the representativeness of your samples in the petition. A good sampling plan should contain the following information:

- Purpose of the sampling effort
- List of the waste stream or streams to be sampled
- Name of the sampler (or sampling crew for larger efforts)
- Professional qualifications of the samplers
- Sampling strategy, e.g., time composite
- Detailed sampling procedures, including location of sampling points, equipment needed, and sample containers
- Safety procedures, including safety equipment
- Any on-site preservation that will be performed
- Analytical lab to be used and method of transport
- Analyses to be performed
- Plans for documentation of the sampling effort

Instructions for reporting your sampling procedures are given in Section 9 below.

8.0 SELECTION OF WASTE ANALYSIS METHODS

In this section, we describe briefly the methods to be used to analyze the waste for the hazardous characteristics and constituents. The methods themselves are complex and require fairly elaborate laboratory facilities. Most of the methods specified for these tests may be found in the following EPA Publication:

"Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," and its supplements and revisions, SW-846 (second edition), June 1982. Referred to here as "SW-846".

Additional methods are contained in Appendix J of this Manual.

The design and execution of the testing program should be done by an analytical chemist with the proper qualifications. If you do not have the necessary personnel or laboratory resources in-house, you should contract with a commercial testing laboratory or a consulting analytical chemist with experience in hazardous waste. A list of typical 1984 prices for the tests described in this section is included in Appendix H.

8.1 Tests for Characteristics

You must determine whether the waste exhibits one of the four characteristics (ignitability, corrosivity, reactivity, and EP toxicity). This determination may take the form of an explanation of why the waste cannot exhibit one or more of the characteristics. (For example, a waste stream composed entirely of organic solvents would not contain any of the EP toxicants listed in Section 261.24.) If you cannot explain conclusively a characteristic's absence, you must test for it instead. If you test for a characteristic, any analyses must be performed on as many samples as are necessary to be representative of the waste (see Chapter 7 above), but on no fewer than four samples.

1. Ignitability. (See Section 261.21) This characteristic identifies wastes that either present fire hazards under routine storage, disposal, and transportation or are capable of severely exacerbating a fire once it is started. Ignitability for a liquid is defined in terms of its flash point. For a non-liquid, it is the ability to cause fire through friction, absorption, moisture, or spontaneous chemical change. The most common test for ignitable liquids, the Pensky-Martens Closed-Cup method, involves heating a sample slowly and determining the minimum temperature at which a small flame ignites the vapor above the sample (see SW-

846). The ignitability characteristic for non-liquids is a descriptive standard, and does not specify a test procedure.

2. Corrosivity. (See Section 261.22) This characteristic identifies wastes which might pose a hazard to human health or the environment due to their ability to:

- Mobilize toxic metals;
- Corrode handling, storage, transportation, and management equipment; or
- Destroy human or animal tissue in the event of inadvertent contact.

A waste is defined as corrosive if: (a) it is aqueous and has a pH of less than or equal to 2 or greater than or equal to 12.5, or (b) it is a liquid and corrodes a specific grade of steel at a rate greater than 6.35 mm per year under standardized test conditions. Test methods are given in SW-846.

3. Reactivity. (See Section 261.23) This characteristic identifies wastes which, because of their extreme instability and tendency to react violently or to explode, pose problems at all stages of the waste management process. In particular, such wastes have any of the following properties:

- They readily undergo violent chemical change;
- They react violently or form potentially explosive mixtures with water;
- They generate toxic fumes when mixed with water or, in the case of cyanide or sulfide-bearing wastes, when exposed to acidic or basic conditions;
- They explode when subjected to a strong initiating force;
- They explode at normal temperatures and pressures; or
- They fit within the Department of Transportation's forbidden explosives classifications.

Several methods for testing for reactivity are available, although none are comprehensive. The Defense Logistics Agency's Explosives Hazard Classification Procedures (DLAR 8220.1) prescribe a blasting-cap test (see Appendix J). Methods 9010 and 9030 in SW-846 measure cyanide and sulfides, respectively. In addition, a gas-generation test for reactive cyanide and sulfides in waste is contained in Appendix J, as is a test for photo-degradable cyanide. Descriptions of reactive wastes may be found in SW-846. In general, if you are dealing with an explosive waste, please contact EPA's Waste Identification Branch at (202) 475-8551 for further guidance on test methods.

4. Extraction Procedure (EP) Toxicity. (See Section 261.24)

The Extraction Procedure is designed to simulate the leaching that a waste will undergo if it is disposed of in a sanitary landfill. In a laboratory, a representative sample of a waste is extracted with deionized water maintained at a pH of 5 using acetic acid. The extract obtained from the procedure (the "EP extract") is analyzed to determine if any of the thresholds for the eight metals, four pesticides, and two herbicides specified in the regulations have been exceeded.* At least one EP toxicity test for each EP metal should be run using the method of standard additions. Spike and recovery concentrations and recovery efficiency should be reported.

8.2 Tests for Constituents

In addition to testing for the characteristics as described above, the following tests should be conducted as appropriate for the waste stream.

- If cyanide was a constituent for which the waste was listed, or if it is expected to be present in the waste, analyze for total cyanide (see SW-846). If the total concentration recorded is greater than 1 ppm, test for free cyanide (see SW-846). If the concentration of total cyanide is greater than 10 ppm, perform the photoconversion test for photodegradable cyanide (see Appendix J).
- If the cyanide analysis indicates the presence of an interference in the waste that produces non-representative concentrations, note and explain the interference. In addition, perform the following test (see Appendix J):

"Test Method for the Determination of Reactive Cyanide and Sulfide Containing Wastes, Final Method".

- Perform a total constituent analysis by complete acid digestion for all the EP metals and nickel (if nickel is a constituent for which the waste was listed). See SW-846 for a description of the method.
- Perform the Total Oil and Grease analysis to determine the percent of total mass that is oil and grease. The

*Note that if the total constituent analysis described below shows that one or more of the EP metals is not present or is present at concentrations of less than regulatory concern, then you may not have to test for those metals in the EP Toxicity Test. Contact the Waste Identification Branch for guidance on specific cases.

method involves drying the waste and then extracting the constituent oil and grease with an organic solvent such as freon.

- If the Total Oil and Grease analysis shows that the total oil and grease content of the waste is 1 percent or more, the EP Toxicity Test for Oily Wastes should be used (see Appendix J).
- Analyze for Total Organic Carbon (see Appendix J). In this test, organic carbon is converted to carbon dioxide by analytic combustion or wet chemical oxidation. The CO_2 formed can be measured or converted to methane (CH_4) and measured. The amount of CO_2 or CH_4 is directly proportional to the concentration of carbonaceous material in the sample.
- Identify and quantify individual organic constituents. This must usually be done using gas chromatography-mass spectrometry (GC-MS) methods. Applicable methods are contained in SW-846.

If chromium, cyanide, and nickel are listed constituents, tests for them may be combined with the EP toxicity test. For the first two compounds, the following special procedures apply:

- Analyze the EP extract for total chromium and hexavalent chromium separately. Report initial and final pH data on the hexavalent chromium EP analysis. If the pH drops from an alkaline or neutral value to an acidic pH, then alkaline digestion of the waste is required before analyzing for hexavalent chromium (Method 3060 in SW-846).
- Test for extractable cyanide using the EP procedure, using distilled water only (instead of acetic acid) as the extract medium.



9.0 PRESENTATION OF ANALYTICAL DATA

The data from the analytical tests should be presented in a format that supports your contention that the waste:

- a. Does not exhibit any of the hazardous waste characteristics, and
- b. Is not hazardous based on the constituents for which it was listed.

In addition, you must provide the necessary information on other hazardous constituents so that the Agency can determine whether the waste may reasonably be hazardous for any other reason. We also request data on other topics such as quality control procedure. This chapter corresponds to Part E of the optional petition form in Appendix A.

9.1 General Information

Please provide the names and addresses of the consultants or laboratory facilities that

- (a) sampled the waste, and
- (b) tested the samples.

If sampling or testing were performed using in-house staff and equipment, indicate that fact. In addition, please provide the names and qualifications of the persons who designed the sampling plan, drew samples, designed the test plan and performed the analytical tests (Section 260.22(i)(1) and (2)).

9.2 Sampling Information

Demonstrating that the waste samples are representative is a particularly important requirement of the delisting process. Many of the petitions we receive are deficient in this area. Therefore, please submit:

- A detailed description of your sampling strategy. The description should state why you believe the samples tested are representative of the waste stream, including any variations in the waste's properties over time and

space. In the case of process outflows, state whether all major equipment items, raw materials, and operating conditions are represented. In the case of storage locations, describe how sampling points were selected and how samples were drawn. Note that each outflow and storage location included in this petition must be sampled in a representative manner.

- A description of the documentation system used to track the samples; or, a statement that the Chain-of-Custody system specified in Section 1.3 of SW-846 was used.

In addition, please furnish the following information for each sample:

- The sample number, as it appears in your logbook or other record.
- The location where the sample was taken. Specify the general location (e.g., the outflow, lagoon, pile, etc.) and the specific point of sampling (e.g., quadrant and depth in a lagoon). Include a diagram.
- The equipment used for drawing the sample (Section 260.22(i)(8)).
- The date on which it was drawn (Section 260.22(i)(3)).
- The time of day when it was drawn.
- The handling and preparation techniques used, including techniques for extraction, containerization, and preservation (Section 260.22(i)(9)).

9.3 Test Results

For each test performed on each sample, please report the following information:

- The hazard being tested for;
- The specific substance or parameter being tested for;
- The date the test was performed (Section 260.22(i)(3));
- The test method used (Section 260.22(i)(10));
- The source of the test method used. Sources for methods are:

- "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," and its supplements and revisions, SW-846 (second edition), June, 1982, and
- Appendix J of this manual.
- The sample workup or preparation method.
- The names and model numbers of all equipment used in the tests (Section 260.22(i)(11)).
- The test results, expressing concentrations in common units such as mg/l, ppm, etc. (Section 260.22(i)(10)).
- Quality control procedures.
- Any supplementary information needed to interpret the test procedures or results.

Append a discussion explaining any inconsistencies or deviations among the analytical results presented.

9.4 Quality Assurance and Quality Control

It is important to report the methods taken to insure the quality of the sampling and testing procedure, so that our reviewers will know how much confidence to place in the results. In the case of inorganic substances, Standards Addition Analysis can be used for this purpose. In this method, a sample of the waste is "spiked" with a known concentration of the substance in question prior to being analyzed. The spike concentration should be approximately the same as the anticipated level of the constituent in the waste. If the concentration of the constituent is below the detection limit, then the spike concentration should be between three and ten times the detection limit. At least one test should be run for each substance. You should report:

- The spike concentration,
- The recovery concentration, and
- The recovery efficiency.

In the case of organic constituents, you should spike the sample with the substance of interest if possible. It may be necessary, however, to use a surrogate substance. This may be the case because a standard is not otherwise available, or because of interferences from other substances in the waste. Surrogates should be chosen on the basis of similar chemical structure to the substance of interest; similarity of physical properties such as boiling and melting points may also be considered. The spike concentration for the substance or its surrogate should be as

described above. Methods for calibrating the gas chromatography apparatus when using internal or external standards are described in SW-846 (see, for example, Section 7.2 of Method 8020).

When reporting the results of the spike analysis for organics, give the spike concentration, recovery concentration, and recovery efficiency as specified above. In addition, please specify which substance, if any, was used as a surrogate for the compound of interest, and provide details of the method used to calibrate the analytical equipment.

Describe any other quality control measures taken as well.

APPENDIX A
OPTIONAL FORM FOR DELISTING PETITIONS

OPTIONAL FORM:
DELISTING PETITION FOR WASTE STREAM

Submitted by:

Date:

INSTRUCTIONS

1. This form is meant to assist you in submitting a petition to delist a RCRA hazardous waste under the provisions of Section 260.22 of the hazardous waste regulations. Its use is optional. Any part of the form may be changed or adapted to your circumstance, provided that all information submitted is clear, complete, and conforms to the regulatory requirements.
2. Instructions for completing this petition form are contained in the document entitled, "Petitions to Delist Hazardous Wastes: A Guidance Manual," EPA/530-SW-85-003, April 1985. The manual is available from the National Technical Information Service. Please review the manual thoroughly before attempting to develop your petition. Should you need further assistance, it may be obtained by calling the Environmental Protection Agency's RCRA Hotline, at (800) 424-9346 (in the Washington, D.C. area, 382-3000).
3. Certain types of facilities, such as petroleum refineries and multiple waste treatment facilities, are required to submit information in addition to or in lieu of the information specified in this form. Petitioners for such facilities should refer to Section 4.3 of the Guidance Manual and adapt this form as appropriate.
4. Items that you are required to submit are designated by references to the appropriate parts of the hazardous waste regulations.
5. If insufficient space is provided for your answers, attach extra sheets as necessary.
6. Please submit completed petitions to:

The Administrator
US Environmental Protection Agency
401 M Street SW
Washington, D.C. 20460

In addition, send a copy to:

Chief, Waste Identification Branch
Office of Solid Waste (WH-562B)
US Environmental Protection Agency
401 M Street, SW
Washington, D.C. 20460

7. Please be sure to provide the following items, which are often omitted. Their omission will delay the review process and may cause extra work for you and for EPA.

RCRA ID Numbers

Facility contact(s) and telephone numbers

Material safety data sheets, where requested

Waste generation quantities

Signed certification statement

Statement of sample representativeness

Statement of waste's ignitibility/reactivity/corrosivity

SECTION A: Administrative Data and Summary

1. Name [260.20(b)(1)]

a. Name of firm: _____

b. Address of firm: Street: _____

City: _____

State: _____ Zip: _____

c. RCRA Generator ID number: _____

2. Facility Location [260.20(b)(1)]

a. Name of facility: _____

b. Location of facility: Street: _____

City: _____

State: _____ Zip: _____

3. Name(s) of personnel to be contacted for additional information pertaining to this petition:

Name	Title	Telephone
_____	_____	() _____
_____	_____	() _____
_____	_____	() _____
_____	_____	() _____

4. Description and Justification for the Proposed Action

Please describe briefly the proposed delisting action, why it is needed, and how it will affect your operation. Describe why you believe that the waste stream of concern (a) is not hazardous for the reasons it was originally listed and (b) contains no other constituents or characteristics that render it hazardous as defined in 40 CFR 261. [260.20(b)(2), (3) and (4)]

5. Certification of Accuracy and Responsibility [260.22(i)(12)]

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Signed,

Waste Generator, Title or
Authorized Representative*
of Waste Generator, Title

*Note: An "authorized representative" is a person responsible for the overall operation of a facility or an operational unit (for example, a plant manager, superintendent, or person of equivalent responsibility). Consultants or other outside parties may not sign the certification statement.

SECTION B: Production Processes

1. Description of Manufacturing Processes and Other Operations [260.22(i)(5)].
 - a. Please provide a brief description of the on-site manufacturing/generating process(es) that produce the waste stream. Include descriptions of major equipment items and production lines. Also, describe the stages of the typical operating cycle (e.g., startup, steady-state operation, cleaning and maintenance) on a daily, weekly, or other basis as appropriate.
 - b. Please provide a description of all surface and equipment preparation, cleaning, degreasing, coating or painting processes used in your facility that you have not described in (a) above.
 - c. Attach a schematic diagram of all manufacturing processes, surface preparation, cleaning, and other operations that may provide influent into the waste stream.

2. Materials Used or Produced

You may comply with the requirements for additional information in either of two ways; see Section 4 of the Guidance Manual for a detailed description of the two approaches.

Approach A:

- a. List all materials used or produced in the manufacturing or other process generating the waste stream(s). Use the correct chemical name wherever possible. Include materials such as:

Raw materials
Intermediate products
By-products
Products
Oils and hydraulic fluids
Surface preparation materials
(solvents, acids, cleaners, surface
preparation agents, paints, etc.)

Also:

- For each material on the list, indicate whether it is discharged to or likely to be present in the waste, and the estimated amount entering the waste stream annually. (Specify kilograms, pounds, or similar units.) Describe your estimation method.
- For each material on the list that you do not expect to be present in the waste, give supporting reasons for this expectation. Supporting reasons may include mass balance and process information.
- Attach Materials Safety Data Sheets (MSDS) for all materials that are identified by trade or generic name only and that are discharged into or likely to be present in the waste stream.

Material	Estimated Amount Entering the Waste Stream Annually
_____	_____
_____	_____
_____	_____
_____	_____

(Continue on additional sheets as necessary)

- b. Please give your assessment of the likelihood that the processes, operations, or feed materials described above might produce a waste stream that is not included in this petition.

Approach B:

You need not furnish any other information regarding your facility's processes and materials. You must, however, test your waste for additional constituents as described in Chapters 4 and 6 of the Guidance Manual.

SECTION C: The Waste Stream

1. EPA hazardous waste number and description of waste stream
(from 261.31 or 261.32):

No. _____ Description _____

Form of the waste (e.g., aqueous solution, sludge, dry solids):

If the waste is a sludge, give the percent solids: _____ %

2. Estimated average and maximum monthly and annual quantities
generated: (Please use consistent units of measurement.)

	Average	Maximum
Monthly	_____	_____
Annually	_____	_____

3. This waste stream: (check all that apply)

_____ Is currently being generated.
_____ Will be generated in the future.
_____ Has been generated in the past and is currently
being treated/stored on-site.
_____ Has been generated in the past and is currently
being treated/stored off-site.

4. Present methods of on-site storage, and amounts being stored:

	Amount
Surface impoundment,	_____
Evaporation pond	_____
Percolation bed	_____
Waste pile(s)	_____
Tank(s)	_____
Containers	_____
Landfill	_____
Drums	_____
Other (please specify)	_____

5. Waste Management Methods:

Briefly describe:

- (a) how the waste is currently managed;
- (b) how it was managed before November 19, 1980; and
- (c) how it will be managed if this petition is approved.

As appropriate, provide names and locations of off-site treatment, storage or disposal facilities, and names and addresses of waste transportation firms.

If the waste is treated prior to disposal, please attach a schematic flow diagram of your present waste treatment system, showing the processes and equipment used.

SECTION D: Selection of Constituents for Testing

The procedures described below apply to all types of wastes other than those from petroleum refineries and multiple waste treatment facilities. Petitioners for these facilities should refer to Section 4 of the Guidance Manual and adapt this section of the petition appropriately.

1. If you have followed Approach A in Section B above, please submit test results on representative samples for the following:
 - The specific hazardous constituents for which the waste was listed (i.e., total concentration of each listed constituent found in Appendix VII of Part 261);
 - The four hazardous waste characteristics (but see the Note immediately below);
 - Appropriate leachate tests for the EP toxic metals, nickel, and cyanide;
 - Total concentrations of the EP toxic metals and nickel;
 - Total organic carbon (TOC); and
 - Total oil and grease.

Note: If you can explain why the waste cannot exhibit one or more of the four hazardous waste characteristics, you may submit your rationale in lieu of test results for those characteristics. For example, if the waste is composed exclusively of organic solvents and there is no chance (on the basis of process considerations) that it contains any of the EP toxicants, you need not test for the EP Toxicity characteristic.

You may omit the rest of this section and go to Part E.

2. If you have opted for Approach B in Section B above, then you must perform the tests specified in the above paragraph, and you should test for all hazardous constituents that may "reasonably be expected" to be in the waste, whether or not they were used as a basis for listing.

The remainder of this section is to be used to support your decision regarding which constituents to test for.

- a. List the constituents (from Appendix VIII to Part 261) that may reasonably be expected to be in the waste. Describe the engineering, chemical, or other considerations that support your choice.

Constituent: _____

Reasons for Selection:

(Repeat as necessary.)

- b. For each of the remaining hazardous constituents (or groups of constituents) in Appendix VIII of Part 261, specify why it may not reasonably be expected to occur in the waste stream. Base your reasoning on process, engineering, mass balance or other considerations as appropriate.

Constituent (or group of constituents): _____

Reasons for non-occurrence:

(Repeat as necessary.)

SECTION E: Sampling and Testing the Waste

The purpose of the data requested below is to demonstrate that representative samples of the waste stream:

- a. Do not exhibit any of the criteria (e.g., hazardous waste characteristics or constituents) for which the waste was listed, and
- b. Do not exhibit any other criteria that could cause it to be listed.

Additional information is also requested as a check on the test results. Refer to the accompanying Guidance Manual for instructions on developing a sampling plan (Chapter 7), selecting proper test methods, (Chapter 8) and presenting the test results (Chapter 9).

1. General Information

- a. Name and address of the laboratory facility performing the sampling [260.22(i)(1)]:

Name _____

Street _____

City _____ State _____ Zip _____

Telephone: (____) ____ - _____

If sampling was done by in-house staff, check here: _____

For each individual person who (a) designed the sampling plan or (b) collected samples, please provide the following information and attach a resume or other statement of qualifications [260.22(i)(2)].

Name _____

Affiliation _____

Title _____

(Repeat as necessary.)

- b. Name and address of the laboratory facility performing the testing, if different from the sampling laboratory [260.22(i)(1)]:

Name _____

Street _____

City _____ State _____ Zip _____

Telephone: (____) _____ - _____

If testing was done by in-house staff, check here: _____

For each individual person who (a) designed the testing plan or (b) performed tests, please provide the following information and attach a resume or other statement of qualifications [260.22(i)(2)].

Name _____

Affiliation _____

Title _____

(Repeat as necessary.)

c. Describe the sampling strategy you followed to insure that the samples were representative [260.22(i)(8)]. Please address specifically:

- the variation of the waste stream over time; and
- the variation of the waste stream in space.

All waste stream outflows or storage locations to which this petition applies must be sampled. The Delisting Petition Guidance Manual (see Instructions to this form) gives directions for developing a sampling plan.

d. State whether the Chain of Custody procedures in Section 1.3 of SW-846 were followed. Please describe any deviations from those procedures and the reasons for them.

2. Sample-Specific Information

For each individual sample, please furnish the information requested in the form on the following page. The notes below refer to those items on the form that are not self-explanatory. The Guidance Manual contains additional instructions.

Notes

Item f, "Parameter/Constituent Tested For": Enter the hazardous waste characteristic or constituent that was the subject of the test.

Item i, "Test Method and Source": See Chapter 8 of the Guidance Manual for a listing of applicable test methods. Sources for test methods may be designated by number, as follows:

1. "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," EPA SW-846 (second edition), July, 1982, and supplements.
2. "Methods for the Evaluation of Water and Wastewater," EPA 600 14-79-020, March, 1979.
3. "Standard Methods for the Examination of Water and Wastewater," (14th Edition).
4. Appendix J of the Guidance Manual

Item j, "Sample Workup or Preparation Method": See Section Four of Reference 1 above.

Item l, "Test Results": Enter concentrations in mg/l, ppm, etc. as appropriate.

Sample Number: _____

Sampling Information:

- a. Sampling location: _____
- b. Person(s) who drew the sample: _____
- c. Equipment used for drawing the sample: _____
- d. Date and time when the sample was drawn: __/__/__, _____ a.m.
p.m.
- e. Handling, containerization, and preservation techniques used: _____

Test Procedures and Results: (Repeat for each test conducted)

- f. Parameter/Constituent Tested For: _____
- g. Date Test Performed: __/__/__
- h. Person(s) who performed the test: _____
- i. Test Method (or Number) and Source: _____
- j. Sample Workup or Preparation Method: _____
- k. Equipment: Name Model Number
- | | | |
|-------|-------|-------|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
- l. Test Results: _____

3. Summary Table of Analytical Results

For each sample, please enter the Test Results from Item 2 above onto the form contained in the following pages.

4. Analytical Discussion

Please furnish explanations or additional information on the following topics as necessary:

- a. Inconsistencies or deviations in the analytical results presented above.
- b. Additional reasons as to why the waste stream should be delisted.

SUMMARY OF TEST RESULTS

Sample Number:						
Sampling Location:						
Date Sample Taken:						
1. <u>Ignitability</u> Liquids Flash point Non-liquids Spontaneous combustion Compressed Gas Flammability Oxidizer Oxygen yield						
2. <u>Corrosivity</u> pH Corrosivity towards steel						
3. <u>Reactivity</u> Violent chemical change Reacts violently with water Water-reactive; explosive						

SUMMARY OF TEST RESULTS (Continued)

Sample Number:						
3. <u>Reactivity</u> (Cont.)	Water-reactive, toxic gases, vapors, fumes					
	Cyanide or sulfur- bearing wastes which, when exposed to acidic/basic conditions, gen- erate toxic gases, vapors, or fumes					
	Explosive when subjected to force or heat					
	Explosive at stan- dard temperature and pressure					
	DOT explosive					
4. <u>Total Metals</u> (Complete Acid Digestion)	Arsenic					
	Barium					
	Cadmium					
	Chromium					

SUMMARY OF TEST RESULTS (Continued)

Sample Number:						
4. <u>Total Metals</u> (cont.)	Lead					
	Mercury					
	Selenium					
	Silver					
	Nickel					
5. <u>EP Toxicity</u> -- <u>Metals</u>	Arsenic					
	Barium					
	Cadmium					
	Chromium					
	Lead					
	Mercury					
	Selenium					
	Silver					
	Nickel					

SUMMARY OF TEST RESULTS (Continued)

Sample Number:						
6. <u>EP Toxicity</u> -- <u>Metals;</u> <u>Oily Waste</u> <u>Methods*</u>	Arsenic					
	Barium					
	Cadmium					
	Chromium					
	Lead					
	Mercury					
	Selenium					
	Silver					
	Nickel					
7. <u>EP Toxicity</u> -- <u>Pesticides</u>	Endrin					
	Lindane					
	Methoxychlor					
	Toxaphene					
8. <u>EP Toxicity</u> -- <u>Herbicides</u>	2,4-D					
	2,4,5-TP (Silvex)					

*For wastes containing greater than 1% total oil and grease.

SUMMARY OF TEST RESULTS (Continued)

Sample Number:						
9. <u>EP Toxicity</u> -- <u>Organics</u>						
10. <u>Total Organ-</u> <u>ic Carbon</u>						
11. <u>Oil and</u> <u>Grease</u>						
12. <u>Cyanide</u> Total Free Extraction procedure Photodegradable						
13. <u>Other</u> Appendix VIII constituents (Add sheets as necessary)						

5. Quality Assurance and Quality Control

- a. For inorganic substances, describe the procedures used for Standard Additions Analysis. Provide the following for each substance tested:

Substance	Spike Concentration	Recovery Concentration	Percent Recovery
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

- b. For organic substances, describe the procedures used for analysis of spiked samples. For each substance tested, provide the information requested in the following table. Also, describe in writing the procedures used to calibrate the analytical equipment.

Substance Tested For	Surrogate, if any	Spike Conc.	Recovery Conc.	Percent Recovery
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

- c. Describe any other QA/QC measures followed in regard to the sampling and analysis procedures.

APPENDIX B

HAZARDOUS WASTE DELISTING REGULATIONS (40 CFR 260 Subpart C)

The regulations in this Appendix are current as of April 1985. Therefore, they do not reflect forthcoming changes in the delisting procedures to be issued in accordance with the Hazardous and Solid Waste Amendments of 1984.

Subpart C—Rulemaking Petitions

§ 260.20 General.

(a) Any person may petition the Administrator to modify or revoke any provision in Parts 260 through 265 of this chapter. This section sets forth general requirements which apply to all such petitions. Section 260.21 sets forth additional requirements for petitions to add a testing or analytical method to Part 261, 264 or 265. Section 260.22 sets forth additional requirements for petitions to exclude a waste at a particular facility from § 261.3 of this chapter or the lists of hazardous wastes in Subpart D of Part 261.

(b) Each petition must be submitted to the Administrator by certified mail and must include:

- (1) The petitioner's name and address;
- (2) A statement of the petitioner's interest in the proposed action;
- (3) A description of the proposed action, including (where appropriate) suggested regulatory language; and
- (4) A statement of the need and justification for the proposed action, including any supporting tests, studies, or other information.

(c) The Administrator will make a tentative decision to grant or deny a petition and will publish notice of such tentative decision, either in the form of an advanced notice of proposed rulemaking, a proposed rule, or a tentative determination to deny the petition, in the **FEDERAL REGISTER** for written public comment.

(d) Upon the written request of any interested person, the Administrator may, at his discretion, hold an informal public hearing to consider oral comments on the tentative decision. A person requesting a hearing must state the issues to be raised and explain why written comments would not suffice to communicate the person's views. The Administrator may in any case decide on his own motion to hold an informal public hearing.

(e) After evaluating all public comments the Administrator will make a final decision by publishing in the **FEDERAL REGISTER** a regulatory amendment or a denial of the petition.

§ 260.21 Petitions for equivalent testing or analytical methods.

(a) Any person seeking to add a testing or analytical method to Part 261, 264, or 265 of this chapter may petition for a regulatory amendment under this section and § 260.20. To be successful, the person must demonstrate to the satisfaction of the Administrator that the proposed method is equal to or superior to the corresponding method prescribed in Part 261, 264, or 265 of this chapter, in terms of its sensitivity, accuracy, and precision (i.e., reproducibility).

(b) Each petition must include, in addition to the information required by § 260.20(b):

(1) A full description of the proposed method, including all procedural steps and equipment used in the method;

(2) A description of the types of wastes or waste matrices for which the proposed method may be used;

(3) Comparative results obtained from using the proposed method with those obtained from using the relevant or corresponding methods prescribed in Part 261, 264, or 265 of this chapter;

(4) An assessment of any factors which may interfere with, or limit the use of, the proposed method; and

(5) A description of the quality control procedures necessary to ensure the sensitivity, accuracy and precision of the proposed method.

(c) After receiving a petition for an equivalent method, the Administrator may request any additional information on the proposed method which he may reasonably require to evaluate the method.

(d) If the Administrator amends the regulations to permit use of a new testing method, the method will be incorporated in "Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods," SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington, D.C. 20460.

[*Comment:* This manual will be provided to any person on request, and will be available for inspection or copying at EPA headquarters or any EPA Regional Office.]

§ 260.22 Petitions to amend Part 261 to exclude a waste produced at a particular facility.

(a) Any person seeking to exclude a waste at a particular generating facility from the lists in Subpart D of Part 261 may petition for a regulatory amendment under this section and § 260.20. To be successful, the petitioner must demonstrate to the satisfaction of the Administrator that the waste produced by a particular generating facility does not meet any of the criteria under which the waste was listed as a hazardous waste and, in the case of an acutely hazardous waste listed under § 261.11(a)(2), that it also does not meet the criterion of § 261.11(a)(3). A waste which is so excluded may still, however, be a hazardous waste by operation of Subpart C of Part 261.

(b) The procedures in this section and § 260.20 may also be used to petition the Administrator for a regulatory amendment to exclude from § 261.3(a)(2)(ii) or (c), a waste which is described in those sections and is either a waste listed in Subpart D, contains a waste listed in Subpart D, or is derived from a waste listed in

§ 260.22

Subpart D. This exclusion may only be issued for a particular generating, storage, treatment, or disposal facility. The petitioner must make the same demonstration as required by paragraph (a) of this section, except that where the waste is a mixture of solid waste and one or more listed hazardous wastes or is derived from one or more hazardous wastes, his demonstration may be made with respect to each constituent listed waste or the waste mixture as a whole. A waste which is so excluded may still be a hazardous waste by operation of Subpart C of Part 261.

(c) If the waste is listed with codes "T", "C", "R", or "E" in Subpart D, the petitioner must show that demonstration samples of the waste do not exhibit the relevant characteristic defined in § 261.21, § 261.22, § 261.23, or § 261.24 using any applicable test methods prescribed therein.

(d) If the waste is listed with code "T" in Subpart D, the petitioner must demonstrate that:

(1) Demonstration samples of the waste do not contain the constituent (as defined in Appendix VII) that caused the Administrator to list the waste, using the appropriate test methods prescribed in Appendix III; or

(2) The waste does not meet the criterion of § 261.11(a)(3) when considering the factors in § 261.11(a)(3) (i) through (xi).

(e) If the waste is listed with the code "H" in Subpart D, the petitioner must demonstrate that the waste does not meet both of the following criteria:

(1) The criterion of § 261.11(a)(2).

(2) The criterion of § 261.11(a)(3) when considering the factors listed in § 261.11(a)(3) (i) through (xi).

(f) [Reserved for listing radioactive wastes.]

(g) [Reserved for listed infectious wastes.]

(h) Demonstration samples must consist of enough representative samples, but in no case less than four samples, taken over a period of time sufficient to represent the variability or the uniformity of the waste.

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(i) Each petition must include, in addition to the information required by § 260.20(b):

(1) The name and address of the laboratory facility performing the sampling or tests of the waste;

(2) The names and qualifications of the persons sampling and testing the waste;

(3) The dates of sampling and testing;

(4) The location of the generating facility;

(5) A description of the manufacturing processes or other operations and feed materials producing the waste and an assessment of whether such processes, operations, or feed materials can or might produce a waste that is not covered by the demonstration;

(6) A description of the waste and an estimate of the average and maximum monthly and annual quantities of waste covered by the demonstration;

(7) Pertinent data on and discussion of the factors delineated in the respective criterion for listing a hazardous waste, where the demonstration is based on the factors in § 261.11(a)(3);

(8) A description of the methodologies and equipment used to obtain the representative samples;

(9) A description of the sample handling and preparation techniques, including techniques used for extraction, containerization and preservation of the samples;

(10) A description of the tests performed (including results);

(11) The names and model numbers of the instruments used in performing the tests; and

(12) The following statement signed by the generator of the waste or his authorized representative:

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

(j) After receiving a petition for an exclusion, the Administrator may re-

quest any additional information which he may reasonably require to evaluate the petition.

(k) An exclusion will only apply to the waste generated at the individual facility covered by the demonstration and will not apply to waste from any other facility.

(l) The Administrator may exclude only part of the waste for which the demonstration is submitted where he has reason to believe that variability of the waste justifies a partial exclusion.

(m) The Administrator may (but shall not be required to) grant a temporary exclusion before making a final decision under § 260.20(d) whenever he finds that there is a substantial likelihood that an exclusion will be finally granted. The Administrator will publish notice of any such temporary exclusion in the **FEDERAL REGISTER**.

APPENDIX C
STATE HAZARDOUS WASTE AGENCIES
AND DELISTING CONTACTS

STATE HAZARDOUS WASTE AGENCIES
AND DELISTING CONTACTS

(Telephone numbers for delisting contacts are the same
as for the agency, unless otherwise shown.)

