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Resource Conservation and Recovery Act (RCRA)

New-Employee Training Manual for the Operations Division RCRA Personnel

B. D. Barkenbus

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Department of Environmental Management
Environmental and Occupational Safety Division

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)

NEW-EMPLOYEE TRAINING MANUAL FOR THE OPERATIONS DIVISION RCRA PERSONNEL

B. D. Barkenbus

Date Published - March 1987

Prepared by the
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ABSTRACT

This manual has been prepared for the training of new employees who will work with RCRA hazardous waste management in the Operations Division. It will be taught by a person who is trained in hazardous waste regulations/procedures. It consists of nine modules. The topics of these modules are: RCRA Training, Hazardous Waste Regulations, Transportation Regulations, Hazardous Waste Management at ORNL, Chemical Hazards and Safety, Hazardous Waste Operations Training, Sampling of Hazardous Waste, Hazardous Waste Identification/Classification, and RCRA Contingency Plans and Emergency Procedures.

The on-the-job training areas are identified in the modules. They are an integral part of training.

I. INTRODUCTION

It is the policy of the Oak Ridge National Laboratory (ORNL) to provide training under Resource Conservation and Recovery Act (RCRA) regulations in order to assure the health and safety of the hazardous waste management staff, the ORNL staff, and the general public.

This manual contains training material used in the training of the Operations Division (OD) RCRA personnel who are newly-hired or who have transferred from other ORNL divisions. The amount of training provided is dependent upon employee work positions. Most of the management and supervisory personnel attend off-site RCRA courses organized by various industrial and governmental organizations. In-house training has been developed with the objective of tailoring a more specific program to the needs and job levels of operational personnel.

The target audience for this training manual will be staff with hands-on responsibilities for hazardous wastes, i.e., the Waste Operating Group (WOG) of OD. Some modules may be used with modifications, by the (a) Plant and Equipment (P&E) Division labor crew and fork-lift operators, (b) Environmental Protection Officers (EPOs), who function as a liaison between their division and the Department of Environmental Management (DEM) and OD, and (c) staff who assure overall RCRA hazardous waste management supervision at OD.

This manual will also constitute documentation of the content of the WOG new-employee RCRA training program. Compiled are nine modules that are covered during training in part or in their entirety, depending on the individuals involved and the type of work to be done. Its intent is to serve as a manual for future training programs. It provides guidelines for trainees and trainers to follow during training. Though some modules can be utilized as a self-taught course, they are designed to be covered in a classroom atmosphere and led by a person qualified in teaching RCRA

regulations and practices. On-the-job training must accompany classroom teaching as specified in the modules.

The new-employee RCRA training manual's objectives are to provide: (a) general background information on RCRA regulations, RCRA training, and DOT regulations; (b) procedures for hazardous waste handlers who sample, pick-up, classify, package, and store waste chemicals; (c) awareness of health, safety, chemical and radiation hazards in jobs; and (d) understanding of the labels, markings, and placards used in the transportation of hazardous materials.

Overall training will consist of approximately 40 hours of classroom training and additional on-the-job training until the trainees become proficient in their jobs. At the end of each module, a quiz will be administered. A comprehensive examination will be administered to measure the attainment of desired knowledge and skills at the end of the program to certify new employee(s). Formal retraining and/or continuous on-the-job training programs will follow the new-employee training program as required by RCRA regulations.

II. RCRA TRAINING - MODULE A

Module A Outline

COURSE OBJECTIVES: To identify RCRA training regulations and their applications at ORNL.

COURSE LENGTH: 3 hours (20 minute break)

COURSE CONTENT:

A. Training requirements

B. Title 40 RCRA training regulations

C. RCRA Training Content

D. RCRA training at ORNL

1. Objectives
2. Methods
3. Content
4. Evaluation
5. Documentation

E. Videotape presentation:

Title: RCRA Training, by ITS Corporation
Length: 20 minutes

F. Quiz: RCRA Training

INSTRUCTED BY: RCRA Training Coordinator

POTENTIAL PARTICIPANTS: Hazardous Waste Technicians
Hazardous Waste Supervisors & Managers
RCRA Related Personnel

COURSE/MATERIALS NEEDED: Overhead projector
Transparencies
Videotape recorder
Videotape
Quiz

MODULE A

Module A emphasizes the need for regulatory compliance in the hazardous waste area. It provides the trainee(s) with background in RCRA training regulations and their application to ORNL.

A. TRAINING REQUIREMENTS

The Resource Conservation and Recovery Act of 1976 (P.L. 94-580) and its amendments in 1978, 1980, and 1984 were passed by the congress to control hazardous waste "from cradle to grave." This expression means that generators of hazardous waste must abide by RCRA regulations to track and document the storage, transportation, treatment, and disposal of all hazardous wastes.

Training is emphasized in RCRA, by its inclusion in the Code of Federal Regulations (CFR) under Title 40, Section 265.16. This section mandates training requirements for owners and operators of hazardous waste treatment, storage, and disposal facilities.

Training requirements have also been included in the Tennessee Department of Public Health, Division of Solid Waste Management regulations. These regulations, under Tennessee Hazardous Waste Management Act Rules, Chapter 1200-1-11.5(2)(g), are parallel to the Environmental Protection Agency (EPA) Title 40 training regulations.

EPA regulations, 40 CFR 265.50-265.56, "Contingency Plan and Emergency Procedures" and 40 CFR 265.30 - 265.37, "Preparedness and Prevention," are also relevant to RCRA training. In addition, Title 49, Sections 171-179, Department of Transportation (DOT) regulations must be followed in transporting hazardous chemicals and wastes. DOT training requirements are found in 49 CFR 173.1 (b).

The ORNL, being a Department of Energy (DOE) contractor, also abides by DOE training requirements. DOE Order 5480.1A entitled "Environmental Protection Safety and Health Protection Program for DOE Operations" outlines personnel selection and training requirements in Chapter 5, "Safety of Nuclear Facilities" and in Chapter 6, "Safety of DOE-Owned Reactors." There are also DOE orders pertinent to transportation. These are DOE 5480.3, "Safety Requirements for Packaging and Transportation of Hazardous Materials, Hazardous Substances and Hazardous Wastes" and DOE-ORO 1540.1 "Materials" Transportation and Traffic Management."

Under RCRA, various waste management activities are required. The primary focus is on safety standards for the operators. These standards ensure that personnel at the facility are properly trained to safeguard their health and safety, as well as protect human health and the environment.

The above regulations are chosen either for their direct reference to the RCRA training or due to their inherent relation to hazardous waste management. The latter refers to the transportation, health, and safety training.

B. TITLE 40 RCRA TRAINING REQUIREMENTS

RCRA training regulations (40 CFR 265.16) are described as follows. The letters and numbers used in parenthesis match the regulations as printed in the CFR.

(a)(1) Facility personnel must successfully complete a program of <u>classroom instruction</u> or <u>on-the-job training</u> that teaches them to perform their duties in a way that ensures the facility's compliance with requirements. The owner or operator must ensure that this program includes all elements described in the document required under paragraph (d)(3) of this section.

(2) This program must be directed by a person trained in hazardous waste management procedures and must include instruction that teaches facility personnel hazardous waste management procedures (including contingency plan implementation) relevant to the positions in which they are employed.

(3) At a minimum, the training program must be designed to ensure that facility personnel are able to respond effectively to emergencies by familiarizing them with emergency procedures and systems, including, where applicable,

(i) procedures for using, inspecting, repairing, and replacing facility emergency and monitoring equipment;
(ii) key parameters for automatic waste feed cutoff systems;
(iii) communications or alarm systems;
(iv) response to fires or explosions;
(vi) shutdown of operations.

(b) Facility personnel must successfully complete the program required in paragraph (a) of this section <u>within six months</u> after the effective date of these regulations or six months after the date of their employment or assignment to a facility or to a new position at the facility, whichever is later. Employees hired after the effective date of these regulations must not work in unsupervised positions until they have completed the training requirements of paragraph (a) of this section.

(c) Facility personnel must take part in an <u>annual review</u> of the initial training required in paragraph (a) of this section.

(d) The owner or operator must maintain the following documents and records at the facility:

(1) The <u>job title</u> for each position at the facility related to hazardous waste management and the <u>name</u> of the employee filling each job;

(2) A written job description for each position listed under paragraph (d)(1) of this section. This description may be consistent in its degree of specificity with descriptions for other similar positions in the same company location or bargaining unit but must include the requisite skill, education, or other qualifications and duties of facility personnel assigned to each position;

(3) A written description of the type and amount of both introductory and continuing training that will be given to each person filling a position listed under paragraph (d)(1) of this section;

(4) Records that document that the training or job experience required under paragraphs (a), (b), and (c) of this section has been given to, and completed by, facility personnel.

(e) Training records on current personnel must be kept until closure of the facility. Training records on former employees must be kept for at least three years from the date the employee last worked at the facility. Personnel training records may accompany those transferred within the same company.

As indicated above, training and retraining is obligatory for RCRA personnel within six months of their hiring or transfer within the organization. Documentation of the training program is necessary.

C. RCRA TRAINING CONTENT

The content of RCRA training has not been specified by the EPA. Its intent is to keep it flexible to meet the needs of the facility and the particular job of an individual. A general area of coverage was identified in a 1978 EPA report entitled "Draft Background Document: Standards for Training," Section 250, 43-4, pp. 17-19. This training report included the following general areas for training:

1. Formal Training

   a. Environmental awareness: considers the potential public health and environmental consequences resulting from inadequate management of hazardous waste.

   b. Contingency procedures: prevention and handling of explosions, fires, leaks, spills, and accidental emissions.

   c. Environmental sampling and monitoring: techniques and analyses.

   d. Basic skills: chemistry, mathematics, physics and laboratory techniques applicable to hazardous waste management.

   e. Treatment processes and systems: (biological, chemical, and physical) characteristic of hazardous waste management facilities.

   f. Equipment operation and maintenance.

   g. Local, state, and federal regulations affecting hazardous waste facilities.

   h. Proper procedures for handling hazardous wastes: involves proper DOT shipping names, classes, required packaging, compatibility, labeling, marking requirement, placarding and shipping documents.

2. On-Site Training

   Supervisors must conduct on-site training of personnel in facility operations and emergency procedures which shall include but shall not be limited to the prevention and handling of explosions, fires, leaks, spills and accidental emissions.

3. Additional Periodic Training

Personnel shall attend appropriate seminars, conferences, and/or refresher courses periodically as conditions warrant.

D. RCRA TRAINING AT ORNL

The RCRA training program at ORNL is under the direction of the RCRA training coordinator. This person coordinates RCRA training courses for RCRA personnel throughout various divisions of ORNL. The RCRA training coordinator ensures that training is provided especially for those who work with the waste management program. Some of these groups are: DEM's Hazardous Materials related personnel; OD's WOG members and Chemical Operators; P&E Division's waste pick-up and transportation labor crew members and riggers; twenty-seven EPO's from ORNL divisions; and other ORNL divisions as needs arrive.

The RCRA training program attempts to structure sessions to provide knowledge and skill to meet the responsibilities of these groups. RCRA personnel must receive introductory training within six months of hiring (or transfer to a RCRA related job) and must be supervised during the training period and be retrained periodically as long as they stay on the job.

In the past, several new employees have been trained through the help of videotapes, off-site RCRA training courses, and participation in on-the-job training. Since March 1983, formal RCRA new-employee training has been established and administered. It consists of formal classroom lectures and discussions accompanied by on-the-job training. Forms are used to document the training (Figures II-1 and II-2).

NEW-EMPLOYEE TRAINING FORM

Name:

Date:

Duration of Training:

Training Topics	Trainee Signature	Trainer Signature

Fig. II-1 New-employee training form

ON-THE-JOB TRAINING FORM

Name of Trainee:

Date of Training:

Division Name:

Group Name:

Field of Training:

Description of the Training:

Trainer's Name:

Date of the Report:

Trainer's Signature Trainee's Signature

Fig. II-2 On-the-job training form

The publication, ORNL/TM-9060, ORNL Resource Conservation and Recovery Training Program provides in-depth information on objectives, methods, content, and documentation of the RCRA training program at ORNL. Copies of this report may be made available to the trainees during training.

1. Objectives

RCRA new-employee training objectives are:

a. To ensure the use of appropriate procedures in hazardous waste pick-up, transportation, packaging, labeling, and sampling techniques;

b. To provide a fundamental background in hazardous waste regulations and issues;

c. To emphasize personal, environmental, chemical, and radiation safety;

d. To teach staff emergency response measures and contingency plans; and

e. To ensure compliance with state and federal regulations in hazardous waste activities.

2. Methods

Training methods used may be categorized into five classes:

a. Formal (instructional - lecture type): is accomplished through off-site courses offered by professional organizations, ORNL in-house courses, and DEM courses;

b. On-the-job training: conducted by hazardous waste supervisors and trained peers;

c. Programmed instruction: implemented through the use of audio and videotapes developed commercially or by the ORNL staff;

d. Emergency response drills: conducted in cooperation by the ORNL's Laboratory Shift Supervisor's office; and

e. Sensitization: involves distribution of warning labels, environmental bulletins, and environmental procedures which are published in the ORNL Environmental Protection Manual and the Hazardous Materials Management and Control Manual to educate and provide awareness to the Laboratory personnel.

3. Content

At ORNL, RCRA topics that have been taught since 1981 can easily be reviewed by the printout of a computer file named "class" which is on the DECsystem-10 computer and system 1022 data management system. These courses can further be explored by studying the documentation of each session in binders 03-2 and 03-3 which are located in the training coordinator's office. Procedures of the ORNL Environmental Protection Manual are also part of the class material. The content page of this manual provides RCRA new-employee training topics.