Alabama

Alabama Dept. of Environmental
Management
Solid & Hazardous Waste
Management Division
State Capitol
Montgomery, Alabama 36130
(205) 832-6728

Delisting Contact:
Bill Gallagher, (404) 881-3016

Alaska

Department of Environmental Conservation
Air & Solid Waste Management
Pouch O
Juneau, Alaska 99811
(907) 465-2635

Delisting Contact:
Dave Ditraglia, (907) 465-2666

American Samoa

Environmental Quality Commission
American Samoa Government
Pago Pago, American Samoa 96799
Overseas Operator 633-4116

Delisting Contact:
Lucy Mlenar (EPA Region IX)
(415) 974-7472

Arizona

Bureau of Waste Control
Department of Health Services
State Health Building
1740 West Adams Street
Phoenix, Arizona 85007
(602) 255-1170

Delisting Contact:
Sally Mates, (602) 255-1160

Arkansas

Department of Pollution Control
and Ecology
Solid Waste Management Division
PO Box 9583
8001 National Drive
Little Rock, Arkansas 72219
(501) 562-7444

Delisting Contact:
Jay Justice, x274

California

Department of Health Services
Toxic Substances Control Division
714 P Street
Sacramento, California 95814
(916) 324-1789

Delisting Contact:
Stan Lau, (916) 324-1807

Colorado

Colorado Department of Health
Waste Management Division
4210 E. 11th Avenue
Denver, Colorado 80220
(303) 320-8333

Delisting Contact:
Ken Waesche

Commonwealth of North Mariana Islands

Department of Public Health and
Environmental Services
Division of Environmental Quality
Commonwealth of the North Mariana Islands
Saipan, Mariana Islands 96950
Overseas Operator: 6984

Delisting Contact:
Lucy Mlenar (EPA Region IX)
(415) 974-7472

Connecticut

Department of Environmental Protection
Hazardous Materials Management Unit
State Office Building
165 Capitol Avenue
Hartford, Connecticut 06115
(203) 549-4924

Delisting Contact:
Barry Giroux, (203) 566-4869

Delaware

Department of Natural Resources
and Environmental Control
Solid Waste Management Branch
89 King Highway
PO Box 1401
Dover, Delaware 19901
(302) 736-4781

Delisting Contact:
Alan Simpson

District of Columbia

Department of Environmental
Services
Division of Pesticides
and Hazardous Materials
5000 Overlook Avenue, S.W.
Washington, D.C. 20032
(202) 767-8422

Delisting Contact:
Angelo Tompros

Florida

Department of Environmental Regulations
Solid Waste Section
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32301
(904) 488-0300

Delisting Contact:
Craig Dieltz

Georgia

Department of Natural Resources
Environmental Protection Division
270 Washington Street, S.W.
Atlanta, Georgia 30334
(404) 656-2833

Delisting Contact:
Shirley Maxwell

Guam

Environmental Protection Agency
Government of Guam
PO Box 2999
Agana, Guam 96910
Overseas Operator 646-8863

Delisting Contact:
Jim Canto

Hawaii

Department of Health
Environmental Health Division
PO Box 3378
Honolulu, Hawaii 96801
(808) 548-4139

Delisting Contact:
Lucy Mlenar (EPA Region IX)
(415) 974-7472

Idaho

Department of Health and Welfare
Hazardous Materials Bureau
State House
Boise, Idaho 83720
(208) 334-4064

Delisting Contact:
Daryl Koch, (208) 384-4118

Illinois

Environmental Protection Agency
Division of Land Pollution Control
2200 Churchill Road
Springfield, Illinois 62706
(217) 782-0246

Delisting Contact:
Gary King, (217) 782-5544

Indiana

State Board of Health
Land Pollution Control Division
1330 West Michigan Street
Indianapolis, Indiana 46206
(317) 633-0194

Delisting Contact:
Gwyn Doyle, (317) 243-5021

Iowa

Department of Environmental Quality
Hazardous Waste Program
Henry A. Wallace Building
900 East Grand Street
Des Moines, Iowa 50319
(515) 281-8853

Delisting Contact:
Ron Kolpa, (515) 281-8925

Kansas

Department of Health and Environment
Bureau of Environmental Sanitation
Forbes Field, Building 321
Topeka, Kansas 66620
(913) 862-9360

Delisting Contact:
John Mitchell

Kentucky

Department of Natural Resources
and Environmental Protection
Division of Waste Management
18 Reilly Road
Frankfort, Kentucky 40601
(502) 564-6716

Delisting Contact:
George Gilbert

Louisiana

Department of Natural Resources
Solid Waste Management Division
PO Box 44066
Baton Rouge, Louisiana 70804
(504) 342-1216

Delisting Contact:
Bill Greenwich, (504) 342-1227

Maine

Department of Environmental Protection
Bureau of Oil and Hazardous Materials
State House - Station 17
Augusta, Maine 04333
(207) 289-2651

Delisting Contact:
Dave Boulter, (207) 289-2651

Maryland

Department of Health and Mental Hygiene
Waste Management Administration
201 West Preston Street
Baltimore, Maryland 21201
(301) 383-5740

Delisting Contact:
Alvin Bowles, (301) 383-5736

Massachusetts

Department of Environmental
Quality Engineering
Division of Hazardous Waste
One Winter Street
Boston, Massachusetts 02108
(617) 292-5589

Delisting Contact:
Steve Dreeszen, (617) 292-5832

Michigan

Department of Natural Resources
Environmental Services Division
Office of Hazardous Waste Management
Box 30028
Lansing, Michigan 48909
(517) 373-2730

Delisting Contact:
Al Howard

Minnesota

Pollution Control Agency
Solid and Hazardous Waste Division
1935 West County Road, R-2
Roseville, Minnesota 55113
(612) 296-7333

Delisting Contact:
Gordon Myer, (612) 296-7784

Mississippi

Department of Natural Resources
Division of Solid & Hazardous
Waste Management
PO Box 10385
Jackson, Mississippi 39209
(601) 961-5171

Delisting Contact:
David Lee, (601) 961-5046

Missouri

Department of Natural Resources
Solid Waste Management Program
PO Box 1368
Jefferson City, Missouri 65102
(314) 751-3241

Delisting Contact:
Stan Jorgenson

Montana

Department of Health and
Environmental Services
Solid Waste Management Bureau
Cogswell Building
Helena, Montana 59602
(406) 444-2821

Delisting Contact:
Roger Thorvilson

Nebraska

Department of Environmental Control
Water and Waste Management Division
PO Box 94877
Lincoln, Nebraska 68509
(402) 471-2186

Delisting Contact:
Mike Steffensmeier

Nevada

Department of Conservation and
Natural Resources
Waste Management Program
Capitol Complex
Carson City, Nevada 89701
(702) 885-4670

Delisting Contact:
Verne Rosse

New Hampshire

Department of Health and Welfare
Office of Waste Management
Health & Welfare Building
Hazen Drive
Concord, New Hampshire 03301
(603) 271-4608

Delisting Contact:
Len Poole, (603) 271-4611

New Jersey

Department of Environmental Protection
Solid Waste Administration
32 E. Hanover Street
Trenton, New Jersey 08625
(609) 292-9877

Delisting Contact:
Sonya Shashova, (609) 292-8341

New Mexico

New Mexico Health and Environment
Department
Environmental Improvement Division
PO Box 968
Santa Fe, New Mexico 87504
(505) 984-0020

Delisting Contacts:
Peter Pache, (505) 984-0020, x340
Trent Thomas, (505) 827-5271

New York

Department of Environmental
Conservation
Division of Solid Waste
50 Wolf Road
Albany, New York 12233
(518) 457-6603

Delisting Contact:
Jim Moran, (518) 457-6858

North Carolina

Department of Human Services
Environmental Health Section
Solid & Hazardous Waste
Management Branch
PO Box 2091
Raleigh, North Carolina 27602
(919) 733-2178

Delisting Contact:
Jerry Rhodes, (919) 733-2178

North Dakota

Department of Health
Division of Environmental
Waste Management & Research
1200 Missouri Avenue
Bismark, North Dakota 58505
(701) 224-2366

Delisting Contact:
Neil Knatterud, (701) 224-2366

Ohio

Ohio Environmental Protection Agency
Office of Land Pollution Control
PO Box 1049
Columbus, Ohio 43216
(614) 466-8934

Delisting Contact:
Tom Carlisle, (614) 462-6735

Oklahoma

Oklahoma State Department of Health
Industrial & Solid Waste Service
1000 NE 10th Street
Oklahoma City, Oklahoma 73152
(405) 271-5338

Delisting Contact:
Donald A. Hensch, (405) 271-5338

Oregon

Department of Environmental Quality
Solid Waste Management Division
PO Box 1760
522 S.W. Fifth Avenue
Portland, Oregon 97207
(503) 229-5913

Delisting Contact:
Rich Reiter, (503) 229-6434

Pennsylvania

Department of Environmental Resources
Bureau of Solid Waste Management
Fulton Building
PO Box 2063
Harrisburg, Pennsylvania 17120
(717) 787-9870

Delisting Contact:
David Freedman, (215) 637-7381

Puerto Rico

Environmental Quality Board
Solid, Toxics, & Hazardous Waste Program
Box 11488
Sanjurjo, Puerto Rico 00910-1488
(809) 725-8992

Delisting Contact:
Yacman Lopez

Rhode Island

Department of Environmental Management
Solid Waste Management Program
Cannon Building
75 Davis Street
Providence, Rhode Island 02908
(401) 277-2797

Delisting Contact:
Steve Majkut

South Carolina

South Carolina Department of
Health & Environmental Control
Bureau of Solid & Hazardous Waste
Management
J. Marion Sims Building
2600 Bull Street
Columbia, South Carolina 29201
(803) 758-5681

Delisting Contacts:
Lynn Martin, Rick Grant

South Dakota

Department of Water & Natural Resources
Office of Air Quality & Solid Waste
Joe Foss Building
Pierre, South Dakota 57501
(605) 773-3329

Delisting Contact:
Kevin Tviedt

Tennessee

Department of Public Health
Bureau of Environmental Services
Division of Solid Waste Management
150 9th Avenue, North
Nashville, Tennessee 37203
(615) 741-3424

Delisting Contact:
Shirley Dunn

Texas

Texas Department of Health
Bureau of Solid Waste Management
1100 West 49th Street, T-602
Austin, Texas 78756
(512) 458-7271

Delisting Contact:
Dick Martin (TDWR), (512) 475-2041

Utah

Bureau of Solid & Hazardous Waste
Waste Management Division
PO Box 2500
150 West North Temple
Salt Lake City, Utah 84110
(801) 533-4145

Delisting Contact:
Kent Gray

Vermont

Agency of Environmental Conservation
Air & Solid Waste Programs
State Office Building
Montpelier, Vermont 05602
(802) 828-3395

Delisting Contact:
John Miller

Virgin Islands

Department of Conservation and
Cultural Affairs
Division of Natural Resources
Hazardous Waste Program
PO Box 4340, Charlotte Amalie
St. Thomas, Virgin Islands 00801
(809) 774-6420

Delisting Contact:
Roger Van Eepoel

Virginia

Virginia Department of Health
Division of Solid and Hazardous
Waste Management
Madison Building
109 Governor Street
Richmond, Virginia 23219
(804) 786-5271

Delisting Contact:
Walt Gulovich, (804) 225-2667

Washington

Department of Ecology
Solid Waste Management Division
Olympia, Washington 98504
(206) 459-6317

Delisting Contact:
Tom Cook, (206) 459-6301

West Virginia

Department of Natural Resources
1201 Greenbrier Street
East Charleston, West Virginia 25311
(304) 348-5935

Delisting Contact:
Robert Jelacic

Wisconsin

Department of Natural Resources
Bureau of Solid Waste Management
PO Box 7921
Madison, Wisconsin 53707
(608) 266-1327

Delisting Contact:
Richard O'Hara, (608) 266-0833

Wyoming

State of Wyoming Department of Environ-
mental Quality
Solid Waste Management Program
Equality State Bank Building
401 West 19th Street
Cheyenne, Wyoming 82002
(307) 777-7752

Delisting Contact:
Dave Finley

APPENDIX D

HAZARDOUS WASTE CHARACTERISTICS (40 CFR 261 Subpart C)

The content of this Appendix was reproduced from the Code of Federal Regulations of July 1, 1984. Users should check the current version of the Code of Federal Regulations and more recent issues of the Federal Register for amendments.

**Subpart C—Characteristics of
Hazardous Waste**

§ 261.20 General.

(a) A solid waste, as defined in § 261.2, which is not excluded from regulation as a hazardous waste under § 261.4(b), is a hazardous waste if it exhibits any of the characteristics identified in this Subpart.

(Comment: § 262.11 of this chapter sets forth the generator's responsibility to determine whether his waste exhibits one or more of the characteristics identified in this Subpart)

(b) A hazardous waste which is identified by a characteristic in this subpart, but is not listed as a hazardous

§ 261.21

waste in Subpart D, is assigned the EPA Hazardous Waste Number set forth in the respective characteristic in this Subpart. This number must be used in complying with the notification requirements of Section 3010 of the Act and certain recordkeeping and reporting requirements under Parts 262 through 265 and Part 270 of this chapter.

(c) For purposes of this Subpart, the Administrator will consider a sample obtained using any of the applicable sampling methods specified in Appendix I to be a representative sample within the meaning of Part 260 of this chapter.

[Comment: Since the Appendix I sampling methods are not being formally adopted by the Administrator, a person who desires to employ an alternative sampling method is not required to demonstrate the equivalency of his method under the procedures set forth in §§ 260.20 and 260.21.]

[45 FR 33119, May 19, 1980, as amended at 48 FR 14294, Apr. 1, 1983]

§ 261.21 Characteristic of ignitability.

(a) A solid waste exhibits the characteristic of ignitability if a representative sample of the waste has any of the following properties:

(1) It is a liquid, other than an aqueous solution containing less than 24 percent alcohol by volume and has flash point less than 60°C (140°F), as determined by a Pensky-Martens Closed Cup Tester, using the test method specified in ASTM Standard D-93-79 or D-93-80 (incorporated by reference, see § 260.11), or a Setaflash Closed Cup Tester, using the test method specified in ASTM Standard D-3278-78 (incorporated by reference, see § 260.11), or as determined by an equivalent test method approved by the Administrator under procedures set forth in §§ 260.20 and 260.21.

(2) It is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard.

(3) It is an ignitable compressed gas as defined in 49 CFR 173.300 and as determined by the test methods described in that regulation or equivalent

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test methods approved by the Administrator under §§ 260.20 and 260.21.

(4) It is an oxidizer as defined in 49 CFR 173.151.

(b) A solid waste that exhibits the characteristic of ignitability, but is not listed as a hazardous waste in Subpart D, has the EPA Hazardous Waste Number of D001.

[45 FR 33119, May 19, 1980, as amended at 46 FR 35247, July 7, 1981]

§ 261.22 Characteristic of corrosivity.

(a) A solid waste exhibits the characteristic of corrosivity if a representative sample of the waste has either of the following properties:

(1) It is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5, as determined by a pH meter using either an EPA test method or an equivalent test method approved by the Administrator under the procedures set forth in §§ 260.20 and 260.21. The EPA test method for pH is specified as Method 5.2 in "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods" (incorporated by reference, see § 260.11).

(2) It is a liquid and corrodes steel (SAE 1020) at a rate greater than 6.35 mm (0.250 inch) per year at a test temperature of 55°C (130°F) as determined by the test method specified in NACE (National Association of Corrosion Engineers) Standard TM-01-69 as standardized in "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods" (incorporated by reference, see § 260.11) or an equivalent test method approved by the Administrator under the procedures set forth in §§ 260.20 and 260.21.

(b) A solid waste that exhibits the characteristic of corrosivity, but is not listed as a hazardous waste in Subpart D, has the EPA Hazardous Waste Number of D002.

[45 FR 33119, May 19, 1980, as amended at 48 FR 35247, July 7, 1981]

§ 261.23 Characteristic of reactivity.

(a) A solid waste exhibits the characteristic of reactivity if a representative sample of the waste has any of the following properties:

(1) It is normally unstable and readily undergoes violent change without detonating.

(2) It reacts violently with water.

(3) It forms potentially explosive mixtures with water.

(4) When mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment.

(5) It is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment.

(6) It is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement.

(7) It is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

(8) It is a forbidden explosive as defined in 49 CFR 173.51, or a Class A explosive as defined in 49 CFR 173.53 or a Class B explosive as defined in 49 CFR 173.88.

(b) A solid waste that exhibits the characteristic of reactivity, but is not listed as a hazardous waste in Subpart D, has the EPA Hazardous Waste Number of D003.

§ 261.24 Characteristic of EP toxicity.

(a) A solid waste exhibits the characteristic of EP toxicity if, using the test methods described in Appendix II or equivalent methods approved by the Administrator under the procedures set forth in §§ 260.20 and 260.21, the extract from a representative sample of the waste contains any of the contaminants listed in Table I at a concentration equal to or greater than the respective value given in that Table. Where the waste contains less than 0.5 percent filterable solids, the waste itself, after filtering, is considered to be the extract for the purposes of this section.

(b) A solid waste that exhibits the characteristic of EP toxicity, but is not listed as a hazardous waste in Subpart D, has the EPA Hazardous Waste Number specified in Table I which corresponds to the toxic contaminant causing it to be hazardous.

TABLE I—MAXIMUM CONCENTRATION OF CONTAMINANTS FOR CHARACTERISTIC OF EP TOXICITY

EPA hazardous waste number	Contaminant	Maximum concentration (milligrams per liter)
D004	Arsenic	5.0
D005	Barium	100.0
D006	Cadmium	1.0
D007	Chromium	5.0
D008	Lead	5.0
D009	Mercury	0.2
D010	Selenium	1.0
D011	Silver	5.0
D012	Endrin (1,2,3,4,10,10-hexachloro-1,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo, endo-5,8-dimethano-naphthalene)	0.02
D013	Lindane (1,2,3,4,5,6-hexachlorocyclohexane, gamma isomer)	0.4
D014	Methoxychlor (1,1,1-Trichloro-2,2-bis (p-methoxyphenyl)ethane)	10.0
D015	Toxaphene (C ₁₂ H ₁₂ Cl ₆ , Technical chlorinated camphene, 67-69 percent chlorine)	0.5
D016	2,4-D, (2,4-Dichlorophenoxyacetic acid)	10.0
D017	2,4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid)	1.0

APPENDIX E

LISTS OF HAZARDOUS WASTES (40 CFR 261 Subpart D)

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Subpart D—Lists of Hazardous Wastes

§ 261.30 General.

(a) A solid waste is a hazardous waste if it is listed in this subpart, unless it has been excluded from this list under §§ 260.20 and 260.22.

(b) The Administrator will indicate his basis for listing the classes or types of wastes listed in this Subpart by employing one or more of the following Hazard Codes:

Ignitable Waste	(I)
Corrosive Waste	(C)
Reactive Waste	(R)
EP Toxic Waste	(E)
Acute Hazardous Waste	(H)
Toxic Waste	(T)

Appendix VII identifies the constituent which caused the Administrator to list the waste as an EP Toxic Waste (E) or Toxic Waste (T) in §§ 261.31 and 261.32.

(c) Each hazardous waste listed in this subpart is assigned an EPA Haz-

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ardous Waste Number which precedes the name of the waste. This number must be used in complying with the notification requirements of Section 3010 of the Act and certain record-keeping and reporting requirements under Parts 262 through 265 and Part 270 of this chapter.

(d) The following hazardous wastes listed in § 261.31 or § 261.32 are subject to the exclusion limits for acutely hazardous wastes established in § 261.5: [Reserved]

[45 FR 33119, May 19, 1980, as amended at 45 FR 74892, Nov. 12, 1980; 48 FR 14294, Apr. 1, 1983]

§ 261.31 Hazardous wastes from non-specific sources.

Industry and EPA hazardous waste No.	Hazardous waste	Hazard code
Genenc:		
F001.....	The following spent halogenated solvents used in degreasing: tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons, and sludges from the recovery of these solvents in degreasing operations.	(T)
F002.....	The following spent halogenated solvents: tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, and trichlorofluoromethane; and the still bottoms from the recovery of these solvents.	(T)
F003.....	The following spent non-halogenated solvents: xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; and the still bottoms from the recovery of these solvents.	(I)
F004.....	The following spent non-halogenated solvents: cresols and cresylic acid, and nitrobenzene; and the still bottoms from the recovery of these solvents.	(T)
F005.....	The following spent non-halogenated solvents: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, and pyridine; and the still bottoms from the recovery of these solvents.	(I, T)
F006.....	Wastewater treatment sludges from electroplating operations except from the following processes: (1) sulfuric acid anodizing of aluminum; (2) tin plating on carbon steel; (3) zinc plating (segregated bases) on carbon steel; (4) aluminum or zinc-aluminum plating on carbon steel; (5) cleaning/stripping associated with tin, zinc and aluminum plating on carbon steel; and (6) chemical etching and miling of aluminum.	(T)
F019.....	Wastewater treatment sludges from the chemical conversion coating of aluminum	(T)
F007.....	Spent cyanide plating bath solutions from electroplating operations (except for precious metals electroplating spent cyanide plating bath solutions).	(R, T)
F008.....	Plating bath sludges from the bottom of plating baths from electroplating operations where cyanides are used in the process (except for precious metals electroplating plating bath sludges).	(R, T)
F009.....	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process (except for precious metals electroplating spent stripping and cleaning bath solutions).	(R, T)
F010.....	Quenching bath sludge from oil baths from metal heat treating operations where cyanides are used in the process (except for precious metals heat-treating quenching bath sludges).	(R, T)
F011.....	Spent cyanide solutions from salt bath pot cleaning from metal heat treating operations (except for precious metals heat treating spent cyanide solutions from salt bath pot cleaning).	(R, T)
F012.....	Quenching wastewater treatment sludges from metal heat treating operations where cyanides are used in the process (except for precious metals heat treating quenching wastewater treatment sludges).	(T)
F024.....	Wastes, including but not limited to, distillation residues, heavy ends, tars, and reactor clean-out wastes from the production of chlorinated aliphatic hydrocarbons, having carbon content from one to five, utilizing free radical catalyzed processes. [This listing does not include light ends, spent filters and filter aids, spent desiccants, wastewater, wastewater treatment sludges, spent catalysts, and wastes listed in § 261.32.]	(T)

[46 FR 4617, Jan. 16, 1981, as amended at 46 FR 27477, May 20, 1981; 49 FR 5312, Feb. 10, 1984]

EFFECTIVE DATE NOTE: At 49 FR 5312, Feb. 10, 1984, the waste stream identified by EPA hazardous waste no. F024 was added to the table in § 261.31, effective August 10, 1984.

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§ 261.32 Hazardous wastes from specific sources.

Industry and EPA hazardous waste No.	Hazardous waste	Hazard code
Wood preservation: K001	Bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol.	(T)
Inorganic pigments:		
K002	Wastewater treatment sludge from the production of chrome yellow and orange pigments.	(T)
K003	Wastewater treatment sludge from the production of molybdate orange pigments.	(T)
K004	Wastewater treatment sludge from the production of zinc yellow pigments.	(T)
K005	Wastewater treatment sludge from the production of chrome green pigments.	(T)
K006	Wastewater treatment sludge from the production of chrome oxide green pigments (anhydrous and hydrated).	(T)
K007	Wastewater treatment sludge from the production of iron blue pigments.	(T)
K008	Oven residue from the production of chrome oxide green pigments.	(T)
Organic chemicals:		
K009	Distillation bottoms from the production of acetaldehyde from ethylene.	(T)
K010	Distillation side cuts from the production of acetaldehyde from ethylene.	(T)
K011	Bottom stream from the wastewater stripper in the production of acrylonitrile.	(R, T)
K013	Bottom stream from the acetonitrile column in the production of acrylonitrile.	(R, T)
K014	Bottoms from the acetonitrile purification column in the production of acrylonitrile.	(T)
K015	Still bottoms from the distillation of benzyl chloride.	(T)
K016	Heavy ends or distillation residues from the production of carbon tetrachloride.	(T)
K017	Heavy ends (still bottoms) from the purification column in the production of epichlorohydrin.	(T)
K018	Heavy ends from the fractionation column in ethyl chloride production.	(T)
K019	Heavy ends from the distillation of ethylene dichloride in ethylene dichloride production.	(T)
K020	Heavy ends from the distillation of vinyl chloride in vinyl chloride monomer production.	(T)
K021	Aqueous spent antimony catalyst waste from fluoromethanes production.	(T)
K022	Distillation bottom tars from the production of phenol/acetone from cumene.	(T)
K023	Distillation light ends from the production of phthalic anhydride from naphthalene.	(T)
K024	Distillation bottoms from the production of phthalic anhydride from naphthalene.	(T)
K025	Distillation light ends from the production of phthalic anhydride from ortho-xylene.	(T)
K026	Distillation bottoms from the production of phthalic anhydride from ortho-xylene.	(T)
K027	Distillation bottoms from the production of nitrobenzene by the nitration of benzene.	(T)
K028	Stripping still tails from the production of methyl ethyl pyridines.	(T)
K027	Centrifuge and distillation residues from toluene diisocyanate production.	(R, T)
K028	Spent catalyst from the hydrochlorinator reactor in the production of 1,1,1-trichloroethane.	(T)
K029	Waste from the product steam stripper in the production of 1,1,1-trichloroethane.	(T)
K095	Distillation bottoms from the production of 1,1,1-trichloroethane.	(T)
K096	Heavy ends from the heavy ends column from the production of 1,1,1-trichloroethane.	(T)
K030	Column bottoms or heavy ends from the combined production of trichloroethylene and perchloroethylene.	(T)
K063	Distillation bottoms from aniline production.	(T)
K103	Process residues from aniline extraction from the production of aniline.	(T)
K104	Combined wastewater streams generated from nitrobenzene/aniline production.	(T)
K085	Distillation or fractionation column bottoms from the production of chlorobenzenes.	(T)
K106	Separated aqueous stream from the reactor product washing step in the production of chlorobenzenes.	(T)
Inorganic chemicals:		
K071	Brine purification muds from the mercury cell process in chlorine production, where separately prepurified brine is not used.	(T)
K073	Chlorinated hydrocarbon waste from the purification step of the diaphragm cell process using graphite anodes in chlorine production.	(T)
K108	Wastewater treatment sludge from the mercury cell process in chlorine production.	(T)
Pesticides:		
K031	By-product salts generated in the production of MSMA and cacodylic acid.	(T)
K032	Wastewater treatment sludge from the production of chlordane.	(T)
K033	Wastewater and scrub water from the chlorination of cyclopentadiene in the production of chlordane.	(T)
K034	Filter solids from the filtration of hexachlorocyclopentadiene in the production of chlordane.	(T)
K067	Vacuum stripper discharge from the chlordane chlorinator in the production of chlordane.	(T)
K035	Wastewater treatment sludges generated in the production of creosote.	(T)
K036	Still bottoms from toluene reclamation distillation in the production of disulfoton.	(T)
K037	Wastewater treatment sludges from the production of disulfoton.	(T)
K038	Wastewater from the washing and stripping of phorate production.	(T)

Industry and EPA hazardous waste No	Hazardous waste	Hazard code
K039	Filter cake from the filtration of diethylphosphorodithioic acid in the production of phorate	(T)
K040	Wastewater treatment sludge from the production of phorate	(T)
K041	Wastewater treatment sludge from the production of toxaphene	(T)
K098	Untreated process wastewater from the production of toxaphene	(T)
K042	Heavy ends or distillation residues from the distillation of tetrachlorobenzene in the production of 2,4,5-T	(T)
K043	2,6-Dichlorophenol waste from the production of 2,4-D	(T)
K099	Untreated wastewater from the production of 2,4-D	(T)
Explosives:		
K044	Wastewater treatment sludges from the manufacturing and processing of explosives	(R)
K045	Spent carbon from the treatment of wastewater containing explosives	(R)
K046	Wastewater treatment sludges from the manufacturing, formulation and loading of lead-based initiating compounds	(T)
K047	Pink/red water from TNT operations	(R)
Petroleum refining:		
K048	Dissolved air flotation (DAF) float from the petroleum refining industry	(T)
K049	Slop oil emulsion solids from the petroleum refining industry	(T)
K050	Heat exchanger bundle cleaning sludge from the petroleum refining industry	(T)
K051	API separator sludge from the petroleum refining industry	(T)
K052	Tank bottoms (lead) from the petroleum refining industry	(T)
Iron and steel:		
K061	Emission control dust/sludge from the primary production of steel in electric furnaces	(T)
K062	Spent pickle liquor from steel finishing operations	(C, T)
Secondary lead:		
K069	Emission control dust/sludge from secondary lead smelting	(T)
K100	Waste leaching solution from acid leaching of emission control dust/sludge from secondary lead smelting	(T)
Veterinary pharmaceuticals:		
K084	Wastewater treatment sludges generated during the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds	(T)
K101	Distillation tar residues from the distillation of aniline-based compounds in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds	(T)
K102	Residue from the use of activated carbon for decolorization in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds	(T)
Ink formulation: K086		
	Solvent washes and sludges, caustic washes and sludges, or water washes and sludges from cleaning tubs and equipment used in the formulation of ink from pigments, driers, soaps, and stabilizers containing chromium and lead	(T)
Coking:		
K080	Ammonia still lime sludge from coking operations	(T)
K087	Decanter tank tar sludge from coking operations	(T)

[46 FR 4618, Jan. 16, 1981, as amended at 46 FR 27476-27477, May 20, 1981]

§ 261.33 Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof.

The following materials or items are hazardous wastes if and when they are discarded or intended to be discarded:

(a) Any commercial chemical product, or manufacturing chemical intermediate having the generic name listed in paragraph (e) or (f) of this section.

(b) Any off-specification commercial chemical product or manufacturing chemical intermediate which, if it met specifications, would have the generic name listed in paragraph (e) or (f) of this section.

(c) Any container or inner liner removed from a container that has been used to hold any commercial chemical product or manufacturing chemical intermediate having the generic names listed in paragraph (e) of this section, or any container or inner liner removed from a container that has been used to hold any off-specification chemical product and manufacturing chemical intermediate which, if it met specifications, would have the generic name listed in paragraph (e) of this section, unless the container is empty as defined in § 261.7(b)(3) of this chapter.

(Comment: Unless the residue is being beneficially used or reused, or legitimately recy-

clied or reclaimed; or being accumulated, stored, transported or treated prior to such use, re-use, recycling or reclamation, EPA considers the residue to be intended for discard, and thus a hazardous waste. An example of a legitimate re-use of the residue would be where the residue remains in the container and the container is used to hold the same commercial chemical product or manufacturing chemical product or manufacturing chemical intermediate it previously held. An example of the discard of the residue would be where the drum is sent to a drum reconditioner who reconditions the drum but discards the residue.]

(d) Any residue or contaminated soil, water or other debris resulting from the cleanup of a spill into or on any land or water of any commercial chemical product or manufacturing chemical intermediate having the generic name listed in paragraph (e) or (f) of this section, or any residue or contaminated soil, water or other debris resulting from the cleanup of a spill, into or on any land or water, of any off-specification chemical product and manufacturing chemical intermediate which, if it met specifications, would have the generic name listed in paragraph (e) or (f) of this section.

[*Comment:* The phrase "commercial chemical product or manufacturing chemical intermediate having the generic name listed in . . ." refers to a chemical substance which is manufactured or formulated for commercial or manufacturing use which consists of the commercially pure grade of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient. It does not refer to a material, such as a manufacturing process waste, that contains any of the substances listed in paragraphs (e) or (f). Where a manufacturing process waste is deemed to be a hazardous waste because it contains a substance listed in paragraphs (e) or (f), such waste will be listed in either §§ 261.31 or 261.32 or will be identified as a hazardous waste by the characteristics set forth in Subpart C of this part.]

(e) The commercial chemical products, manufacturing chemical intermediates or off-specification commercial chemical products or manufacturing chemical intermediates referred to in paragraphs (a) through (d) of this section, are identified as acute hazardous wastes (H) and are subject to be the small quantity exclusion defined in § 261.5(e).

[*Comment:* For the convenience of the regulated community the primary hazardous properties of these materials have been indicated by the letters T (Toxicity), and R (Reactivity). Absence of a letter indicates that the compound only is listed for acute toxicity.]

These wastes and their corresponding EPA Hazardous Waste Numbers are:

Hazardous waste No.	Substance
P023.....	Acetaldehyde, chloro-
P002.....	Acetamide, N-(aminothioxomethyl)-
P057.....	Acetamide, 2-fluoro-
P058.....	Acetic acid, fluoro-, sodium salt
P066.....	Acetimidic acid, N-[(methycarbamoyloxy)thio-, methyl ester
P001.....	3-(alpha-Acetoxybenzyl)-4-hydroxycoumarin and salts, when present at concentrations greater than 0.3%
P002.....	1-Acetyl-2-thiourea
P003.....	Acrolein
P070.....	Aldicarb
P004.....	Aldrin
P005.....	Allyl alcohol
P006.....	Aluminum phosphide
P007.....	5-(Aminomethyl)-3-isoxazolol
P008.....	4-Aminopyridine
P009.....	Ammonium picrate (R)
P119.....	Ammonium vanadate
P010.....	Arsenic acid
P012.....	Arsenic (III) oxide
P011.....	Arsenic (V) oxide
P011.....	Arsenic pentoxide
P012.....	Arsenic trioxide
P038.....	Arsine, diethyl-
P054.....	Azidine
P013.....	Barium cyanide
P024.....	Benzenamine, 4-chloro-
P077.....	Benzenamine, 4-nitro-
P028.....	Benzene, (chloromethyl)-
P042.....	1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-
P014.....	Benzenethiol
P026.....	Benzyl chloride
P015.....	Beryllium dust
P016.....	Bis(chloromethyl) ether
P017.....	Bromacetone
P017.....	Brucine
P021.....	Calcium cyanide
P123.....	Camphene, octachloro-
P103.....	Carbamimidoseleonic acid
P022.....	Carbon disulfide
P022.....	Carbon disulfide
P095.....	Carbonyl chloride
P033.....	Chlorine cyanide
P023.....	Chloroacetaldehyde
P024.....	p-Chloroaniline
P026.....	1-(o-Chlorophenyl)thiourea
P027.....	3-Chloropropionitrile
P029.....	Copper cyanides
P030.....	Cyanides (soluble cyanide salts), not elsewhere specified
P031.....	Cyanogen
P033.....	Cyanogen chloride
P036.....	Dichlorophenylarsine
P037.....	Dieldrin
P038.....	Diethylarsine

Hazardous waste No.	Substance	Hazardous waste No.	Substance
P039	O,O-Diethyl S-(2-(ethylthio)ethyl) phosphorodithioate	P074	Nickel(II) cyanide
P041	Diethyl-p-nitrophenyl phosphate	P073	Nickel tetracarbonyl
P040	O,O-Diethyl O-pyrazinyl phosphorothioate	P075	Nicotine and salts
P043	Diisopropyl fluorophosphate	P076	Nitric oxide
P044	Dimethoate	P077	p-Nitroaniline
P045	3,3-Dimethyl-1-(methylthio)-2-butanone, O-[(methylamino)carbonyl] oxime	P078	Nitrogen dioxide
P071	O,O-Dimethyl O-p-nitrophenyl phosphorothioate	P078	Nitrogen(II) oxide
P082	Dimethylnitrosamine	P078	Nitrogen(IV) oxide
P046	alpha, alpha-Dimethylphenethylamine	P081	Nitroglycerine (R)
P047	4,6-Dinitro-o-cresol and salts	P082	N-Nitrosodimethylamine
P034	4,6-Dinitro-o-cyclohexylphenol	P084	N-Nitrosomethylvinylamine
P048	2,4-Dinitrophenol	P050	5-Norbornene-2,3-dimethanol, 1,4,5,6,7,7-hexachloro, cyclic sulfite
P020	Dinoseb	P085	Octamethylpyrophosphoramide
P085	Diphosphoramide, octamethyl-	P087	Osmium oxide
P039	Disulfoton	P087	Osmium tetroxide
P049	2,4-Dithioburet	P088	7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
P109	Dithiopyrophosphoric acid, tetraethyl ester	P089	Parathion
P050	Endosulfan	P034	Phenol, 2-cyclohexyl-4,6-dinitro-
P088	Endothall	P048	Phenol, 2,4-dinitro-
P051	Endrin	P047	Phenol, 2,4-dinitro-6-methyl-
P042	Epinephrine	P020	Phenol, 2,4-dinitro-6-(1-methylpropyl)-
P046	Ethanamine, 1,1-dimethyl-2-phenyl-	P009	Phenol, 2,4,6-trinitro- ammonium salt (R)
P084	Ethanamine, N-methyl-N-nitroso-	P036	Phenyl dichloroarsine
P101	Ethyl cyanide	P092	Phenylmercuric acetate
P054	Ethyleneimine	P083	N-Phenylthiourea
P097	Famphur	P094	Phorate
P056	Fluorine	P095	Phosgene
P057	Fluoroacetamide	P096	Phosphine
P058	Fluoroacetic acid, sodium salt	P041	Phosphonic acid, diethyl p-nitrophenyl ester
P085	Fulminic acid, mercury(II) salt (R,T)	P044	Phosphorodithioic acid, O,O-dimethyl S-(2-(methylamino)-2-oxoethyl)ester
P059	Heptachlor	P043	Phosphorothioic acid, bis(1-methylethyl)-ester
P051	1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo,endo-1,4,5,8-dimethanonaphthalene	P084	Phosphorothioic acid, O,O-diethyl S-(ethylthio)methyl ester
P037	1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo,exo-1,4,5,8-dimethanonaphthalene	P089	Phosphorothioic acid, O,O-diethyl O-(p-nitrophenyl) ester
P080	1,2,3,4,10,10-Hexachloro-1,4,4a,5,6,7,8,8a-hexahydro-1,4,5,8-endo,endo-dimethanonaphthalene	P040	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester
P004	1,2,3,4,10,10-Hexachloro-1,4,4a,5,6,7,8,8a-hexahydro-1,4,5,8-endo,exo-dimethanonaphthalene	P097	Phosphorothioic acid, O,O-dimethyl O-[p-((dimethylamino)sulfonyl)phenyl]ester
P080	Hexachlorohexahydro-endo,exo-dimethanonaphthalene	P110	Plumbane, tetraethyl-
P082	Hexaethyl tetraphosphate	P096	Potassium cyanide
P116	Hydrazinecarbothioamide	P099	Potassium silver cyanide
P088	Hydrazine, methyl-	P070	Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino)carbonyl]oxime
P083	Hydrocyanic acid	P101	Propanenitrile
P083	Hydrogen cyanide	P027	Propanenitrile, 3-chloro-
P086	Hydrogen phosphide	P089	Propanenitrile, 2-hydroxy-2-methyl-
P084	Isocyanic acid, methyl ester	P081	1,2,3-Propanetriol, trimethyl- (R)
P007	3(2H)-Isoxazalone, 5-(aminomethyl)-	P017	2-Propanone, 1-bromo-
P082	Mercury, (acetato-O)phenyl-	P102	Propargyl alcohol
P085	Mercury fulminate (R,T)	P003	2-Propanol
P016	Methane, oxybis(chloro-	P005	2-Propan-1-ol
P112	Methane, tetranitro- (R)	P067	1,2-Propyleneimine
P118	Methanethiol, trichloro-	P102	2-Propyn-1-ol
P059	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-	P008	4-Pyridinamine
P066	Methomyl	P075	Pyridine, (S)-3-(1-methyl-2-pyrrolidinyl)-, and salts
P067	2-Methylaziridine	P111	Pyrophosphoric acid, tetraethyl ester
P068	Methyl hydrazine	P103	Selenourea
P084	Methyl isocyanate	P104	Silver cyanide
P089	2-Methylacetonitrile	P105	Sodium azide
P071	Methyl parathion	P106	Sodium cyanide
P072	alpha-Naphthylthiourea	P107	Strontium sulfide
P073	Nickel carbonyl	P108	Strychnidin-10-one, and salts
P074	Nickel cyanide	P018	Strychnidin-10-one, 2,3-dimethoxy-
		P108	Strychnine and salts
		P115	Sulfuric acid, thallium(I) salt
		P109	Tetraethylthiopyrophosphate

Hazardous waste No.	Substance	Hazardous Waste No.	Substance
P110 ..	Tetraethyl lead	U006 ..	Acetyl chloride (C,R,T)
P111 ..	Tetraethylpyrophosphate	U007 ..	Acrylamide
P112 ..	Tetranitromethane (R)	U008 ..	Acrylic acid (I)
P062 ..	Tetraphosphoric acid, hexaethyl ester	U009 ..	Acrylonitrile
P113 ..	Thalic oxide	U150 ..	Alanine, 3-[(p-bis(2-chloroethyl)amino) phenyl-, L-
P113 ..	Thallium(III) oxide	U011 ..	Amitrole
P114 ..	Thallium(I) selenate	U012 ..	Aniline (I,T)
P115 ..	Thallium(I) sulfate	U014 ..	Auramine
P045 ..	Thiofanox	U015 ..	Azasenne
P049 ..	Thiomethyldicarbonyl diamide	U010 ..	Azino(2',3':3,4')pyrrolo(1,2-a)indole-4,7-dione, 6-amino-8-(((aminocarbonyl) oxy)methyl)-, 1,1a,2,8,8a,8b-hexahydro-8a-methoxy-5-methyl-,
P014 ..	Thiophenol	U157 ..	Benz[<i>l</i>]acanthrylene, 1,2-dihydro-3-methyl-
P116 ..	Thiosemicarbazide	U016 ..	Benz[<i>c</i>]acridine
P026 ..	Thiourea, (2-chlorophenyl)-	U016 ..	3,4-Benzacridine
P072 ..	Thiourea, 1-naphthalenyl-	U017 ..	Benzal chloride
P093 ..	Thiourea, phenyl-	U018 ..	Benz[<i>a</i>]anthracene
P123 ..	Toxaphene	U018 ..	1,2-Benzanthracene
P118 ..	Trichloromethanethiol	U094 ..	1,2-Benzanthracene, 7,12-dimethyl-
P119 ..	Vanadic acid, ammonium salt	U012 ..	Benzenamine (I,T)
P120 ..	Vanadium pentoxide	U014 ..	Benzenamine, 4,4'-carbonimidoylbis(N,N-dimethyl-
P120 ..	Vanadium(V) oxide	U049 ..	Benzenamine, 4-chloro-2-methyl-
P001 ..	Warfium, when present at concentrations greater than 0.3%	U093 ..	Benzenamine, N,N'-dimethyl-4-phenylazo-
P121 ..	Zinc cyanide	U158 ..	Benzenamine, 4,4'-methylenebis(2-chloro-
P122 ..	Zinc phosphide, when present at concentrations greater than 10%	U222 ..	Benzenamine, 2-methyl-, hydrochloride
		U181 ..	Benzenamine, 2-methyl-5-nitro
		U019 ..	Benzene (I,T)
		U038 ..	Benzenesulfonic acid, 4-chloro- α -(4-chlorophenyl)- α -hydroxy, ethyl ester
		U030 ..	Benzene, 1-bromo-4-phenoxy-
		U037 ..	Benzene, chloro-
		U190 ..	1,2-Benzenedicarboxylic acid anhydride
		U028 ..	1,2-Benzenedicarboxylic acid, [bis(2-ethylhexyl)] ester
		U069 ..	1,2-Benzenedicarboxylic acid, dibutyl ester
		U088 ..	1,2-Benzenedicarboxylic acid, diethyl ester
		U102 ..	1,2-Benzenedicarboxylic acid, dimethyl ester
		U107 ..	1,2-Benzenedicarboxylic acid, di-n-octyl ester
		U070 ..	Benzene, 1,2-dichloro-
		U071 ..	Benzene, 1,3-dichloro-
		U072 ..	Benzene, 1,4-dichloro-
		U017 ..	Benzene, (dichloromethyl)-
		U223 ..	Benzene, 1,3-diisocyanatomethyl- (R,T)
		U239 ..	Benzene, dimethyl-(I,T)
		U201 ..	1,3-Benzenediol
		U127 ..	Benzene, hexachloro-
		U056 ..	Benzene, hexahydro- (I)
		U188 ..	Benzene, hydroxy-
		U220 ..	Benzene, methyl-
		U105 ..	Benzene, 1-methyl-1,2,4-dinitro-
		U106 ..	Benzene, 1-methyl-2,6-dinitro-
		U203 ..	Benzene, 1,2-methylenedioxy-4-ethyl-
		U141 ..	Benzene, 1,2-methylenedioxy-4-propenyl-
		U090 ..	Benzene, 1,2-methylenedioxy-4-propyl-
		U055 ..	Benzene, (1-methylethyl)- (I)
		U169 ..	Benzene, nitro- (I,T)
		U183 ..	Benzene, pentachloro-
		U185 ..	Benzene, pentachloro-nitro-
		U020 ..	Benzenesulfonic acid chloride (C,R)
		U020 ..	Benzenesulfonyl chloride (C,R)
		U207 ..	Benzene, 1,2,4,5-tetrachloro-
		U023 ..	Benzene, (trichloromethyl)-(C,R,T)
		0234 ..	Benzene, 1,3,5-trinitro- (R,T)
		U021 ..	Benzbisoxazole
		U202 ..	1,2-Benzisothiazolin-3-one, 1,1-dioxide
		U120 ..	Benzo[<i>k</i>]fluorene
		U022 ..	Benzo[<i>a</i>]pyrene
		U022 ..	3,4-Benzopyrene
		U197 ..	p-Benzoquinone

(f) The commercial chemical products, manufacturing chemical intermediates, or off-specification commercial chemical products referred to in paragraphs (a) through (d) of this section, are identified as toxic wastes (T) unless otherwise designated and are subject to the small quantity exclusion defined in § 261.5 (a) and (f).

[Comment: For the convenience of the regulated community, the primary hazardous properties of these materials have been indicated by the letters T (Toxicity), R (Reactivity), I (Ignitability) and C (Corrosivity). Absence of a letter indicates that the compound is only listed for toxicity.]

These wastes and their corresponding EPA Hazardous Waste Numbers are:

Hazardous Waste No.	Substance
U001 ..	Acetaldehyde (I)
U034 ..	Acetaldehyde, trichloro-
U187 ..	Acetamide, N-(4-ethoxyphenyl)-
U005 ..	Acetamide, N-9H-fluoren-2-yl-
U112 ..	Acetic acid, ethyl ester (I)
U144 ..	Acetic acid, lead salt
U214 ..	Acetic acid, thallium(I) salt
U002 ..	Acetone (I)
U003 ..	Acetonitrile (I,T)
U248 ..	3-(α -Acetonylbenzyl)-4-hydroxycoumarin and salts, when present at concentrations of 0.3% or less
U004 ..	Acetophenone
U005 ..	2-Acetylaminofluorene

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Hazardous Waste No	Substance
U023	Benzotrichloride (C,R,T)
U050	1,2-Benzphenanthrene
U085	2,2'-Bioxirane (I,T)
U021	(1,1'-Biphenyl)-4,4'-diamine
U073	(1,1'-Biphenyl)-4,4'-diamine, 3,3'-dichloro-
U091	(1,1'-Biphenyl)-4,4'-diamine, 3,3'-dimethoxy-
U095	(1,1'-Biphenyl)-4,4'-diamine, 3,3'-dimethyl-
U024	Bis(2-chloroethoxy) methane
U027	Bis(2-chloroisopropyl) ether
U244	Bis(dimethylthiocarbamoyl) disulfide
U028	Bis(2-ethylhexyl) phthalate
U246	Bromine cyanide
U225	Bromoform
U030	4-Bromophenyl phenyl ether
U128	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-
U172	1-Butanamine, N-butyl-N-nitroso-
U035	Butanoic acid, 4-(Bis(2-chloroethyl)amino)-benzene-
U031	1-Butanol (I)
U159	2-Butanone (I,T)
U160	2-Butanone peroxide (R,T)
U053	2-Butenal
U074	2-Butene, 1,4-dichloro- (I,T)
U031	n-Butyl alcohol (I)
U136	Cacodylic acid
U032	Calcium chromate
U236	Carbamic acid, ethyl ester
U178	Carbamic acid, methyl nitroso-, ethyl ester
U176	Carbamide, N-ethyl-N-nitroso-
U177	Carbamide, N-methyl-N-nitroso-
U219	Carbamide, thio-
U097	Carbamoyl chloride, dimethyl-
U215	Carbonic acid, dithalium(I) salt
U156	Carbonochloridic acid, methyl ester (I,T)
U033	Carbon oxyfluoride (R,T)
U211	Carbon tetrachloride
U033	Carbonyl fluoride (R,T)
U034	Chloral
U035	Chlorambucil
U036	Chlorodane, technical
U026	Chloromaphazine
U037	Chlorobenzene
U039	4-Chloro-m-cresol
U041	1-Chloro-2,3-epoxypropene
U042	2-Chloroethyl vinyl ether
U044	Chloroform
U046	Chloromethyl methyl ether
U047	beta-Chloronaphthalene
U048	o-Chlorophenol
U049	4-Chloro-o-toluidine, hydrochloride
U032	Chromic acid, calcium salt
U050	Chrysene
U051	Creosote
U052	Cresols
U052	Crealyic acid
U053	Crotonaldehyde
U055	Cumene (I)
U246	Cyanogen bromide
U197	1,4-Cyclohexadienedione
U056	Cyclohexane (I)
U057	Cyclohexanone (I)
U130	1,3-Cyclopentadiene, 1,2,3,4,5,5-hexa- chloro-
U058	Cyclophosphamide
U240	2,4,4-D, salts and esters
U059	Daunomycin
U060	DDD
U061	DDT
U142	Decachlorooctaahydro-1,3,4-methano-2H-cyclobuta(c,d)-pentalen-2-one
U062	Diislate
U133	Diamine (R,T)
U221	Diaminotoluene

Hazardous Waste No	Substance
U063	Dibenz(a,h)anthracene
U063	1,2,5,6-Dibenzanthracene
U064	1,2,7,8-Dibenzopyrene
U064	Dibenz(a,i)pyrene
U066	1,2-Dibromo-3-chloropropane
U069	Diethyl phthalate
U062	S-(2,3-Dichloroallyl) desopropylthiocarbamate
U070	o-Dichlorobenzene
U071	m-Dichlorobenzene
U072	p-Dichlorobenzene
U073	3,3'-Dichlorobenzidine
U074	1,4-Dichloro-2-butene (I,T)
U075	Dichlorodifluoromethane
U192	3,5-Dichloro-N-(1,1-dimethyl-2-propynyl) benzamide
U060	Dichloro diphenyl dichloroethane
U061	Dichloro diphenyl trichloroethane
U078	1,1-Dichloroethylene
U079	1,2-Dichloroethylene
U025	Dichloroethyl ether
U081	2,4-Dichlorophenol
U082	2,6-Dichlorophenol
U240	2,4-Dichlorophenoxyacetic acid, salts and esters
U083	1,2-Dichloropropane
U084	1,3-Dichloropropane
U085	1,2,3,4-Diepoxybutane (I,T)
U108	1,4-Diethylene dioxide
U086	N,N-Diethylhydrazine
U087	O,O-Diethyl-S-methyl-dithiophosphate
U088	Diethyl phthalate
U089	Diethylstilbestrol
U148	1,2-Dihydro-3,6-pyridinedione
U090	Dihydrosafrole
U091	3,3'-Dimethoxybenzidine
U092	Dimethylamine (I)
U093	Dimethylaminoazobenzene
U094	7,12-Dimethylbenz(a)anthracene
U095	3,3'-Dimethylbenzidine
U096	alpha,alpha-Dimethylbenzylhydroperoxide (R)
U097	Dimethylcarbamoyl chloride
U098	1,1-Dimethylhydrazine
U099	1,2-Dimethylhydrazine
U101	2,4-Dimethylphenol
U102	Dimethyl phthalate
U103	Dimethyl sulfate
U105	2,4-Dinitrotoluene
U106	2,6-Dinitrotoluene
U107	Di-n-octyl phthalate
U108	1,4-Dioxane
U109	1,2-Diphenylhydrazine
U110	Dipropylamine (I)
U111	Di-N-propylnitrosamine
U001	Ethanal (I)
U174	Ethanamine, N-ethyl-N-nitroso-
U067	Ethane, 1,2-dibromo-
U076	Ethane, 1,1-dichloro-
U077	Ethane, 1,2-dichloro-
U114	1,2-Ethanedithiobis(carbamodithioic acid
U131	Ethane, 1,1,1,2,2,2-hexachloro-
U024	Ethane, 1,1'-[(methylenebis(oxy))]bis(2-chloro-
U003	Ethanenitrile (I, T)
U117	Ethane, 1,1'-oxybis- (I)
U025	Ethane, 1,1'-oxybis(2-chloro-
U184	Ethane, pentachloro-
U208	Ethane, 1,1,1,2-tetrachloro-
U209	Ethane, 1,1,2,2-tetrachloro-
U218	Ethanethioamide
U247	Ethane, 1,1,1-trichloro-2,2-bis(p-methoxy-phenyl)-
U227	Ethane, 1,1,2-trichloro-
U043	Ethene, chloro-

Hazardous Waste No.	Substance	Hazardous Waste No.	Substance
U042	Ethene, 2-chloroethoxy-	U068	Methane, dibromo-
U078	Ethene, 1,1-dichloro-	U080	Methane, dichloro-
U079	Ethene, trans-1,2-dichloro-	U075	Methane, dichlorodifluoro-
U210	Ethene, 1,1,2,2-tetrachloro-	U138	Methane, iodo-
U173	Ethanol, 2,2'-(nitrosomino)bis-	U119	Methanesulfonic acid, ethyl ester
U004	Ethanone, 1-phenyl-	U211	Methane, tetrachloro-
U006	Ethanoyl chloride (C,R,T)	U121	Methane, trichlorofluoro-
U112	Ethyl acetate (I)	U153	Methanethiol (I,T)
U113	Ethyl acrylate (I)	U225	Methane, tribromo-
U238	Ethyl carbamate (urethan)	U044	Methane, trichloro-
U038	Ethyl 4,4'-dichlorobenzolate	U121	Methane, trichlorofluoro-
U114	Ethylenebis(dithiocarbamic acid)	U123	Methanoic acid (C,T)
U067	Ethylene dibromide	U036	4,7-Methanondan, 1,2,4,5,6,7,8,8-octa-chloro-3a,4,7,7a-tetrahydro-
U077	Ethylene dichloride	U154	Methanol (I)
U115	Ethylene oxide (I,T)	U155	Methapyriene
U116	Ethylene thiourea	U247	Methoxychlor
U117	Ethyl ether (I)	U154	Methyl alcohol (I)
U076	Ethylene dichloride	U029	Methyl bromide
U118	Ethylmethacrylate	U186	1-Methylbutadiene (I)
U119	Ethyl methanesulfonate	U045	Methyl chloride (I,T)
U139	Femic dextran	U156	Methyl chlorocarbonate (I,T)
U120	Fluoranthene	U226	Methylchlorotorm
U122	Formaldehyde	U157	3-Methylcholanthrene
U123	Formic acid (C,T)	U158	4,4'-Methylenebis(2-chloroaniline)
U124	Furan (I)	U132	2,2'-Methylenebis(3,4,6-trichlorophenol)
U125	2-Furancarboxaldehyde (I)	U068	Methylene bromide
U147	2,5-Furandione	U080	Methylene chloride
U213	Furan, tetrahydro- (I)	U122	Methylene oxide
U125	Furfural (I)	U159	Methyl ethyl ketone (I,T)
U124	Furfuran (I)	U160	Methyl ethyl ketone peroxide (R,T)
U206	D-Glucopyranose, 2-deoxy-2(3-methyl-3-nitro-souredo)-	U138	Methyl iodide
U126	Glycidylaldehyde	U161	Methyl isobutyl ketone (I)
U163	Guanidine, N-nitroso-N-methyl-N'-nitro-	U162	Methyl methacrylate (I,T)
U127	Hexachlorobenzene	U163	N-Methyl-N'-nitro-N-nitrosoguanidine
U128	Hexachlorobutadiene	U161	4-Methyl-2-pentanone (I)
U129	Hexachlorocyclohexane (gamma isomer)	U164	Methylthiouracil
U130	Hexachlorocyclopentadiene	U010	Mitomycin C
U131	Hexachloroethane	U059	5,12-Naphthacenedione, (8S-cis)-8-acetyl-10-((3-amino-2,3,6-indeoxy-alpha-L-xyxo-hexopyranosyl)oxyl)-7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-
U132	Hexachlorophene	U165	Naphthalene
U243	Hexachloropropene	U047	Naphthalene, 2-chloro-
U133	Hydrazine (R,T)	U166	1,4-Naphthalenedione
U086	Hydrazine, 1,2-diethyl-	U236	2,7-Naphthalenedisulfonic acid, 3,3'-((3,3'-dimethyl-(1,1'-biphenyl)-4,4'-diyl))-bis (azo)bis(5-amino-4-hydroxy)-, tetrasodium salt
U088	Hydrazine, 1,1-dimethyl-	U166	1,4-Naphthoquinone
U099	Hydrazine, 1,2-dimethyl-	U167	1-Naphthylamine
U109	Hydrazine, 1,2-diphenyl-	U168	2-Naphthylamine
U134	Hydrofluoric acid (C,T)	U167	alpha-Naphthylamine
U134	Hydrogen fluoride (C,T)	U168	beta-Naphthylamine
U135	Hydrogen sulfide	U026	2-Naphthylamine, N,N'-bis(2-chloromethyl)-
U086	Hydroperoxide, 1-methyl-1-phenylethyl- (R)	U169	Nitrobenzene (I,T)
U136	Hydroxydimethylarsine oxide	U170	p-Nitrophenol
U116	2-Imidazolidinethione	U171	2-Nitropropane (I)
U137	Indeno[1,2,3-cd]pyrene	U172	N-Nitrosod-n-butylamine
U139	Iron dextran	U173	N-Nitrosodethanolamine
U140	Isobutyl alcohol (I,T)	U174	N-Nitrosodiethylamine
U141	Isosafrole	U111	N-Nitroso-N-propylamine
U142	Kepone	U176	N-Nitroso-N-ethylurea
U143	Laccocarpine	U177	N-Nitroso-N-methylurea
U144	Lead acetate	U178	N-Nitroso-N-methylurethane
U145	Lead phosphate	U179	N-Nitrosopyrrolidine
U146	Lead subacetate	U180	N-Nitrosopyrrolidine
U129	Lindane	U181	5-Nitro-o-toluidine
U147	Maleic anhydride	U193	1,2-Oxathiolane, 2,2-dioxide
U148	Maleic hydrazide	U058	2H-1,3,2-Oxazaphosphonine, 2-[(bis(2-chloro-ethyl)amino)tetrahydro-, oxide 2-
U149	Malononitrile	U115	Oxurane (I,T)
U150	Melphalan		
U151	Mercury		
U152	Methacrylonitrile (I,T)		
U092	Methanamine, N-methyl- (I)		
U029	Methane, bromo-		
U045	Methane, chloro- (I,T)		
U046	Methane, chloromethoxy-		

Hazardous Waste No	Substance	Hazardous Waste No	Substance
U041	Oxirane, 2-(chloromethyl)-	U205	Sulfur selenide (R,T)
U182	Paraldehyde	U232	2,4,5-T
U183	Pentachlorobenzene	U207	1,2,4,5-Tetrachlorobenzene
U184	Pentachloroethane	U208	1,1,1,2-Tetrachloroethane
U185	Pentachloronitrobenzene	U209	1,1,2,2-Tetrachloroethane
U242	Pentachlorophenol	U210	Tetrachloroethylene
U186	1,3-Pentadiene (I)	U212	2,3,4,6-Tetrachlorophenol
U187	Phenacetin	U213	Tetrahydrofuran (I)
U188	Phenol	U214	Thallium(I) acetate
U048	Phenol, 2-chloro-	U215	Thallium(I) carbonate
U039	Phenol, 4-chloro-3-methyl-	U216	Thallium(I) chloride
U081	Phenol, 2,4-dichloro-	U217	Thallium(I) nitrate
U082	Phenol, 2,6-dichloro-	U218	Thioacetamide
U101	Phenol, 2,4-dimethyl-	U153	Thiomethanol (I,T)
U170	Phenol, 4-nitro-	U219	Thiourea
U242	Phenol, pentachloro-	U244	Thiram
U212	Phenol, 2,3,4,6-tetrachloro-	U220	Toluene
U230	Phenol, 2,4,6-trichloro-	U221	Toluenediamine
U231	Phenol, 2,4,6-trichloro-	U223	Toluene diisocyanate (R,T)
U137	1,10-(1,2-phenylene)pyrene	U222	O-Toluidine hydrochloride
U145	Phosphonic acid, Lead salt	U011	1H-1,2,4-Triazol-3-amine
U087	Phosphorodithioic acid, 0,0-diethyl-, S-methyl-ester	U226	1,1,1-Trichloroethane
U189	Phosphorous sulfide (R)	U227	1,1,2-Trichloroethane
U190	Phthalic anhydride	U228	Trichloroethene
U191	2-Picoline	U228	Trichloroethylene
U192	Pronamide	U121	Trichloromono-fluoromethane
U194	1-Propanamine (I,T)	U230	2,4,5-Trichlorophenol
U110	1-Propanamine, N-propyl- (I)	U231	2,4,6-Trichlorophenol
U066	Propane, 1,2-dibromo-3-chloro-	U232	2,4,5-Trichlorophenoxyacetic acid
U149	Propanedinitrile	U234	sym-Tri-nitrobenzene (R,T)
U171	Propane, 2-nitro- (I)	U182	1,3,5-Trioxane, 2,4,5-trimethyl-
U027	Propane, 2,2'-oxybis(2-chloro-	U235	Tris(2,3-dibromopropyl) phosphate
U193	1,3-Propane sulfone	U236	Trypan blue
U235	1-Propanol, 2,3-dibromo-, phosphate (3:1)	U237	Uracil, 5[bis(2-chloromethylamino)-
U126	1-Propanol, 2,3-epoxy-	U237	Uracil mustard
U140	1-Propanol, 2-methyl- (I,T)	U043	Vinyl chloride
U002	2-Propanone (I)	U248	Warfarin, when present at concentrations of 0.3% or less
U007	2-Propanamide	U239	Xylene (I)
U084	Propene, 1,3-dichloro-	U200	Yohimben-16-carboxylic acid, 11,17-dimethoxy-18-[(3,4,5-trimethoxybenzoyl)oxy]-, methyl ester
U243	1-Propene, 1,1,2,3,3,3-hexachloro-	U249	Zinc phosphide, when present at concentrations of 10% or less
U008	2-Propenenitrile		
U152	2-Propenenitrile, 2-methyl- (I,T)		
U008	2-Propenoic acid (I)		
U113	2-Propenoic acid, ethyl ester (I)		
U118	2-Propenoic acid, 2-methyl-, ethyl ester		
U162	2-Propenoic acid, 2-methyl-, methyl ester (I,T)		
U233	Propionic acid, 2-(2,4,5-trichlorophenoxy)-		
U194	n-Propylamine (I,T)		
U083	Propylene dichloride		
U198	Pyridine		
U155	Pyridine, 2-[(2-(dimethylamino)-2-thenylamino)-		
U179	Pyridine, hexahydro-N-nitroso-		
U191	Pyridine, 2-methyl-		
U164	4(1H)-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-		
U180	Pyrolo, tetrahydro-N-nitroso-		
U200	Reserpine		
U201	Resorcinol		
U202	Saccharin and salts		
U203	Safrole		
U204	Selenous acid		
U204	Selenium dioxide		
U205	Selenium disulfide (R,T)		
U015	L-Serine, diazoacetate (ester)		
U233	Silver		
U089	4,4'-Stibenediol, alpha, alpha'-diethyl-		
U206	Streptozotocin		
U135	Sulfur hydride		
U103	Sulfuric acid, dimethyl ester		
U189	Sulfur phosphide (R)		

[45 FR 78529, 78541, Nov. 25, 1980, as amended at 46 FR 27477, May 20, 1981; 49 FR 19923, May 10, 1984]

APPENDIX F

HAZARDOUS CONSTITUENTS (40 CFR 261, APPENDIX VIII)

The content of this Appendix was reproduced from the Code of Federal Regulations of July 1, 1984. Users should check the current version of the Code of Federal Regulations and more recent issues of the Federal Register for amendments.

APPENDIX VIII—HAZARDOUS CONSTITUENTS

Acetonitrile (Ethanenitrile)
 Acetophenone (Ethanone, 1-phenyl)
 3-(alpha-Acetylbenzyl)-4-hydroxycoumarin and salts (Warfarin)
 2-Acetylaminofluorene (Acetamide, N-(9H-fluoren-2-yl)-)
 Acetyl chloride (Ethanoyl chloride)
 1-Acetyl-2-thiourea (Acetamide, N-(aminothioxomethyl)-)
 Acrolein (2-Propenal)
 Acrylamide (2-Propenamide)
 Acrylonitrile (2-Propenenitrile)
 Aflatoxins
 Aldrin (1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a,8b-hexahydro-endo,exo-1,4:5,8-Dimethanonaphthalene)
 Allyl alcohol (2-Propen-1-ol)
 Aluminum phosphide
 4-Aminobiphenyl ([1,1'-Biphenyl]-4-amine)
 6-Amino-1,1a,2,8,8a,8b-hexahydro-8-(hydroxymethyl)-8a-methoxy-5-methyl-carbamate azirino(2',3':3,4)pyrrolo(1,2-a)indole-4,7-dione, (ester) (Mitomycin C)
 (Azirino(2'3':3,4)pyrrolo(1,2-a)indole-4,7-dione, 6-amino-8-(((amino-carbonyl)oxy)methyl)-1,1a,2,8,8a,8b-hexahydro-8amethoxy-5-methy-)
 5-(Aminomethyl)-3-isoxazolol (3(2H)-Isoxazolone, 5-(aminomethyl)-) 4-Aminopyridine (4-Pyridinamine)
 Amitrole (1H-1,2,4-Triazol-3-amine)
 Aniline (Benzenamine)
 Antimony and compounds, N.O.S.*
 Aramite (Sulfurous acid, 2-chloroethyl-, 2-[4-(1,1-dimethylethyl)phenoxy]-1-methylethyl ester)

* The abbreviation N.O.S. (not otherwise specified) signifies those members of the general class not specifically listed by name in this appendix.