Below is the list of video and audio tapes used for the RCRA training program. These tapes are in the RCRA training coordinator's room.

- Handling Hazardous Chemicals - BNA Inc. (videotapes) - 20 min.

- The Hazardous Materials Control Program at ORNL (videotape) - 16:44 min.

- Environmental Management at ORNL (videotape) - 30:18 min.

- Our Hidden National Product - NAC (videotape) - 25 min.

- Superfund - EPA (videotape) 28 min.

- Hazardous Waste, The Gross National By-Product - NAC (audiotape) - 20 min.

- Hazardous Materials Transportation Emergencies - NFPA (4 sets of audiotapes) - 30 min. each.

  - Assessing the problem
  - Identifying hazardous products
  - Responding to the incident
  - Resolving the incident

- The Chemical Bases for Environmental Issues - ACS (6 audiotapes) - 30 min. each.

- Chemistry for Nonchemist - ACS (6 audiotapes) - 60 min. each.

- Century III: Man and His Environment - NAC (videotape) - 28 min.

- Chemical Laboratory Techniques - ACS (3 videotapes) - 34:45 min., 46:30 min,., and 57:00 min.

- Safety Training; Hazardous Substances - NUS (videotape) - 60 min.
- Hazardous Materials Spill Management; Chemical Properties - ITS Corp. (videotape) - 13:15 min.
- RCRA Training - ITS Corp. (videotape) - 20 min.
- RCRA Contingency Plans and Emergency Procedures - TSP Inc, (audiotape) - 15 min.
- Fire Hazard Properties of Flammable and Combustible Liquids - NFPA (audiotape).
- Hazardous Materials Classification - E. I. DuPont (audiotape) - 12 min.
- Hazardous Materials Spills Management; Health Effects and Safety - ITS Corp. (videotape) - 20 min.
- EPA Particulate Sampling - AS&S (3 videotapes) - 45 min. each.
- Transporting Hazardous Wastes - E. I. DuPont (audiotape) - 12 min.
- A Hazardous Materials Incident and Identification Procedures for Hazardous Materials - The HAZMAT Resource Inc. (videotape) - 34 min.
- Blueprint for Safety - E. I. DuPont (videotape) - 12 min.
- Anatomy of Crisis Response - EPA (videotape) - 25 min.
- Strategy for Crisis Response - EPA (videotape) - 23 min.
- Pride in Action - Getting Involved - ORNL (videotape) - 19 min.

- Safety Training; Personal Safety - NUS Corp. (videotape) - 1 hr.

- Safety Training; Respiratory Protection - NUS Corp. (videotape) - 1 hr.

- Chem Safe - BNA Inc. (8 videotapes) - 10-15 mins. each.

  - Introduction to Chemical Safety
  - Corrosives
  - Poisons
  - Gases
  - Solvents
  - Oxidizers
  - Explosives
  - Carcinogens

- Protecting the Environment - ITS Corp. (videotape) - 14 min.

- Reducing the Risks of PCBs - EPA (videotape) - 12 min.

- TSCA: Balancing Risks and Benefits - EPA (videotape) - 15 min.

ACS: American Chemical Society
BNA: Bureau of National Affairs
ITS: Industrial Training Systems Corp.
NFPA: National Fire Protection Association
TSP: Transportation Skills Program
NAC: National Audiovisual Center
AMA: American Management Association
EPA: Environmental Protection Agency
ASA: Alsid, Snowden, and Associates
TSCA: Toxic Substances Control Act

4. Evaluation

Evaluation is done in three stages.

a. Results Evaluation

- Supervisor's Evaluation
- Yearly Training Reviews
- Environmental Audit - Internal and External

b. Learning Evaluation

- Written Tests
- Certificates

c. Reaction Evaluation

- Questionnaires and Survey Forms
- Informal Feedback by Trainees

5. Documentation

The RCRA training records are kept by the department's RCRA training coordinator in RCRA training binders 03-1, 03-2, and 03-3. It includes the following documents:

a. Job/Task Descriptions;
b. Class Participation Records;
c. Yearly Review Documents;
d. On-the-Job Forms;
e. New-Employee Training/Orientation Forms;
f. Individual Records on Computer Database (Filename is "DO.RCRA").

III. HAZARDOUS WASTE REGULATIONS - MODULE B

Module B Outline

COURSE OBJECTIVES: To introduce trainees to Federal environmental regulations and to study Resource Conservation & Recovery Act regulations.

COURSE LENGTH: 3 hours (20 minute break)

COURSE CONTENT:

A. Overview of Environmental Regulations

B. Regulatory Rule Making in the United States

C. Resource Conservation & Recovery Act, 1976

D. Title 40 Requirements

1. Parts
2. Definitions
3. Characteristics of Hazardous Wastes
4. Lists of Hazardous Wastes
5. Standards for Generators
6. Standards for Transporters
7. Interim Status Standards for Treatment, Storage, and Disposal Facilities
8. Recent Amendments

E. Videotape Presentation:

Title: Hazardous Wastes: The Gross National By-Product, by the EPA.
Length: 20 minutes

F. Quiz: RCRA Regulations

INSTRUCTED BY: Persons familiar with compliance requirements.

POTENTIAL PARTICIPANTS: Hazardous Waste Technicians
Hazardous Waste Supervisors
RCRA Related Personnel

COURSE/MATERIALS NEEDED: Overhead projector
Transparencies
Audioviewer
Slides and Tape
Quiz

MODULE B

Module B is a general introduction to environmental regulations and a specific introduction to the Resource Conservation and Recovery Act.

A. ENVIRONMENTAL REGULATIONS

The following Environmental regulations and their legislative history provide a brief background.

1. The Clean Air Act (CAA)

The CAA of 1963, as amended in 1970 and 1977 is a comprehensive federal statute which regulates air emissions from "stationary" and "mobile" sources.

a. National ambient air quality standards (NAAQS) are set for maximum concentration levels for various pollutants. These standards are based on:

- Primary standards (health);
- Secondary standards (public welfare);
- Criteria pollutants are sulfur/dioxide, particulate matter (dust or total suspended particulates), carbon monoxide, ozone, nitrogen dioxide, and lead.

b. A "Prevent Significant Deterioration" objective is established in areas where air quality is cleaner than the national standard.

c. A "Nonattainment Program" standard is set for restricting new source construction in areas with poor air quality. "New Source Performance Standards" which are used to review new stationary sources are technology-based standards.

d. National Emission Standards set for Hazardous Air Pollutants (NESHAPs) for new and existing sources are designed for health protection. Presently there are NESHAPs for asbestos, beryllium, mercury, and vinyl chloride.

2. The Clean Water Act (CWA)

The Federal Water Pollution Control Act (FWPCA) of 1973, as amended by the CWA of 1977 and 1978, is intended to establish water-quality standards and a permit process for sources of polluted effluent in the nation's surface waters. The following terms are defined within the Act:

- Discharge means to add any pollutant to navigable waters from any point source;

- Navigable water means all waters of the U.S., including the territorial seas;

- Point source means any discernible, confined, and discrete conveyance;

- Best Available Control Technology (BACT), as defined by EPA, must be employed by industries to control the discharge of pollutants into navigable waters;

- The National Pollutant Discharge Elimination System (NPDES) permits, issued by the EPA, control pollution discharges by setting effluent limitations based on BACT.

3. The Safe Drinking Water ACT (SDWA)

The SDWA of 1974, as amended in 1977, assures that water-supply systems serving the public meet national standards for the protection of the public health. This protection is in the

context of drinking water through the use of national "primary drinking water regulations." It also protects drinking water from contamination through the underground injection of waste.

4. The Solid Waste Disposal Act (SWDA)

The SWDA of 1975, as amended by the Resource Recovery Act (RRA) of 1970 is a feasibility study which discusses the creation of a system of national disposal sites for the storage and disposal of hazardous wastes (radioactive, toxic chemical, biological, and other). There were no regulations produced by this Act.

5. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

The CERCLA, better known as SUPERFUND, is concerned with releases of hazardous materials to the environment and is responsible for cleanup at old hazardous waste dump sites.

6. The Toxic Substances Control Act (TSCA)

The TSCA of 1976 established requirements for identifying and controlling toxic chemical hazards to human health and the environment. EPA has the authority to determine the extent to which people and the environment are exposed, and take control actions and/or regulate particular chemicals.

7. The Federal Environmental Insecticide, Fungicide and Rodenticide Act (FIFRA)

The FIFRA of 1972, as amended in 1975-78, takes measures to protect people and the environment against pesticides, herbicides, rodenticides, and biocides.

B. REGULATORY RULE MAKING IN THE UNITED STATES

Four basic steps are involved in establishing regulations:

a. Before the rule is proposed, each interest group lobbies informally for its position;

b. EPA publishes an announced notice of proposed rules (ANPR) in the Federal Register (FR) and holds public hearings to collect responses to the proposal. Opposition gets a chance to comment and experts provide their views;

c. The regulatory package reaches the desk of the top government policymaker. The administrator evaluates requests and establishes the agency's regulations; and

d. "Final rules" are published in the FR. However, several groups can still sue the agency for neglecting their expressed needs.

The Code of Federal Regulations (CFR) is a codification of the general and permanent rules published in the FR by Executive departments and agencies of the federal government. The Code is divided into 50 <u>titles</u>. Each title is divided into <u>chapters</u>. Each chapter is further subdivided into <u>parts</u>. Each volume of the Code is revised at least once each calendar year.

Copies of FR and CFR should be shown to the trainees.

C. RESOURCE CONSERVATION AND RECOVERY ACT

The Resource Conservation and Recovery Act, [Public Law (P.L.) 94-580], passed in 1976, subjected hazardous waste to comprehensive regulations. This law was amended in 1978 (P.L. 96-609), in 1980 (P.L. 96-482), and in 1984 (P.L. 98-616) with the objective of promoting the protection of health and the environment from

uncontrolled industrial waste and of conserving energy sources and materials. Section 1003 of the RCRA stated the following objectives:

1. to provide technical and financial assistance to state and local governments and interstate agencies for the development of solid waste management plans that will promote solid waste management techniques; new and improved methods of collection, separation, and recovery of solid waste; and environmentally safe disposal of nonrecoverable residues;

2. to provide training grants in occupations involving the design, operation, and maintenance of solid waste disposal systems;

3. to prohibit future open dumping on the land and to require the conversion of existing open dumps to facilities that do not pose a danger to health or to the environment;

4. to provide for the promulgation of guidelines for solid waste collection, transportation, separation, recovery, and disposal practices and systems;

5. to promote a national research and development program for improved solid waste management and resource conservation techniques; more effective organizational arrangements; new and improved methods of collection, separation, recovery, and recycling of solid wastes; and environmentally safe disposal of nonrecoverable residues;

6. to promote the demonstration, construction, and application of solid waste management, resource recovery, and resource conservation systems that preserve and enhance the quality of air, water, and land resources; and

7. to establish a cooperative effort among federal, state, and local governments and private enterprise to recover valuable materials and energy from solid waste.

With the passage of this law and the enactment of the regulations in November 1980 by the Environmental Protection Agency (EPA), the system for tracking hazardous wastes from the time they are generated until they are disposed of (what is referred to as "cradle to grave") was established. Hence, the RCRA is intended to protect the public and the environment from adverse effects of hazardous wastes. Until 1985, EPA regulated only what are termed "large quantity generators," which are defined as those generators that produce more than 1000 kg of hazardous waste each calendar month. The November 1984 amendments, however, included generators who produce 100-1000 kg. When regulations were promulgated, all the existing facilities were given an "interim status" (40 CFR 270.70). This mechanism utilized by EPA let the existing facilities continue receiving hazardous waste prior to having received a permit. However, a Part A Permit had to be filed and to receive a final permit, existing facilities had to file Part B Permits.

Authorized state hazardous waste programs give individual states the responsibility for administering RCRA. States were required to obtain and retain interim and final authorization from EPA to implement the state program in lieu of the federal program.

The Tennessee Department of Public Health, Division of Solid Waste Management, adopted EPA regulations on January 14, 1981 (effective March 2, 1981), and was granted interim status in July 1981 to enforce these regulations for the state. The EPA granted final authorization to the state of Tennessee on February 1985. Some of the Tennessee laws pertinent to solid waste management are shown in Table III-1.

Table III-1. Tennessee solid waste laws and regulations

Solid Waste Regulations	Chapter 1200-1-7
Hazardous Waste Management Act	TN Code, Title 53, Chapter 63
Solid Waste Disposal Act	TN Code, Title 53, Chapter 43
Hazardous Waste Management Act Rules	Chapter 1200-1-11

D. TITLE 40 REQUIREMENTS

EPA regulations for hazardous waste management are published in the Code of Federal Regulations, under Title 40 to enforce the RCRA.

EPA regulations emphasize:

- Identifying wastes that are hazardous and can pose risks;
- Tracking hazardous wastes from their generation to their disposal;
- Setting standards through the permit process for all hazardous waste management facilities to meet the minimum national design, performance, and operating standards;
- Assuring that facilities will be maintained properly after their closure;
- Making hazardous waste management facilities financially responsible for the cleaning up of accidental spills at their facilities; and

- Abiding by RCRA as well as by Department of Transportation (DOT) regulation when waste is transported to another facility for treatment, storage, or disposal.

- Reduction/minimization of hazardous wastes.

1. Parts

The selected regulations below can be found in CFR, Title 40, in the following parts:

a.	Hazardous Waste Management System: General	260
b.	Identification and Listing of Hazardous Waste	261
c.	Generator Standards	262
d.	Transporter Standards	263
e.	Treatment, Storage and/or Disposal Facility (TSDF) Standards	264, 265 266, 267
f.	Permits for TSDF	260-265, 270

2. Definitions (40 CFR 260.10)

Certain terms and definitions must be understood well in the context of RCRA. The following are some of these definitions with which trainees must be familiar.

a. Generator: any person, by site, whose act or process that produces hazardous waste identified or listed in 40 CFR 261, or whose act first causes a hazardous waste to become subject to regulation.

b. Transporter: a person engaged in the off-site transportation of hazardous waste by air, rail, highway, or water.

c. Transportation: the movement of hazardous waste by air, rail, highway or water.

d. Storage: the holding of hazardous waste for a temporary period, at the end of which the hazardous waste is treated, disposed of, or stored elsewhere.

e. Disposal: the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters.

f. Disposal Facility: a facility or part of a facility at which hazardous waste is intentionally placed into or on any land or water, and at which waste will remain after closure.

g. Treatment: any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste, or so as to recover energy or material resources from the waste, or so as to render such waste non-hazardous, or less hazardous; safer to transport, store, or dispose of; or amenable for recovery, amenable for storage, or reduce in volume.

h. Hazardous Waste Constituent: a constituent that caused the administrator to list the hazardous waste in 40 CFR 261, Subpart D, or a constituent listed in Table 1 of 40 CFR 261.24.

i. TSDF: Treatment, Storage and Disposal Facility.

j. EPA Hazardous Waste Number: the number assigned by EPA to each hazardous waste listed in Part 261, Subpart D, of this chapter and to each characteristic identified in Part 261, Subpart C, of this chapter.

k. EPA Identification Number: the number assigned by EPA to each generator, transporter, and treatment, storage, or disposal facility.

l. Incompatible Waste: a hazardous waste which is unsuitable for (1) placement in a particular device or facility because it may cause corrosion or decay of containment materials (e.g., container inner liners or tank walls); or (2) commingling with another waste or material under uncontrolled conditions because the commingling might produce heat or pressure, fire or explosion, violent reaction, toxic dusts, mists, fumes, or gases, or flammable fumes or gases.

m. Manifest: the shipping document EPA form 8700-22 and, if necessary, EPA form 8700-22A, originated and signed by the generator in accordance with the instructions.

n. Hazardous Waste: the term is defined by the RCRA in Section 1004(5) as a solid waste or combination of solid wastes, which because of its quantity, concentration or physical, chemical or infectious characteristics may (a) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illness; or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed, or otherwise managed (see Module H, Figure IX-3).

o. Solid Waste: defined in Section 1004(27) as any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or

contained gaseous material resulting from industrial, commercial mining, and agricultural operations, and from community activities (see Module H, Figure IX-2).

p. Solid waste: defined in 40 CFR 261.2 as any discarded material that is not excluded by 261.4(a) or by variance granted under 260.30 and 260.31 (case-by-case evaluation of certain recycled materials).

A discarded material is any material which is abandoned, recycled, or considered inherently waste-like.

° Materials are solid waste if they are abandoned by being "disposed of," "burned or incinerated," or "accumulated, stored, or treated" (but not recycled) before or in lieu of being abandoned.

° Materials are solid wastes if they are recycled (or accumulated, stored, or treated before recycling):

- used in a manner constituting disposal;
- burned for energy recovery;
- reclaimed;
- accumulated speculatively.

° Inherently waste-like materials

- Materials with hazardous waste numbers F020, F021, F022, F013, F026, and F028 are solid wastes if they are recycled in any manner.

q. Hazardous waste: defined in 40 CFR 261.3 as a solid waste (261.2) and:

° it is not excluded from 261.4(b);

- it exhibits any one of the characteristics of hazardous waste identified in Subpart C;

- it is listed in Subpart D and has not been excluded from the lists in Subpart D under 260.20 and 260.22;

- it is a mixture of a listed hazardous waste (Subpart D) and a solid waste, unless delisted;

- it is a mixture of a non-listed hazardous waste and a solid waste and exhibits hazardous waste characteristics.

Exemptions to the mixture rule are allowed:

- if a listed waste in the mixture was listed solely on the basis of characteristic hazard and the mixture does not exhibit that characteristic, or

- if the mixture consists of certain specified hazardous wastes and wastewater, the discharge of which is subject to regulation under the Clean Water Act, if the concentrations of specified hazardous wastes are within certain limits.

3. Characteristics of Hazardous Wastes

There are four RCRA parameters to evaluate hazardous wastes. These parameters are ignitability, corrosivity, reactivity, and Extraction Procedure (EP) toxicity. A short description of each characteristic is outlined below.

a. Ignitable Waste D001 (40 CFR 261.21)

- Liquid with a flash point < 140°F (60°C) (cyclohexanone);
- Non-liquid that can cause fires through friction, absorption of moisture, spontaneous chemical changes, or retained heat from manufacturing (magnesium powder, charcoal dust);
- Ignitable compressed gas per 49 CFR 173.300 (hydrogen gas in cylinders);
- An oxidizer per 49 CFR 173.151 (permanganates, perchlorates).

b. Corrosive Waste D002 (40 CFR 261.22)

- $2.0 \geq pH \geq 12.5$;
- Corrodes steel greater than 0.250 inches per year at 130°F (55°C).

c. Reactive Waste D003 (40 CFR 261.23)

- Explosives - Unstable;
- Pyrophorics - Violent chemical reaction without detonating;
- Water-reactives - sodium;
- Forms explosive mixtures - Calcium carbide;
- Generates toxic gases, vapors, fumes with water - Phosphides;
- Cyanide or sulfide-bearing waste, generates gases, vapors, fumes when exposed to mild acidic and basic conditions;

- Capable of detonation or explosive reaction, but needs initiating source - nitromethane, trinotrobenzene, picric acid or must be heated under confinement before initiation can take place (charcoal chlorate mixtures, 1-chloro, 2,5 dinitrobenzene) or reacts explosively with water (aluminum alkyls, zinc alkyls);

- Capable of detonation, explosive decomposition or reaction at normal temperatures and pressures (organic peroxides);

- Forbidden explosive per 49 CFR 173.51 (liquid nitroglycerin, perchloric acid exceeding 72%);

- Class A explosive per 49 CFR 173.53 (trinitrotoluene);

- Class B explosive per 49 CFR 173.58 (propellants, nitrocarbonitrates).

d. E.P. Toxic Waste D004-D017 (40 CFR 261.24)

- Fails leach test for eight metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver) and several herbicides and pesticides.

4. Lists of Hazardous Wastes

The bases for Listing Hazardous Wastes are due to the following reasons (40 CFR 261.11):

a. Waste exhibits a hazardous waste characteristic (40 CFR 261.21-261.24).

b. Waste is fatal to humans in low doses or found dangerous in animal studies.

c. Waste contains Appendix VIII toxic constituents (40 CFR 261).

Lists used to determine EPA hazardous waste numbers:

a. Non-specific sources (F00X series 40 CFR 261.31);

b. Specific sources (K00X series 40 CFR 261.32);

c. Discarded commercial chemical products, off-specification species, and spill residues thereof (P00X and U00X series 40 CFR 261.33).

Certain wastes are excluded from RCRA hazardous waste rules. Those coded in 40 CFR 261.4 are:

a. domestic sewage;

b. industrial waste discharges regulated under the Clean Water Act (applies only to the actual point source discharges);

c. nuclear wastes regulated under the Atomic Energy Act of 1954;

d. irrigation return flows;

e. materials subjected to in-situ mining technique;

f. mining extraction, beneficiation, and processing wastes;

g. pulping liquors;

h. spent sulfuric acid used to produce virgin sulfuric acid;

i. coal combustion wastes (flyash, bottom ash, slag, and flue gas emission control wastes);

j. oil, gas, and geothermal drilling muds and brines;

k. soil fertilizers that come from the growing and harvesting of agricultural crops and the raising of animals;

l. cement kiln dust; and

m. samples.

5. Standards for Generators (40 CFR 262)

a. Hazardous waste determination;

b. EPA identification number;

c. Manifest compliance (3 years retention of records).

In addition to DOT hazardous materials shipping paper requirements, the following must be complied with:

° Manifest;

° Document number, generator's name, address, telephone number, and EPA ID number;

° Transporter's name and EPA ID number;

° TSDF's name, address, and EPA ID number (same information for an alternate facility);

° The words ".....and the EPA" added at the end of the required DOT hazardous materials certifications statement;

° Preparation of <u>exception report</u> by the generator, if the generator does not receive a signed manifest from the TSDF within 35 days.

d. Pre-transport requirements (40 CFR 262, Subpart C):

- Packaging (49 CFR 173, 178, 179);
- Labeling (49 CFR 172);
- Marking (49 CFR 172);
- A generator must mark each container of 110 gallons or less with the "hazardous waste" label;
- Placarding (49 CFR 172).

e. Accumulation time (90 days without permit).

f. Recordkeeping and reporting (annual, biennial reports, exception reporting, test results, waste analyses).

6. Standards for Transporters (40 CFR 263)

a. EPA identification number;

b. Transfer facility requirements;

c. Manifest compliance;

d. Recordkeeping (3 years retention of records);

e. Hazardous waste discharges (notification per 49 CFR 171.15 to the NRC and a written report to DOT per 49 CFR 171.16);

f. Spill cleanup.

7. Interim Status Standards for Hazardous Waste Treatment, Storage, & Disposal Facilities (TSDF) Include (40 CFR 265)

a. EPA ID #;
b. Waste analysis requirements;
c. Identification of hazardous waste;
d. Pre-transport requirements;
e. Manifest system;
f. Permit requirements;
g. Security;
h. Inspections;
i. Training;
j. Preparedness & Prevention;
k. Contingency Plans & Emergency Response Procedures;
l. Recordkeeping and reporting;
m. Groundwater monitoring;
n. Closure and post-closure care;
o. Financial requirements;
p. Use and management of containers;
q. Tanks;
r. Surface impoundments;
s. Waste piles;
t. Land treatment;
u. Landfills;
v. Incinerators;
w. Thermal treatment;
x. Underground injection;
y. Chemical, physical, and biological treatment.

8. Recent Amendments

On November 8, 1984, Congress enacted new amendments to RCRA. Some of the subjects included in the preamble are:

a. Land disposal amendments

- Forbidding non-containerized liquid hazardous waste and hazardous waste containing free liquids (May 8, 1985) and non-hazardous liquids in landfills (November 8, 1985);

- Minimum technological requirements for permitted and interim status facilities;

- The placement of bulk liquids in salt domes, salt beds, underground mines is prohibited;

- Ban on use of materials mixed with hazardous waste for dust suppression.

b. Small quantity generators

- Manifest requirements for small quantity generators (100 - 1,000 kg per month).

c. Permits and interim status

- Permit life (10 years and review in 5 years);
- Expansion of interim status for newly regulated units;
- Loss of interim status (failure to submit Part B Permit).

d. Burning and blending of hazardous waste

- Ban on hazardous waste in certain cement kilns (in a city > 500,000 population);

- Labeling of hazardous waste fuels.

e. Exposure information and health assessments

- Beginning August 8, 1985, Part B permit application for surface impoundment and landfills must include exposure information and health assessment.

f. State authorization

- Extension of interim authorization for state programs;
- Applicability of new requirements in authorized states.

g. Waste minimization

- Generator must sign a certification in the Uniform Hazardous Waste Manifest form (September 1, 1985);
- Biennial reports must indicate waste reduction efforts.

h. Financial responsibility

i. Underground storage tanks

- Installation of new underground storage tank (May 7, 1985).

Additional new amendments must be discussed.

IV. TRANSPORTATION REGULATIONS - MODULE C

Module C Outline

COURSE OBJECTIVES: To familiarize trainees with Department of Transportation regulations applying to hazardous waste transportation.

COURSE LENGTH: 3 hours (20 minute break)

COURSE CONTENT:

A. Code of Federal Regulations, Title 49 requirements:

1. Parts
2. Definitions
3. Training requirements

B. Department of Transportation Hazard Classes

C. Transportation Requirements

1. Shipping papers
2. Hazardous materials table
3. Packaging
4. Labeling
5. Markings
6. Placarding

D. Spills and accidents during transportation

1. Reporting requirements

E. Audiotape presentation:

Title: Transporting Hazardous Wastes, by DuPont Co.
Length: 15 minutes

F. Quiz: DOT Regulations

INSTRUCTED BY: Qualified RCRA trainer.

POTENTIAL PARTICIPANTS:
Environmental Protection Officers
Hazardous Waste Technicians
Hazardous Waste Supervisors
RCRA Related Personnel

COURSE/MATERIALS NEEDED:
Overhead projector
Transparencies
Audioviewer

MODULE C

Module C introduces transportation regulations pertinent to hazardous waste management. The U.S. Congress enacted the Hazardous Materials Transportation Act (P.L. 93-633) becoming effective on January 1975.

- The enforcement of transportation rules and procedures provides safe transportation of hazardous materials in commerce and protects the public from risks related to transportation of materials;

- The Department of Transportation (DOT) implements the act;

- DOT identifies materials in the quantity, form, group, or class that may pose an unreasonable risk to the public in transportation.