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Arsenic and compounds, N.O.S.*
 Arsenic acid (Orthoarsenic acid)
 Arsenic pentoxide (Arsenic (V) oxide)
 Arsenic trioxide (Arsenic (III) oxide)
 Auramine (Benzenamine, 4,4'-carbonimidoylbis(N,N-Dimethyl-, mono-hydrochloride)
 Azaserine (L-Serine, diazoacetate (ester))
 Barium and compounds, N.O.S.*
 Barium cyanide
 Benz(c)acridine (3,4-Benzacridine)
 Benz(a)anthracene (1,2-Benzanthracene)
 Benzene (Cyclohexatriene)
 Benzenearsonic acid (Arsonic acid, phenyl-)
 Benzene, dichloromethyl- (Benzal chloride)
 Benzenethiol (Thiophenol)
 Benzidine ([1,1'-Biphenyl]-4,4'-diamine)
 Benzo(b)fluoranthene (2,3-Benzofluoranthene)
 Benzo(j)fluoranthene (7,8-Benzofluoranthene)
 Benzo(a)pyrene (3,4-Benzopyrene)
 p-Benzquinone (1,4-Cyclohexadienedione)
 Benzotrichloride (Benzene, trichloromethyl)
 Benzyl chloride (Benzene, (chloromethyl)-)
 Beryllium and compounds, N.O.S.*
 Bis(2-chloroethoxy)methane (Ethane, 1,1'-(methylenebis(oxy))bis(2-chloro-))
 Bis(2-chloroethyl) ether (Ethane, 1,1'-oxybis(2-chloro-))
 N,N-Bis(2-chloroethyl)-2-naphthylamine (Chlornaphazine)
 Bis(2-chloroisopropyl) ether (Propane, 2,2'-oxybis(2-chloro-))
 Bis(chloromethyl) ether (Methane, oxybis(chloro-))
 Bis(2-ethylhexyl) phthalate (1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester)
 Bromoacetone (2-Propanone, 1-bromo-)
 Bromomethane (Methyl bromide)
 4-Bromophenyl phenyl ether (Benzene, 1-bromo-4-phenoxy-)
 Brucine (Strychnidin-10-one, 2,3-dimethoxy-)
 2-Butanone peroxide (Methyl ethyl ketone, peroxide)
 Butyl benzyl phthalate (1,2-Benzenedicarboxylic acid, butyl phenylmethyl ester)
 2-sec-Butyl-4,6-dinitrophenol (DNBP) (Phenol, 2,4-dinitro-6-(1-methylpropyl)-)
 Cadmium and compounds, N.O.S.*
 Calcium chromate (Chromic acid, calcium salt)
 Calcium cyanide
 Carbon disulfide (Carbon bisulfide)
 Carbon oxyfluoride (Carbonyl fluoride)
 Chloral (Acetaldehyde, trichloro-)
 Chlorambucil (Butanoic acid, 4-(bis(2-chloroethyl)amino)benzene-)
 Chlordane (alpha and gamma isomers) (4,7-Methanoindan, 1,2,4,5,6,7,8,8-octachloro-3,4,7,8a-tetrahydro-) (alpha and gamma isomers)
 Chlorinated benzenes, N.O.S.*
 Chlorinated ethane, N.O.S.*
 Chlorinated fluorocarbons, N.O.S.*

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Chlorinated naphthalene, N.O.S.*
 Chlorinated phenol, N.O.S.*
 Chloroacetaldehyde (Acetaldehyde, chloro-)
 Chloroalkyl ethers, N.O.S.*
 p-Chloroaniline (Benzenamine, 4-chloro-)
 Chlorobenzene (Benzene, chloro-)
 Chlorobenzilate (Benzenecetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-, ethyl ester)
 2-Chloro-1,3-butadiene (chloroprene)
 p-Chloro-m-cresol (Phenol, 4-chloro-3-methyl)
 1-Chloro-2,3-epoxypropane (Oxirane, 2-(chloromethyl)-)
 2-Chloroethyl vinyl ether (Ethene, (2-chloroethoxy)-)
 Chloroform (Methane, trichloro-)
 Chloromethane (Methyl chloride)
 Chloromethyl methyl ether (Methane, chloromethoxy-)
 2-Chloronaphthalene (Naphthalene, beta-chloro-)
 2-Chlorophenol (Phenol, o-chloro-)
 1-(o-Chlorophenyl)thiourea (Thiourea, (2-chlorophenyl)-)
 3-Chloropropene (allyl chloride)
 3-Chloropropionitrile (Propanenitrile, 3-chloro-)
 Chromium and compounds, N.O.S.*
 Chrysene (1,2-Benzphenanthrene)
 Citrus red No. 2 (2-Naphthol, 1-((2,5-dimethoxyphenyl)azo)-)
 Coal tars
 Copper cyanide
 Creosote (Creosote, wood)
 Cresols (Cresylic acid) (Phenol, methyl-)
 Crotonaldehyde (2-Butenal)
 Cyanides (soluble salts and complexes), N.O.S.*
 Cyanogen (Ethanedinitrile)
 Cyanogen bromide (Bromine cyanide)
 Cyanogen chloride (Chlorine cyanide)
 Cycasin (beta-D-Glucopyranoside, (methyl-ONN-azoxy)methyl-)
 2-Cyclohexyl-4,6-dinitrophenol (Phenol, 2-cyclohexyl-4,6-dinitro-)
 Cyclophosphamide (2H-1,3,2-Oxazaphosphorine, [bis(2-chloroethyl)amino]-tetrahydro-, 2-oxide)
 Daunomycin (5,12-Naphthacenedione, (8S-cis)-8-acetyl-10-[(3-amino-2,3,6-trideoxy)-alpha-L-lyxo-hexopyranosyl]oxy]-7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-)
 DDD (Dichlorodiphenyldichloroethane) (Ethane, 1,1-dichloro-2,2-bis(p-chlorophenyl)-)
 DDE (Ethylene, 1,1-dichloro-2,2-bis(4-chlorophenyl)-)
 DDT (Dichlorodiphenyltrichloroethane) (Ethane, 1,1,1-trichloro-2,2-bis(p-chlorophenyl)-)
 Diallate (S-(2,3-dichloroallyl) diisopropylthiocarbamate)
 Dibenz(a,h)acridine (1,2,5,6-Dibenzacridine)
 Dibenz(a,j)acridine (1,2,7,8-Dibenzacridine)

- Dibenz[a,h]anthracene (1,2,5,6-Dibenzanthracene)
- 7H-Dibenzo[c,g]carbazole (3,4,5,6-Dibenzcarbazole)
- Dibenzo[a,e]pyrene (1,2,4,5-Dibenzpyrene)
- Dibenzo[a,h]pyrene (1,2,5,6-Dibenzpyrene)
- Dibenzo[a,i]pyrene (1,2,7,8-Dibenzpyrene)
- 1,2-Dibromo-3-chloropropane (Propane, 1,2-dibromo-3-chloro-)
- 1,2-Dibromoethane (Ethylene dibromide)
- Dibromomethane (Methylene bromide)
- Di-n-butyl phthalate (1,2-Benzenedicarboxylic acid, dibutyl ester)
- o-Dichlorobenzene (Benzene, 1,2-dichloro-)
- m-Dichlorobenzene (Benzene, 1,3-dichloro-)
- p-Dichlorobenzene (Benzene, 1,4-dichloro-)
- Dichlorobenzene, N.O.S.* (Benzene, dichloro-, N.O.S.*)
- 3,3'-Dichlorobenzidine ([1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-)
- 1,4-Dichloro-2-butene (2-Butene, 1,4-dichloro-)
- Dichlorodifluoromethane (Methane, dichlorodifluoro-)
- 1,1-Dichloroethane (Ethylidene dichloride)
- 1,2-Dichloroethane (Ethylene dichloride)
- trans-1,2-Dichloroethene (1,2-Dichloroethylene)
- Dichloroethylene, N.O.S.* (Ethene, dichloro-, N.O.S.*)
- 1,1-Dichloroethylene (Ethene, 1,1-dichloro-)
- Dichloromethane (Methylene chloride)
- 2,4-Dichlorophenol (Phenol, 2,4-dichloro-)
- 2,6-Dichlorophenol (Phenol, 2,6-dichloro-)
- 2,4-Dichlorophenoxyacetic acid (2,4-D), salts and esters (Acetic acid, 2,4-dichlorophenoxy-, salts and esters)
- Dichlorophenylarsine (Phenyl dichloroarsine)
- Dichloropropane, N.O.S.* (Propane, dichloro-, N.O.S.*)
- 1,2-Dichloropropane (Propylene dichloride)
- Dichloropropanol, N.O.S.* (Propanol, dichloro-, N.O.S.*)
- Dichloropropene, N.O.S.* (Propene, dichloro-, N.O.S.*)
- 1,3-Dichloropropene (1-Propene, 1,3-dichloro-)
- Dieldrin (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octa-hydro-endo,exo-1,4:5,8-Dimethanonaphthalene)
- 1,2:3,4-Diepoxybutane (2,2'-Bioxirane)
- Diethylarsine (Arsine, diethyl-)
- N,N-Diethylhydrazine (Hydrazine, 1,2-diethyl-)
- O,O-Diethyl S-methyl ester of phosphorodithioic acid (Phosphorodithioic acid, O,O-diethyl S-methyl ester)
- O,O-Diethylphosphoric acid, O-p-nitrophenyl ester (Phosphoric acid, diethyl p-nitrophenyl ester)
- Diethyl phthalate (1,2-Benzenedicarboxylic acid, diethyl ester)
- O,O-Diethyl O-2-pyrazinyl phosphorothioate (Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester)
- Diethylstilbesterol (4,4'-Stilbenediol, alpha,alpha-diethyl, bis(dihydrogen phosphate, (E)-)
- Dihydrosafrole (Benzene, 1,2-methylenedioxy-4-propyl-)
- 3,4-Dihydroxy-alpha-(methylamino)methyl benzyl alcohol (1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-)
- Diisopropylfluorophosphate (DFF) (Phosphorofluoridic acid, bis(1-methylethyl) ester)
- Dimethoate (Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] ester)
- 3,3'-Dimethoxybenzidine ([1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethoxy-)
- p-Dimethylaminoazobenzene (Benzenamine, N,N-dimethyl-4-(phenylazo)-)
- 7,12-Dimethylbenz[a]anthracene (1,2-Benzanthracene, 7,12-dimethyl-)
- 3,3'-Dimethylbenzidine ([1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-)
- Dimethylcarbamoyl chloride (Carbamoyl chloride, dimethyl-)
- 1,1-Dimethylhydrazine (Hydrazine, 1,1-dimethyl-)
- 1,2-Dimethylhydrazine (Hydrazine, 1,2-dimethyl-)
- 3,3-Dimethyl-1-(methylthio)-2-butanone, O-[(methylamino) carbonyl]oxime (Thiofanox)
- alpha,alpha-Dimethylphenethylamine (Eth-
anamine, 1,1-dimethyl-2-phenyl-)
- 2,4-Dimethylphenol (Phenol, 2,4-dimethyl-)
- Dimethyl phthalate (1,2-Benzenedicarboxylic acid, dimethyl ester)
- Dimethyl sulfate (Sulfuric acid, dimethyl ester)
- Dinitrobenzene, N.O.S.* (Benzene, dinitro-, N.O.S.*)
- 4,6-Dinitro-o-cresol and salts (Phenol, 2,4-dinitro-6-methyl-, and salts)
- 2,4-Dinitrophenol (Phenol, 2,4-dinitro-)
- 2,4-Dinitrotoluene (Benzene, 1-methyl-2,4-dinitro-)
- 2,6-Dinitrotoluene (Benzene, 1-methyl-2,6-dinitro-)
- Di-n-octyl phthalate (1,2-Benzenedicarboxylic acid, dioctyl ester)
- 1,4-Dioxane (1,4-Diethylene oxide)
- Diphenylamine (Benzenamine, N-phenyl-)
- 1,2-Diphenylhydrazine (Hydrazine, 1,2-diphenyl-)
- Di-n-propylnitrosamine (N-Nitroso-di-n-propylamine)
- Disulfoton (O,O-diethyl S-[2-(ethylthio)ethyl] phosphorodithioate)
- 2,4-Dithiobiuret (Thiolimidodicarbonic diamide)
- Endosulfan (5-Norbornene, 2,3-dimethanol, 1,4,5,6,7,7-hexachloro-, cyclic sulfite)
- Endrin and metabolites (1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo,endo-1,4:5,8-dimethanonaphthalene, and metabolites)

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Ethyl carbamate (Urethan) (Carbamic acid, ethyl ester)
 Ethyl cyanide (propanenitrile)
 Ethylenebisdithiocarbamic acid, salts and esters (1,2-Ethanedithiylbiscarbamodithioic acid, salts and esters)
 Ethyleneimine (Aziridine)
 Ethylene oxide (Oxirane)
 Ethylenethiourea (2-Imidazolidinethione)
 Ethyl methacrylate (2-Propenoic acid, 2-methyl-, ethyl ester)
 Ethyl methanesulfonate (Methanesulfonic acid, ethyl ester)
 Fluoranthene (Benzo[*j,k*]fluorene)
 Fluorine
 2-Fluoroacetamide (Acetamide, 2-fluoro-)
 Fluoroacetic acid, sodium salt (Acetic acid, fluoro-, sodium salt)
 Formaldehyde (Methylene oxide)
 Formic acid (Methanoic acid)
 Glycidylaldehyde (1-Propanol-2,3-epoxy)
 Halomethane, N.O.S.*
 Heptachlor (4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-)
 Heptachlor epoxide (alpha, beta, and gamma isomers) (4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-2,3-epoxy-3a,4,7,7-tetrahydro-, alpha, beta, and gamma isomers)
 Hexachlorobenzene (Benzene, hexachloro-)
 Hexachlorobutadiene (1,3-Butadiene, 1,1,2,3,4,4-hexachloro-)
 Hexachlorocyclohexane (all isomers) (Lindane and isomers)
 Hexachlorocyclopentadiene (1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-)
 Hexachloroethane (Ethane, 1,1,1,2,2,2-hexachloro-)
 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-endo,endo-dimethanonaphthalene (Hexachlorohexahydro-endo,endo-dimethanonaphthalene)
 Hexachlorophene (2,2'-Methylenebis(3,4,6-trichlorophenol))
 Hexachloropropene (1-Propene, 1,1,2,3,3,3-hexachloro-)
 Hexaethyl tetraphosphate (Tetraphosphoric acid, hexaethyl ester)
 Hydrazine (Diamine)
 Hydrocyanic acid (Hydrogen cyanide)
 Hydrofluoric acid (Hydrogen fluoride)
 Hydrogen sulfide (Sulfur hydride)
 Hydroxydimethylarsine oxide (Cacodylic acid)
 Indeno(1;2,3-cd)pyrene (1,10-(1,2-phenylene)pyrene)
 Iodomethane (Methyl iodide)
 Iron dextran (Ferric dextran)
 Isocyanic acid, methyl ester (Methyl isocyanate)
 Isobutyl alcohol (1-Propanol, 2-methyl-)
 Isosafrole (Benzene, 1,2-methylenedioxy-4-allyl-)
 Kepone (Decachlorooctahydro-1,3,4-Methano-2H-cyclobuta[cd]pentalen-2-one)

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Lasiocarpine (2-Butenoic acid, 2-methyl-, 7-[(2,3-dihydroxy-2-(1-methoxyethyl)-3-methyl-1-oxobutoxy)methyl]-2,3,5,7a-tetrahydro-1H-pyrrolizin-1-yl ester)
 Lead and compounds, N.O.S.*
 Lead acetate (Acetic acid, lead salt)
 Lead phosphate (Phosphoric acid, lead salt)
 Lead subacetate (Lead, bis(acetato-O)tetrahydroxytri-)
 Maleic anhydride (2,5-Furandione)
 Maleic hydrazide (1,2-Dihydro-3,6-pyridazin-4-one)
 Malononitrile (Propanedinitrile)
 Melphalan (Alanine, 3-[p-bis(2-chloroethyl)amino]phenyl-, L-)
 Mercury fulminate (Fulminic acid, mercury salt)
 Mercury and compounds, N.O.S.*
 Methacrylonitrile (2-Propenenitrile, 2-methyl-)
 Methanethiol (Thiomethanol)
 Methapyrilene (Pyridine, 2-[(2-dimethylamino)ethyl]-2-thenylamino-)
 Metholmyl (Acetimidic acid, N-[(methylcarbamoyl)oxylthio-, methyl ester)
 Methoxychlor (Ethane, 1,1,1-trichloro-2,2'-bis(p-methoxyphenyl)-)
 2-Methylaziridine (1,2-Propylenimine)
 3-Methylcholanthrene (Benz[*j*]aceanthrylene, 1,2-dihydro-3-methyl-)
 Methyl chlorocarbonate (Carbonochloridic acid, methyl ester)
 4,4'-Methylenebis(2-chloroaniline) (Benzenamine, 4,4'-methylenebis(2-chloro-))
 Methyl ethyl ketone (MEK) (2-Butanone)
 Methyl hydrazine (Hydrazine, methyl-)
 2-Methylactonitrile (Propanenitrile, 2-hydroxy-2-methyl-)
 Methyl methacrylate (2-Propenoic acid, 2-methyl-, methyl ester)
 Methyl methanesulfonate (Methanesulfonic acid, methyl ester)
 2-Methyl-2-(methylthio)propionaldehyde-O-(methylcarbonyl) oxime (Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino)carbonyl]oxime)
 N-Methyl-N'-nitro-N-nitrosoguanidine (Guanidine, N-nitroso-N-methyl-N'-nitro-)
 Methyl parathion (O,O-dimethyl O-(4-nitrophenyl) phosphorothioate)
 Methylthiouracil (4-1H-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-)
 Mustard gas (Sulfide, bis(2-chloroethyl)-)
 Naphthalene
 1,4-Naphthoquinone (1,4-Naphthalenedione)
 1-Naphthylamine (alpha-Naphthylamine)
 2-Naphthylamine (beta-Naphthylamine)
 1-Naphthyl-2-thiourea (Thiourea, 1-naphthalenyl-)
 Nickel and compounds, N.O.S.*
 Nickel carbonyl (Nickel tetracarbonyl)
 Nickel cyanide (Nickel (II) cyanide)

- Nicotine and salts (Pyridine, (S)-3-(1-methyl-2-pyrrolidinyl)-, and salts)
 Nitric oxide (Nitrogen (II) oxide)
 p-Nitroaniline (Benzenamine, 4-nitro-)
 Nitrobenzene (Benzene, nitro-)
 Nitrogen dioxide (Nitrogen (IV) oxide)
 Nitrogen mustard and hydrochloride salt (Ethanamine, 2-chloro-, N-(2-chloroethyl)-N-methyl-, and hydrochloride salt)
 Nitrogen mustard N-Oxide and hydrochloride salt (Ethanamine, 2-chloro-, N-(2-chloroethyl)-N-methyl-, and hydrochloride salt)
 Nitroglycerine (1,2,3-Propanetriol, trinitrate)
 4-Nitrophenol (Phenol, 4-nitro-)
 4-Nitroquinoline-1-oxide (Quinoline, 4-nitro-1-oxide-)
 Nitrosamine, N.O.S.*
 N-Nitrosodi-n-butylamine (1-Butanamine, N-butyl-N-nitroso-)
 N-Nitrosodiethanolamine (Ethanol, 2,2'-(nitrosoimino)bis-)
 N-Nitrosodiethylamine (Ethanamine, N-ethyl-N-nitroso-)
 N-Nitrosodimethylamine (Dimethylnitrosamine)
 N-Nitroso-N-ethylurea (Carbamide, N-ethyl-N-nitroso-)
 N-Nitrosomethylethylamine (Ethanamine, N-methyl-N-nitroso-)
 N-Nitroso-N-methylurea (Carbamide, N-methyl-N-nitroso-)
 N-Nitroso-N-methylurethane (Carbamic acid, methylnitroso-, ethyl ester)
 N-Nitrosomethylvinylamine (Ethanamine, N-methyl-N-nitroso-)
 N-Nitrosomorpholine (Morpholine, N-nitroso-)
 N-Nitrosornicotine (Nornicotine, N-nitroso-)
 N-Nitrosopiperidine (Pyridine, hexahydro-, N-nitroso-)
 Nitrosopyrrolidine (Pyrrole, tetrahydro-, N-nitroso-)
 N-Nitrososarcosine (Sarcosine, N-nitroso-)
 5-Nitro-o-toluidine (Benzenamine, 2-methyl-5-nitro-)
 Octamethylpyrophosphoramidate (Diphosphoramidate, octamethyl-)
 Osmium tetroxide (Osmium (VIII) oxide)
 7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid (Endothal)
 Paraldehyde (1,3,5-Trioxane, 2,4,6-trimethyl-)
 Parathion (Phosphorothioic acid, O,O-diethyl O-(p-nitrophenyl) ester)
 Pentachlorobenzene (Benzene, pentachloro-)
 Pentachloroethane (Ethane, pentachloro-)
 Pentachloronitrobenzene (PCNB) (Benzene, pentachloronitro-)
 Pentachlorophenol (Phenol, pentachloro-)
 Phenacetin (Acetamide, N-(4-ethoxyphenyl)-)
 Phenol (Benzene, hydroxy-)
 Phenylenediamine (Benzenediamine)
 Phenylmercury acetate (Mercury, acetatophenyl-)
 N-Phenylthiourea (Thiourea, phenyl-)
 Phosgene (Carbonyl chloride)
 Phosphine (Hydrogen phosphide)
 Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester (Phorate)
 Phosphorothioic acid, O,O-dimethyl O-(p-[(dimethylamino)sulfonyl]phenyl) ester (Famphur)
 Phthalic acid esters, N.O.S.* (Benzene, 1,2-dicarboxylic acid, esters, N.O.S.*)
 Phthalic anhydride (1,2-Benzenedicarboxylic acid anhydride)
 2-Picoline (Pyridine, 2-methyl-)
 Polychlorinated biphenyl, N.O.S.*
 Potassium cyanide
 Potassium silver cyanide (Argentate(1-), dicyano-, potassium)
 Pronamide (3,5-Dichloro-N-(1,1-dimethyl-2-propynyl)benzamide)
 1,3-Propane sultone (1,2-Oxathiolane, 2,2-dioxide)
 n-Propylamine (1-Propanamine)
 Propylthiouracil (Undecamethylenediamine, N,N'-bis(2-chlorobenzyl)-, dihydrochloride)
 2-Propyn-1-ol (Propargyl alcohol)
 Pyridine
 Reserpine (Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[(3,4,5-trimethoxybenzoyl)oxyl-, methyl ester)
 Resorcinol (1,3-Benzenediol)
 Saccharin and salts (1,2-Benzisothiazolin-3-one, 1,1-dioxide, and salts)
 Safrole (Benzene, 1,2-methylenedioxy-4-allyl-)
 Selenious acid (Selenium dioxide)
 Selenium and compounds, N.O.S.*
 Selenium sulfide (Sulfur selenide)
 Selenourea (Carbamimidoseleonic acid)
 Silver and compounds, N.O.S.*
 Silver cyanide
 Sodium cyanide
 Streptozotocin (D-Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-)
 Strontium sulfide
 Strychnine and salts (Strychnidin-10-one, and salts)
 1,2,4,5-Tetrachlorobenzene (Benzene, 1,2,4,5-tetrachloro-)
 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) (Dibenzo-p-dioxin, 2,3,7,8-tetrachloro-)
 Tetrachloroethane, N.O.S.* (Ethane, tetrachloro-, N.O.S.*)
 1,1,1,2-Tetrachlorethane (Ethane, 1,1,1,2-tetrachloro-)
 1,1,2,2-Tetrachlorethane (Ethane, 1,1,2,2-tetrachloro-)
 Tetrachloroethane (Ethene, 1,1,2,2-tetrachloro-)
 Tetrachloromethane (Carbon tetrachloride)
 2,3,4,6-Tetrachlorophenol (Phenol, 2,3,4,6-tetrachloro-)
 Tetraethyldithiopyrophosphate (Dithiopyrophosphoric acid, tetraethyl-ester)

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Tetraethyl lead (Plumbane, tetraethyl-)
 Tetraethylpyrophosphate (Pyrophosphoric
 acid, tetraethyl ester)
 Tetranitromethane (Methane, tetranitro-)
 Thallium and compounds, N.O.S.*
 Thallous oxide (Thallium (III) oxide)
 Thallium (I) acetate (Acetic acid, thallium
 (I) salt)
 Thallium (I) carbonate (Carbonic acid, dithal-
 lium (I) salt)
 Thallium (I) chloride
 Thallium (I) nitrate (Nitric acid, thallium
 (I) salt)
 Thallium selenite
 Thallium (I) sulfate (Sulfuric acid, thallium
 (I) salt)
 Thioacetamide (Ethanethioamide)
 Thiosemicarbazide (Hydrazinecarbothioa-
 mide)
 Thiourea (Carbamide thio-)
 Thiuram (Bis(dimethylthiocarbamoyl) di-
 sulfide)
 Toluene (Benzene, methyl-)
 Toluenediamine (Diaminotoluene)
 o-Toluidine hydrochloride (Benzenamine, 2-
 methyl-, hydrochloride)
 Toluene diisocyanate (Benzene, 1,3-diiso-
 cyanatomethyl-)
 Toxaphene (Camphene, octachloro-)
 Tribromomethane (Bromoform)
 1,2,4-Trichlorobenzene (Benzene, 1,2,4-trich-
 lora-)
 1,1,1-Trichloroethane (Methyl chloroform)
 1,1,2-Trichloroethane (Ethane, 1,1,2-trich-
 lora-)
 Trichloroethene (Trichloroethylene)
 Trichloromethanethiol (Methanethiol,
 trichloro-)
 Trichloromonofluoromethane (Methane,
 trichlorofluoro-)
 2,4,5-Trichlorophenol (Phenol, 2,4,5-trich-
 lora-)
 2,4,6-Trichlorophenol (Phenol, 2,4,6-trich-
 lora-)
 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)
 (Acetic acid, 2,4,5-trichlorophenoxy-)
 2,4,5-Trichlorophenoxypropionic acid (2,4,5-
 TP) (Silvex) (Propionic acid, 2-(2,4,5-
 trichlorophenoxy-))
 Trichloropropane, N.O.S.* (Propane, trich-
 lora-, N.O.S.*)
 1,2,3-Trichloropropane (Propane, 1,2,3-trich-
 lora-)
 O,O,O-Triethyl phosphorothioate (Phos-
 phorothioic acid, O,O,O-triethyl ester)
 sym-Trinitrobenzene (Benzene, 1,3,5-trini-
 tro-)
 Tris(1-aziridinyl) phosphine sulfide (Phos-
 phine sulfide, tris(1-aziridinyl-))
 Tris(2,3-dibromopropyl) phosphate (1-Pro-
 panol, 2,3-dibromo-, phosphate)
 Trypan blue (2,7-Naphthalenedisulfonic
 acid, 3,3'-[(3,3'-dimethyl(1,1'-biphenyl)-
 4,4'-diyl)bis(azo)]bis(5-amino-4-hydroxy-,
 tetrasodium salt)
 Uracil mustard (Uracil 5-[bis(2-
 chloroethyl)amino]-)

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Vanadic acid, ammonium salt (ammonium
 vanadate)
 Vanadium pentoxide (Vanadium (V) oxide)
 Vinyl chloride (Ethene, chloro-)
 Zinc cyanide
 Zinc phosphide

[46 FR 27477, May 20, 1981; 46 FR 29708,
 June 3, 1981; 49 FR 5312, Feb. 10, 1984]

EFFECTIVE DATE NOTE: At 49 FR 5312, Feb.
 10, 1984, the entries for 2-Chloro-1, 3-butadi-
 ene (chloroprene), and 3-Chloropropene
 (allyl chloride), were added to the table in
 Part 261, App. VIII, effective August 10,
 1984.

APPENDIX G

HOW TO USE A RANDOM NUMBER TABLE

How to Use a Random Number Table

The sampling procedure for contained wastes that is described in Section 7 of the Manual requires you to select sampling points using a random number table. This Appendix gives the general procedure for using such a table, which can be found in almost any statistical text or handbook.

The general problem is to select a sample of n members (such as grid points to be sampled) from a population of N members (such as the total number of points in the grid). Below we present a "single-stage" method of drawing such a sample. Other methods provide somewhat greater assurance of randomness, but at the cost of additional complexity. The method is as follows:

1. Decide upon an arbitrary rule for selecting entries from the table. You might want to choose the second row in the first column, the third row in the second column, and so on, or every k th number.
2. Number your universe from 1 to N . If N has three digits, the first number in your universe would be 001, and so forth.
3. The number of digits in each random number in the table may exceed the number of digits in N . If so, decide upon an arbitrary rule to select from each random number in the table another number with the correct number of digits. For example, if the table is made up of five-digit numbers and N has three digits, you could use the first three of each random number, or digits 1-3-5, or 2-3-4, or any three-digit set.
4. Construct a list of n random numbers using the rules in Steps 1 and 3 above. This list will then constitute a random sample of the set N .
5. If you exhaust the table before n random numbers have been drawn, start at a new place near the beginning of the table and continue as before.

An alternative to the manual process described above is to use the random number function RANDOM that is contained in the BASIC software on most microcomputers.

APPENDIX H

TYPICAL PRICES FOR HAZARDOUS WASTE TEST PROCEDURES

TYPICAL PRICES FOR HAZARDOUS WASTE TEST PROCEDURES

The prices given below are based chiefly on a survey of testing laboratories that was conducted by Industrial Economics, Inc. (IEC) in the course of its work for the Office of Solid Waste. The prices are current as of the spring of 1984. In two cases (Ignitability and Corrosivity), figures missing from the IEC survey were supplied by telephone calls to laboratories in the New England region. The figures are indicative of unit prices charged for small numbers of samples. Runs involving large numbers of samples would receive price discounts.

<u>Test Method</u>	<u>Price (\$ per sample)</u>
Ignitability	25 - 60
Corrosivity	
pH	5
Steel corrosion test	75 - 200
EP Toxicity	
Extraction procedure	100 - 150
8 SDWA metals	145 - 475
Pesticides analysis	125 - 215
Herbicides analysis	150 - 270
Cyanide (with separate extraction procedure)	100
Oily Waste EP Toxicity	
Extraction procedure plus 8 SDWA metals	750
Total Organic Carbon	
Non-standard matrix (solid, sludge)	20 - 65
Standard matrix (wastewater)	20 - 60
Total Oil and Grease	
Non-standard matrix	16 - 75
Standard matrix	16 - 70

<u>Test Method</u>	<u>(\$ per sample)</u>
Total Metals	
Digestion	
Non-standard matrix	10 - 25
Standard matrix	0 - 15
Metals analysis	
As: furnace	10 - 20
Ba: furnace	10 - 20
Cd: furnace	10 - 20
Hex Cr: colorimetric	15 - 30
Cr: furnace	10 - 20
Pb: furnace	10 - 20
Hg: cold-vapor	15 - 30
Ag: furnace	10 - 20
Ni: furnace	10 - 20
8 SDWA metals	200
13 priority pollutant metals	200 - 250
Organic Analyses	
Sample preparation	
Solid, sludge	0 - 40
Extraordinary preparation/cleanup	
Refinery organics in sludge	100 - 500
Appendix VIII constituents in sludge	100 - 1500
Gas Chromatography	
Halogenated volatile organics	80 - 120
Non-halogenated volatile organics	80 - 120
Aromatic volatile organics	80 - 120
Polychlorinated biphenyls	150 - 180
Pesticides and PCBs, including fractionation	175 - 200
Gas Chromatography/Mass Spectrometry	
Volatile organics	
Priority pollutants	170 - 240
Appendix VIII constituents	450

<u>Test Method</u>	<u>(\$ per sample)</u>
Acid extractables	
Priority pollutants	200 - 250
Appendix VIII constituents	500
Base/neutral extractables	
Priority pollutants	250 - 400
Appendix VIII constituents	650

APPENDIX I
EXAMPLES OF DELISTING PETITIONS

The following types of wastes are represented:

- Inorganic wastes
- Organic wastes

A complete petition is presented for the former; excerpts are given for the latter. For the other two major types of facilities -- petroleum refineries and multiple waste treatment facilities -- there is too much variability from petition to petition to construct representative examples.

The information contained in the Inorganics example is based on an actual petition submitted by Texas Instruments, Inc. of Dallas, TX. Names of people have been altered, and some of the content has been changed for the purpose of providing a more general illustration.

INORGANIC WASTESTREAM

OPTIONAL FORM:

DELISTING PETITION FOR WASTE STREAM

**F006: Wastewater treatment sludges from electroplating
processes**

Submitted by:

**ABC INDUSTRIES, INC.
120 Smith Lane
Dallas, TX 75266**

Date:

December 12, 1982

SECTION A: Administrative Data and Summary

1. Name [260.20(b)(1)]

a. Name of firm: ABC Industries, Inc.

b. Address of firm: Street: 120 Smith Lane
City: Dallas
State: Texas Zip: 75226

c. RCRA Generator ID Number: TXD000567890

2. Facility Location [260.20(b)(1)]

a. Name of facility: Long Horn Avenue Site

b. Location of facility: Street: 5 Long Horn Avenue
City: Dallas
State: TX Zip: 75266

3. Name(s) of personnel to be contacted for additional information pertaining to this petition:

Name	Title	Telephone
<u>Frederick Lewis</u>	<u>Mgr, Process Eng.</u>	<u>(214) 555-5555</u>
<u>Susan Smith</u>	<u>Process Engineer</u>	<u>(214) 555-5555</u>
<u>Thomas Roberts</u>	<u>Engineering Analyst</u>	<u>(214) 555-5555</u>
<u>Joseph Kale</u>	<u>Mgr, Anal. Svcs Div</u> <u>Green Laboratories</u>	<u>(214) 555-5555</u>

4. Description and Justification for the Proposed Action

Please describe briefly the proposed delisting action, why it is needed, and how it will affect your operation. Describe why you believe that the waste stream of concern (a) is not hazardous for the reasons it was originally listed and (b) contains no other constituents or characteristics that render it hazardous as defined in 40 CFR 261. [260.20(b)(2), (3) and (4)]

This petition seeks to exclude from regulation under Subpart D of 40 CFR Part 261 a waste stream that is generated at a metal finishing shop at the ABC Industries Manufacturing Facility at Long Horn Avenue in Dallas, TX. The waste stream is EPA HW Code F006, Wastewater Treatment Sludges from Electroplating Operations. This action is needed because the disposal of these materials as a hazardous waste imposes an unnecessary burden on the petitioner, if indeed these materials are non-hazardous as defined by 40 CFR 261. This action will affect only the waste stream generated at the metal finishing shop of the above-mentioned facility.

Testing of the sludges in question indicates that: (a) the leachate from the sludge does not exceed the EP Toxicity Limits shown in Table 1, Section 261.24; (b) it does not contain appreciable amounts of the constituents for which it was listed as hazardous (as given in Part 261, Appendix VII); and (c) it contains no other constituents that would render it hazardous as defined in 40 CFR 261.

5. Certification of Accuracy and Responsibility [260.22(i)(12)]

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Signed,

Frederick Lewis
VP for Operations



Waste Generator, Title or
Authorized Representative*
of Waste Generator, Title

*Note: An "authorized representative" is a person responsible for the overall operation of a facility or an operational unit (for example, a plant manager, superintendent, or person of equivalent responsibility). Consultants or other outside parties may not sign the certification statement.

SECTION B: Production Processes

1. Description of Manufacturing Processes and Other Operations [260.22(i)(5)].

- a. Please provide a brief description of the on-site manufacturing/generating process(es) that produce the waste stream. Include descriptions of major equipment items and production lines. Also, describe the stages of the typical operating cycle on a daily, weekly, or other basis as appropriate.

The on-site processes that produce the waste stream are from metal finishing operations that are outlined in (b) below.

- b. Please provide a description of all surface and equipment preparation, cleaning, degreasing, coating or painting processes used in your facility that you have not described in (a) above. (See Attachment I)

1. Chromate conversion coating of aluminum / MIL-C-5541
2. Passivation of corrosion resistant steels / QQ-P-35 Types II,IV,V
3. Anodizing of aluminum alloy parts / MIL-A-8625
4. Phosphatizing, light, iron
5. Cadmium plate*
6. Cyanide copper plate*
7. Sulfamate nickel
8. Electroless nickel plate
9. Woods nickel strike
10. Tin plate*
11. Various cleaning of oils and coolants from machinery

***NOTES:**

All of the above process solutions are followed by one or more water rinse tanks which also pass through the treatment facility.

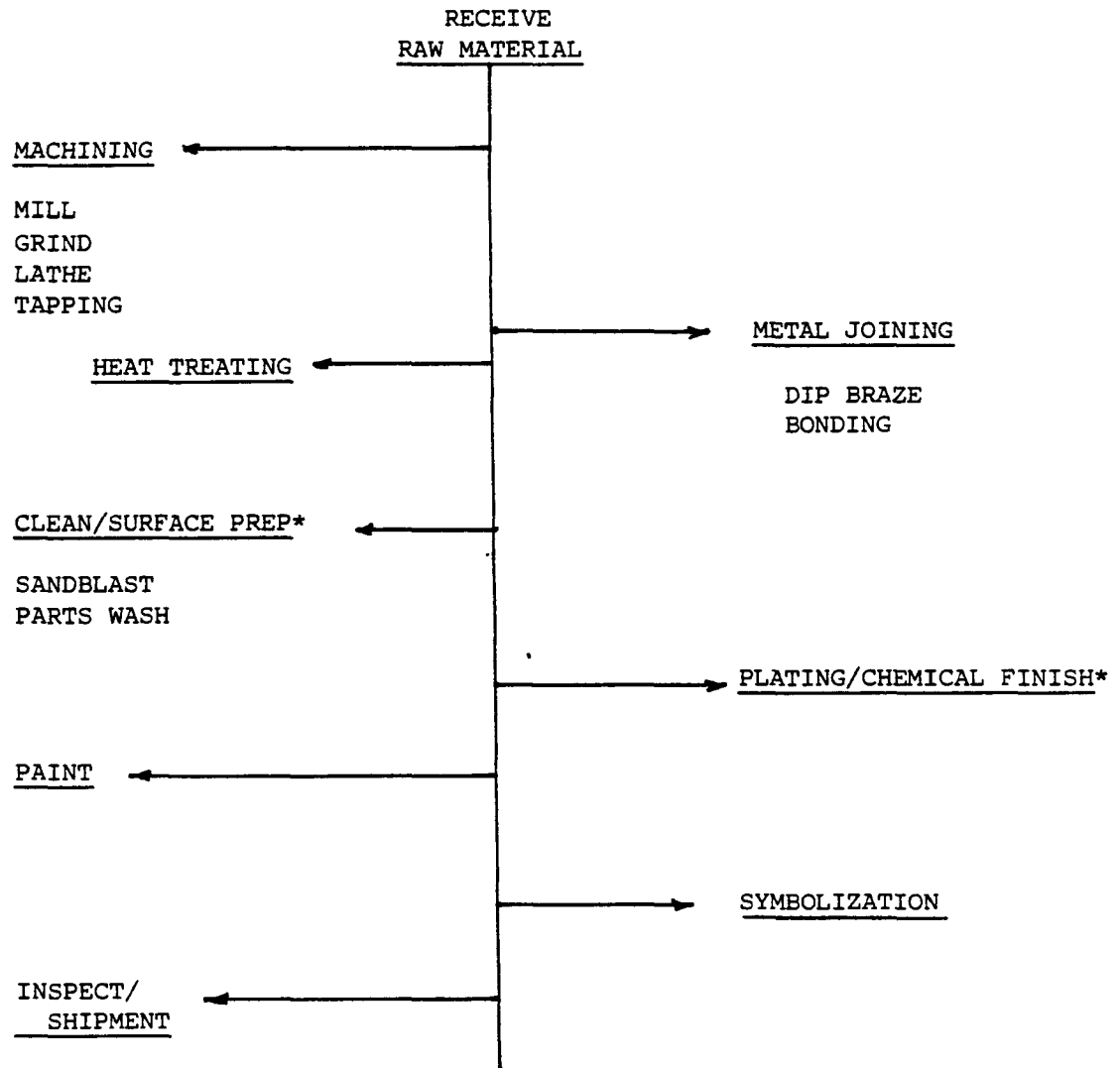
All pretreatments for plating operations use the same cleaning steps as alodine, anodize, or passivate, and are therefore not listed separately.