A. CODE OF FEDERAL REGULATIONS

The DOT regulations for handling and transportation of hazardous materials, and consequently for hazardous wastes are published in CFR, under Title 49, Part 171-178. DOT regulations provide rules for:

- Personnel Training;

- Inspection;

- Use of equipment and facilities involved in the handling and transportation of materials;

- Safety aspects of transportation, including packaging, handling, labeling, marking, placarding, and routing as well as the manufacture and maintenance of packaging.

1. Parts

Selected regulations below are found in CFR, Title 49, in the following parts:

a. Hazardous Materials (HM) Regulations: General 171

b. HM Tables and HM Communications Regulations (shipping papers, marking, labeling, placarding) 172

c. Shippers: General Requirements for Shipment and Packaging 173

d. Carriage by Public Highway 177

e. Shipping Container Specifications 178

2. DOT Definitions (49 CFR 171.8)

Certain terms and definitions will be studied here to provide background in understanding the DOT regulations.

a. Carrier/Transporter: A person or firm actually moving hazardous material;

b. Designated Facility: The Treatment, Storage and Disposal Facility designated on the manifest by the generator;

c. Hazardous Materials: A material designated by DOT as being capable of posing an unreasonable risk to health, safety and property when transported;

d. Multiple Hazards: A material meeting the definition of more than one hazard class;

e. Forbidden: Material is prohibited from being offered or accepted for transportation;

f. Reportable Quantity (RQ): The quantity of hazardous substance specified in the Hazardous Materials Table;

g. Hazardous Substance: A material which is identified by a letter "E" in column 1 of the hazardous materials table, and whose quantity in one package, or one transport vehicle if unpackaged, equals or exceeds the RQ specified by EPA in 40 CFR Parts 116 and 117 (CERCLA term);

h. Hazardous Waste: Any material subject to the EPA manifest requirements in 40 CFR 262;

i. n.o.s.: Abbreviation for not otherwise specified (applies to materials not specifically listed in the hazardous materials table);

j. Hazardous Chemical: OSHA term;

k. Flash point: The minimum temperature at which the flammable vapors of a substance (in contact with spark) will ignite;

l. Overpack: An enclosure not intended for reuse that is used to consolidate two or more containers for handling convenience;

m. Shipping Paper: A shipping order, bill of lading, manifest or other shipping document which contains the information specified by 49 CFR Part 172 Subpart C;

n. Shipper/Generator: The person or firm preparing the hazardous material for shipment.

3. Training Requirement

Under 49 CFR 173.1(b) training is stated as a requirement to be complied with under the law. This section says: "It is the duty of each person who offers hazardous materials for transportation to instruct each of his officers, agents, and employees having any responsibility for preparing hazardous materials for shipment as to applicable regulations in this subchapter."

B. IDENTIFICATION OF HAZARDOUS MATERIALS

1. DOT Hazard Classes

Definitions for the DOT hazard classes are as follows (49 CFR 173):

a. Class A Explosive: An explosive possessing detonating or otherwise maximum hazard. The nine types of Class A explosives are defined in Section 173.53.

b. Class B Explosive: An explosive possessing flammability hazard - In general, functions by rapid burning rather than detonation. Includes some explosive devices such as special fireworks, flash powders, etc. [Section 173.88].

c. Class C Explosive: An explosive of minimum hazard - Certain types of fireworks and certain types of manufactured articles containing restricted quantities of Class A and/or Class B explosives as components [Sec. 173.100].

d. Blasting Agent: A material designed for blasting which has been tested in accordance with Sec. 173.114a(b). It must be so insensitive that there is very little probability of: (1) accidental explosion or (2) going from burning to detonation.

e. Combustible Liquid: Any liquid having a flash point at or above 100°F and below 200°F. Authorized flash point methods are listed in Sec. 173.115(d). Exceptions are found in Sec. 173.115(b).

f. Corrosive Material: Any liquid or solid that causes visible destruction or irreversible damage to human skin tissue. Also, it may be a liquid that has a severe corrosion rate on steel [see Sec. 173.240(a) and (b) for details].

g. Flammable Liquid: Any liquid having a flash point below 100°F. Authorized flash point methods are listed in Sec. 173.115(d). For exceptions, see Section 173.115(a).

h. Flammable Gas: Any compressed gas meeting criteria as specified in Sec, 174.200(b). This includes: lower flammability limit, flammability limit range, flame projection, or flame propagation.

i. Flammable Solid: Any solid material (other than an explosive) which is liable to cause fires through friction or retained heat from manufacturing or processing. It can be ignited readily and burns so vigorously and persistently, as to create a serious transportation hazard. Included in this class are spontaneously combustible and water-reactive materials [Sec. 173.150].

j. Organic Peroxide: An organic compound containing the bivalent -O-O- structure. It may be considered a derivative of hydrogen peroxide where one more of the hydrogen atoms have been replaced by organic radicals. It must be classed as an organic peroxide unless it meets certain criteria listed in Sec. 173.15(a).

k. Oxidizer: A substance such as chlorate, permanganate, inorganic peroxide or a nitrate, that yields oxygen readily. It accelerates the combustion of organic matter [Sec. 173.151].

l. Poison A: Extremely Dangerous Poisons - Poisonous gases or liquids -- a very small amount of the gas, or vapor of the liquid, mixed with air is dangerous to life [Sec. 173.326].

m. Poison B: Less Dangerous Poisons - Substances, liquids or solids (including pastes and semi-solids), other than Class A or irritating materials - so toxic or presumed to be toxic to man that they are a hazard to health during transportation [Sec. 173.381].

n. Irritating Material: A liquid or solid substance which, upon contact with fire or air, gives off dangerous or intensely irritating fumes. They do not include any poisonous material, Class A [Sec 173.381].

o. Etiological Agent: A living micro-organism (or its toxin) which causes (or may cause) human disease [Sec. 173.386].

p. Radioactive Material: Any material, or combination of materials, that spontaneously gives off ionizing radiation. It has a specific activity greater than 0.002 microcuries per gram [Sec. 173.389 (a) through (1) for details].

q. ORM (Other Regulated Material): (1) Any material that may pose an unreasonable risk to health and safety or property when transported in commerce; and (2) does not meet any of the definitions of the other hazard classes specified in this subpart; or (3) has been reclassed an ORM (specifically or permissively) according to this subchapter [Sec. 173.500(a) (1)].

r. ORM-A: A material which has an anesthetic irritating, noxious, toxic, or other similar property. If the material leaks during transportation passengers and crew would have extreme annoyance and discomfort [Sec. 173.500(b)(1)].

s. ORM-B: A material (including a solid when wet with water) the leakage of which could cause significant damage to the vehicle transporting it. Materials meeting one or both of the following criteria are ORM-B materials: (1) specifically designated by name in Sec. 172.101 and/or (2) a liquid substance that has a corrosion rate exceeding 0.250 inch per year on non-clad aluminum. An acceptable test is described in NACE Standard TM-01-69 [Sec. 173.500 (b)(2)].

t. ORM-C: A material which has other inherent characteristics not described as an ORM-A or ORM-B. It is unsuitable for shipment, unless properly identified and prepared for transportation. Each ORM-C material is specifically named in Sec. 172.101 [Sec. 173,500 (b)(3)].

u. ORM-D: A material such as a consumer commodity which presents a limited hazard during transportation due to its form, quantity and packaging. They must be materials for which exceptions are provided in Sec. 172.101. A shipping description applicable to ORM-D material if found in Sec. 172.101 [Sec. 173.500(b) (4)].

v. ORM-E: A material that is not included in any other hazard class, but is subject to the requirements of this subchapter.

Materials in this class include (1) Hazardous Waste and (2) Hazardous Substance, as defined in Sec. 171.8 [Sec. 173.500 (b)(5)].

The following definitions are included to explain some of the additional hazards:

Compressed Gas: Any material or mixture having in-the-container a pressure exceeding 40 psia at 70°F., or a pressure exceeding 104 psia at 130°F., or any liquid flammable material having a vapor pressure exceeding 40 psia at 100°F. [Sec. 173.300(a)].

Non-liquified compressed gas: A gas (other than gas in solution) which, under the charged pressure, is entirely gaseous at a temperature of 70°F.

Liquified compressed gas: A gas which, under the charged pressure, is partially liquid at a temperature of 70°F.

Compressed gas in solution: A compressed gas which is dissolved in a solvent.

Nonflammable gas: Any compressed gas other than a flammable compressed gas.

Spontaneously Combustible Material (Solid): A solid substance (including sludges and pastes) which may undergo spontaneous heating or self-burning under normal transportation conditions. These materials may increase in temperature and ignite when exposed to air [Sec 171.8].

Water Reactive Material (Solid): Any solid substance (including sludges and pastes) which react with water by igniting or giving off dangerous quantities of flammable or toxic gases [Sec. 171.8].

C. TRANSPORTATION REQUIREMENTS

DOT implements transportation requirements for safe transportation of hazardous materials in commerce and for the protection of the public. Shipment requirements for hazardous wastes are the following:

- Shipping Papers;
- Packaging;
- Labeling Requirements;
- Markings on Packages;
- Placarding.

1. Shipping Papers

Shipping paper is a shipping order, bill of lading, or a manifest (Appendix A) containing DOT required information. It must identify:

a. Proper Shipping Name;
b. Hazard Class;
c. Identification Number;
d. Quantity of Material (weight/volume).

These four items are called basic descriptions (49 CFR 172.202). The Hazardous Materials Table 172.101 provides us with the necessary information for three of these items. The first pages of Table 172.101 are included as Appendix B. The complete and up-to-date version of Table 172.101 must be distributed to trainees during training.

Example: Gasoline, Flammable Liquid, UN 1203, 3000 lbs.
Corrosive Liquid, N.O.S., UN 1760, 25 lbs.

Other requirements for the shipping paper include:

a. Specific requirements are necessary for radioactive materials and poisons;

b. Exemptions must show a "DOT-E" notation followed by the exemption number assigned;

c. "Limited Quantity" must follow basic description if materials are so defined;

d. The letters "RQ" must be entered for hazardous substances before or after the basic description;

e. "Dangerous When Wet" will be entered on the shipping paper if described package is so labeled;

f. If a hazardous material being shipped meets the definition of a hazard class other than a poison, but also contains a poison, and the poisonous constituent is not included in the proper shipping name, additional description must include: (1) the word "poison" and (2) the technical name of the constituent that makes it poisonous;

g. The person who offers a hazardous material for transportation shall certify that the material offered for transportation is in accordance with the governing regulations by printing (either manually or mechanically) the following statement on the shipping paper:

"This is to certify that the above-named (or herein-named) materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation." (49 CFR 172.204).
Wording changes on certificates of hazardous wastes.

h. A manifest is used for hazardous waste shipments. Federal manifest requirements per EPA are:

- Manifest document number;
- Generator's name, address, telephone number, and EPA identification number;
- Transporter's name and EPA identification number;
- Designated disposal facility's name, address, and EPA identification number;
- Description of waste per 49 CFR, Parts 172.101, 202, and 203;
- Quantity of waste (unit of weight or volume; type and number of containers);
- Certification statement per 49 CFR 172.204, plus the words "....and the EPA";
- Manifest is signed by generator, transporter, and TSDF Facility;
- A copy of the shipping paper is retained for three years by generator, transporter, and TSDF Facility;
- State manifest requirements may also apply, and these may vary from state to state.

2. Hazardous Materials Table

Hazardous Materials Table 49 CFR 172.101 columns will be explained here. Module F will be studied for detailed use of this table to classify hazardous wastes.

a. Column 2 - proper shipping name

There are rules to choose proper names to use on the shipping document. Proper shipping names have to come from column 2 of this table.

- The word "waste" must precede the proper shipping name when hazardous waste is shipped.

b. Column 1 - hazard code

This column provides hazard codes. Symbols A, W, E, and (+) are used as codes in this column.

- No entry means <u>all</u> modes;
- "A" means material is regulated only by air;
- "W" means material is regulated only by water;
- "E" means material is regulated by the EPA as a hazardous substance and is subject to additional regulations regardless of the mode of transportation or hazard code;
- "+" means the material always uses the shipping name in column 2.

c. Column 3 - Hazard Class and Identification Number

Column 3 is actually two columns:

- The first column contains either the Hazard Class of the material or the word "Forbidden."

- The second column, 3A, contains the Identification Number assigned to that material. "UN" (United Nations) and "NA" (North American) symbols are used with appropriate number identifying particular material.

d. Column 4 - Required Label

Column 4 will specify the label required for the package, based on the proper shipping name.

e. Column 5 - Packaging

Two columns on packaging provide us with a) exceptions and b) specific requirements. Each reference should be checked carefully in 49 CFR sections.

f. Column 6 - Quantity Limitations

Column 6 consists of two columns and specifies the maximum net quantity allowed in one package. The first column is for transportation by passenger-carrying aircraft or passenger rail car. The second column is for transportation by cargo-only aircraft. If package exceeds the quantity allowed on a cargo-only aircraft, it is forbidden for transportation by air.

g. Column 7 - Water Shipments

Column 7 specifies each of the authorized locations on board cargo vessels and passenger vessels for hazardous materials.

3. Packaging

Columns 5A, exceptions, and 5B, specific requirements, of the Hazardous Materials table are used to identify special packaging requirements. There are three types of packaging requirements. These are: (a) general requirements; (b) hazardous class requirements; and (c) material specific requirements.

a. General Requirements

These are the requirements that apply to all hazardous material shipments. Standard requirements for all packages are contained in Part 173.24.

- Strong tight containment;
- Limited contents;
- No significant release of contents;
- No mixture of materials (gases or vapors that may reduce the effectiveness of the packaging).

b. Hazard Class Requirements

Each hazard class also has some general packaging requirements that apply to all the materials meeting the definition of the hazard class. These additional packaging requirements can generally be found in the subpart applying to the hazard class, in the sections immediately following the definition section. For example, packaging for corrosive materials (not specifically provided for) are listed in Part 173.245 following the definition section 173.240(a).

c. Material Specific Requirements

These are the requirements specified under column 5B of the hazardous materials table (unless it meets the packaging exception of Column 5A).

Specification packaging (49 CFR 178) and performance packaging (for specific types and quantities of materials) are some of the common packages.

Lab packs are special packaging of small containers of hazardous materials packed in large 55-gallon drums. Packaging of hazardous wastes will be studied in detail in Module E.

4. Labeling

Packages containing hazardous materials must be labeled to caution people handling it. The labels are highly colored, adhesive backed, diamond shaped warning devices. They measure 4" on a side (see Figure IV-1). In some cases, labels may not be the same as the hazard class.

a. Multiple Labels: As a general rule, a package containing a hazardous material that meets the definition of more than one hazard must be labeled with the appropriate label for each hazard class. Multiple labeling requirements for specific hazards are contained in 172.402(a) (1) through (9).

b. Dangerous When Wet: A water reactive material transported by any mode that requires a "Dangerous When Wet" label must be so labeled. [172.402(a)(4) and (c)]

c. Hazardous Waste Label: The EPA hazardous waste label must be used for hazardous waste in addition to DOT hazard labels (Figure IV-2) for all packages of 110 gallons or less.

d. Placement of Labels (172.406)

- Labels must be printed on the package or affixed to the package <u>near</u> the marked proper shipping name;

- Multiple labels must be placed <u>next to each other</u>;

- Labels must be placed on two sides or two ends of the package.

5. Markings (49 CFR 172.301, 306)

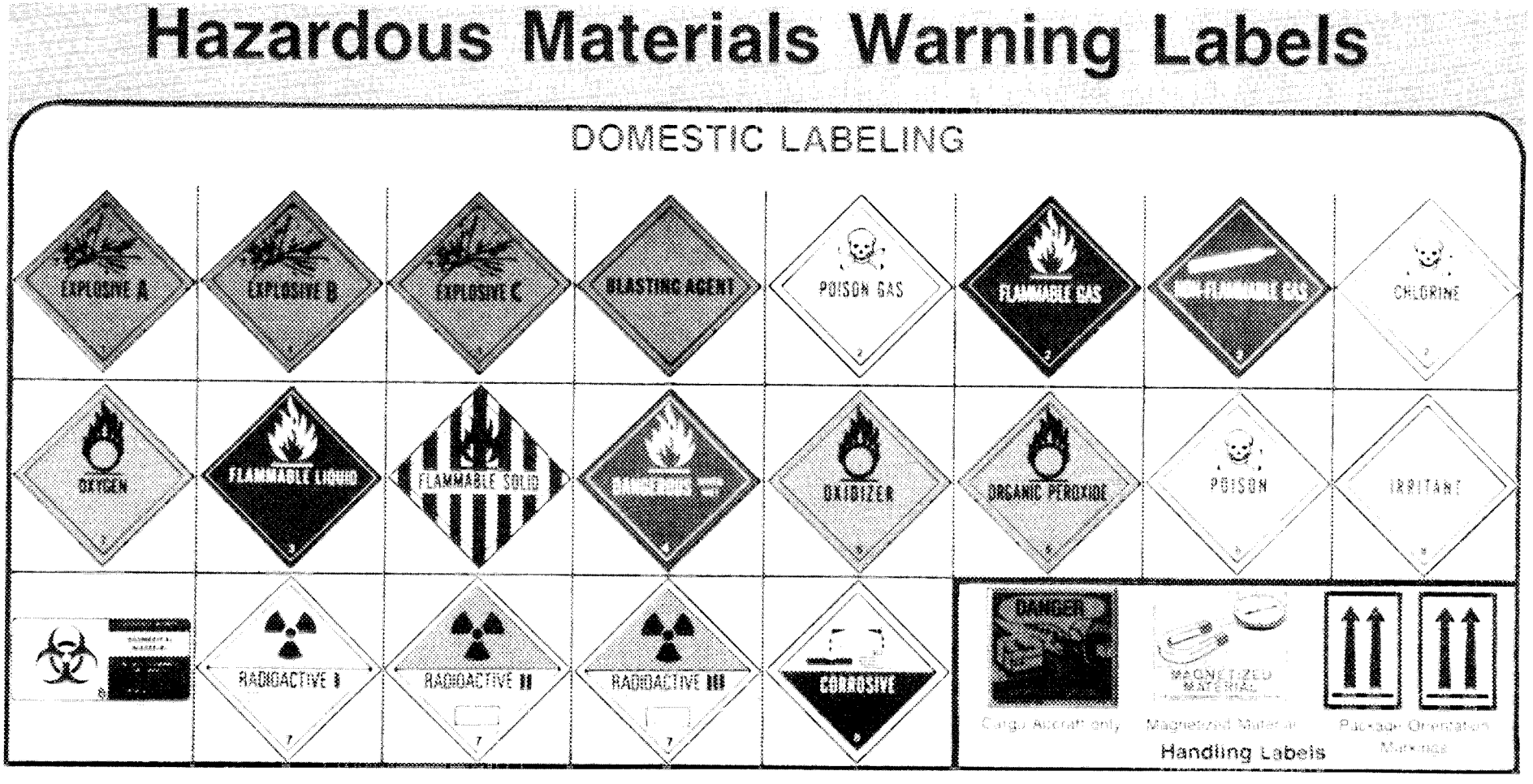


Fig. IV-1. Hazardous materials warning labels

HAZARDOUS WASTE

FEDERAL LAW PROHIBITS IMPROPER DISPOSAL

IF FOUND, CONTACT THE NEAREST POLICE, OR
PUBLIC SAFETY AUTHORITY, OR THE
U.S. ENVIRONMENTAL PROTECTION AGENCY

PROPER D.O.T.
SHIPPING NAME_____ UN OR NA#_____

GENERATOR INFORMATION:

NAME U.S. DOE-OAK RIDGE NATIONAL LABORATORY

ADDRESS P.O. BOX X

CITY OAK RIDGE STATE TN ZIP 37830

EPA ID NO. TN1890090003

EPA WASTE NO._____

ACCUMULATION START DATE_____

MANIFEST DOCUMENT NO._____

HANDLE WITH CARE!

CONTAINS HAZARDOUS OR TOXIC WASTES

STYLE WM-8-P

© LABELMASTER, CHICAGO, IL 60646

Fig. IV-2. Hazardous waste label

Packages containing hazardous materials must be marked in order to instruct freight handlers of the special care which should be exercised when moving these shipments.

a. The marking must be:

- Durable;
- In English;
- Affixed to the surface of the package or on a label, tag, or sign.
- Displayed on a background of a sharply contrasting color;
- Unobscured by labels or attachments;
- Located away from any other marking (such as advertising).

b. Each package of 110 gallons capacity or less must be marked with:

- Proper shipping name;
- Identification number;
- Consignee's name and address and the consignor's name and address;
- Liquid hazardous materials (173.312) must have "This Side Up" or "This End Up" orientation markings (Figure IV-3). Orientation arrows should accompany these markings.

6. Placarding (49 CFR 172.504)

Placards are brightly colored warning devices, diamond shaped, and measuring 10 inches on a side. There are about 20 different placards from which to select (see Figure IV-4). The placard is selected based on the hazards present and the quantity of each hazard and is placed on the transport vehicle (motor and rail).

There are <u>two</u> tables in 49 CFR 172.504 to determine proper placard usage (Table IV-1). After determining the hazard class of the material that is shipped, these tables are consulted to find the listing for the hazard class.

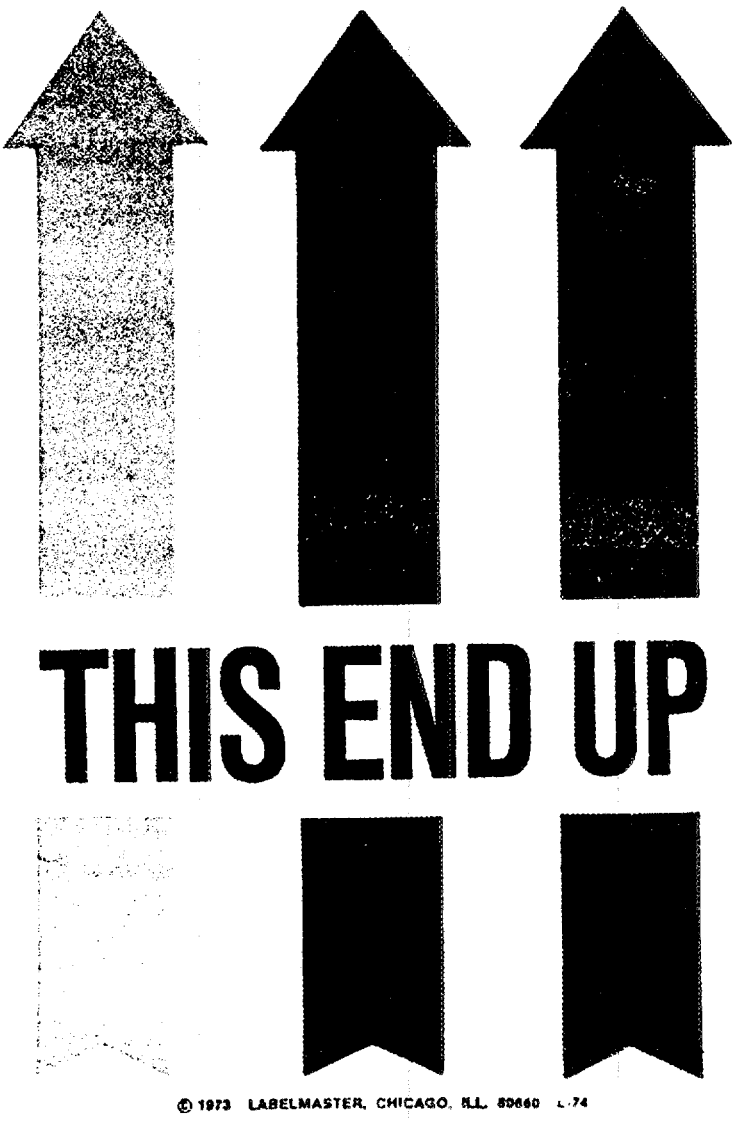
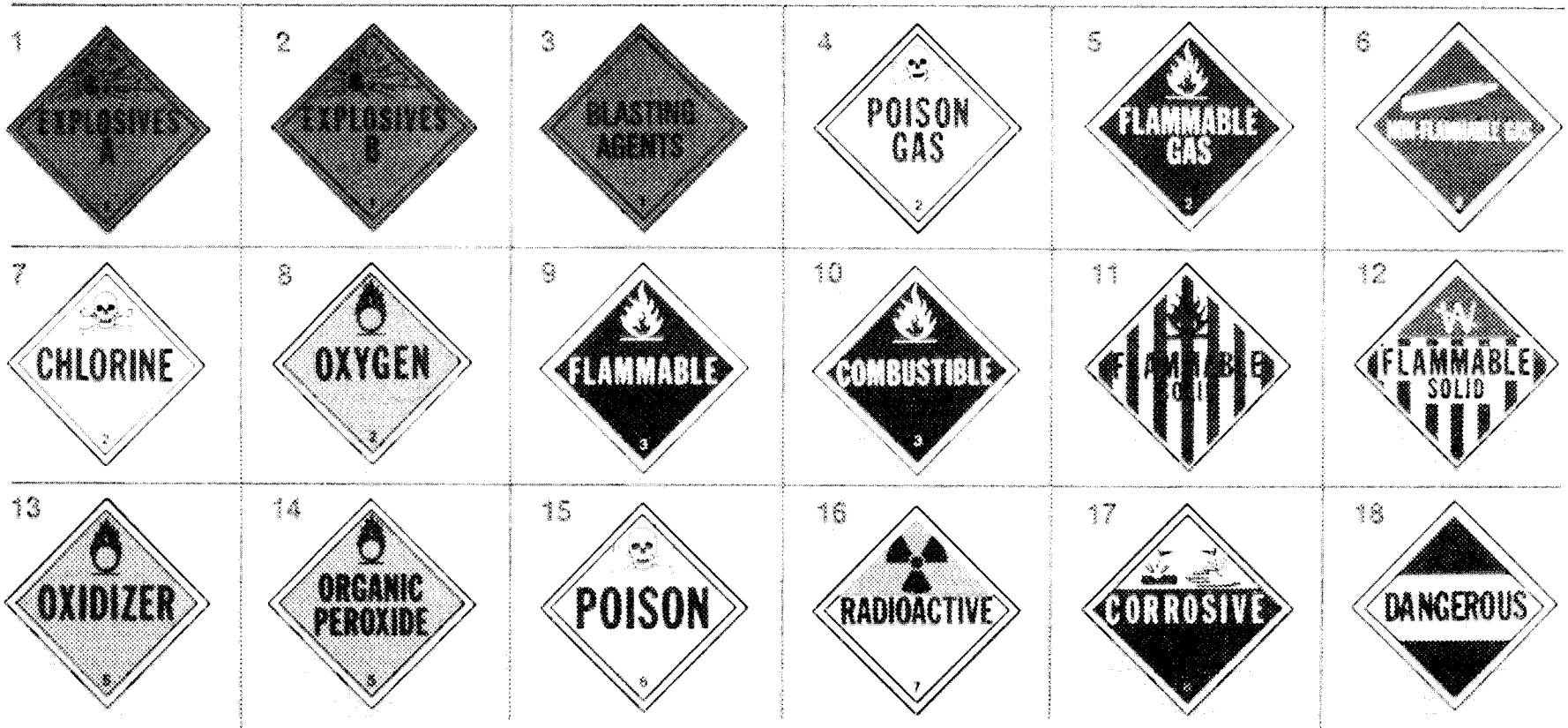


Fig. IV-3. DOT orientation marking

DOT Hazardous Materials Warning Placards



★ Numbers in each square (illustration numbers) refer to TABLES 1 and 2.