- c. Attach a schematic diagram of all manufacturing processes, surface preparation, cleaning, and other operations that may provide influent into the waste stream.

(See Attachment I)

ATTACHMENT I

Process Flow
TEXAS INSTRUMENTS/LEMMON AVENUE



* WATER USED IN THESE TWO OPERATIONS IS THE ONLY WATER PROCESSED THROUGH WASTE TREATMENT.

2. Materials Used or Produced

You may comply with the requirements for additional information in either of two ways; see Section 4 of the Guidance Manual for a detailed description of the two approaches.

Approach A:

- a. List all materials used or produced in the manufacturing or other process generating the waste stream(s) of concern. Use the correct chemical name wherever possible. Include materials such as:

Raw materials
Intermediate products
By-products
Products
Oils and hydraulic fluids
Surface preparation materials
(solvents, acids, cleaners, surface
preparation agents, paints, etc.)

Also:

- For each material on the list, indicate whether it is discharged to or likely to be present in the waste, and the estimated amount entering the waste stream annually. (Specify kilograms, pounds, or similar units.) Describe your estimation method. **SEE NOTE 1**
- For each material on the list that you do not expect to be present in the waste, give supporting reasons for this expectation. Supporting reasons may include mass balance and process information. **SEE NOTE 2**
- Attach Materials Safety Data Sheets (MSDS) for all materials that are identified by trade or generic name only and that are discharged into or likely to be present in the waste stream.

Material	Estimated Amount Entering the Waste Stream Annually
<u>Sodium Hydroxide</u>	<u>6 kg</u>
<u>Sodium cyanide</u>	<u>.5 "</u>
<u>Sodium dichromate</u>	<u>.5 "</u>
<u>Sodium carbonate</u>	<u>none</u>

(Continue on additional sheets as necessary.)

Item (d) continued:

Material	Estimated Amount Entering the Waste Stream Annually
Potassium dichromate	.5 kg
Nickel metal	40 "
Nickel sulfamate	32 "
Liquid nickel chloride	.6 "
Nickel acetate	.8 "
Stannous sulfate	.5 "
Rochelle salt	none
Black dye	none
Acid phosphate salts	20 "
Cadmium oxide	60 "
Copper cyanide	25 "
Chromic acid	12 "
Hydrochloric acid	30 "
Boric acid	12 "
Oxalic acid	8 "
Nitric acid	.5 "
Sulfuric acid	.5 "
Chromic acid, flake	.2 "
Potassium sulfate	none
SAE 90 gear lube	none
White grease	none
SAE 10W light oil	none

(MSDS's attached for the following:)

Ebonol C Special	200 "
Enbond NS-35	375 "
Luster-on Utility 15	436 "
Oakite 190	56 "
Shipley Catalyst 9F	43 "
Niposit R Nickel Replenisher	7 "
Niposit Electroless Nickel 65M	8 "

- NOTES: 1. Estimates of amounts of each substance in the waste stream have been calculated using mass balances. The calculations are available to EPA upon request.
2. Supporting calculations for why we believe certain of these materials to be absent from the waste are available to EPA upon request.

[Note to the reader: The Agency would request the supporting calculations referred to above; proper procedure would be to submit them with the original petition.]



OMB No. 1218-0074
Expiration Date 05/31/86

Section I

Manufacturer's Name Shipley Company Inc. Emergency Telephone Number (617) 969-5500
Address (Number, Street, City, State, and ZIP Code) 2300 Washington Street
Newton, MA 02162
Chemical Name and Synonyms n.a.
Trade Name and Synonyms NIPOSIT® NICKEL REPLENISHER 65S
Chemical Family n.a. Formula Proprietary

Section II - Hazardous Ingredients

Paints, Preservatives, and Solvents	%	TLV (Units)	Alloys and Metallic Coatings	%	TLV (Units)
Pigments n.a.			Base Metal n.a.		
Catalyst n.a.			Alloys n.a.		
Venice n.a.			Metallic Coatings n.a.		
Solvents n.a.			Filler Metal Plus Coating or Core Flux n.a.		
Additives n.a.			Others n.a.		
Others n.a.					

Hazardous Mixtures of Other Liquids, Solids or Gases

	%	TLV (Units)
Sodium Hypophosphite	25	unknown
Ammonium Carbonate	18	unknown
Lead, soluble compounds (as Pb)	less than .01	0.15 mg/m ³

Section III - Physical Data

Boiling Point (°F)	212	Specific Gravity (H ₂ O=1)	1.18
Vapor Pressure (mm Hg.)	n.a.	Percent Volatile by Volume (%)	n.a.
Vapor Density (AIR=1)	n.a.	Evaporation Rate	n.a.

Solubility in Water

Complete

Appearance and Odor

Water-white liquid ammoniacal odor

Section IV - Fire and Explosion Hazard Data

Flash Point (Method Used) Non-Flammable	Flammable Limits	Let n.a.	Uet n.a.
---	------------------	----------	----------

Extinguishing Media

Water, CO₂, Dry Chemical

Special Fire Fighting Procedures

None

Unusual Fire and Explosion Hazards

Dried residues may be ignited or decomposed by excessive heat.

Section V - Health Hazard DataThreshold Limit Value 0.1 mg/m³ - based on nickel

Effects of Overexposure As for nickel

Emergency First Aid Procedures

Swallowing: Contact physician immediately; Eye Contact: Flush with copious amounts of water; Inhalation: Move to fresh air.

Section VI - Reactivity Data

Stability	Unstable		Conditions to Avoid
	Stable	X	

Incompatibility (Materials to Avoid) Strong oxidants

Hazardous Decomposition Products Unknown

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	

Section VII - Spill or Leak Procedures

Steps to be Taken in Case Material is Released or Spilled Flush with cold water

Waste Disposal Method Contact Shipley Product Services Department

Section VIII - Special Protection Information

Respiratory Protection (Specify Type) n.a.

Ventilation	Local Exhaust	Local Exhaust Recommended	Special
	Mechanical (General)		Other

Protective Gloves Yes Eye Protection Yes

Other Protective Equipment Suitable protective clothing

Section IX - Special Precautions

Precautions to be Taken in Handling and Storing

Treat as an acidic solution of nickel salts. Store in a dry area, away from strong oxidants, at 50-90°F. Do not store in direct sunlight. Keep sealed when not in use.

Other Precautions

- b. Please give your assessment of the likelihood that the processes, operations, or feed materials described above might produce a waste stream that is not included in this petition.

It is unlikely that the manufacturing process or the waste treatment process described could produce a waste that is not covered by this petition. The flow diagram of the waste water treatment system (Attachment II) shows that chromium, cyanide, and cadmium, are treated prior to metal filtration. This system produces a sludge of uniform composition with little variation from week to week or month to month.

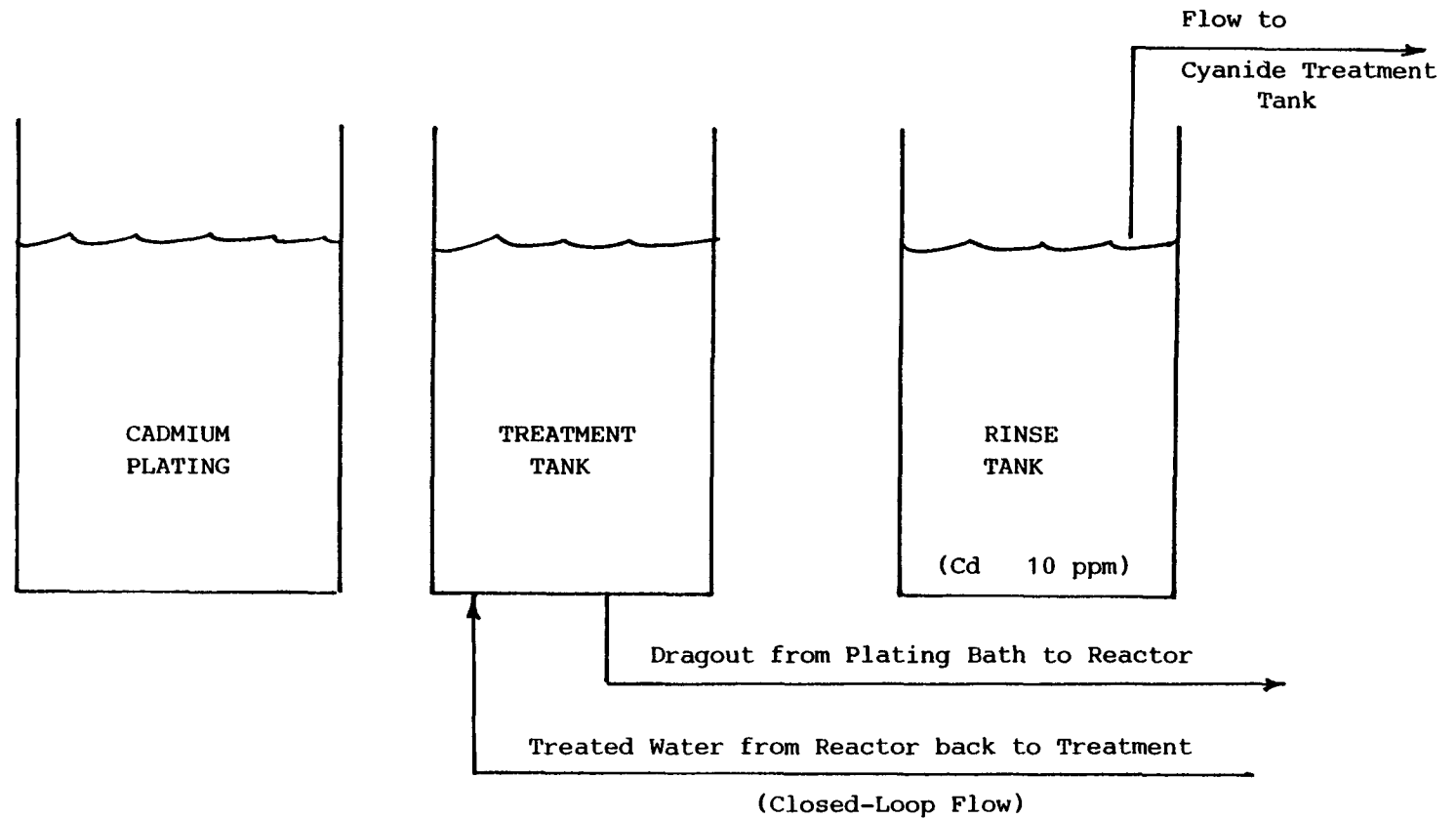
Approach B:

You need not furnish any other information regarding your facility's processes and materials. You must, however, test your waste for additional constituents as described in Chapters 4 and 6 of the Guidance Manual.

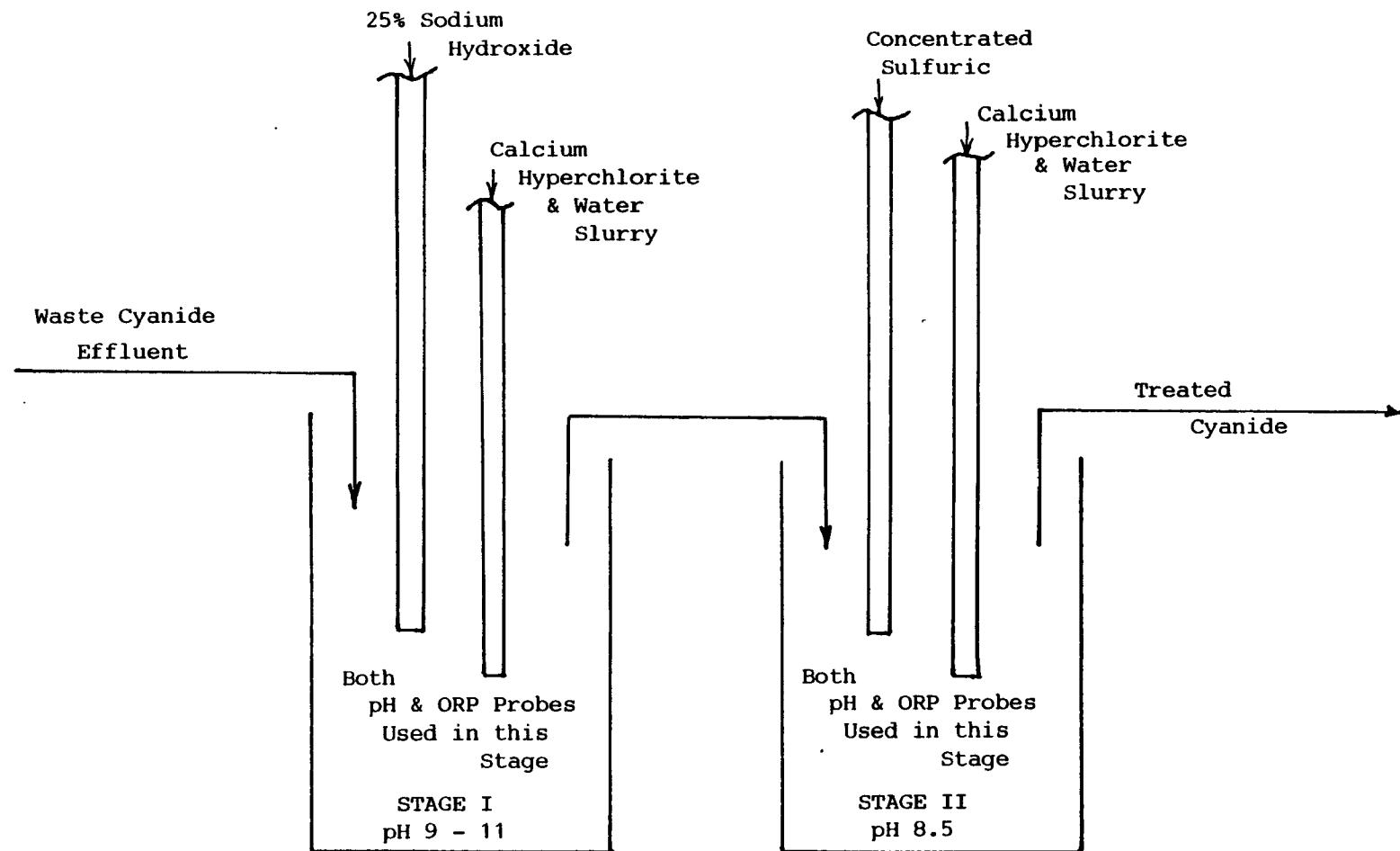
CADMIUM RECOVERY SYSTEM LOCATED IN PLATING SHOP.

TREATMENT TANK IS CLOSED LOOP FLOW TO REACTOR - ALSO LOCATED IN SHOP.
FLOW FROM SECOND RINSE IS PLUMBED FROM TANK INTO CYANIDE SYSTEM.

I-14

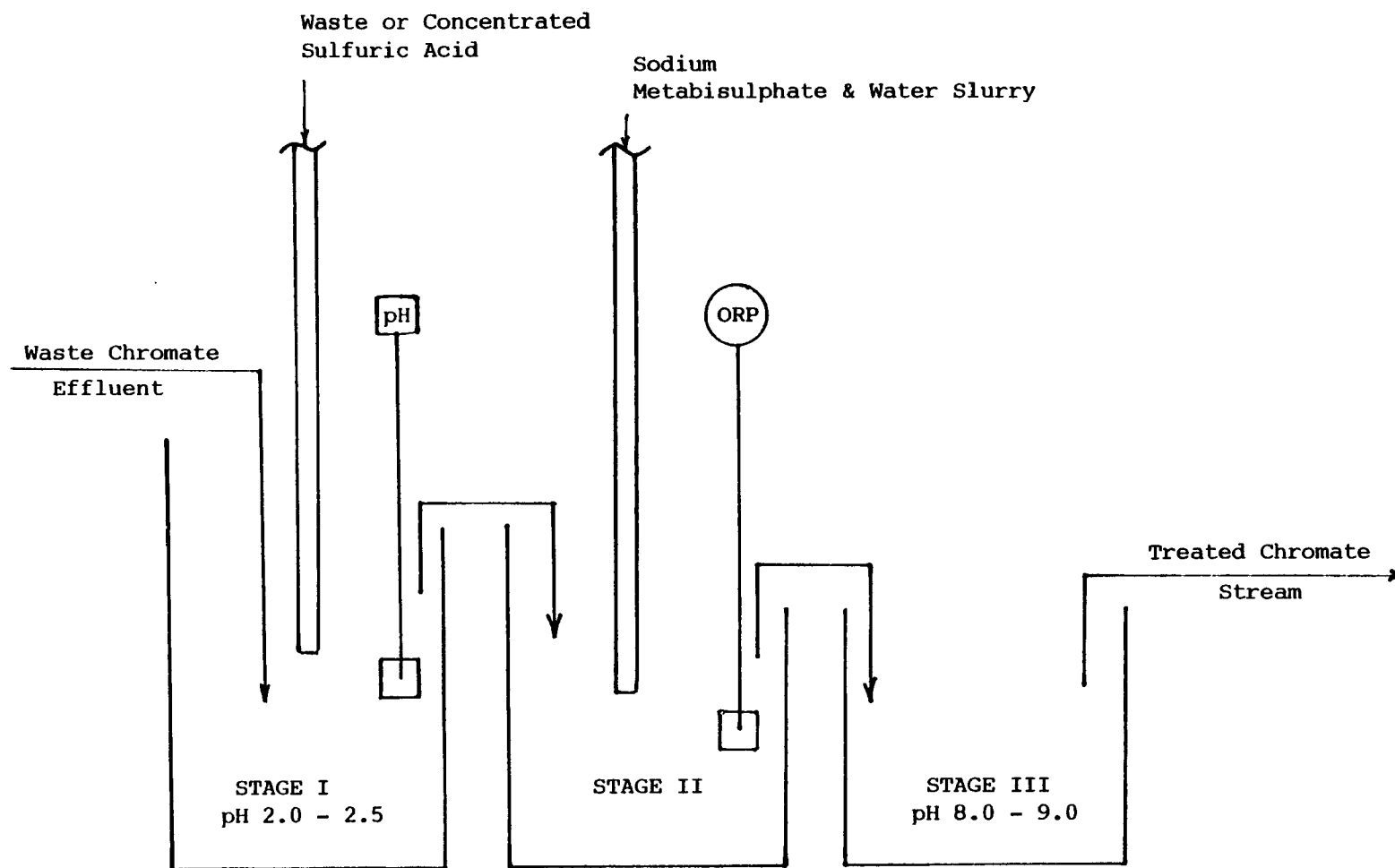


I-15



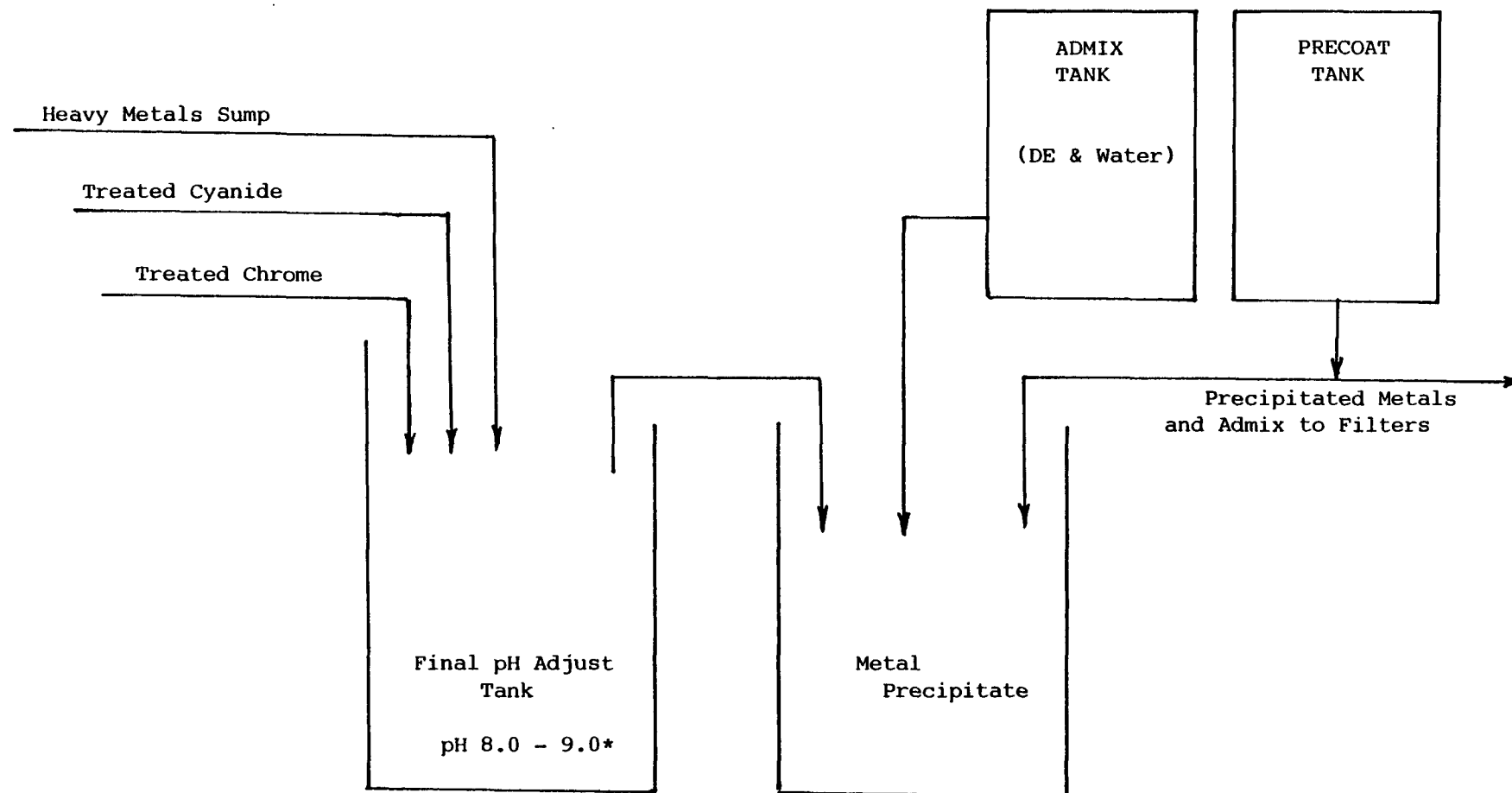
CYANIDE DESTRUCTION

91-I



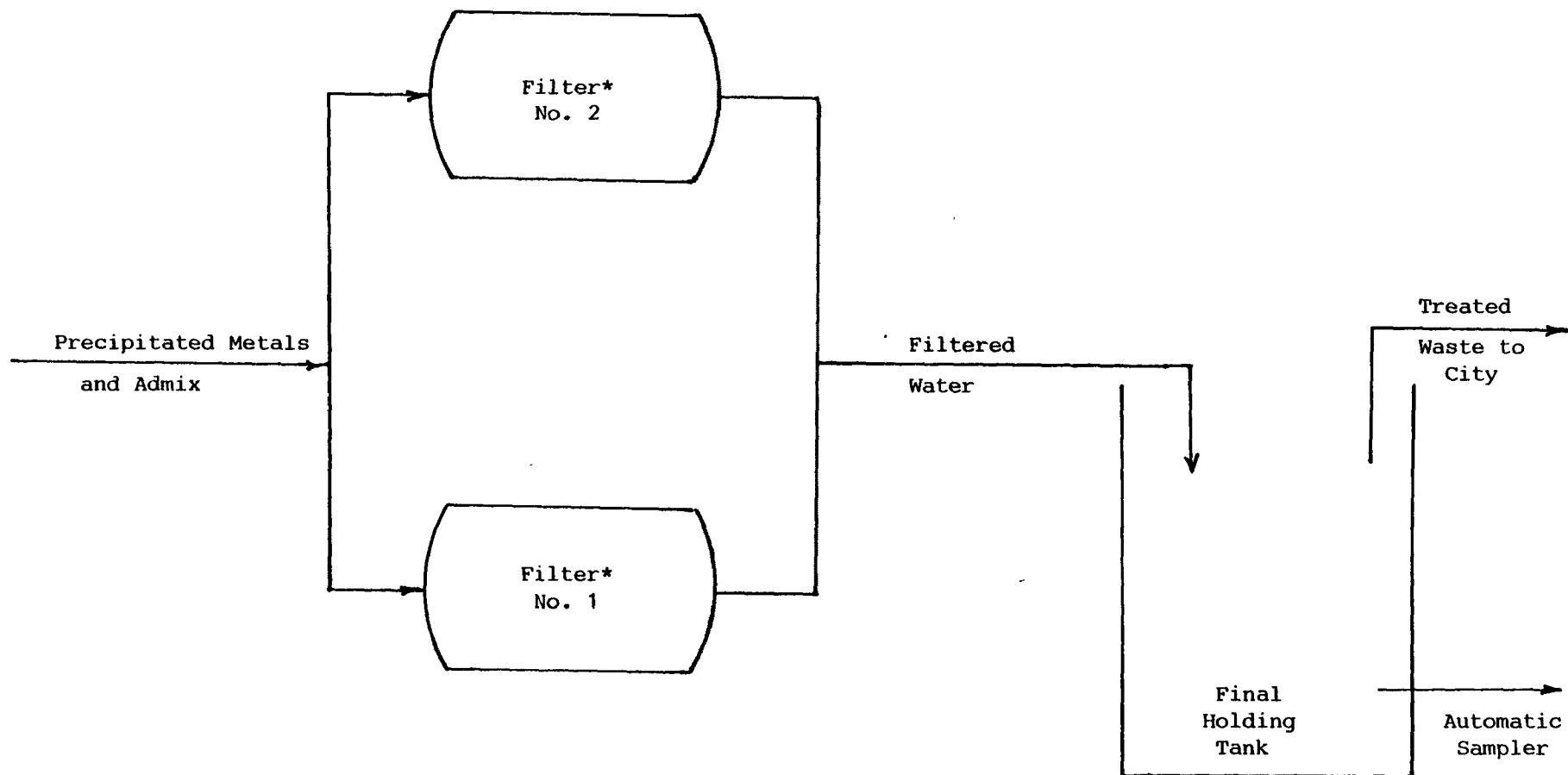
CHROMATE REDUCTION

I-17



HEAVY METALS PRECIPITATION

81-1



* Only one filter is operational at a time. While filter #1 is being cleaned, flow is directed to filter #2.

FILTER OPERATION

SECTION C: The Waste Stream

1. EPA hazardous waste number and description of waste stream (from 261.31 or 261.32):

No. F006 Description Wastewater treatment sludge from electroplating operations

Form of the waste (e.g., aqueous solution, sludge, dry solids):

Sludge

If the waste is a sludge, give the percent solids: 55 %

2. Estimated average and maximum monthly and annual quantities generated: (Please use consistent units of measurement.)

	Average	Maximum
Monthly	<u>22 cu yd</u>	<u>60 cu yd*</u>
Annually	<u>264 cu yd</u>	<u>335 cu yd</u>

*This number is atypically high; it represents the first month that we were required to ship our wastes.

3. This waste stream: (check all that apply)

☒ Is currently being generated.

☒ Will be generated in the future.

☒ Has been generated in the past and is currently being treated/stored on site.

☐ Has been generated in the past and is currently being treated/stored off-site.

4. Present methods of on-site storage, and amounts being stored:

	Amount
Surface impoundment,	<u>NA</u>
Evaporation pond	<u>NA</u>
Percolation bed	<u>NA</u>
Waste pile(s)	<u>NA</u>
Tank(s)	<u>NA</u>
Containers	<u>One 30 cu yd hopper</u>
Landfill	<u>NA</u>
Drums	<u>NA</u>
Other (please specify)	<u></u>

5. Waste Management Methods:

Briefly describe:

- (a) how the waste is currently managed;
- (b) how it was managed before November 19, 1980; and
- (c) how it will be managed if this petition is approved.

As appropriate, provide names and locations of off-site treatment, storage or disposal facilities, and names and addresses of waste transportation firms.

If the waste is treated prior to disposal, please attach a schematic flow diagram of your present waste treatment system, showing the processes and equipment used.

(a) The petitioner treats waste water from its Long Horn Avenue metal finishing shop with a treatment facility that is designed to totally reduce hexavalent chromium, destroy cyanide, and precipitate metal oxides. In addition, the facility has recently installed a Cadmium Recovery System which recovers cadmium oxide from the rinse tank prior to the waste treatment process. Metal ions produced in the process include chromium, cadmium, copper, and nickel. Cyanide is present, but is reduced completely during the treatment process to carbon dioxide and nitrogen gas. Precipitated metal hydroxides are filtered through a filter precoated with diatomaceous earth (DE) and additional DE is added during filtration to improve filterability; this process occurs during treatment. The sludge is thus composed of DE primarily, and 0.04 to 1.0 percent metal oxides. (See Attachment II.)

The current disposal method used for the sludge employs the following offsite Subtitle C facility:

Rolling Haulers
2300 Fieldcrest Road
Deer Crossing, TX 77556

(b) Prior to November 19, 1980, the waste sludge was disposed of at:

Dallas Municipal Landfill
Walnut Hill Road
Dallas, TX 75266

(c) Upon reclassification, the sludge will once again be disposed of at the Dallas Municipal Landfill.

SECTION D: Selection of Constituents for Testing

The procedures described below apply to all types of wastes other than those from petroleum refineries and multiple waste treatment facilities. Petitioners for these facilities should refer to Section 4 of the Guidance Manual and adapt this section of the petition appropriately.

1. If you have followed Approach A in Section B above, please submit test results on representative samples for the following:
 - The specific hazardous constituents for which the waste was listed (i.e., total concentration of each listed constituent found in Appendix VII of Part 261);
 - The four hazardous waste characteristics (but see the Note immediately below);
 - Appropriate leachate tests for the EP toxic metals, nickel, and cyanide;
 - Total concentrations of the EP toxic metals and nickel;
 - Total organic carbon (TOC); and
 - Total oil and grease.

Note: If you can explain why the waste cannot exhibit one or more of the four hazardous waste characteristics, you may submit your rationale in lieu of test results for those characteristics. For example, if the waste is composed exclusively of organic solvents and there is no chance (on the basis of process considerations) that it contains any of the EP toxicants, you need not test for the EP Toxicity characteristic.

You may omit the rest of this section and go to Part E.

2. If you have opted for Approach B in Section B above, then you must perform the tests specified in the above paragraph, and you should test for all hazardous constituents that may "reasonably be expected" to be in the waste, whether or not they were used as a basis for listing.

The remainder of this section is to be used to support your decision regarding which constituents to test for.

- a. List the constituents (from Appendix VIII to Part 261) that may reasonably be expected to be in the waste. Describe the engineering, chemical, or other considerations that support your choice.

Constituent: None

Reasons for Selection:

Although several Appendix VIII constituents are included in our materials listings, we believe that mass balance considerations render these substances absent from the waste stream. Therefore, it is unreasonable to expect their occurrence in the waste.

(Repeat as necessary.)

[Note to the reader: The Agency would request the supporting calculations referred to above; proper procedure would be to submit them with the original petition.]

- b. For each of the remaining hazardous constituents (or groups of constituents) in Appendix VIII of Part 261, specify why it may not reasonably be expected to occur in the waste stream.

Constituent (or group of constituents): See above

Reasons for non-occurrence: See above

(Repeat as necessary.)

SECTION E: Sampling and Testing the Waste

The purpose of the data requested below is to demonstrate that representative samples of the waste stream:

- a. Do not exhibit any of the criteria (e.g., hazardous waste characteristics or constituents) for which the waste was listed, and
- b. Do not exhibit any other criteria that could cause it to be listed.

Additional information is also requested as a check on the test results. Refer to the accompanying Guidance Manual for instructions on developing a sampling plan (Chapter 7), selecting proper test methods, (Chapter 8) and presenting the test results (Chapter 9).

1. General Information

- a. Name and address of the laboratory facility performing the sampling [260.22(i)(1)]:

Name _____

Street _____

City _____ State _____ Zip _____

Telephone: (____) ____ - _____

If sampling was done by in-house staff, check here: X

For each individual person who (a) designed the sampling plan or (b) collected samples, please provide the following information and attach a resume or other statement of qualifications [260.22(i)(2)].

Name Susan Smith

Affiliation ABC Industries, Inc.

Title Process Engineer
(resume attached)

(Repeat as necessary.)

Susan Smith
24 Green Street
Dallas, Texas 75206

Education

August 1975 - May 1979

University of Missouri - Columbia, MO

B.S. Chemical Engineering

G.P.A. 2.75/4.0

Work Experience

June 1979 - May 1980

ABC Amalgamated Industries, Inc.

Optics Department - set up process documentation and process control procedures for optics fabrication.

May 1980 - June 1981

ABC Amalgamated Industries, Inc.

Process Engineering - provide process support for organic coating area. Evaluate new coating materials, procedures.

June 1981 - Present

ABC Amalgamated Industries, Inc.

Process Engineering - support waste treatment/chemical finishing, plating operations. Maintain data on waste treat system, documents for solid waste disposal, and applicable permits. Technical support for plating shop and waste treatment. Perform troubleshooting and new system evaluations.