Fig. IV-4. DOT hazardous materials warning placards

a. Each motor vehicle containing any quantity of the hazardous materials listed in Table 1 of Part 172.504 (see Table IV-1) must be placarded as required in that table.

b. Each motor vehicle containing 1000 pounds aggregate gross weight or more of the hazardous materials in Table 2 of Part 172.504 must be placarded as required in that table.

c. The motor vehicle, freight container, or rail car must be placarded on <u>each end and each side</u> with the type of placards specified in the tables.

d. A freight container, motor vehicle, or rail car containing two or more classes of materials (multiple hazards) requiring different placards in Table 2 of 49 CFR 172.504 may be placarded "Dangerous" in place of the separate placarding specified. However, whenever 5000 pounds or more of one class of material is loaded at one loading facility, the placard specified for that class in Table 2 <u>must</u> be applied.

e. There are exemptions to the placarding requirements. You are not required to placard any shipments of:

- Etiologic Agents;
- ORM-A, B, C, D, or E;
- Limited quantities of hazardous materials, as long as they are properly identified on the shipping papers.

f. Placarding on any motor vehicle, freight container, etc., is prohibited when that vehicle does not contain a hazardous material that is represented by the placard per 172.502.

Table IV-1. DOT tables for placard usage

TABLE 1

If the motor vehicle, rail car, or freight container contains a material classed (described) as—	The motor vehicle, rail car, or freight container must be placarded on each side and each end—
Class A explosives	EXPLOSIVES A.[1]
Class B explosives	EXPLOSIVES B.[2]
Poison A	POISON GAS.[3]
Flammable solid (DANGEROUS WHEN WET label only)	FLAMMABLE SOLID W.[3]
Radioactive material	RADIOACTIVE.[4, 5]
Radioactive material:	
Uranium hexafluoride, fissile (containing more than 0.7 pct U^{235})	RADIOACTIVE[4] AND CORROSIVE.[6]
Uranium hexafluoride, low specific activity (containing 0.7 pct or less U^{235})	RADIOACTIVE[4, 5] AND CORROSIVE.[6]

[1]See § 172.510(a).
[2]EXPLOSIVES B placard not required if the freight container, motor vehicle, or rail car contains class A explosives and is placarded EXPLOSIVES A as required.
[3]FLAMMABLE SOLID "W" placard is required only when the DANGEROUS WHEN WET label is specified in § 172.101 for a material classed as a Flammable solid.
[4]Applies only to any quantity of packages bearing the RADIOACTIVE YELLOW III label. (See § 172.403.)
[5]See §§ 173.389(c) and 173.389(o), for full-load shipments of radioactive materials meeting the definition of low specific activity when transported pursuant to § 173.392(b).
[6]CORROSIVE placard not required for shipments of less than 1000 pounds gross weight.

TABLE 2

If the motor vehicle, rail car or freight container contains a material classed (described) as—	The motor vehicle, rail car, or freight container must be placarded on each side and each end—
Class C explosives	DANGEROUS.[1, 9]
Blasting agents	BLASTING AGENTS.[9, 10]
Nonflammable gas	NONFLAMMABLE GAS.[8]
Nonflammable gas (Chlorine)	CHLORINE.[7]
Nonflammable gas (Fluorine)	POISON.
Nonflammable gas (Oxygen, pressurized liquid)	OXYGEN.[2]
Flammable gas	FLAMMABLE GAS.[8]
Combustible liquid	COMBUSTIBLE.[3, 4]
Flammable liquid	FLAMMABLE.
Flammable solid	FLAMMABLE SOLID.[5]
Oxidizer	OXIDIZER.[9, 10]
Organic peroxide	ORGANIC PEROXIDE.
Poison B	POISON.
Corrosive material	CORROSIVE.[6]
Irritating material	DANGEROUS.
* * * * * * *	

[1]Applies only to a class C explosive required to be labeled with an EXPLOSIVE C label.
[2]OXYGEN placards may be used to identify liquefied pressurized oxygen contained in a manner so it does not meet the definition in sec. 173.300 of this subchapter.
[3]COMBUSTIBLE placard required only when a material classed as a combustible liquid is transported in a packaging having a rated capacity of more than 110 gallons, a cargo tank, or a tank car.
[4]A FLAMMABLE placard may be used on a cargo tank and a portable tank during transportation by highway and water.
[5]Except when offered for transportation by water, a FLAMMABLE placard may be displayed in place of a FLAMMABLE SOLID placard except when a DANGEROUS WHEN WET label is specified for the material in sec. 172.101. (See table 1. this section.)
[6]See § 173.245(b) of this subchapter for authorized exemptions.
[7]CHLORINE placard required only for a packaging having a rated capacity of more than 110 gallons; the NON-FLAMMABLE GAS placard for packagings having a rated capacity of 110 gallons or less.
[8]A NON-FLAMMABLE GAS placard is not required on a motor vehicle displaying a FLAMMABLE GAS placard.
[9]BLASTING AGENTS, OXIDIZER and DANGEROUS placards need not be displayed if a freight container, motor vehicle, or rail car also contains Class A or Class B explosives and is placarded EXPLOSIVES A or EXPLOSIVES B as required.
[10]Except for shipments by water, OXIDIZER placards need not be displayed if a freight container, motor vehicle or rail car also contains blasting agents and is placarded BLASTING AGENT as required.

g. Affixing Placards

- Each person offering a hazardous material for transportation by highway shall provide to the carrier the required placards. Each person offering a hazardous material for transportation by rail shall affix the required placards to the rail car containing the material. No carrier may transport a hazardous material unless the required placards are affixed.

- Freight containers having a capacity of 640 cubic feet or more must be placarded with four placards in accordance with 172.504. There is the 1000 pound exception for placarding of materials listed in Table 2 of 172.04, but this applies only to freight containers that are being transported solely by highway.

- Freight containers with capacity of less than 640 cubic feet (that do not contain any radioactive material, which requires a Yellow III label) may be placarded with one of the required placards or be labeled on both sides or both ends with the required labels, as appropriate.

h. Visibility

- Placards affixed to a motor vehicle must be four in number, one on each side, and one on the front and back of the vehicle.

- Placards must be readily visible from the direction that the motor vehicle is heading. Placards may be placed on either the front of the trailer or the front of the tractor.

D. SPILLS AND ACCIDENTS DURING TRANSPORTATION

1. Incident Reporting requirements (171.15)

a. Carriers are required to report immediately any incident that occurs during the course of transportation (including loading, temporary storage, or unloading), in which, as a direct result of hazardous materials (including hazardous wastes):

- A person is killed;
- A person receives injuries requiring hospitalization;
- Estimated carrier or property damage exceeds $50,000;
- Fire, breakage, spillage, or contamination occurs involving radioactive materials or etiologic agents;
- A situation results (though not covered above) that, in the opinion of the carrier, produces a danger to life at the incident scene;

b. Reports shall be made by telephone to the DOT, National Response Center at (800) 424-8802 <u>or</u> for incidents involving etiologic agents, to the Center for Disease Control at (404) 633-5313.

c. The following information shall be given:

- Name of reporter;
- Name and address of carrier represented by reporter;
- Phone number where reporter can be reached;

- Date, time, and location of incident;
- Extent of injuries, if any;
- Hazard class, name, and quantity of materials involved;
- Type of incident, nature of hazardous material involvement, and whether life-threatening danger exists at the scene.

d. Follow-Up Reports (171.16) - Each carrier making a telephone report must provide a follow-up report of an incident in writing within 25 days after the incident, using DOT Form F.

If the incident has involved a hazardous waste discharge, the report must also include the following information:

- A copy of the hazardous waste manifest;
- An estimated quantity of waste removed from the scene;
- Name and address of the facility to which the waste was taken;
- The manner of disposition of any unremoved waste.

e. When a reportable quantity of material has been released, discharge of hazardous substances reports shall be made by the carrier to: U.S. Coast Guard, National Response Center, (800) 424-8802 or (202) 426-2675. The following additional information will be provided:

- The name and address of the shipper;
- The quantity of the hazardous substance.

REFERENCES:

Radioactive Materials Transportation Workshop Attendee Workbook, prepared by U.S. DOE.

V. HAZARDOUS WASTE MANAGEMENT AT ORNL - MODULE D

Module D Outline

COURSE OBJECTIVES: To provide the trainee with an overall understanding of integrated hazardous waste management activities at ORNL.

COURSE LENGTH: 3 hours (20 minute break)

COURSE CONTENT:

A. Orientation/Contacts

1. Maps
2. Building Locations
3. Hazardous waste and emergency contacts
4. Environmental Protection Officers

B. Selected Bibliography

C. Hazardous Waste Management Responsibilities at ORNL

D. Hazardous Waste Disposal Steps

E. Hazardous Waste Description at ORNL

1. Hazardous waste streams
2. Possible DOT classes at ORNL
3. Special disposal problems
4. Landfills

F. Procedures

G. On-the-Job Training Areas

H. Videotape Presentation:

Title: The Hazardous Materials Control Program at ORNL, by ORNL.
Length: 17 minutes

I. Quiz: Hazardous Waste Management at ORNL

INSTRUCTED BY: Person who is familiar with hazardous waste management operations at ORNL.

POTENTIAL PARTICIPANTS: RCRA related personnel and hands-on hazardous waste personnel.

COURSE/MATERIALS NEEDED:
Overhead projector
Transparencies
Videotape
Videotape Recorder
Quiz

Module D

A centralized hazardous waste management program was established at ORNL following the enactment of RCRA regulations by the EPA in November 1980. ORNL, being an already existing facility, was classified as an "interim status" facility under RCRA regulations. Hence, ORNL obtained an EPA identification number and complied with interim status requirements described under RCRA regulations.

Hazardous Waste Management responsibilities at ORNL are shared between the DEM of the E&OS Division and the Waste Operating Group (WOG) of the Operations Division. In addition, the "Nuclear and Chemical Waste Programs" have overall program responsibilities. DEM is active in providing compliance requirements, establishing procedures for handling, storage, and disposal of hazardous wastes, as well as recordkeeping, reporting, and personnel training. Hazardous waste operational activities such as collection, transportation, identification/classification, packaging, and labeling of wastes are carried out by the WOG.

A. ORIENTATION/CONTACTS

1. Maps

Personnel working in hazardous waste management must be familiar with the plant buildings and regions. Employees will be provided with a map (ORN-DWG 77-76602 R) which can be obtained from the ORNL Public Relations Office, 4500N, K254 (Phone 4-4166).

2. Building Locations

The following selected buildings at ORNL are used in hazardous waste operations. Building numbers and their locations must be very familiar to hazardous waste personnel.

Building Location	Name of Building
7507	Hazardous Waste Storage Building
7507-W	Mixed Waste Storage Pad (Vials)
7075	Oil/Photographic Solution Storage Facility
7065	Oil Storage Tank
Sandia Site	Gas Cylinders, Wrecker, Miscellaneous
BG-6	Asbestos Trenches
1000-W	Contractor's Landfill

	New Facilities
7652	Hazardous Waste Storage Facility
7653	Chemical Waste Storage Facility
7654	Long Term Hazardous Waste Storage Facility

There is a directory at ORNL entitled ORNL Building Directory which lists building numbers, descriptions, type of construction, floor area, responsible division, and field engineer for all ORNL buildings. Maps of areas are also included. This will be provided to the trainees.

3. Hazardous Waste Management Personnel

The following individuals are listed to provide contact for the new trainees:

Names	Phone
P. S. Rohwer, ORNL Environmental Coordinator	4-6670
ORNL Hazardous Materials Contact Number	4-6674
L. C. Lasher, OD	6-5223
K. G. Edgemon, OD	4-1779
C. Y. Horton, OD	4-7467
B. D. Barkenbus, DEM	4-6665
W. A. Alexander, DEM	6-5106
H. M. Hubbard, DEM	6-6829

D. M. Walls	6-7929
J. Billingsley, Labor Crew	4-4229
B. Williams, Labor Crew	4-4228
L. Reeves, Riggers	4-4218
J. Bolinksy, Burial Ground	4-7044
LSS Office	4-6606
Building 7507	6-5642

The following emergency contacts are listed to provide emergency preparedness.

Emergency Calls	911
ORNL Medical Director	4-7431
ORNL Guard Shift Captain	4-6646
ORNL Fire Shift Captain	4-5678
ORNL Safety Director	4-6679
ORNL Industrial Hygiene	4-6165
Prime Police Dept. - ORNL Security Personnel	911
Supporting Police Dept. - Oak Ridge Police Dept.	3-911
Prime Fire Dept. - ORNL Fire Dept.	911
Supporting Fire Dept. - Oak Ridge Fire Dept.	3-911
Emergency Response Team	4-6606
Supporting Team - Oak Ridge Fire Dept.	3-911
Hospital - ORNL Medical Department	911
Oak Ridge Hospital	3-482-2441 or 3-482-8188

To become familiar with ORNL emergency alarms, call 4-4462.

4. Environmental Protection Officers

A list of Environmental Protection Officers and their phone numbers are listed below:

January 1987

ENVIRONMENTAL PROTECTION OFFICERS

Division	Name	Bldg/MS	Telephone
Analytical Chemistry	J. H. Stewart	4500S 125	4-4895
Biology	J. A. Otten	9207	4-1198 or 4-0126
Chemical Technology	C. E. Lamb	4500N 229	4-6883
	H. A. Friedman	4500N 268	4-7461
Chemistry	G. D. O'Kelley	5505 375	4-5008
Computing & Telecommun.	L. S. Finch	4500N 239	4-5312
Employee Relations	F. K. Edwards	3550 292	4-6169
Energy	F. C. Kornegay	2001 049	4-5776
Engineering	W. L. Ahls	1000 336	4-9863
Engineering Physics	K. M. Wallace	6010 354	4-4592
Engineering Technology	Sharon Mashburn	9201-3	6-7114
Env. & Occ. Safety	H. M. Hubbard	4500S 102	6-6829
Environmental Sciences	R. K. McConathy	1505 035	4-7307
Finance and Materials	G. E. Proffitt	7018 347	4-5520
Fuel Recycle Division	D. E. Dunning	7601 305	4-7140
Fusion Energy	E. R. Wells	9201-2	4-0130
Health	F. K. Edwards	3550 292	4-6169
Health and Safety Res.	R. B. Gammage	4500S 109	4-6256
	M. Uziel	4500S 101	6-3986
Information	L. M. Schier	4500N 286	4-6732
I & C	E. M. Robinson	3500 005	4-6681
Laboratory Protection	H. D. Rose	2500 307	4-6277
Metals & Ceramics	J. L. Johnson	4508 078	4-4363
Operations	H. R. Gaddis (X-10)	3001 029	6-0224
	J. G. Tracy (Y-12)	9204-3	4-0425
Physics	G. D. Mills	6000 368	4-1498
Plant and Equipment	L. E. Stokes	2518 327	4-4303
Solid State	S. P. Withrow	3003 048	6-6719
QA & Inspection	J. E. Batey	2024 053	4-7233

B. SELECTED BIBLIOGRAPHY

Various books have been used in hazardous waste management activities. Some of the literature is cited to provide background information.

- Emergency Response Guidebook, Guidebook for Hazardous Materials Incidents (DOT P 5800.2).

- A Guide to the Safe Handling of Hazarous Materials Accidents, STP 825, Philadelphia, PA.

- Dangerous Properties of Industrial Materials, N. I. Sax, 6th. Ed., Van Nostrand Reinhold Co., 1984.

- The Merck Index, 10th Ed., Merck and Co., Inc., Rahway, New Jersey, 1983.

- Handbook of Reactive Chemical Hazards, L. Bretherick, 2nd Ed., Butterworth Publishers, Inc., 1979.

- Fire Protection Guide on Hazardous Materials, NFPA, 7th Ed., Quincy, MA, 1978.

- Hazardous Chemical Data Sheets - Published by the U.S. Coast Guard, available through the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

- The Condensed Chemical Dictionary - Published by Van Nostrand Reinhold Company, 135 West 50th Street, New York, New York, 10020.

- Matheson Gas Data Book - Available from the Matheson Company.

- Thorpe's Dictionary of Applied Chemistry - Published by John H. Wiley and Sons, Inc.

- NIOSH/OSHA Guide to Chemical Hazards, U.S. Department of Health & Human Services, CDC, National Institute for Occupational Safety and Health, 1978, Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

- Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academy Press, Washington, D.C., 1981.

- Prudent Practices for Disposal of Chemicals from Laboratories, National Academy Press, Washington, D.C., 1981.

- Code of Federal Regulations, Title 40, Parts 190-399, Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

- Code of Federal Regulations, Title 49, Parts 100-177, Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

C. HAZARDOUS WASTE MANAGEMENT RESPONSIBILITIES AT ORNL

Present hazardous waste management responsibilities can be outlined as follows:

1. Environmental and Occupational Safety Division

   a. Department of Environmental Management
      - has regulatory oversight of all hazardous waste activities to ensure compliance with hazardous waste regulations and procedures;

      - prepares required state and federal forms and documents;

      - conducts audit-type inspections for hazardous waste activities to ensure regulatory compliance;

      - implements contingency plan;

      - provides proper disposal procedures for hazardous waste activities;

      - reviews waste related procedures;

- evaluates chemical spill incidents;
- interfaces with WOG of the OD;
- coordinates RCRA training;
- provides guidelines during chemical spills to the environment;
- audits hazardous waste program.

2. Operations Division

a. Waste Operating Group

- supervises P&E Labor Crew in collection and transportation of hazardous wastes;
- segregates wastes in accordance with EPA and DOT regulations;
- selects proper containers;
- maintains hazardous waste records via a computer tracking system;
- labels, marks, and packages waste in compliance with federal and state regulations;
- provides "Request for Disposal of Hazardous Materials", form UCN-13698 to ORNL personnel;
- coordinates shipment of hazardous wastes to off-site EPA approved disposal facilities;
- develops criteria for new hazardous waste treatment and storage facilities;

- reviews disposal forms for classification of hazardous wastes;
- identifies and classifies wastes according to EPA and DOT regulations;
- operates and maintains storage areas according to proper procedures;
- responds to chemical spills.

b. Chemical Operators

- provide assistance to the WOG during chemical spills.

3. Plant and Equipment Division

a. Labor Crew

- provides services to the OD for the collection of hazardous wastes from generators;
- transports, loads, and unloads hazardous wastes during regular pick-ups;
- provides equipment and services during emergencies.

b. Riggers

- load and unload hazardous waste drums when they are palletized and during off-site shipments.

4. Environmental Protection Officers (EPOs)

- serve as contact for questions about environmental concerns with their division waste generators;

- keep up to date on ORNL Environmental Protection Manual procedures.

- assist their division personnel in hazardous materials procurement.

- ensure all storage areas are maintained properly and all hazardous materials are contained, labeled, and segregated properly.

- assist division personnel for disposal of waste chemicals,

- notify DEM for assistance in determining the nature and extent of a spill.

- ensure all containers of hazardous wastes are identified and labeled properly before requesting disposal.

- ORNL Environmental Protection Manual Procedure 7.0 describes the duties of Environmental Protection Officers in detail.

5. Other ORNL Divisions

- abide by the procedures contained in the ORNL Environmental Protection Manual;

- are familiar with the disposal practices and procedures;

- are aware of the types of wastes within their divisions;

- provide awareness of health and safety implications of working with and disposing of hazardous materials.

D. HAZARDOUS WASTE DISPOSAL STEPS

An overview of waste handling/disposal procedure includes the following steps:

- Notification for waste disposal (form UCN-13698, Request for Disposal of Hazardous Waste Material);
- Notification for radiation check-up;
- Form review;
- Sampling;
- Analysis;
- Form UCN-13698 processing;
- Waste identification on site;
- Waste pick-up;
- On-site transport;
- Packaging/labeling;
- Storage/treatment/on-site disposal;
- Recordkeeping;
- Off-site transport/disposal.

1. Notification for Waste Disposal

Notification for waste disposal is described in detail in Procedure 8.0 of the Environmental Protection Manual. In short, the procedure first requires obtaining Form UCN-13698 (see Figure V-1) from the WOG. This form (in triplicate) is filled out by the generator as complete as possible. Each line must be used only for the same chemical in the same type of container. The generator keeps the

No.

REQUEST FOR DISPOSAL OF HAZARDOUS WASTE MATERIAL

Date			Page 1 of
Waste Generator		Bldg.	Room No.
Plant	Employee No.	Phone No.	Charge/Work Order No.
Location of Material		Room or Area	

ITEM NO.	DESCRIPTION OF MATERIAL *	QUANTITY	RADIOACTIVE/ NONRADIOACTIVE	HAZARD INFORMATION	EPA WASTE NO./ CONTAINER NO. **
1	Benzene	1 Gallon	Nonradioactive	Suspected Carcinogen	
2	Mixture of Organic Solvents	Acetone 1 Gallon Methanol 1 Gallon Xylene 1 Gallon	Nonradioactive	Flammable	

* IF THE WASTE IS A CHEMICAL MIXTURE OR AN ITEM SUCH AS CONTAMINATED CLOTHING, LIST EACH CHEMICAL AND APPROXIMATE AMOUNTS OF EACH. ALL FORMS NOT PROPERLY FILLED OUT WILL BE RETURNED!

TO BE COMPLETED BY THE DEPARTMENT OF ENVIRONMENTAL MANAGEMENT.

STORAGE LOCATION		TOTAL WEIGHT/VOLUME
DATE TO STORAGE	RECYCLE/DISPOSAL DATE	RECYCLE/DISPOSAL SITE

WHITE - DEM
CANARY - CONTAINER
BLUE - WASTE GENERATOR

** INFORMATION TO BE COMPLETED BY DEM

UCN-13898
(3 8-92)

Fig. V-1. Request for disposal of hazardous waste materials form

blue copy and attaches the yellow copy to the waste. The last column: EPA Waste No./Container No. and the section at the lower portion of the form is for the use of waste management personnel. The white copy of Form UCN-13698 is forwarded to WOG by the generator (the Environmental Protection Officer of the division may assist the generator).

2. Notification for Radiation Check-Up

Before the waste can be picked up, it must be checked by the radiation and safety surveyor for possible radioactive contamination. The green tag, brown tag, or yellow tag (see Appendix C) is issued by the surveyor. (Health Physics procedure 2.5 explains this in detail).

3. Form Review

WOG personnel receive Form UCN-13698 from the generator and review it for completeness and accuracy. When there are questions in identification or location, the WOG staff contacts the generator to clarify the situation. If there are extremely hazardous chemicals on the list that are aged, unstable, shock sensitive, or potentially explosive, WOG is notified immediately for their removal.

4. Sampling

Sampling is done by the sampling technicians. Waste products still in labeled containers, as they were received from the manufacturer, are not normally sampled. Unknown wastes, potential incompatibles, all PCB-liquid wastes, and oil streams (unless decided otherwise) are sampled and analyzed according to test methods outlined in the waste analysis plan prior to being picked up from the generator.

5. Analysis

The ORNL Analytical Chemistry Division analyzes RCRA samples. Test methods followed are from Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA Office of Solid Waste and Emergency Response, SW-846, July 1982. Other EPA approved methods may also be used.

6. Form UCN-13698 Processing

Each chemical on the disposal form is classified for its RCRA hazardous waste characteristics (EPA Waste No.) and DOT hazard class (hazard information). WOG hazardous waste staff process Form UCN-13698 (Figure V-1). Besides the manufacturer's label, the Material Safety Data Sheets, CFR, Titles 40 and 49 tables, and various reference books (see Module H) are utilized in obtaining information to classify wastes.

7. Waste Identification On-Site

When wastes on Form UCN-13698 are identified and classified by the WOG personnel, their technicians and/or supervisor makes site visits to waste storage locations to evaluate the condition and packaging of waste. Waste is repackaged if necessary before transportation. Incompatible wastes are segregated. Waste is grouped for its on-site transport to storage, treatment, and/or on-site disposal. Each waste bottle or group of waste bottles must have a health physics surveyor's tag attached (Appendix C).

8. Waste Pick-Up

Identified and prepackaged wastes are picked-up by the P&E labor crew personnel under the supervision of the WOG personnel from the generators. Appropriate personnel protection measures must be taken during these operations. Minimum requirements include gloves, safety goggles, protective clothing, and when necessary, a respirator.

9. On-Site Transport

Waste is picked up from the generators and transported by truck by the P&E labor crew. The truck is a stake bed truck with a hydraulic lift gate and tie-down points to secure loaded material. The truck carries equipment such as a fire extinguisher, flat and drum dollies, and tie-down equipment. It is placarded to indicate the hazard of the waste it transports. The truck driver and the laborers are trained in hazardous chemical safety. The WOG personnel, in another vehicle, follow the truck during transport. This vehicle carries emergency response equipment. In case of an accident and/or a spill, WOG personnel respond to it. Chemical wastes are transported to the storage building, 7507. The labor crew with the help of the hydraulic lift gate and dollies unload the materials. They store them in accordance with WOG instructions. Mixed wastes, which contain RCRA-defined hazardous wastes and are contaminated with radioactivity, are taken to the 7507-W pad.

10. Packaging/Labeling

Upon arrival at the hazardous waste storage building, waste in small containers are kept in separate groups according to their hazard class. Wastes are packaged in proper drums as soon as possible. In general, wastes are packaged as lab packs or bulks. Packaged drums are marked and labeled in accordance with the regulations. The assigned ORNL container number is inserted on disposal Form UCN-13598, in the last column, under the "Container No." heading. The disposal form is then submitted for entry into the computerized hazardous waste tracking system.

11. Storage/Treatment

Wastes at ORNL usually follow three general routes.

- Following proper packaging, marking, and labeling, wastes are generally stored until their shipment to an EPA approved commercial, off-site disposal facility.

- Some wastes are treated on-site. Mercury purification, silver recovery from the photographic waste solutions, and neutralization of some acids are included in this category.

- Certain chemicals that cannot be shipped to off-site disposal facilities are disposed of by on-site disposal methods or stored for later disposal. These are: water reactives, explosives, shock resistant or peroxide forming chemicals, gas cylinders, radioactive-mixed wastes, and asbestos.