- b. Name and address of the laboratory facility performing the testing, if different from the sampling laboratory [260.22(i)(1)]:

Name _____

Street _____

City _____ State _____ Zip _____

Telephone: (____) ____ - _____

If testing was done by in-house staff, check here: X

For each individual person who (a) designed the testing plan or (b) performed tests, please provide the following information and attach a resume or other statement of qualifications [260.22(i)(2)].

Name Thomas Roberts

Affiliation ABC Industries, Inc.

Title Engineering Analyst
 (resume attached)

(Repeat as necessary.)

Thomas Roberts
29 Turner Street
Lewisville, Texas 75067

Education

1972 - 1974

St. Louis University - St. Louis, MO

Courses taken included, but were not limited to, Chemistry 101 and 102, Quantitative Analysis (with emphasis on atomic absorption analysis), Organic Chemistry, Physical Chemistry and Biology 101 and 102.

1982

Lancerette Laboratories

Received Certification for both flame and flameless atomic absorption spectrophotometry on the Instrumentation laboratory 551 video spectrophotometer.

Work History

1972 - 1974

U.S. Army Corps of Engineers, Water Quality Lab, Foot of Arsenal Street - St. Louis, MO

Work included sampling and analysis of Corps controlled bodies of water in the Missouri and Illinois districts. Analysis included wet chemistries as well as atomic absorption and biological testing.

1974 - 1978

Washington University, Department of Pediatrics - St. Louis, MO

Hematology and Oncology research and routing clinical testing of cancer patients on drug therapy.

1978 - 1980

Enreglory Engineering, Inc.

Analysis Laboratory - work on the effluent guidelines project 1434 and 1444 and RCRA for the EPA.

Duties included metals analysis by atomic absorption, phenolics, cyanides and pesticides and other analysis.

Tom Roberts
Page 2

Work History - (Continued)

1980 - Present

ABC Amalgamated Industries, Inc.

Process Engineering Lab - Senior Technician in research, routine evaluations, plating, wastewater, sludge analysis and training of technical personnel in the use of atomic absorption spectrophotometry.

- c. Describe the sampling strategy you followed to insure that the samples were representative [260.22(i)(9)]. Please address specifically:

- the variation of the waste stream over time; and
- the variation of the waste stream in space.

All waste stream outflows or storage locations to which this petition applies must be sampled. The Delisting Petition Guidance Manual (see Instructions to this form) gives directions for developing a sampling plan.

Time-composite sampling was used, with an interval that coincided with each dumping of the filter cake from the filter press. This averaged three times per week.

Each time that a filter was dumped into the small (1.5 cu yd) hopper (see Attachment III) the waste treatment operator notified the Process Engineer. The Process Engineer then put on a neoprene glove and collected four samples from the hopper using a trier. Sample locations were selected by dividing the hopper horizontally into quadrants and taking one sample from the centroid of each quadrant. The samples, approximately twenty grams each, were then stored in heavy-walled plastic bags and sealed to maintain freshness. At the end of each week, equal weight samples were taken from the individual bags to compile the composite 100 gram sample, which was then used for the leachate test.

The small hopper is emptied into the larger (30 cu yd) hopper following each filter dump.

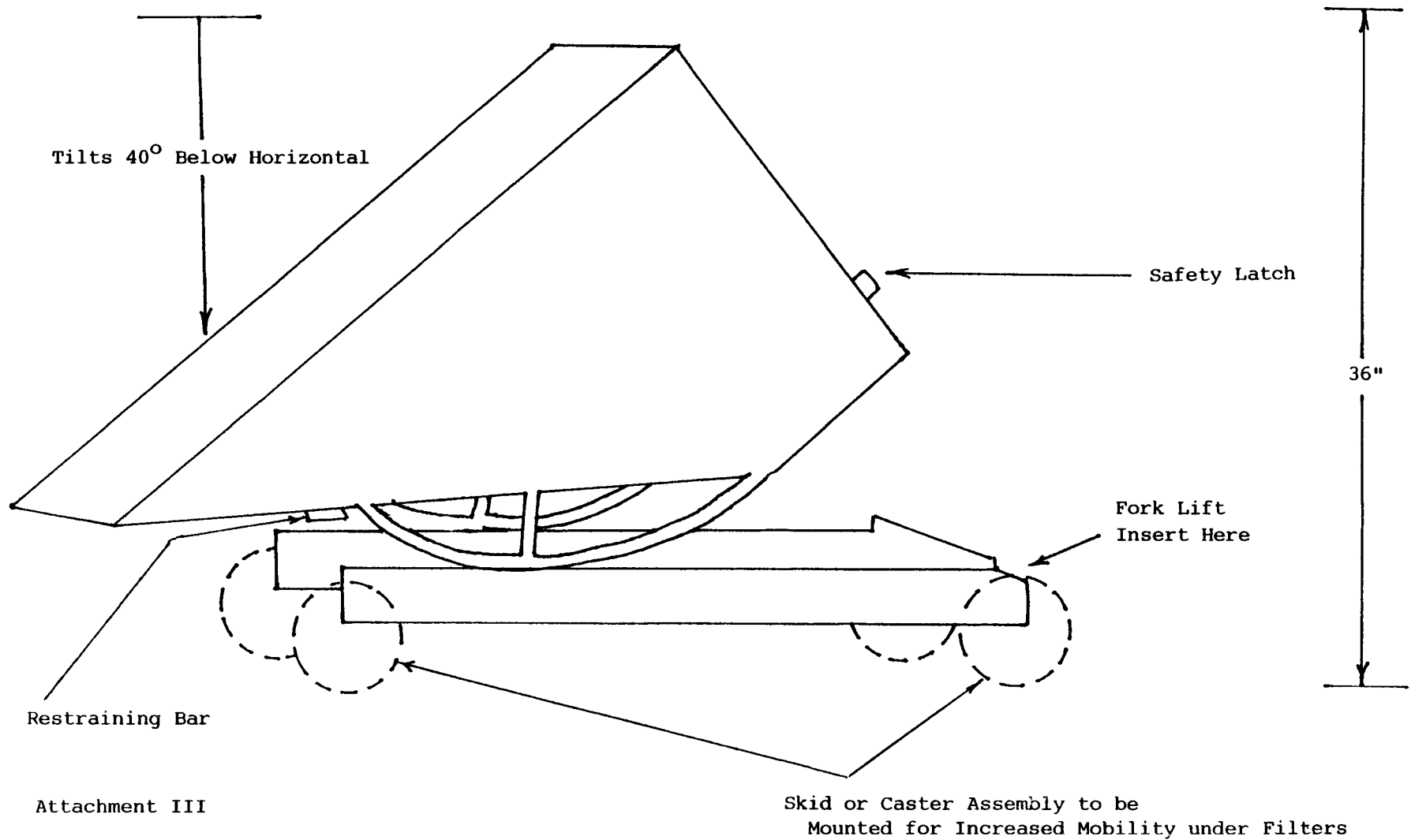
- d. State whether the Chain of Custody procedures in Section 1.3 of SW-846 were followed. Please describe any deviations from those procedures and the reasons for them.

All chain-of-custody procedures as outlined in Section 1.3 of SW-846 were followed.

NOTE: After each filter was dumped into the hopper, four samples were obtained, the waste was then emptied into a larger 30 yd³ hopper, and the process repeated 3 to 4 times per week.

1.5 CUBIC YARD CAPACITY

I-30



2. Sample-Specific Information

For each individual sample, please furnish the information requested in the form on the following page. The notes below refer to those items on the form that are not self-explanatory. The Guidance Manual contains additional instructions.

Notes

Item f, "Parameter/Constituent Tested For": Enter the hazardous waste characteristic or constituent that was the subject of the test.

Item i, "Test Method and Source": See Chapter 8 of the Guidance Manual for a listing of applicable test methods. Sources for test methods may be designated by number, as follows:

1. "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods," EPA SW-846 (second edition), July, 1982, and supplements.
2. "Methods for the Evaluation of Water and Wastewater," EPA 600 14-79-020, March, 1979.
3. "Standard Methods for the Examination of Water and Wastewater," (14th Edition).
4. Appendix J of the Guidance Manual

Item j, "Sample Workup or Preparation Method": See Section Four of Reference 1 above.

Item l, "Test Results": Enter concentrations in mg/l, ppm, etc. as appropriate.

Sample Number: 1

Sampling Information:

- a. Sampling location: The 1.5 cu yd hopper
- b. Person(s) who drew the sample: Susan Smith
- c. Equipment used for drawing the sample: Trier
- d. Date and time when the sample was drawn: Daily at 9:00 a.m.
10/4 /82, _____ P.M.
to 10/8/82
- e. Handling, containerization, and preservation techniques used:
Daily samples were combined & mixed to get a weekly composite.
Composites were stored in sealed, heavy-weight plastic bags.

Test Procedures and Results: (Repeat for each test conducted)

- f. Parameter/Constituent Tested For: All EP metals, Ni, Cu, Zn,
Total cyanide
- g. Date Test Performed: 10/12 /82
- h. Person(s) who performed the test: Thomas Roberts
- i. Test Method (or Number) and Source: see Summary Table
- j. Sample Workup or Preparation Method: see Summary Table
- k. Equipment: Name Model Number

<u>Perkin-Elmer</u>	<u>603</u>
<u>Perkin-Elmer</u>	<u>406</u>
<u>Bausch & Lomb Sectronic</u>	<u>23</u>
<u>Perkin-Elmer</u>	<u>54B</u>
<u>Instrumentation Laboratories</u>	<u>251</u>
<u>Atomic Absorption Spectrophotometer</u>	

- l. Test Results: see Attachment IV

Sample Number: 2

Sampling Information:

- a. Sampling location: The 1.5 cu yd hopper
- b. Person(s) who drew the sample: Susan Smith
- c. Equipment used for drawing the sample: Trier
- d. Date and time when the sample was drawn: Daily at 9:00 a.m.
10/11/82, ~~8:00~~ to 10/15/82
- e. Handling, containerization, and preservation techniques used:
Daily samples were combined & mixed to get a weekly composite.
Composites were stored in sealed, heavy-weight plastic bags.

Test Procedures and Results: (Repeat for each test conducted)

- f. Parameter/Constituent Tested For: All EP metals, Ni, Cu, Zn,
Total cyanide
- g. Date Test Performed: 10/19 /82
- h. Person(s) who performed the test: Thomas Roberts
- i. Test Method (or Number) and Source: see Summary Table
- j. Sample Workup or Preparation Method: see Summary Table
- k. Equipment: Name Model Number

<u>Perkin-Elmer</u>	<u>603</u>
<u>Perkin-Elmer</u>	<u>406</u>
<u>Bausch & Lomb Sectronic</u>	<u>23</u>
<u>Perkin-Elmer</u>	<u>54B</u>
<u>Instrumentation Laboratories</u>	<u>251</u>
<u>Atomic Absorption Spectrophotometer</u>	

- l. Test Results: see Attachment V

Sample Number: 3

Sampling Information:

- a. Sampling location: The 1.5 cu yd hopper
- b. Person(s) who drew the sample: Susan Smith
- c. Equipment used for drawing the sample: Trier
- d. Date and time when the sample was drawn: Daily at 9:00 a.m.
10/18/82, 8:00 p.m.
to 10/22/82
- e. Handling, containerization, and preservation techniques used:
Daily samples were combined & mixed to get a weekly composite.
Composites were stored in sealed, heavy-weight plastic bags.

Test Procedures and Results: (Repeat for each test conducted)

- f. Parameter/Constituent Tested For: All EP metals, Ni, Cu, Zn,
Total cyanide
- g. Date Test Performed: 10/26 /82
- h. Person(s) who performed the test: Thomas Roberts
- i. Test Method (or Number) and Source: see Summary Table
- j. Sample Workup or Preparation Method: see Summary Table
- k. Equipment:
- | Name | Model Number |
|--|--------------|
| <u>Perkin-Elmer</u> | <u>603</u> |
| <u>Perkin-Elmer</u> | <u>406</u> |
| <u>Bausch & Lomb Sectronic</u> | <u>23</u> |
| <u>Perkin-Elmer</u> | <u>54B</u> |
| <u>Instrumentation Laboratories</u> | <u>251</u> |
| <u>Atomic Absorption Spectrophotometer</u> | |
- l. Test Results: see Attachment VI

Sample Number: 4

Sampling Information:

- a. Sampling location: The 1.5 cu yd hopper
- b. Person(s) who drew the sample: Susan Smith
- c. Equipment used for drawing the sample: Trier
- d. Date and time when the sample was drawn: Daily at 9:00 a.m.
10/25/82, ~~p.m.~~
to 10/29/82
- e. Handling, containerization, and preservation techniques used:
Daily samples were combined & mixed to get a weekly composite.
Composites were stored in sealed, heavy-weight plastic bags.

Test Procedures and Results: (Repeat for each test conducted)

- f. Parameter/Constituent Tested For: All EP metals, Ni, Cu, Zn,
Total cyanide
- g. Date Test Performed: 11/ 2 /82
- h. Person(s) who performed the test: Thomas Roberts
- i. Test Method (or Number) and Source: see Summary Table
- j. Sample Workup or Preparation Method: see Summary Table
- k. Equipment:
- | Name | Model Number |
|--|--------------|
| <u>Perkin-Elmer</u> | <u>603</u> |
| <u>Perkin-Elmer</u> | <u>406</u> |
| <u>Bausch & Lomb Sectronic</u> | <u>23</u> |
| <u>Perkin-Elmer</u> | <u>54B</u> |
| <u>Instrumentation Laboratories</u> | <u>251</u> |
| <u>Atomic Absorption Spectrophotometer</u> | |

- l. Test Results: see Attachment VII

3. Summary Table of Analytical Results

For each sample, please enter the Test Results from Item 2 above onto the form contained in the following pages.

4. Analytical Discussion

Please furnish explanations or additional information on the following topics as necessary:

- a. Inconsistencies or deviations in the analytical results presented above.
- b. Additional reasons as to why the waste stream should be delisted.

Summary Table

Analytical Methods Used:

	<u>Workup</u>	<u>Analysis</u>
Arsenic	1310	7060
Barium	1310	7080
Cadmium	1310	7130
Chromium (tot.)	1310	7190
Lead	1310	7420
Mercury	1310	7470
Selenium	1310	7740
Silver	1310	7760
Nickel	1310	7520
Cyanide (tot.)		9010
TOC		5020
Oil & Grease		415.1

SUMMARY OF TEST RESULTS

Sample Number:		1	2	3	4	
Sampling Location:		1.5 cu yd hopper	1.5 cu yd hopper	1.5 cu yd hopper	1.5 cu yd hopper	
Date Sample Taken:		Oct 4-8'82	Oct 11-15	Oct 18-22	Oct 25-29	
1. <u>Ignitability</u>						
Liquids	Flash point					
Non-liquids	Spontaneous combustion					
Compressed Gas	Flammability					
Oxidizer	Oxygen yield					
2. <u>Corrosivity</u>						
	pH					
	Corrosivity towards steel					
3. <u>Reactivity</u>						
	Violent chemical change					
	Reacts violently with water					
	Water-reactive; explosive					

SUMMARY OF TEST RESULTS (Continued)

I-39

Sample Number:						
3. <u>Reactivity</u> (Cont.)	Water-reactive, toxic gases, vapors, fumes					
	Cyanide or sulfur- bearing wastes which, when exposed to acidic/basic conditions, gen- erate toxic gases, vapors, or fumes					
	Explosive when subjected to force or heat					
	Explosive at stan- dard temperature and pressure					
	DOT explosive					
4. <u>Total Metals</u> (Complete Acid Digestion)	Arsenic					
	Barium					
	Cadmium					
	Chromium					

SUMMARY OF TEST RESULTS (Continued)

Sample Number:		1	2	3	4	
4. <u>Total Metals</u> (cont.)	Lead					
	Mercury					
	Selenium					
	Silver					
	Nickel					
5. <u>EP Toxicity</u> -- <u>Metals</u>	Arsenic	.11 ug/l	1.0	1.0	1.0	
	Barium	.01	0.3	0.3	0.2	
	Cadmium	.06	0.12	0.12	0.18	
	Chromium	.05*	.05*	.05*	.05*	
	Lead	.05*	.01*	.01*	.01*	
	Mercury	.05	.05	.05	.05	
	Selenium	.01	.02	.02	.02	
	Silver	.01*	.01*	.01*	.01*	
	Nickel	2.00	1.00	0.11	0.58	

*Less than

SUMMARY OF TEST RESULTS (Continued)

Sample Number:						
6. <u>EP Toxicity</u> -- <u>Metals;</u> <u>Oily Waste</u> <u>Methods*</u>	Arsenic					
	Barium					
	Cadmium					
	Chromium					
	Lead					
	Mercury					
	Selenium					
	Silver					
	Nickel					
7. <u>EP Toxicity</u> -- <u>Pesticides</u>	Endrin					
	Lindane					
	Methoxychlor					
	Toxaphene					
8. <u>EP Toxicity</u> -- <u>Herbicides</u>	2,4-D					
	2,4,5-TP (Silvex)					

*For wastes containing greater than 1% total oil and grease.

SUMMARY OF TEST RESULTS (Continued)

Sample Number:		1	2	3	4	
9. <u>EP Toxicity</u> -- <u>Organics</u>						
10. <u>Total Organ- ic Carbon</u>						
11. <u>Oil and Grease</u>		0.8 ppm	1.0	0.9	0.9	
12. <u>Cyanide</u> Total Free Extraction procedure Photodegradable		0.01 ppm	0.18	0.07	0.18	
13. <u>Other</u> Appendix VIII constituents (Add sheets as necessary)						

5. Quality Assurance and Quality Control

- a. For inorganic substances, describe the procedures used for Standard Additions Analysis. Provide the following for each substance tested:

SEE ATTACHED SHEETS

Substance	Spike Concentration	Recovery Concentration	Percent Recovery
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

- b. For organic substances, describe the procedures used for analysis of spiked samples. For each substance tested, provide the information requested in the following table. Also, describe in writing the procedures used to calibrate the analytical equipment.

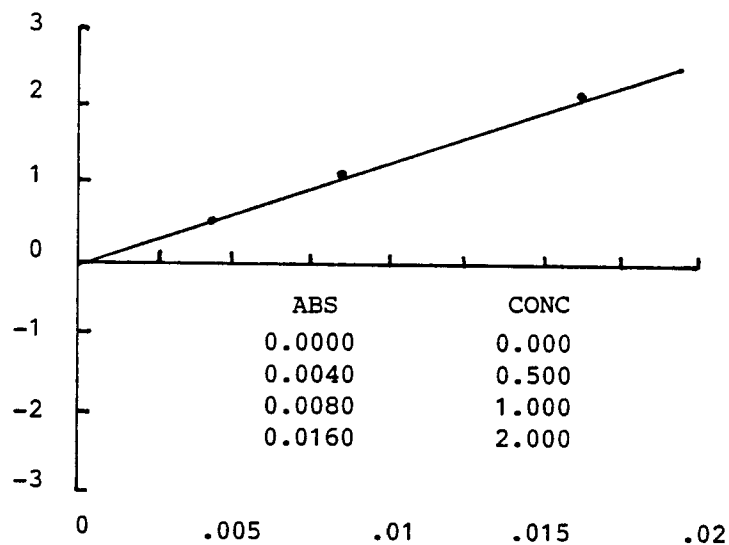
Substance Tested For	Surrogate, if any	Spike Conc.	Recovery Conc.	Percent Recovery
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

- c. Describe any other QA/QC measures followed in regard to the sampling and analysis procedures.

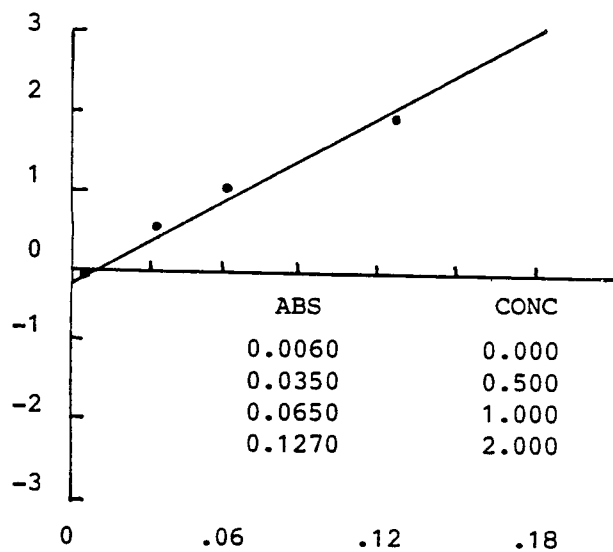
STANDARD ADDITION ANALYSIS FOR WEEK 1

Attachment IV (cont.)

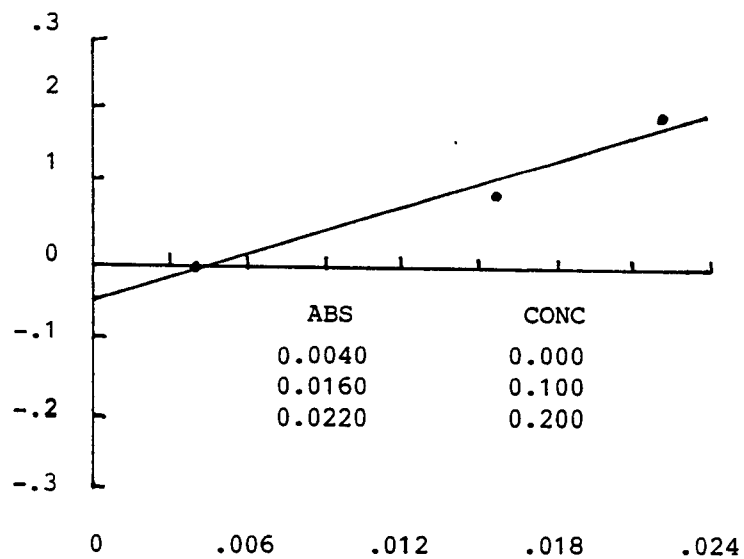
Concentration = 0.00 mg/l
Cr



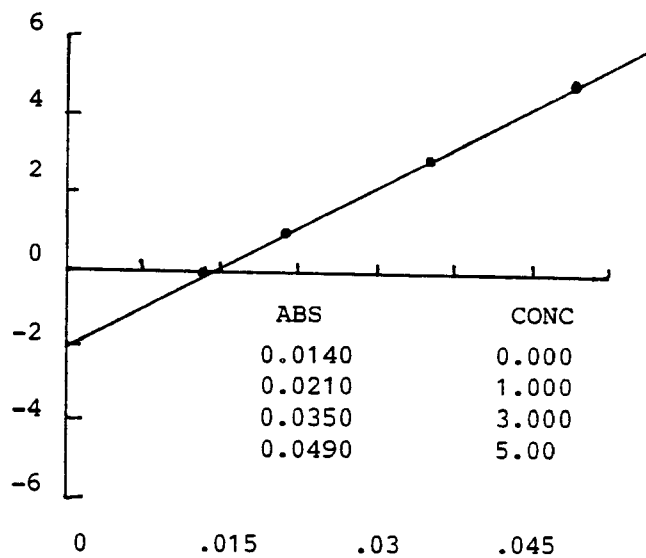
Concentration = 0.06 mg/l
Cd



Concentration = 0.05 mg/l
Pb



Concentration = 2.00 mg/l
Ni

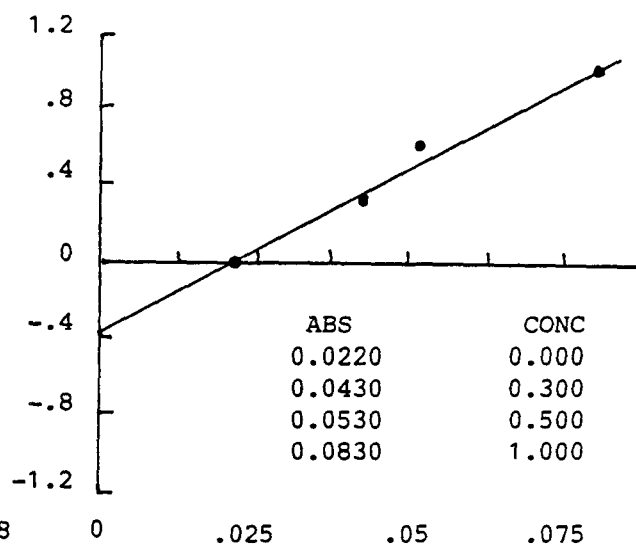
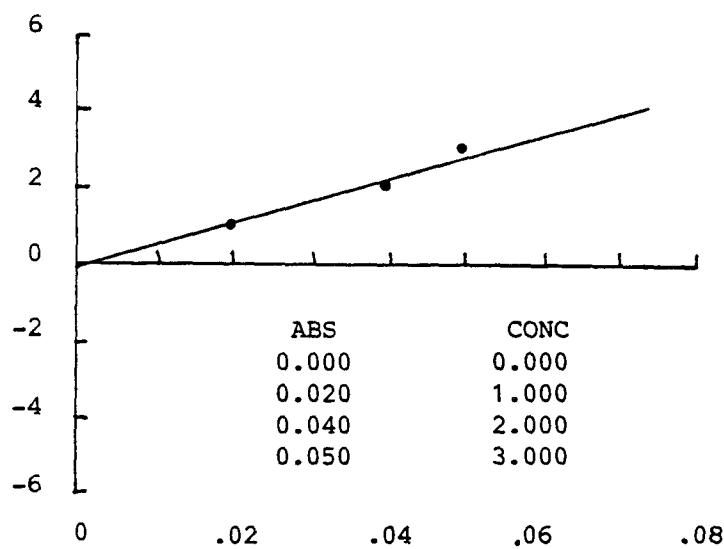


STANDARD ADDITION ANALYSIS FOR WEEK 1 (cont.)

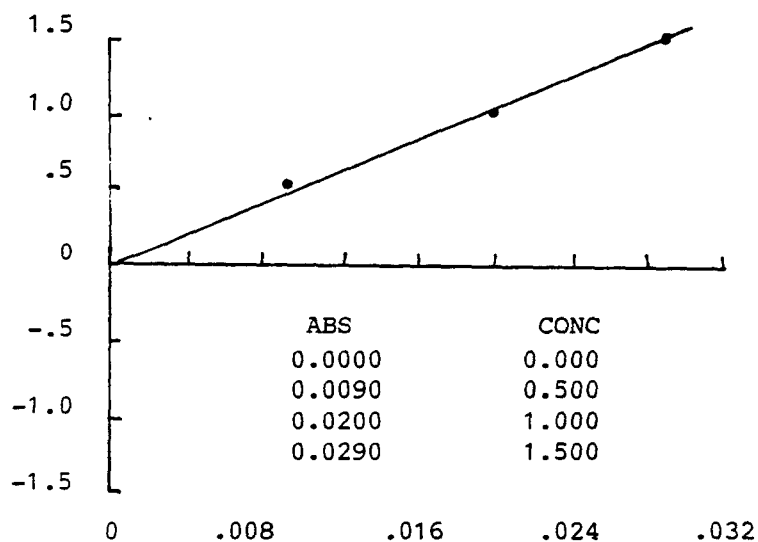
Attachment IV (cont.)

Concentration = 0.00 mg/l
Cu

Concentration = 0.38 mg/l
Zn



Concentration = 0.00 mg/l
Ag



ORGANIC WASTESTREAM

OPTIONAL FORM:

DELISTING PETITION FOR WASTE STREAM

**K027 -- Centrifuge and Distillation Residues from Toluene
Diisocyanate Production**

Submitted by:

**Mayblor Chemical Corporation
Ardmore Boulevard
Pittsburgh, PA 15208**

Date:

April 15, 1982

4. Description and Justification for the Proposed Action

Please describe briefly the proposed delisting action, why it is needed, and how it will affect your operation. Describe why you believe that the waste stream of concern (a) is not hazardous for the reasons it was originally listed and (b) contains no other constituents or characteristics that render it hazardous as defined in 40 CFR 261. [260.20(b)(2), (3) and (4)]

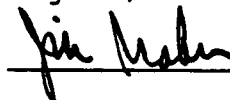
Mayblor Chemical Corporation proposes to exclude EPA Hazardous Waste No. K027, Centrifuge and distillation residues from toluene diisocyanate production, from Subpart D, 40 CFR 261.32. This residue was listed by EPA as a hazardous waste from a specific source because the residue was considered reactive (R) and toxic (T). Mayblor's process currently produces this residue in such a manner that it eliminates the residue's characteristics of reactivity and toxicity. Additional testing by Mayblor indicates that the residue contains no other constituents or characteristics that render it hazardous as defined in 40 CFR 261.

The need for the proposed action is to relieve Mayblor of the burden and cost of disposing of this residue. The proposed action will affect Mayblor's operations by allowing for the marketing of the processed residue as a supplemental fuel for steam and/or electrical generating plants. In addition to these benefits, scarce landfill capacity will not be utilized by a material with definite resource recovery potential.

5. Certification of Accuracy and Responsibility [260.22(i)(12)]

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this demonstration and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Signed,



Waste Generator, Title or
Authorized Representative*
of Waste Generator, Title

*Note: An "authorized representative" is a person responsible for the overall operation of a facility or an operational unit (for example, a plant manager, superintendent, or person of equivalent responsibility). Consultants or other outside parties may not sign the certification statement.

SECTION B: Production Processes

1. Description of Manufacturing Processes and Other Operations [260.22(i)(5)].

- a. Please provide a brief description of the on-site manufacturing/generating process(es) that produce the waste stream. Include descriptions of major equipment items and production lines. Also, describe the stages of the typical operating cycle (e.g., startup, steady-state operation, cleaning and maintenance) on a daily, weekly, or other basis as appropriate.**

Toluene diisocyanate (TDI) distillation residues are isolated during the distillation of TDI from the by-product higher-molecular-weight polymers that are formed during the reaction of toluene diamine (TDA) with phosgene. This reaction produces the product TDI.

Mayblor Chemical's process as described above is generally represented by the schematic and process description given in EPA's "Listing Background Document: Toluene Diisocyanate Production."

A more detailed explanation of the process and associated equipment has been supplied to EPA. Because of its confidential nature this description is not included in the public record file.

- b. Please provide a description of all surface and equipment preparation, cleaning, degreasing, coating or painting processes used in your facility that you have not described in (a) above.**

See above.

- c. Attach a schematic diagram of all manufacturing processes, surface preparation, cleaning, and other operations that may provide influent into the waste stream.**

See above.

2. Materials Used or Produced

You may comply with the requirements for additional information in either of two ways; see Section 4 of the Guidance Manual for a detailed description of the two approaches.

Approach A:

- a. List all materials used or produced in the manufacturing or other process generating the waste stream(s) of concern. Use the correct chemical name wherever possible. Include materials such as:

Raw materials
Intermediate products
By-products
Products
Oils and hydraulic fluids
Surface preparation materials
(solvents, acids, cleaners, surface
preparation agents, paints, etc.)

Also:

- o For each material on the list, indicate whether it is discharged to or likely to be present in the waste, and the estimated amount entering the waste stream annually. (Specify kilograms, pounds, or similar units.)
- o For each material on the list that you do not expect to be present in the waste, give supporting reasons for this expectation. Supporting reasons may include mass balance and process information. **SEE NOTES**
- o Attach Materials Safety Data Sheets (MSDS) for all materials that are identified by trade or generic name only and that are discharged into or likely to be present in the waste stream.

Material	Estimated Amount Entering the Waste Stream Annually
<u>Toluene-2,4-diamine</u>	<u>none¹</u>
<u>2,6-Toluene-diamine</u>	<u>none¹</u>
<u>o-Dichlorobenzene</u>	<u>none¹</u>
<u>gaseous phosgene</u>	<u>none¹</u>
<u>Toluene diisocyanate</u>	<u>none²</u>

NOTES TO MATERIALS LIST

1. These materials are completely consumed in the TDI production process, and therefore do not appear in the waste stream.
2. TDI is the process end-product. Analytical tests indicate that it is undetectable in the waste (see Section E below).

- b. Please give your assessment of the likelihood that the processes, operations, or feed materials described above might produce a waste stream that is not included in this petition.

The waste-generating operation is carried out in a completely closed process. All inputs and outputs have been identified. Therefore, it is highly unlikely that a waste stream not included in this petition would be produced from the processes, operations and feed materials described above.

Approach B:

You need not furnish any other information regarding your facility's processes and materials. You must, however, test your waste for additional constituents as described in Chapters 4 and 6 of the Guidance Manual.

SECTION C: The Waste Stream

1. EPA hazardous waste number and description of waste stream (from 261.31 or 261.32):

No. K027 Description Centrifuge and distillation residues
from toluene diisocyanate production

Form of the waste (e.g., aqueous solution, sludge, dry solids):

Sludge

If the waste is a sludge, give the percent solids: 80 %

2. Estimated average and maximum monthly and annual quantities generated: (Please use consistent units of measurement.)

	Average	Maximum
Monthly	<u>300 tons</u>	<u>550 tons</u>
Annually	<u>3600 tons</u>	<u>6600 tons</u>

3. This waste stream: (check all that apply)

☒ Is currently being generated.

☒ Will be generated in the future.

☒ Has been generated in the past and is currently being treated/stored on-site.

☐ Has been generated in the past and is currently being treated/stored off-site.

4. Present methods of on-site storage, and amounts being stored:

	Amount
Surface impoundment,	<u>NA</u>
Evaporation pond	<u>NA</u>
Percolation bed	<u>NA</u>
Waste pile(s)	<u>NA</u>
Tank(s)	<u>NA</u>
Containers	<u>Less than or equal to 550 tons</u>
Landfill	<u>NA</u>
Drums	<u>NA</u>
Other (please specify)	<u></u>

5. Waste Management Methods:

Briefly describe:

- (a) how the waste is currently managed;
- (b) how it was managed before November 19, 1980; and
- (c) how it will be managed if this petition is approved.

As appropriate, provide names and locations of off-site treatment, storage or disposal facilities, and names and addresses of waste transportation firms.

If the waste is treated prior to disposal, please attach a schematic flow diagram of your present waste treatment system, showing the processes and equipment used.

- a) The waste is currently held on-site in large, covered containers until our contracted hauler arrives on the twentieth of each month. The hauler then delivers the residue to either a fuel burning facility (with interim storage and staging) or, more often, to a properly permitted landfill.

Hauler:	ABC Trucking & Hauling	Landfill:	XYZ Landfill
	22 Dalean Avenue		102 Lancer Street
	Thurston, PA		Sewickley, PA

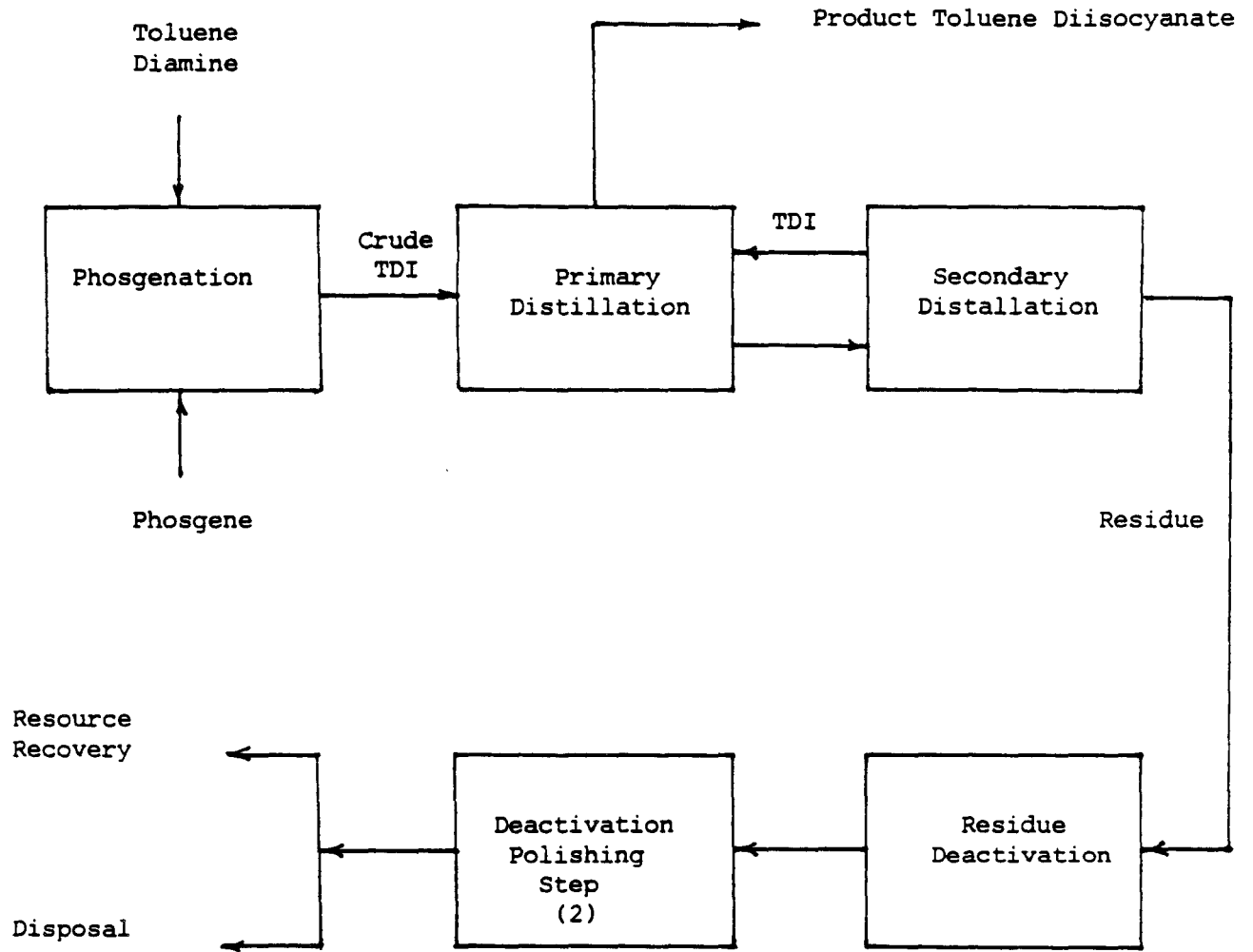
Fuel burners: Steam Generators, Inc.
2 Tavern Lane
Thurston, PA

- b) Prior to November 19, 1980, the treated residue was shipped solely to Steam Generators, Inc. for resource recovery.
- c) If this petition is approved, we shall employ resource recovery to the largest extent possible to manage the residue.

Attachment I: Toluene Diisocyanate Production Schematic -- includes diagram of present waste system, showing processes and equipment used. A more detailed explanation of the process and associated equipment has been supplied to EPA. Because of its confidential nature, this description is not included in the public record file.

Attachment I

TOLUENE DIISOCYANATE PRODUCTION SCHEMATIC



SECTION D: Selection of Constituents for Testing

The procedures described below apply to all types of wastes other than those from petroleum refineries and multiple waste treatment facilities. Petitioners for these facilities should refer to Section 4 of the Guidance Manual and adapt this section of the petition appropriately.

1. If you have followed Approach A in Section B above, please submit test results on representative samples for the following:
 - The specific hazardous constituents for which the waste was listed (i.e., total concentration of each listed constituent found in Appendix VII of Part 261);
 - The four hazardous waste characteristics (but see the Note immediately below);
 - Appropriate leachate tests for the EP toxic metals, nickel, and cyanide;
 - Total concentrations of the EP toxic metals and nickel;
 - Total organic carbon (TOC); and
 - Total oil and grease.

Note: If you can explain why the waste cannot exhibit one or more of the four hazardous waste characteristics, you may submit your rationale in lieu of test results for those characteristics. For example, if the waste is composed exclusively of organic solvents and there is no chance (on the basis of process considerations) that it contains any of the EP toxicants, you need not test for the EP Toxicity characteristic.

You may omit the rest of this section and go to Part E.

2. If you have opted for Approach B in Section B above, then you must perform the tests specified in the above paragraph, and you should test for all hazardous constituents that may "reasonably be expected" to be in the waste, whether or not they were used as a basis for listing.

The remainder of this section is to be used to support your decision regarding which constituents to test for.

- a. List the constituents (from Appendix VIII to Part 261) that may reasonably be expected to be in the waste. Describe the engineering, chemical, or other considerations that support your choice.

Constituent: Toluene diisocyanate

Reasons for Selection:

- . This is the only Appendix VIII constituent that is not totally consumed in the production process.

(Repeat as necessary.)

- b. For each of the remaining hazardous constituents (or groups of constituents) in Appendix VIII of Part 261, specify why it may not reasonably be expected to occur in the waste stream.

Constituent (or group of constituents): All others

Reasons for non-occurrence:

All Appendix VIII constituents except for TDI are completely consumed in the closed production process.

(Repeat as necessary.)

Sample Number: 1

Sampling Information:

- a. Sampling location: Reaction container
- b. Person(s) who drew the sample: T. Nugent
- c. Equipment used for drawing the sample: grain sampler
- d. Date and time when the sample was drawn: 3 / 1/82, 7 ^{a.m.} ~~p.m.~~
- e. Handling, containerization, and preservation techniques used:
Sampling container was immediately capped, labelled and
sealed. Sample was then immediately delivered to the
laboratory.

Test Procedures and Results: (Repeat for each test conducted)

- f. Parameter/Constituent Tested For: Toluene diisocyanate
- g. Date Test Performed: 3 / 5 /82
- h. Person(s) who performed the test: Barney Kessel
- i. Test Method (or Number) and Source: 9010, SW-846
- j. Sample Workup or Preparation Method: As in (i) above
- k. Equipment:
- | Name | Model Number |
|---------------------|-------------------|
| <u>Perkin Elmer</u> | <u>Model 5000</u> |
| <u></u> | <u></u> |
| <u></u> | <u></u> |
- l. Test Results: Not detectable

3. Summary Table of Analytical Results

For each sample, please enter the Test Results from Item 2 above onto the form contained in the following pages.

4. Analytical Discussion

Please furnish explanations or additional information on the following topics as necessary:

- a. Inconsistencies or deviations in the analytical results presented above.
- b. Additional reasons as to why the waste stream should be delisted.

The attached material from the International Isocyanate Institute, Inc. comprises our additional reasons for delisting this waste.

INTERNATIONAL ISOCYANATE INSTITUTE, INC.

P.O. Box 1268

71 ELM STREET

NEW CANAAN, CONN. 06840

CABLE ADDRESS:
ISOCYANATE-NEW CANAAN, CONN.

(203) 966-7555

July 16, 1980

Docket Clerk (Docket No. 3000)
Office of Solid Waste (WH-562)
United States Environmental Protection Agency
401 M Street, S.W.
Washington, D. C. 20460

Dear Sir:

The following comments have been prepared by the International Isocyanate Institute (III) regarding the Hazardous Waste Management System Part 261 Identification and Listing of Hazardous Waste, Subpart D - List of Hazardous Waste as published in the May 19, 1980 Federal Register (Vol. 45 No. 98). Specifically the III would like to offer comments on the listing of centrifuge residue from toluene diisocyanate production (Section 261.32 EPA Hazardous Waste No. K-027) and on the listing of Urethane (Section 261.33 of EPA Hazardous Waste No. U-238)."

The International Isocyanate Institute, Inc., was founded August 18, 1971 as a non-profit Corporation. It is organized under the laws of the United States and is registered in the State of New York. As presently constituted, the Institute has 22 members who are located in the Americas, Europe and Japan. To qualify for Membership, a company must be engaged in the manufacture of Isocyanates. A list of the present Member Companies will be found on the last page of this submission.

Centrifuge residue from toluene diisocyanate production has been designated as hazardous waste No. K-027 in Section 261.32 of the May 19th, 1980 Federal Register Regulations. The EPA listed both toxicity and reactivity as the properties that allegedly qualify this material for inclusion on the list. Examination of the listing background document (Document #11 pp 431-432) produces several questions relative to the accuracy of this data, and therefore, the validity of the hazardous waste designation.

The following comments are offered for the Agency's consideration relative to the listing of TDI centrifuge residue as a hazardous waste:

1. The EPA characterizes the waste from TDI production as centrifuge residues in the Federal Register while the background document makes reference to "Evaporator residue processing centrifuge or vacuum distillation." It is unclear if the Agency intends to limit the scope of the listed material to only the wastes generated via a centrifuge unit operation.

2. In general, each TDI producer deactivates TDI residue differently and each firm does employ some form of aging or other means of deactivation after generation of the final distillation or centrifuge bottoms. The III believes the listing of TDI residue needs further clarification that it is limited to undeactivated material as it is directly discharged from the distillation or centrifuge unit operation and not de-activated materials.

If a TDI producer elects to include additional processing steps (i.e. hydrolysis, additional distillation, aging, etc.) to render the material less reactive or non-reactive then the resultant material should be evaluated against the criteria found in Sub-part C- Characteristics of Hazardous Waste 261.20 - 261.24.

3. The background document indicates the centrifuge residue (contains toxic organic substances, mutagenic substances and substances that are probably carcinogenic". It further states that toluene diisocyanate, toluene diamine and polymeric tars are "suspected carcinogens". These statements raise several questions:

(a) It has not been documented that all centrifuge residue contains toluene diamine. In general, companies indicate that either TDA is not present or if present it is only in low ppm concentrations. The analytical techniques used to conduct this determination are subject to variability and are currently being evaluated by industry.

(b) Although the Federal Register (Appendix VII of the May 19, 1980 publication - basis for listing hazardous wastes) sites benzidimidazapone as the principal compound in tars, we are not aware of the existence of this substance and any data that exists to substantiate the claim that it is mutagenic or carcinogenic.

(c) TDI has not been declared a suspect carcinogen. In the NIOSH Criteria for a Recommended Standard...Occupational Exposure to Diisocyanates published in September 1978, there is the statement "No reports were found to indicate that TDI, MDI, HDI, NDI, or other diisocyanates produce carcinogenic, teratogenic, or reproductive effects in humans or animals." The Isocyanates as a class of compounds are not listed in the OSHA proposed carcinogen regulations.

(d) Only the meta-isomer of TDA is a suspect carcinogen.

4. Disposition of raw centrifuge residue in drum quantities in a landfill is generally not practiced as a "known management method for this waste."

Therefore, on the basis of apparent inaccuracies in the background document, the III respectfully requests the EPA to review and clarify its data and information based on the items enumerated in this correspondence.

On another matter, the EPA designates urethane as a commercial chemical product or manufacturing intermediate (Section 261.33f) that will be subjected to the Hazardous Waste Regulations. (An examination of the "Urethane" terminology reveals that this term was improperly applied in 1960.)

It is most imperative that this gross misnomer be corrected. Twenty years ago Hueper published a paper (W.C. Hueper, Experimental Production of Cancer by Means of Implanted Polyurethane Plastic, Amer.Jour.Clin.Pa. 34, p.334-337, October 1960). Hueper's work and subsequent work by the National Cancer Institute was with ethyl carbamate (urethan) which he erroneously thought was synonymous with "urethane". In spite of considerable effort on the part of some of us to correct this misnomer (which is even perpetuated by the 1973 Toxic Substances List, No.5015), polyurethanes continue to be associated with the known human carcinogen ethyl carbamate or "urethan".

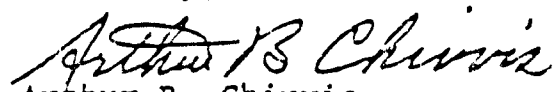
In view of the name similarity of urethan (ethyl carbamate) and polyurethane plastics, it is important to point out the differences in chemical structure of both compositions in order to avoid confusion.

It is readily apparent that urethan (ethyl carbamate) is not a precursor of the polyurethanes. Thus there is no basis for assuming that any toxicity characteristics associated with ethyl carbamate in any way apply to the polyurethanes.

The III respectfully requests that to clarify this ambiguity, the EPA replace urethane (hazardous waste No. U-238 with the proper chemical terminology - ethyl carbamate.

We would welcome an opportunity to discuss this matter further with you or other appropriate EPA personnel. If you have any questions or comments regarding this issue, please do not hesitate to call me.

Sincerely,


Arthur B. Chivvis
Managing Director

ABC:vor

APPENDIX J

TEST METHODS NOT AVAILABLE IN SW-846

Extraction Procedure for Oily Wastes

Total Organic Carbon

Total Oil and Grease

Determination of Reactive Cyanide and Sulfide

Determination of Photodegradable Cyanide

Explosive Hazard

EP TOXICITY TEST FOR OILY WASTE

(Proposed as Method 1330 in SW-846)

1. Separate the sample (minimum 100 gm) into its solid and liquid components. The liquid component is defined as that portion of the sample which passes through a 0.45 um filter media under a pressure differential of 75 psi.
2. Determine the quantity of liquid (ml) and the concentration of the toxicants of concern in the liquid phase (mg/l).
3. Place the solid phase into a Soxhlet extractor, charge the concentration flask with tetrahydrofuran, and extract for 3 hours.
4. Remove the flask containing tetrahydrofuran and replace it with one containing toluene.
5. Extract the solid for a second time, for 3 hours, with the toluene.
6. Combine the tetrahydrofuran and toluene extracts.
7. Analyze the combined extracts for the toxicants of concern.
8. Determine the quantity of liquid (ml) and the concentration of the toxicants of concern in the combined extracts (mg/l).
9. Take the solid material remaining in the Soxhlet thimble and dry it at 100°C for 30 minutes.
10. Run the EP on the dried solid.
11. Calculate the mobile metal concentration (MMC) using the following formula:

$$MMC = 1000 ([Q_1 + Q_2 + Q_3] / [L_1 + L_2])$$

Q_1 = Amount of toxicant in initial liquid phase of sample (amount of liquid X concentration of toxicant) (mg)

Q_2 = Amount of toxicant in combined organic extracts of sample (amount of liquid X concentration of toxicant) (mg)

Q_3 = Amount of toxicant in EP extract of solid (amount of extract X concentration of toxicant) (mg)

L_1 = Amount of initial liquid (ml)

L_2 = Amount of liquid in EP = weight of dried solid from step 9 X 20 (ml)

TOTAL ORGANIC CARBON

Method 415.1 (Combustion or Oxidation)
(Proposed as Method 9060 in SW-846)

1. Scope and Application

- 1.1 This method includes the measurement of organic carbon in drinking, surface and saline waters, domestic and industrial wastes. Exclusions are noted under Definitions and Interferences.
- 1.2 The method is most applicable to measurement of organic carbon above 1 mg/l.

2. Summary of Method

- 2.1 Organic carbon in a sample is converted to carbon dioxide (CO_2) by catalytic combustion or wet chemical oxidation. The CO_2 formed can be measured directly by an infrared detector or converted to methane (CH_4) and measured by a flame ionization detector. The amount of CO_2 or CH_4 is directly proportional to the concentration of carbonaceous material in the sample.

3. Definitions

- 3.1 The carbonaceous analyzer measures all of the carbon in a sample. Because of various properties of carbon-containing compounds in liquid samples, preliminary treatment of the sample prior to analysis dictates the definition of the carbon as it is measured. Forms of carbon that are measured by the method are:
 - A) soluble, nonvolatile organic carbon; for instance, natural sugars.
 - B) soluble, volatile organic carbon; for instance, mercaptans.
 - C) insoluble, partially volatile carbon; for instance, oils.
 - D) insoluble, particulate carbonaceous materials; for instance, cellulose fibers.
 - E) soluble or insoluble carbonaceous materials adsorbed or entrapped on insoluble inorganic suspended matter; for instance, oily matter adsorbed on silt particles.
- 3.2 The final usefulness of the carbon measurement is in assessing the potential oxygen-demanding load of organic material on a receiving stream. This statement applies whether the carbon measurement is made on a sewage plant effluent, industrial waste, or on water taken directly from the stream. In this light, carbonate and bicarbonate carbon are not a part of the oxygen demand in the stream and therefore should be discounted in the final calculation

or removed prior to analysis. The manner of preliminary treatment of the sample and instrument settings defines the types of carbon which are measured. Instrument manufacturer's instructions should be followed.

4. Sample Handling and Preservation

- 4.1 Sampling and storage of samples in glass bottles is preferable. Sampling and storage in plastic bottles such as conventional polyethylene and cubitainers is permissible if it is established that the containers do not contribute contaminating organics to the samples.

NOTE 1: A brief study performed in the EPA Laboratory indicated that distilled water stored in new, one quart cubitainers did not show any increase in organic carbon after two weeks exposure.

- 4.2 Because of the possibility of oxidation or bacterial decomposition of some components of aqueous samples, the lapse of time between collection of samples and start of analysis should be kept to a minimum. Also, samples should be kept cool (4°C) and protected from sunlight and atmospheric oxygen.
- 4.3 In instances where analysis cannot be performed within two hours (2 hours) from the time of sampling, the sample is acidified (pH<2) with HCl or H₂SO₄.

5. Interferences

- 5.1 Carbonate and bicarbonate carbon represent an interference under the terms of this test and must be removed or accounted for in the final calculation.
- 5.2 This procedure is applicable only to homogeneous samples which can be injected into the apparatus reproducibly by means of a micro-liter type syringe or pipette. The openings of the syringe or pipette limit the maximum size of particles which may be included in the sample.

6. Apparatus

- 6.1 Apparatus for blending or homogenizing samples: Generally a Waring-type blender is satisfactory.
- 6.2 Apparatus for total and dissolved organic carbon:
- 6.2.1 A number of companies manufacture systems for measuring carbonaceous material in liquid samples. Considerations should be made as to the types of samples to be analyzed, the expected concentration range, and forms of carbon to be measured.
- 6.2.2 No specific analyzer is recommended as superior.

7. Reagents

- 7.1 Distilled water used in preparation of standards and for dilution of samples should be ultra pure to reduce the carbon concentration of the blank. Carbon dioxide-free, double distilled water is recommended. Ion exchanged waters are not recommended because of the possibilities of contamination with organic materials from the resins.
- 7.2 Potassium hydrogen phthalate stock solution, 1000 mg carbon/liter: Dissolve 0.2128 g of potassium hydrogen phthalate (Primary Standard Grade) in distilled water and dilute to 100.0 ml.

NOTE 2: Sodium oxalate and acetic acid are not recommended as stock solutions.

- 7.3 Potassium hydrogen phthalate, standard solutions: Prepare standard solutions from the stock solution by dilution with distilled water.
- 7.4 Carbonate-bicarbonate stock solution, 1000 mg carbon/liter: Weigh 0.3500 g of sodium bicarbonate and 0.4418 g of sodium carbonate and transfer both to the same 100 ml volumetric flask. Dissolve with distilled water.
- 7.5 Carbonate-bicarbonate, standard solution: Prepare a series of standards similar to step 7.3.

NOTE 3: This standard is not required by some instruments.

- 7.6 Blank solution: Use the same distilled water (or similar quality water) used for the preparation of the standard solutions.

8. Procedure

- 8.1 Follow instrument manufacturer's instructions for calibration, procedure, and calculations.
- 8.2 For calibration of the instrument, it is recommended that a series of standards encompassing the expected concentration range of the samples be used.

9. Precision and Accuracy

- 9.1 Twenty-eight analysts in twenty-one laboratories analyzed distilled water solutions containing exact increments of oxidizable organic compounds, with the following results:

Increment as TOC <u>mg/liter</u>	Precision as Standard Deviation <u>TOC, mg/liter</u>	Bias, <u>%</u>	Accuracy as Bias, <u>mg/liter</u>
4.9	3.93	+15.27	+0.75
107	8.32	+ 1.01	+1.08

(FWPCA Method Study 3, Demand Analyses)

Bibliography

1. Annual Book of ASTM Standards, Part 31, "Water", Standard D 2547-79, p 469 (1976).
2. Standard Methods for the Examination of Water and Wastewater, 14th Edition, p 532, Method 505, (1975).

EXTRACTION METHOD FOR TOTAL OIL AND GREASE

(Proposed as Methods 9070 (liquids) and 9071 (solids) in SW-846)

1. General Discussion

- a. Principle: Drying acidified sludge by heating leads to low results. Magnesium sulfate monohydrate is capable of combining with 75% of its own weight in water forming the heptahydrate and is used to dry sludge. After drying, the oil and grease can be extracted with freon.
- b. Interference: See 502C.1b.

2. Apparatus

- a. Extraction apparatus, Soxhlet.
- b. Vacuum pump or other source of vacuum.
- c. Extraction thimble, paper.

3. Reagents

- a. Hydrochloric acid, HCl, conc.
- b. Magnesium sulfate monohydrate. Prepare $\text{MgSO}_4 \cdot \text{H}_2\text{O}$ by overnight drying of a thin layer of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ in an oven at 103°C .
- c. Freon (1,1,2-trichloro-1,2,2-trifluoroethane), boiling point 47°C . The solvents should leave no measurable residue on evaporation. Distill if necessary.
- d. Grease-free cotton: Extract non-absorbent cotton with freon.

4. Procedure

In a 150 ml beaker weigh a sample of wet sludge 20 ± 0.5 g, of which the dry-solids content is known. Acidify to pH 2.0 (generally 0.3 ml conc. HCl is sufficient). Add 25 g $\text{MgSO}_4 \cdot \text{H}_2\text{O}$. Stir to a smooth paste and spread on the sides of the beaker to facilitate subsequent removal. Allow to stand until solidified, 15 to 30 min. Remove the solids and grind in a porcelain mortar. Add the powder to a paper extraction thimble. Wipe the beaker and mortar with small pieces of filter paper moistened with freon and add to the thimble. Fill the thimble with glass wool or small glass beads. Extract in a Soxhlet apparatus, using freon, at a rate of 20 cycles/hr for 4 hr. If any turbidity or suspended matter is present in the extraction flask, remove by filtering through grease-free cotton into another weighed flask. Rinse flask and cotton with freon. Distill the solvent from the extraction flask in water at 70°C . Place the flask on a warm steam bath for 15 min and draw air through the flask by means of an applied vacuum for the final 1 min. Cool in a desiccator for exactly 30 min and weigh.

5. Calculation

$$\text{Grease and oil as \% solids} = \frac{\text{gain in weight of flask, g} \times 100}{\text{weight of wet solids, g} \times \% \text{dry solids}}$$

6. Precision

The examination of six replicate samples of sludge yielded a standard deviation of 4.6%.

Source: Standard Methods For the Examination of Water and Wastewater, 14th edition. pp. 519-520.

TEST METHOD FOR THE DETERMINATION OF
REACTIVE CYANIDE AND SULFIDE CONTAINING WASTES
FINAL METHOD

1. Scope and Application

- 1.1 This method is applicable to water, wastewater and industrial wastes.
- 1.2 This method provides a fast and simple method to determine if a waste is a reactive waste as a result of its tendency to release toxic levels of hydrogen cyanide or hydrogen sulfide upon contact with acidic medium. The approach is based on a reasonable "worst case" disposal scenario.
- 1.3 This method is designed to measure only the hydrogen cyanide and/or hydrogen sulfide gas evolved at the test conditions and not to reflect the total concentration of these gases, or their precursors, in the sample. Variations in temperature, ionic strength and total volume of the test solution will affect the amount of gas evolved. The total volume of solution is kept constant from test to test. Temperature and ionic strength are not controlled as they are inherent properties of each waste.

2. Summary of Method

- 2.1 An aliquot of the waste is acidified to pH 2 in a closed system. The gas generated is swept from the reaction chamber using a pump and passed through a calibrated gas detector tube. The detector tube reading is used to calculate the concentration of gas evolved.

3. Sample Handling and Preservation

- 3.1 Samples containing, or suspected of containing sulfide or a combination of sulfide and cyanide wastes, should be collected with a minimum of aeration. The sample bottle should be filled completely, excluding all head space, and stoppered. Analysis should commence as soon as possible and samples should be kept in a cool, dark place until analysis begins.
- 3.2 Samples containing or suspected of containing cyanide wastes without the presence of sulfide compounds, can be preserved if analysis can not begin immediately. Samples are preserved by adjusting to pH 12 with strong sodium hydroxide solution and storing in a cool, dark place.
- 3.3 Determination should be performed in a well ventilated hood.

4. Interferences

- 4.1 The analyst should consult manufacturers' literature on the type and nature of potential interferences when using specific detector tubes.

5. Apparatus

- 5.1 Three neck round bottom flask with 24/40 ground glass joints, 250 mL.
- 5.2 Magnetic stirrer bar with magnetic stirring apparatus.

- 5.3 Separatory funnel with pressure equalizing line and 24/40 ground glass joint, 125 mL.
- 5.4 Straight glass adapter tubes with ground glass joint 24/40 and rubber adapter sleeve, 2 each.
- 5.5 Flexible tubing to make connection from detector tube to pump.
- 5.6 Detector tubes: HCN detector tube with range of 10-120 μ L (Draeger 67 28441 or equivalent). H₂S detector tube with range 5-60 μ L (Draeger 67 28141 or equivalent).
- 5.7 pH meter and pH electrode of sufficient length to reach liquid level (approximately 18 cm).
- 5.8 Pump capable of pulling 60 mL per minute \pm 3 mL per minute (MSA Model C-210 or equivalent).
- 5.9 Bubble meter for calibrating pump.
- 5.10 Stopwatch.

6. Reagents

- 6.1 Sulfuric acid, H₂SO₄, 1 N.
- 6.2 Cyanide Reference Solution: Dissolve approximately 2.5 g KOH and 2.51 g KCN in one liter distilled water. Concentration approximately 1 mg/mL.
- 6.3 Sulfide Reference Solution: Prepare from crystals of sodium sulfide as described in Method 376.2 (Sulfide, Colorimetric, Methylene Blue) Section 5.8 of *Methods for Chemical Analysis of Water and Wastes*, EPA 600/4-79-020, March, 1979. The solution may be standardized by the titrimetric iodine Method 376.1 of the same publication, although this is not required.

7. System Check

- 7.1 The operation of the system can be checked using the cyanide or sulfide reference solutions. It is difficult to predict a detector tube reading from a known amount of reference solution due to variations in response of detector tubes of different sources. Reaction flask temperature variations and total volumes also influence the amount of gases evolved. However, the reference solutions can be used to verify system operation and replicates can be expected to agree to within approximately \pm 20%

8. Procedure

- 8.1 Place 10g* of the waste to be tested into a beaker. Add approximately 80 mL deionized water and determine the amount of 1 N H₂SO₄ required to adjust pH to 2.0.
- 8.2 Place a second 10g* aliquot of the waste into the 250 mL round bottom flask. Add deionized water in an amount so that the sum of the volume of water and the volume of 1 N H₂SO₄ required for pH adjustment, will equal 100 mL.

* or 10 mL

- 8.3 Assemble the apparatus as shown in Figure 2 using the proper detection tube or tubes (see Figure 1).
- 8.4 Calibrate the pump in line to a flow of 60 mL/min \pm 3 mL/min using the bubble meter attached to the pump outlet. The flow can be checked during and after the test period.
- 8.5 Begin stirring and make sure all connections are tight.
- 8.6 Carefully adjust the test solution to pH 2.0 using the 1 N H₂SO₄.
- 8.7 Note the readings of stain length at five minute intervals. If the length of the stain exceeds the capacity of the detector tube, re-analyze using a smaller aliquot. If very little or no stain develops, the aliquot size may be increased, depending on the nature of the sample. Solid samples require a certain amount of dilution to reach a slurry state so that the acid may contact all portions of the sample and so that stirring may take place.
- 8.8 Continue to monitor the pH of the test solution, adjusting if necessary to maintain at pH 2.0. Continue the pump operation for 30 min. from the time of initial pH adjustment.
- 8.9 Stop the pump and record the final reading on the detector tube.

Note 1: The chemistry of some detector tubes may permit their use in series to determine both H₂S and HCN concurrently. With the use of the Draeger detector tubes mentioned in Section 5.6, the H₂S tube must be first tube in the system. Other detector tubes may operate differently.

Note 2: As an optional step to determine a "total" evolvable gas value, at the end of 30 minutes, the pH can be lowered to less than pH 1 and a sand bath used to elevate the temperature. Increased evolution rates may be observed from some samples.

9. Calculations

- 9.1 The concentration of gas evolved may be calculated as follows:

ppm gas evolved (HCN or H₂S)/g or mL =

$$\frac{\text{final detector tube reading (uL)}}{\text{volume of gas passed through detector tube (L)} \times \text{aliquot (g or mL)}}$$

and:

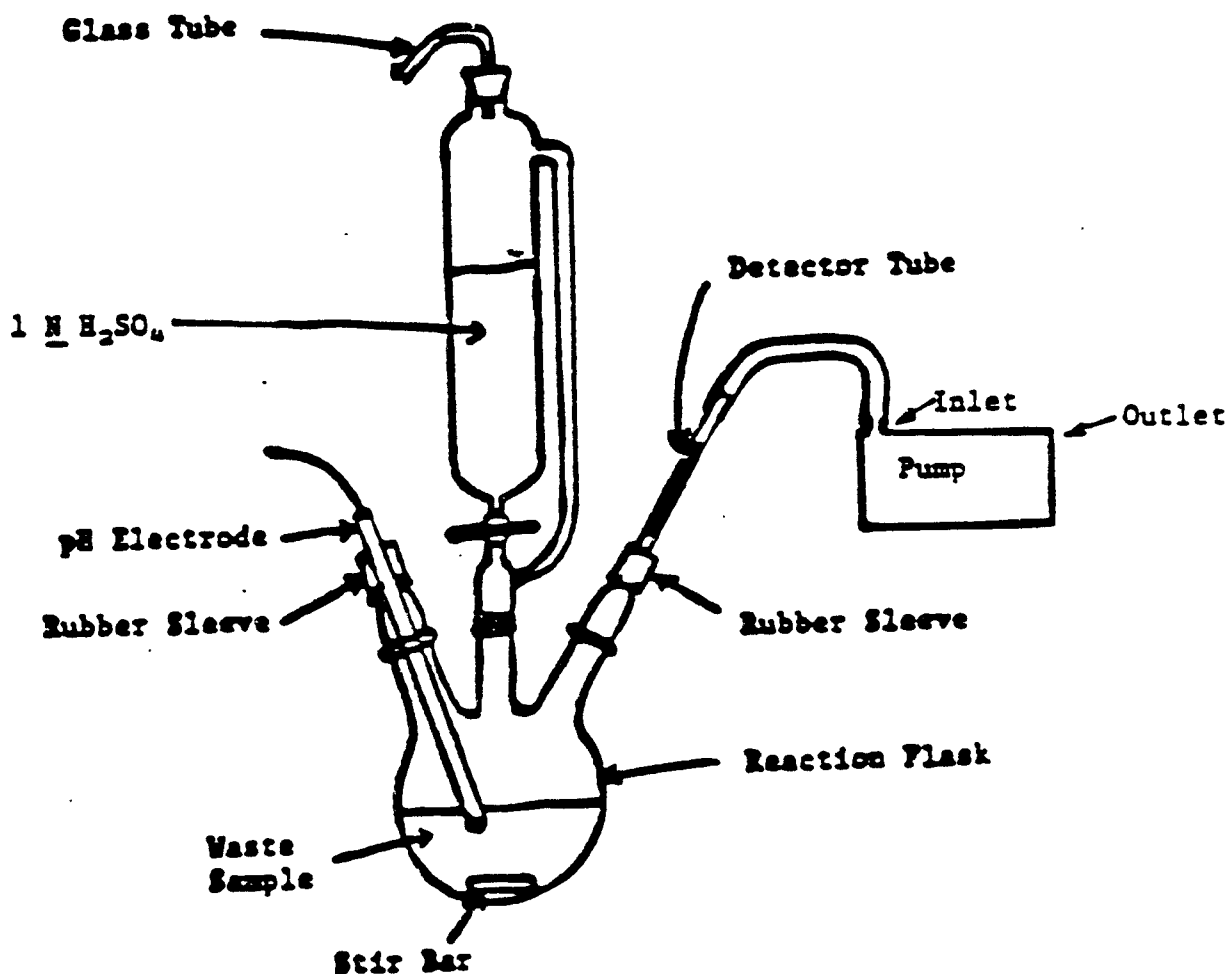
$$\text{volume of gas passed through detector tube (L)} = \frac{\text{pump flow rate (mL/min)} \times \text{length of test (min)}}{1000}$$

- 9.2 The time of maximum gas evolution rate can be determined by comparing the rate of change over each five minute period to the elapsed time.

10. Precision and Accuracy

- 10.1 The precision of the method as determined by evaluation on standards can be expected to be approximately $\pm 17\%$.
- 10.2 The accuracy of the method cannot be determined directly due to the difficulty of providing a sample of known gas evolution qualities. Calibration of the detector tubes used in method (see Section 5.6) with standard gas mixtures indicate the bias of the H_2S tubes to be approximately $+ 16\%$ at 20°C and the bias of the HCN tubes to be approximately $+ 35\%$ at 20°C .

FIGURE 2
TEST APPARATUS
FINAL METHOD



METHOD 9011

Method for the Determination of Photodegradable Cyanides

1.0 Scope and Application

- 1.1 Method 9011 is used for the determination of photodegradable cyanides in wastes under hypothetical field conditions. It is used to determine whether particular wastes will form releasable cyanides (cyanide amenable to chlorinate) as a result of exposure to UV radiation.

2.0 Summary of Method

- 2.1 Four representative waste samples are tested. Each sample is split into two equal portions. One portion is subjected to UV irradiation by a low pressure mercury arc lamp to test for photodegradation. During irradiation, any HCN evolved is trapped in the gas absorber. After photolysis is completed, each portion is analyzed according to method 9010. The presence of photodegradable cyanides is determined by the differences in results.

3.0 Interferences

- 3.1 Refer to Method 9010

4.0 Apparatus and Materials

- 4.1 Quartz tube, (1.26 cm I.D. x 15 cm, "Vycor" brand from corning, or 11-369E in Fisher catalogue) with provision for air inlet and vacuum outlet, transparent to UV frequencies greater than 220nm.
- 4.2 Low pressure mercury lamp (G15T8 lamp, General Electric or equivalent capable of emitting UV radiation at a frequency below 300nm).
- 4.3 Microburet; refer to Method 9010.
- 4.4 Flasks, condenser, and tubing are needed as shown in Figure 1. The boiling flask should be of 1-liter size with inlet tube and provision for a condenser. The gas absorber may be a Fisher-Milligan scrubber. Assemble as shown in Figure 1.

5.0 Reagents

- 5.1 Refer to Method 9010.

6.0 Sample Collection, Preservation and Handling

- 6.1 Refer to Method 9010.

7.0 Procedure

- 7.1 Test for interferences according to the procedure in Method 9010.
- 7.2 Take a 20 gram sample of waste and split into two 10 gram portions.
- 7.3 Analyze one portion (A) for total and amenable cyanide according to Method 9010.

7.4 Take the second 10 gram portion (B) of the sample and place in a quartz tube.

7.4.1 Connect quartz tube inlet to an air source and the tube outlet to the adsorber as specified in procedure 7.3 in Method 9010.

7.4.2 Using the mercury arc lamp at a distance of twelve inches from the quartz tube, irradiate for thirty minutes while drawing air through the system.

Caution: Low pressure mercury arc lamps emit high energy ultra-violet radiation. Use caution to avoid exposing eyes or skin.

7.4.3 Determine the presence or total and amenable cyanide according to procedures 7.3 - 7.5 in Method 9010 on the sample in the quartz tube.

7.4.4 Determine the amount of CN in the scrubber.

7.5 Report results for the five measurements from each sample.

EXAMPLE:

CN in ppm

	total	Cn Amenable	Scrubber
Sample 1A	82.5	10.4	--
Sample 1B	63.1	21.8	5.7

This example would result from a sample which converted complexed cyanide to amenable.

7.6 Spiked standards and check standards should be routinely analyzed.

8.0 Quality Control

8.1 All quality control data should be maintained and available for easy reference and inspection.

8.2 Employ a minimum of one blank per sample batch to determine if contamination or any memory effects are occurring.

8.3 Analyze check standards after approximately every 15 samples.

8.4 Run one duplicate sample for every 10 samples. A duplicate sample is a sample brought through the whole sample preparation process.

8.5 Spiked samples or standard reference materials shall be periodically employed to ensure that correct procedures are being followed and that all equipment is operating properly.

8.6 The method of standard additions shall be used for the analysis of all samples that suffer from matrix interferences.

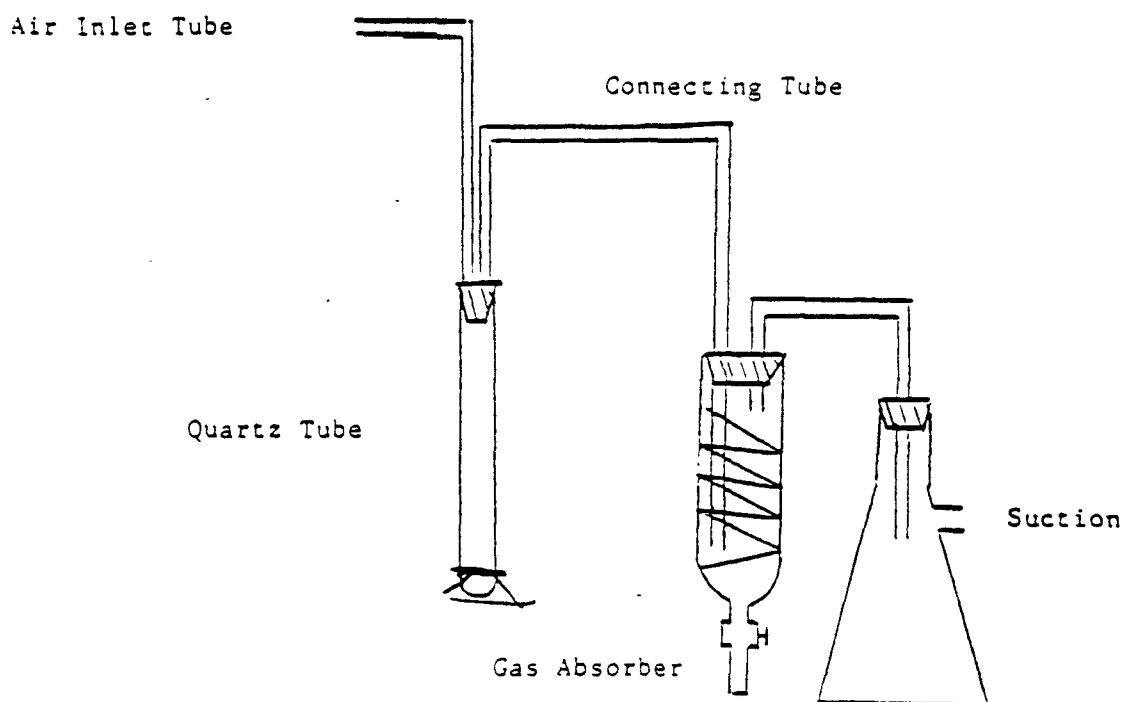


Figure 1. Apparatus for Cyanide Distillation

EXPLOSIVE REACTIVITY

(From "Department of Defense Explosives Hazard Classification Procedures," Army Technical Bulletin 700-2, September 1982)

5-1. General. *a.* This chapter prescribes tests that are required by Title 49 Code of Federal Regulations for transport purposes and by STANAG No. 4123 and DOD for the establishment of storage hazard classification.

b. Lethal and incapacitating chemical munitions will be tested under criteria which are unique to chemical weapons.

c. Binary chemical munitions will be classed in accordance with their industrial chemical hazards until the essential components are combined with their explosive components at which time paragraph *b* above applies.

5-2. Transport Testing Requirements.

a. These tests must be conducted prior to shipment in commerce of any explosive or propellant composition except liquid explosives and are intended to develop data on stability and sensitivity of new compositions of bulk explosives and solid propellants to determine if they are safe to handle, transport and store. Laboratory samples are used, with weights and dimensions limited to the minimum necessary for drawing conclusions. Preliminary testing with even smaller samples is recommended to provide test personnel with an indication of hazards to be encountered. The tests specified in this paragraph generally do not require instrumentation other than that normally associated with the equipment involved, e.g., ovens for thermal stability tests.

b. Recording of data. The results of tests performed under this paragraph are to be recorded in a manner similar to that shown in figure 5-1. The format shown is intended only as a guide and maybe modified as required to fit a particular test program.

c. Instrumentation. Due to the limited quantity of material involved in these tests, instrumentation to record peak pressure, impulse, and ambient temperature as well as high speed photography may be eliminated.

d. Equipment. The following equipment is required for tests under this paragraph:

(1) One Bureau of Explosives impact apparatus. Drawings are available at the Bureau of Explosives, Association of American Railroads, 1920 'L' Street, NW, Washington, DC 20036.

(2) One ventilated explosion-proof oven capable

of maintaining a temperature of 75°C or above for a period of 48 hours. The oven will be equipped to continuously record the temperature. Dual thermostats that fail safe will be provided for temperature control.

(3) Number 8 electric blasting caps or caps of equivalent strength as required. A number 8 blasting cap means a cap which contains 0.4—0.45 grams of PETN base charge pressed into an aluminum shell with bottom thickness not to exceed 0.03 inch, to a specific gravity of not less than 1.4 grams/cubic centimeter, and primed with standard weights of primer, in accordance with the manufacturer's specifications.

(4) One blasting machine or equivalent for initiating electric blasting caps.

(5) Kerosene-soaked sawdust sufficient for three beds, 1-foot square and ¼-inch thick.

(6) Electric match-head igniters as required.

(7) Solid lead cylinders 1½-inch diameter by 4 inches high as required.

(8) One piece of mild steel plate SAE 1010 to 1030, ½-inch thick by 12 inches square.

(9) Mild steel plates (SAE 1010 to 1030) 6-inch × 6-inch × 3/8-inch as required.

(10) Tubing, steel, cold drawn seamless, mechanical, composition 1015, 1-7/8 inch OD, 0.219 inch wall thickness variations ± 10 percent acceptable by 5½ inches long as required.

(11) Cellulose acetate, or equivalent, cards, 2-inch diameter by 0.01-inch thick as required.

(12) Wire (demolition cable) as required for connecting blasting machine to electrically initiated items.

(13) Engineers special electric blasting caps (J-2) as required.

(14) Two inch diameter by 1-inch long pressed pentolite peller, National Stock No. 1375-991-8891 as required.*

e. Test samples. The following test samples are required for this paragraph:

(1) Twelve samples $2 \pm \frac{1}{4}$ -inch cubes. (Cardboard containers of comparable size to be used for granular substances.)

(2) Ten 10mg (approx) samples suitable for use in the Bureau of Explosives impact apparatus (0.20 in. ± .02 in. diameter × 0.10 in. ± .02 in. long).

*Available from: Commanding Officer, Navy Ships Parts Control Center, Mechanicsburg, PA. 17055, ATTN: Code 370.

Date _____

Sponsoring Agency _____

Contract No. _____

Explosive or Propellant Identity (Type No.) _____

Spec. _____ Batch _____

Mfg. Date _____

Detonation Test		Detonated		Burned		Fragmented	
		Yes	No	Yes	No	Yes	No
No. 8 Blasting Cap	Test I	_____	_____	_____	_____	_____	_____
	Test II	_____	_____	_____	_____	_____	_____
	Test III	_____	_____	_____	_____	_____	_____
	Test IV	_____	_____	_____	_____	_____	_____
	Test V	_____	_____	_____	_____	_____	_____

Samples: Five 2-inch cubes. Test: One blasting cap per sample.

Ignition & Unconfined Burning Test	Exploded		Average Burning Time
	Yes	No	Seconds
One 2-inch cube	_____	_____	_____
One 2-inch cube	_____	_____	_____
Four 2-inch cubes	_____	_____	_____

Samples: Six 2-inch cubes. Test: 48 hours at 75°C in vented oven.

Card Gap Test 50% Value _____ (No. of Cards)

Impact Sensitivity Test

Bureau of Explosives Impact Apparatus

Ten 3 3/4" (\pm 1/16") Drop Test 10 Trials			Ten 10" (\pm 1/16") Drop Test 10 Trials		
Number of Trials Exhibiting			Number of Trials Exhibiting		
Explosion	Decomposition	No Reaction	Explosion	Decomposition	No Reaction
Flame and	Smoke	No Smoke	Flame and	Smoke	No Smoke
Noise	No Noise	No Noise	Noise	No Noise	No Noise
_____	_____	_____	_____	_____	_____

Approved:

Test Director _____

Test Department Head _____

Assigned Classification	
DOT Forbidden	_____
DOT Restricted*	_____
DOT Class A	_____
DOT Class B	_____
DOT Class C	_____
UN Number	_____

DOD Approval (see para 3-2)

Signature _____

Title _____

Organization _____

*Shipping instructions are to be requested from DOT.

Figure 5-1. Sample summary data sheet.

(3) Samples sufficient to fill 12 each of item 5-2d(10) above (para 5-2j(1)(b)).

f. Detonation test.

(1) Place one lead cylinder (5-2d(7)) upon the steel plate (5-2d(8)). Place a No. 8 blasting cap (5-2d(3)) perpendicular to and in contact with a flat surface of the 2-inch cube sample (5-2e(1)) which is then placed on top of the lead cylinder. A 2-inch diameter wood block with a hole drilled in its center similar to that shown in figure 5-2 may be used for positioning the blasting cap. Deformation (mushrooming) of the lead cylinder 1/8-inch or more will be considered as evidence of detonation. Conduct this test a minimum of five times, or until detonation occurs, whichever is the least number of tests.

(2) Data from this test will be recorded under Detonation Test.

g. Ignition and unconfined burning test.

(1) Place a 2-inch sample (5-2e(1)) on a bed of kerosene-soaked sawdust (5-2d(5)), and ignite the sawdust with an electric match-head igniter (5-2d(6)). Perform this test twice.

(2) Place four 2-inch (5-2e(1)) samples end-to-end in a single row in contact with each other on a single bed of kerosene-soaked sawdust (5-2d(5)) and ignite the sawdust with an electric match-head igniter (5-2d(6)) at one end.

(3) Record results under Ignition and Unconfined Burning Test.

h. Thermal stability test.

(1) Place one 2-inch sample (5-2e(1)) in constant temperature explosion-proof oven (5-2d(2)). Raise the temperature of the oven to 75°C and maintain the temperature at 75°C for a period of 48 hours. The temperature will be continuously recorded. Constant observation is not required.

(2) Record results under Thermal Stability Test.

i. Impact sensitivity test.

(1) This test need not be conducted if:

(a) The substance did not detonate in the detonation test (para 5.2f), or

(b) The substance is in a granular or powder form encased into a finished article and is not to be transported in bulk containers, or

(c) The substance detonated in the detonation test (para 5.2f) and is to be cast, pressed or extruded into cases.

(2) Conduct ten individual tests at each height using one sample (5-2e(2)) per test in the Bureau of Explosives impact apparatus (5-2d(1)).

(3) The sample (5-2e(2)) is placed in the cup assembly, the weight is then dropped from the desired height (from 3-3/4" 10 times). If no explosion occurs,

repeat the test dropping the weight from 10-inches. Observe results to supply data as required under Impact Sensitivity.

(4) Use cleaning equipment as required to thoroughly clean and dry the anvil and cup assemblies of the impact apparatus prior to each test. Apparatus must be at ambient temperature (room temperature) 25°C ± 5° prior to each test.

(5) Check that the equipment is properly leveled and replace the tools when worn.

j. Card gap test.

(1) Materials required for each test are as follows:

(a) One each tubing (5-2d(10))

(b) Sample (5-2e(3)) cast into or machined to fit into above tubing.

(c) Two pentolite pellets 2-inch diameter by 1 inch long 5-2d(14).

(d) One Engineers Special Blasting Cap J-2 (5-2d(13)).

(e) One steel plate 6-inch × 6-inch × 3/8-inch (5-2d(9)).

(f) Cellulose acetate, or equivalent, cards 2-inch diameter × 0.01-inch thick (5-2d(11)).

(g) Four pieces of plastic material 1/16-inch × 1/2-inch × 1/2-inch.

(2) Test configuration. The components of the test are arranged in the following manner. The witness plate is supported on two edges parallel to and approximately 6 inches above the ground surface. Four small pieces of plastic material 1/16-inch × 1/2-inch are placed on the plate to support the pipe containing the test sample, and maintain the 1/16-inch air gap, which should not overlap onto the propellant or explosive. The air gap between the acceptor and witness plate should be free of solid material. The test sample is to be located approximately in the center of the witness plate. The pentolite booster is then placed on top of and in contact with the sample at the top of the pipe and the J-2 blasting cap attached. The arrangement of components for this test is similar to that shown in figure 5-2 except the cellulose acetate cards and the cardboard tube are omitted in the first test. Detonation is indicated when a clean hole is cut in the witness plate. The test sample and explosives booster are to be at a temperature of approximately 25°C ± 5° at time of test. Should no detonation occur in the first test, it will be repeated two times for a total of three tests. If detonation occurs, proceed to paragraph 5-2j(3).

(3) The following tests are to be performed when the test sample detonates in the above tests (5-2j(2)). If no detonation of the test sample occurs in the above tests, this test will not be performed.

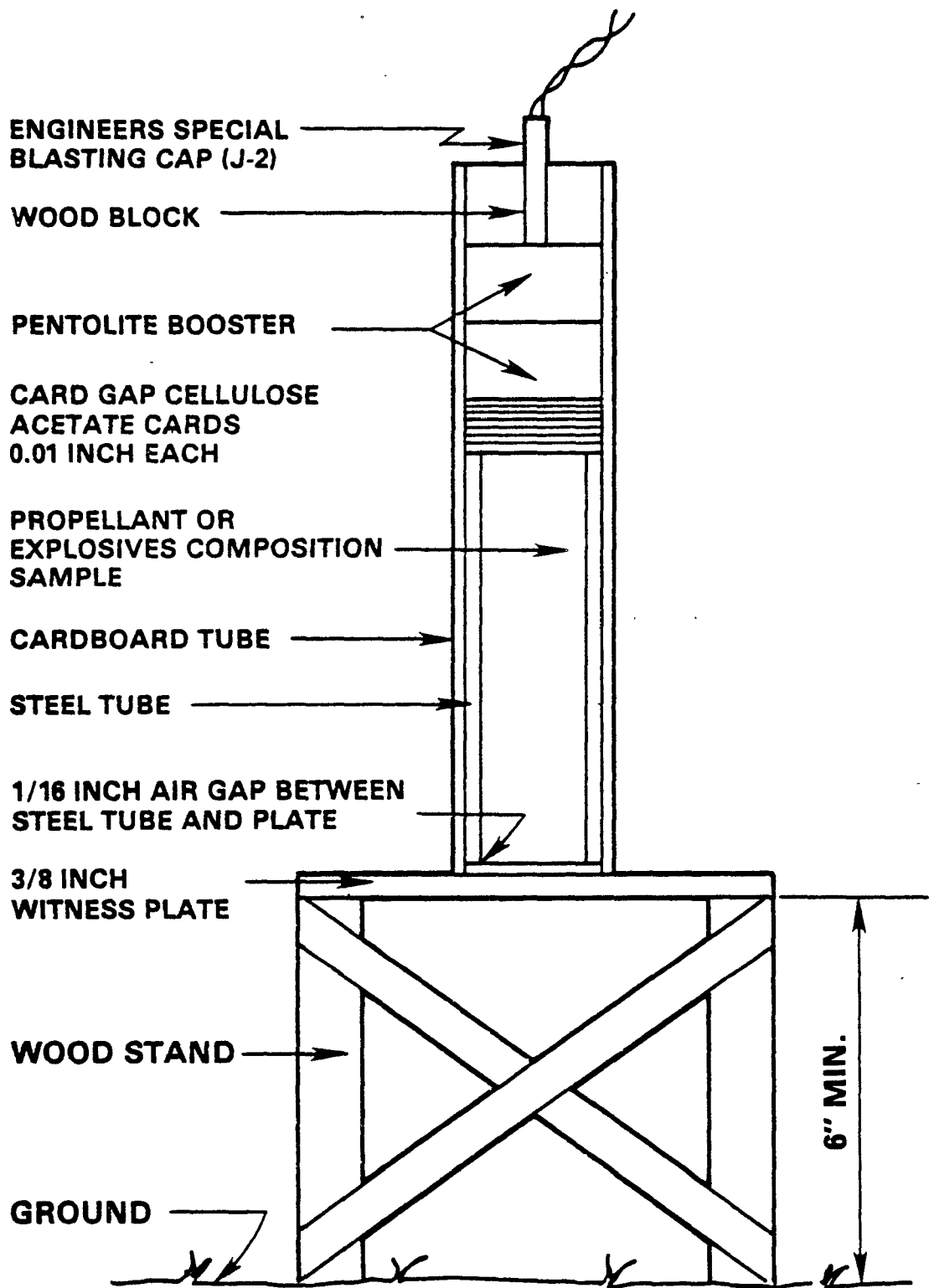


FIGURE 5-2. SET-UP FOR CARD GAP TEST

(a) The test samples, high explosive boosters and witness plates used in these tests are as given in paragraph 5-2j(1) above. The attenuation cards used are 0.01-inch cellulose acetate sheet or equivalent (5-2d(11)). These tests are to be conducted with the test sample and booster at a temperature of approximately $25^{\circ}\text{C} \pm 5^{\circ}$ throughout. The test setup is as shown in figure 5-2. The cellulose acetate cards should be held firmly but not pressed.

(b) The first test to be performed will utilize 8 cards; if a detonation occurs, the number of cards will be doubled (i.e., 16 cards) for the second test. If no detonation occurs, reduce the number of cards by one-half (i.e., 4 cards). Doubling of the number of cards will be continued in succeeding tests until no detonation occurs. When a number of cards is reached that prevents detonation, the next test will be with the number of cards reduced by half the preceding increment of increase (i.e., if detonation occurs at 32 cards but not at 64 cards, the next test will be with 48 cards). If detonation occurs at the reduced number of cards (48 cards in the example cited above) the number of cards in the next test will be increased by one-half the preceding increment (i.e., from 48 to 56 cards), etc. This procedure will be followed until the point of 50 percent probability of detonation is obtained. If the card gap sensitivity of a similar propellant or explosive composition is known testing should begin at approximately that number of cards.

(c) Detonation is indicated when a clean hole is cut in the witness plate. The measure of charge sensitivity is the length of attenuation (gap length) at which there is 50 percent probability of detonation according to the above criterion. The charge sensitivity will be expressed in terms of number of 0.01-inch cards necessary for the 50 percent value between detonation and no detonation. Normally, a maximum of 12 tests will be required to determine the 50 percent value.

5-3. Tests Required by STANAG 4123 and Department of Defense for Storage Hazard Classification.

a. The following tests will be performed on end items:

(1) Single package test — uses internal source of ignition or detonation, respectively, for items that are expected to deflagrate or detonate, to cause article(s) to function in order to ascertain the violence and extent of deflagration or propagation of detonation, and to assess the external hazard. Where more than one initiator is present, the initiator capable of producing the most energetic reaction will be functioned.

(2) Stack test — uses internal source of ignition or detonation, respectively, for items that are expected to deflagrate or detonate, to ascertain the violence and extent of deflagration or propagation of detonation, and to assess the external hazard when one item or package in a stack of five unpackaged items or five packages of items is ignited or initiated. In special cases the DODC may specify a different number.

(3) External fire, stack test — to ascertain the effect of fire external to the items or packages and, in the event that the fire causes deflagration, detonation, or explosion, to ascertain the violence and extent of propagation and the external hazard.

b. Test program.

(1) The simplest program of tests to prescribe is that any new item should be subjected to each of the three types of tests, with appropriate replication. However, this would often waste effort and money because it is not always necessary to perform all the tests. Certain types of ammunition and certain results in the early tests permit short cuts in the program. The flow chart figure 5-3 shows appropriate combinations of tests.

(2) Replication of tests. It is usual to perform the single package test three times at least, to demonstrate that the observed effects are reasonably reproducible. Though this limited amount of replication is statistically insignificant, it does provide the possibility to detect any gross mistakes in the conduct of the tests and does enable a controlling authority to exercise judgment in the interpretation of results. Furthermore, in those tests where it is possible to observe the proportions of the articles that explode rather than a simple go/no-go result, limited replication enables an experienced worker to assess the reproducibility of the tests and the level of confidence.

(3) Curtailment of testing. Some of the classification tests are quite costly so that inevitably there must be a compromise between the number of tests performed to give a reliable, comprehensive picture of the behavior of a product and the requirement for economy. Sometimes, it is possible to curtail the testing program in the light of the results of early tests. For example, there is no point in continuing with a second and third test with single packages or stacks if the first test gives explosion of the total contents. Due caution requires that this result be accepted at face value so that testing may proceed directly to the next stage in the program. Also there is always the option at any stage of detonation testing to assume the worst assessment (risk of mass detonation) and to proceed directly to the external fire test.

c. *Packaging to be recorded.* Records of tests should include details of the method and materials of packaging used in the tests, so that the need for further tests can be properly judged if the method or materials of packaging should be changed at a later date.

d. *Required instrumentation is given under each type test.* Details of this instrumentation are given in chapter 6.

e. *Single package test.*

(1) *Scope of test.* Figure 5-3 indicates the two circumstances when this test may be used as a cheaper preliminary to the expensive test with a stack of packages. In the event of certain favorable results, it is then unnecessary to perform the stack test. The first circumstance is an outer package containing more than one article. The second is a package containing only a single article when it is anticipated that the article will present no significant hazard and thus qualify for class division 1.4.

(2) *Test procedure.* Place the package containing the product(s) to be tested on the ground. To provide the necessary confinement, surround and cover the package with sacks or boxes filled with earth or sand creating a barrier in every direction. In the case of packages exceeding 1m in any dimension, the barrier should be at least 1m in every direction. Another method is to place the package in a pit of sufficient depth and cover it with earth or sand-filled sacks or boxes to the specified thickness. An article near the center of the package should be caused to function by using its own integral detonator or igniter or a stimulus of similar power to the detonator or igniter. For articles which do not function by an integral detonator or igniter, a device which simulates the detonation or ignition of one article near the center, or other appropriate stimulus,* is used. Perform the test a minimum of three times unless detonation of the total content occurs first. Blast instrumentation as specified in chapter 6 will be utilized. Fragment collection is not required.

f. *Stack test.*

(1) *Scope of test.* Figure 5-3 indicates four circumstances in which a test should be performed in a stack of five packages or five unpackaged articles. The term "severe effects" refers to effects falling short of explosion of the total contents (in a package containing more than one item) but being so severe or so directional as to raise doubts about their effect in a stack.

(2) *Test procedure.* Stack a minimum of five packages or unpackaged articles to simulate storage or

stowage conditions. They should be stacked in such a manner that their contents are in a position most likely to cause propagation of explosion. To provide the necessary confinement, surround and cover the stack with sacks or boxes filled with earth or sand creating a barrier 1 meter thick in every direction. An article near the centered package or an article most nearly centered should be caused to function by using its own integral detonator or igniter or a stimulus of similar power to the detonator or igniter. For articles which do not function by an integral detonator or igniter, a device which simulates the detonation or ignition of one article near the center, or other appropriate stimulus, is used. Perform the test a minimum of three times, unless an explosion of the total contents occurs earlier. Blast instrumentation as specified in chapter 6 will be utilized. Fragment collection and analysis as specified in chapter 6 is not mandatory but is encouraged to obtain additional information on this possible hazard.

g. *External fire, stack test.*

(1) *Scope of test.* An external fire test on a stack of packages or articles is required. Fragment collection and analysis will be made for each test other than those of bulk high explosives packaged in wooden or fiberboard containers. Fragment collection, blast instrumentation and analysis of results as specified in chapter 6 are to be employed for each test, except that when the anticipated reaction is other than mass explosion, blast instrumentation need not be employed.

(2) *Test procedure.* Stack a minimum of five packages or unpackaged articles on a wooden platform about 1m above the ground surface. Place a steel band around the stack to maintain it during the test. Pile kindling, or other air dried wood not thicker than 30mm beneath the platform and around the stack of packages to give at least one half meter in every direction to promote uniform test results. Drench the kindling with about 15 gallons of diesel fuel or kerosene. Ignite the pile on two sides by means of an electric squib, an igniting composition, small arms propellant, or other suitable means. The test is usually performed once only.

5-4. Interpretation of Results and Transport Tests. Results of paragraph 5-2 tests will be interpreted as follows:

a. DOT "Forbidden" if the following occurs:

Thermal stability test (5-2h) results in either a detonation, burning, or marked decomposition of the sample.

*For bulk granular propellants, an electric squib and 2 oz. of black powder will be placed within 4-inches of the bottom of the container (49CFR 173.53v).

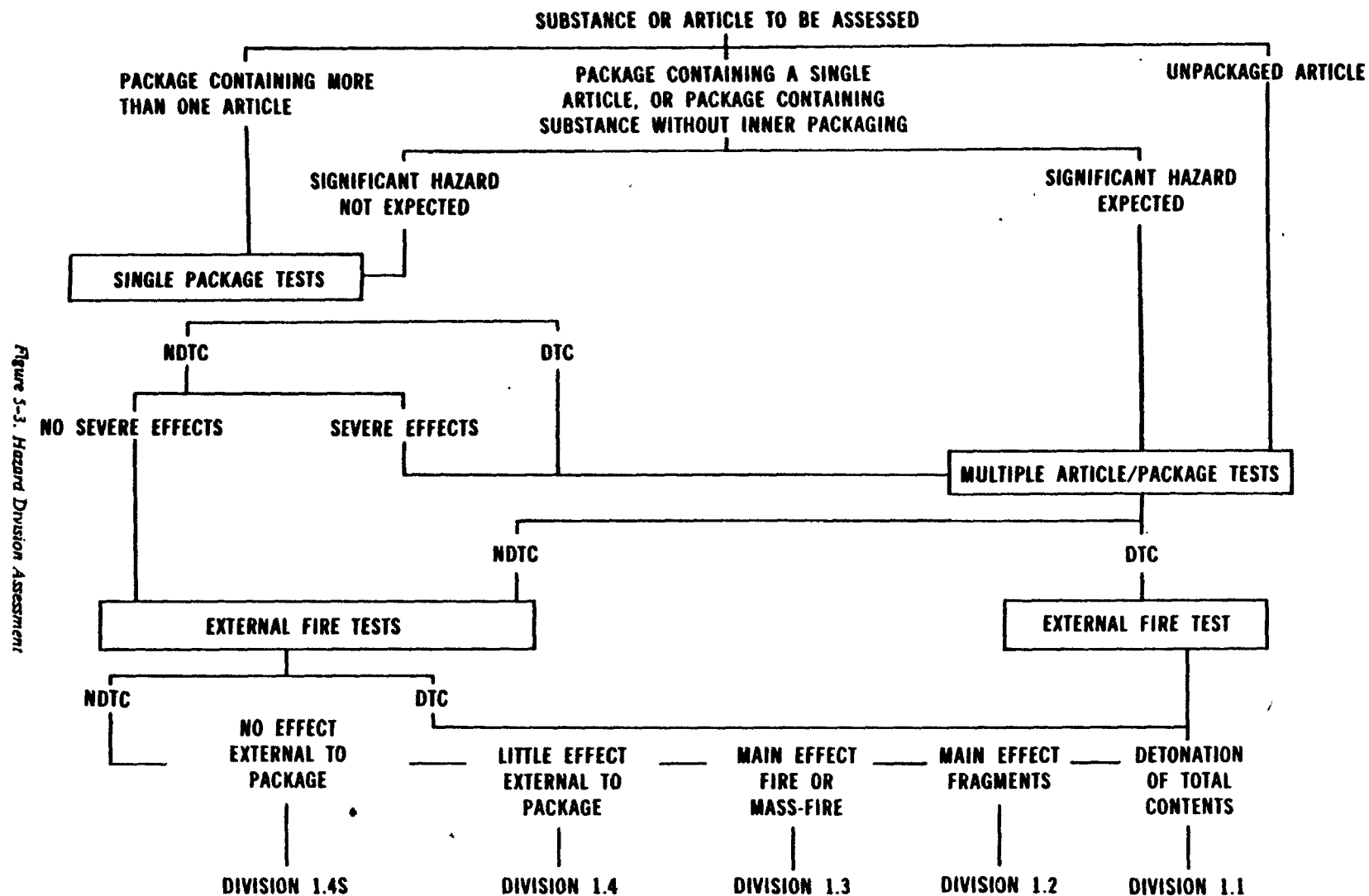


Figure 5-3. Hazard Division Assessment

FIGURE 5-3. HAZARD DIVISION ASSESSMENT

b. DOT Restricted: Compositions with an explosive impact sensitivity of less than 4-inches of drop height (5-2i) will not be shipped until instructions have been requested and received from the Materials Transportation Bureau, Department of Transportation.

c. DOT Class A (DOD Class/Division 1.1) if one or more of the following occur:

(1) Detonation test (5-2f) resulted in an explosion.

(2) Card gap tests (5-2j) have determined a detonation sensitivity value of 70 or more cards.

(3) Impact sensitivity test (5-2i) produces an explosion at 4 inches or more, but not more than 10-inches of drop height.

(4) Ignition and unconfined burning test (5-2g) produces a detonation of the sample.

d. DOT Class B (DOD Class/Division 1.3) if all of the following occur:

(1) Ignition and unconfined burning tests (5-2g) resulted in burning deflagration.

(2) The Thermal stability test (5-2h) did not result in an explosion, burning, or marked decomposition.

(3) Test (5-2f) did not result in a detonation, and card gap tests (5-2j) have indicated a detonation sensitivity value of less than 70 cards or no reaction at zero cards.

(4) Impact sensitivity test did not result in an explosion at 10 inches or less.

(5) The classifications derived from these tests may be interim only. Final classifications will be based on results of tests of packages as stored or transported.

5-5. Interpretation of STANAG and DOD Tests.

Results of tests given in paragraph 5-3 will be interpreted as follows:

a. The ammunition should be classified in the light of the test results and of other relevant data in accordance with the characteristics of the class divisions as indicated hereunder. Sometimes, the observed hazard effects may vary among replicate tests or may not correspond exactly to the definitions. When this occurs, the DODC should use its judgment, or arrange for further testing. It is prudent to err on the side of caution, particularly in the crucial decision as to whether or not a product is susceptible to mass detonation.

b. Division 1.4 (DOT class C) comprises items which are primarily a moderate fire hazard. They will

not contribute excessively to a fire. The effects are largely confined to the package. No fragments of appreciable size or range are to be expected. An external fire must not cause the simultaneous explosion of the total contents of a package of such items. The least hazardous of these items, namely those which are so designed and/or packaged that any hazardous effect arising from accidental functioning during storage or transport is confined within the article or package, are called Safety Ammunition and are placed in compatibility group S regardless of their other inherent characteristics. Articles containing about 1 ounce or less of explosives and classified based on test results as 1.4S may be considered as inert for storage purposes and are not subject to part 173 title 49 CFR for transport. Articles containing larger quantities of explosives, but also classified as 1.4S based upon tests may be considered inert for storage purposes but must be reviewed on an individual basis to determine if part 173 title 49 CFR is to be applied for transport.

c. Division 1.3 (DOT class B) comprises items which are a mass fire hazard. Some items burn with great violence and intense heat emitting considerable thermal radiation. Others burn sporadically. They may explode, but without the risk of mass detonation. Usually these items do not produce dangerous fragments; however, firebrands and burning containers may be thrown. (See paragraph 4-2 and indicate minimum separation distance when required.)

d. Division 1.2 (DOT class A) comprises items that burn or detonate progressively, a few at a time. A considerable number of fragments, firebrands and unexploded items may be projected; some of these may explode on impact and propagate fire or explosions. Blast effects are limited to the immediate vicinity. (See paragraph 4-2 and indicate minimum separation distances based upon data collected in accordance with chapter 6.)

e. Division 1.1 (DOT class A) comprises items that detonate en masse. The explosion will result in severe structural damage, the severity and range being determined by the amount of high explosives involved. There may also be a risk of fragmentation from the article or package in which the explosion occurs. (See paragraph 4-2 and indicate minimum separation distances required based upon data collected in accordance with chapter 6.)

5-6. Identification of the Hazard Assessment by Assignment of a Hazard Classification. Based on results obtained from

tests outlined herein, the appropriate Hazard Class/Division/Storage Compatibility Group can be assigned. To determine the DOT criteria, it is necessary to refer to

Title 49 CFR. Additionally, the appropriate United Nations Serial Number will be determined by referring to appropriate lists of UN numbers (see paragraph 4—6).