12. Recordkeeping

The information on disposal Form UCN-13698 is computerized. The Hazardous Materials Tracking System (HMTS) is an on-line information system managed by the WOG to maintain inventory records of hazardous waste. The system is processed on the DEC System-10 computer at ORNL with System 1022 as the system screen processor. The container number, a description of the waste, the date placed in storage, and other pertinent information are entered into a computer file for later use. Before the shipments of waste for off-site facilities, a computer printed manifest inventory list is generated which identifies the contents of each drum/container. This list is attached to the manifest which accompanies the transporter to the TSD facility. All manifest records are maintained in fireproof file cabinets as well as being stored in computer files under the supervision of the WOG of the OD.

13. Off-Site Disposal

When a sufficient quantity of drums accumulates to warrant a shipment, a purchase order and later a manifest is prepared by the WOG for the shipment of wastes. The DEM oversees these shipments.

E. HAZARDOUS WASTE DESCRIPTION AT ORNL

1. Hazardous Waste Streams

The ORNL is involved in many challenging and diverse research programs. In the course of these programs, various quantities of radioactive and nonradioactive wastes are generated. The procedures of concern in this manual are RCRA-defined wastes and radioactive-mixed wastes. Figure V-2, Hazardous Waste Flowchart, is included to provide an overview of the types of wastes, their sources, and disposal methods used at ORNL. Hazardous wastes at ORNL can be broadly segregated into bulk chemicals and laboratory chemicals in small quantity bottles. Each category of waste should be reviewed to give a clear understanding to the trainees.

2. Possible DOT Classes at ORNL

Transportation of hazardous wastes must abide by DOT rules; hence the proper shipping name and description of waste is in accordance with the Hazardous Materials Table. The DOT classes below are some of the common ones used at ORNL. These are also separated as liquids and solids.

- Flammables;
- Combustibles;
- Oxidizers;
- Corrosives;
  - Acids
  - Bases
- Poisons;
- Hazardous Substance;
- ORM-E.

3. Special disposal problems:

Certain waste streams at ORNL need special attention. These are discussed in detail in Module F. Some of the wastes with special handling and disposal problems are:

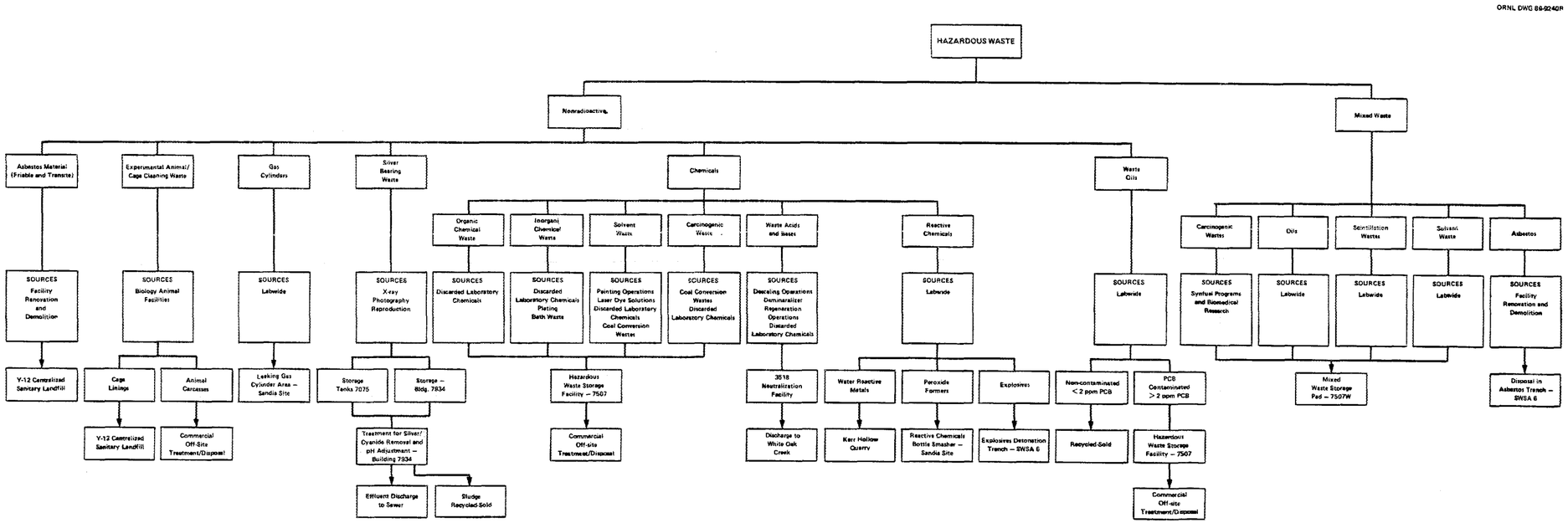


Fig. V-2. Hazardous waste flowchart

- Asbestos;
- PCBs;
- Explosives/Reactives;
- Radioactive-mixed waste;
- Mercury;
- Photographic waste;
- Acids;
- Lead;
- Gas cylinder.

4. Landfills

Two landfills, Y-12 Landfill and Contractors' Landfill (at ORNL), are used for nonradioactive and nonhazardous wastes. Module F specifies wastes that are acceptable at these sites.

F. PROCEDURES

Two ORNL manuals, ORNL Environmental Protection Manual and Hazardous Materials - Management and Control Manual, provide ORNL employees with hazardous material and waste procedures. Trainees should be provided with copies of these manuals from the ORNL Laboratory Records Department. Tables V-1 and V-2 are Tables of Contents from these manuals.

G. ON-THE-JOB TRAINING AREAS

- Site visits to ORNL hazardous waste related buildings;
- Site visits to ORNL facilities at Y-12;
- Walk-through of hazardous waste pick up and transportation route with the P&E labor crew.

02/15/87

Table V-I. Environmental Protection Manual - Table of Contents

PROCEDURE		LATEST ISSUE
1.0	ASBESTOS	07/15/85
2.0	OILS (NON-PCB)	08/01/81
3.0	MERCURY	08/01/81
4.0	POLYCHLORINATED BIPHENYLS	01/15/87
5.0	COOLING TOWER SLUDGE	08/01/81
6.0	SUBSTANTIAL RISK NOTIFICATION UNDER THE TOXIC SUBSTANCES CONTROL ACT	10/15/85
7.0	ENVIRONMENTAL PROTECTION OFFICERS	09/01/84
8.0	DISPOSAL PROCEDURES FOR HAZARDOUS WASTE MATERIALS	10/01/84
9.0	AIR EMISSION PERMIT	08/01/81
10.0	ENVIRONMENTAL ASSESSMENTS	07/15/81
11.0	INSPECTION AND TESTING PROCEDURE FOR DIKES	04/30/82
12.0	PRUDENT PRACTICES FOR STORAGE OF NONRADIOACTIVE HAZARDOUS CHEMICALS IN LABORATORIES	07/16/84
13.0	DIKING CRITERIA	TO BE ISSUED LATER
14.0	CONTRACTOR'S LANDFILL	04/12/82
15.0	TANK LABELING CRITERIA	06/15/83
16.0	CENTRALIZED SANITARY LANDFILL	10/15/83
17.0	SOLID WASTE DISPOSAL	02/15/87
18.0	LIQUID WASTE DISPOSAL	05/15/85
19.0	MANIFEST FOR TRANSPORT OF HAZARDOUS WASTE	06/01/84
20.0	REVIEW PROCESS FOR THE ENVIRONMENTAL PROTECTION MANUAL'S PROCEDURES	06/20/85
21.0	CONTROL OF EXPLOSIVES	TO BE ISSUED LATER
22.0	ENVIRONMENTAL REVIEW AND DOCUMENTATION PROGRAM	12/16/85
23.0	ENVIRONMENTAL ALARA AND CHECKLIST	TO BE ISSUED LATER

Table V-2. Hazardous Materials Management and Control Manual - Table of Contents

Foreword		v
Executive Summary		xi
Part I	Introduction - Policy and General Information	I-1
Part II	Procurement of Hazardous Materials	II-1
Part III	Transportation of Hazardous Materials	III-1
Part IV	Storage of Hazardous Materials	IV-1
Part V	Use of Hazardous Materials	V-1
Part VI	Disposal of Hazardous Materials	VI-1
Appendix	Report 7017, Hazardous Materials Controlled by ORNL	A-1

VI. CHEMICAL HAZARDS AND SAFETY - MODULE E

Module E Outline

COURSE OBJECTIVES: To provide a short introduction to chemistry and familiarize trainees with the properties of chemicals.

COURSE LENGTH: Two 3-hour sessions (20 minute breaks)

COURSE CONTENT:

A. Overview of Chemistry

B. Character of Chemicals

C. Chemical Hazards and Safety Measures
   1. Flammability
   2. Corrosivity
   3. Reactivity
   4. Toxicity

D. Radiation Hazards and Safety Measures
   1. Characteristics
   2. Safety Measures

E. Gases
   1. Characteristics
   2. Safety in Working with Compressed Gas Cylinders

F. Videotape Presentations:

   Title: Chemsafe: Introduction to Chemical Safety, by BNA, Inc.
   Length: 15 minutes

   Title: Chemsafe: Solvents, by BNA Inc.
   Length: 10 minutes

   Title: Chemsafe: Corrosives, by BNA Inc.
   Length: 12 minutes

   Title: Chemsafe: Oxidizers, by BNA Inc.
   Length: 12 minutes

   Title: Chemsafe: Poisons, by BNA Inc.
   Length: 12 minutes

   Title: Radiation, Protection, and Safety at ORNL, by ORNL
   Length: 15 minutes

   Title: Gas Cylinders, by ITS corp.
   Length: 10 minutes

G. Quiz: Chemical Hazards

VI. CHEMICAL HAZARDS AND SAFETY - MODULE E (Continued)

INSTRUCTED BY: Person knowledgeable in chemistry and the properties and hazards of chemicals.

POTENTIAL PARTICIPANTS:
- Hazardous Waste Technicians
- Hazardous Waste Supervisors
- RCRA Related Personnel

COURSE/MATERIALS NEEDED:
- Overhead Projector
- Transparencies
- Videotape Recorder
- Videotape
- Quiz

MODULE E

This module will provide an overview of chemical terms and various hazards involved with hazardous materials. Considering the enormous numbers of chemicals and various capabilities of chemicals under a given set of conditions, this module will be a short course to stimulate awareness of hazardous materials that will be handled.

A. OVERVIEW OF CHEMISTRY

1. Definitions

a. Chemistry: Study of composition, structure, and properties of matter and the changes that it undergoes.

b. Matter: Anything that occupies space and has mass.

c. Element: Substances which cannot be reduced to simpler ones by ordinary chemical methods (heat, light or electricity). 106 elements are known at the present time.

d. Compound: Substances which are composed of two or more chemically combined elements and can be decomposed by chemical changes.

e. Physical Properties: The properties that involve a change in the state of matter, but do not produce a new substance. For example, evaporation of carbon disulfide. The boiling point, freezing point, vapor pressure, density, and evaporation are some of the physical constants.

f. Pressure: Force applied to an area. It is expressed in units of pounds per square inch (psi), atmosphere (atm), and absolute pressure.

1 atmosphere = 76 cm = 14.6 psi

P(absolute) = P(gauge) + 14.7 (in units of psi)

g. Temperature: Measurement of hotness or coldness measured on a definite scale.

Fahrenheit $t°(F) = \frac{9}{5} t° (C) + 32$

Centigrade $t°(C) = \frac{5}{9} [t°(F) - 32]$

h. Heat: Form of energy caused by the motion of small particles of which matter is composed. Heat occurs due to:

- Change in temperature;
- Physical change of the state of matter;
- Change in the chemical identity of a substance.

i. Exothermic process: A process resulting in the release of heat to the surroundings.

j. Endothermic process: A process resulting in the absorption of heat.

k. Vapor pressure: A pressure exerted by the vapor that is in equilibrium with the liquid at a given temperature. It is a characteristic property of liquids and varies with temperature. Liquids with a high vapor pressure are generally more hazardous.

l. Boiling point: The temperature of a liquid when its vapor pressure is equal to the atmospheric pressure. At this temperature boiling occurs.

m. Flash point: A minimum temperature of the liquid at which it gives off sufficient vapor to form an ignitable mixture with the air (an instantaneous flash) in the vapor space above the liquid.

n. Chemical properties: Changes that alter the composition of a substance and thereby its chemical identity. For example, iron rusts in air, carbon disulfide burns, and forms carbon dioxide and sulfur dioxide.

o. Chemical formula: An abbreviation of element or compound representing the composition of its molecules (see Figure VI-1, Periodic Table of the Elements).

p. Periodic table: The arrangement of the elements on the basis of their similarity in property and behavior (Figure VI-1).

q. Bonds: Force holding chemical compounds together.

r. Chemical reaction: A conversion of one chemical substance to another one.

reactants → products

- Synthesis Reactions;
- Decomposition Reactions;
- Displacement Reactions;
- Double-Replacement Reactions;
- Oxidation Reduction Reaction.

s. Reducing agent: The substance that gives up electrons. It contains atoms which are oxidized.

t. Oxidizing agent: The substance that gains the electrons, hence contains the atoms which are reduced.

u. Combustion: A process in which two or more substances chemically combine, usually accompanied by the evolution of heat and light. One of the substances is always oxygen. Combustion is equivalent to burning. (In oxidation, an atom losing an electron can be oxygen or another substance).

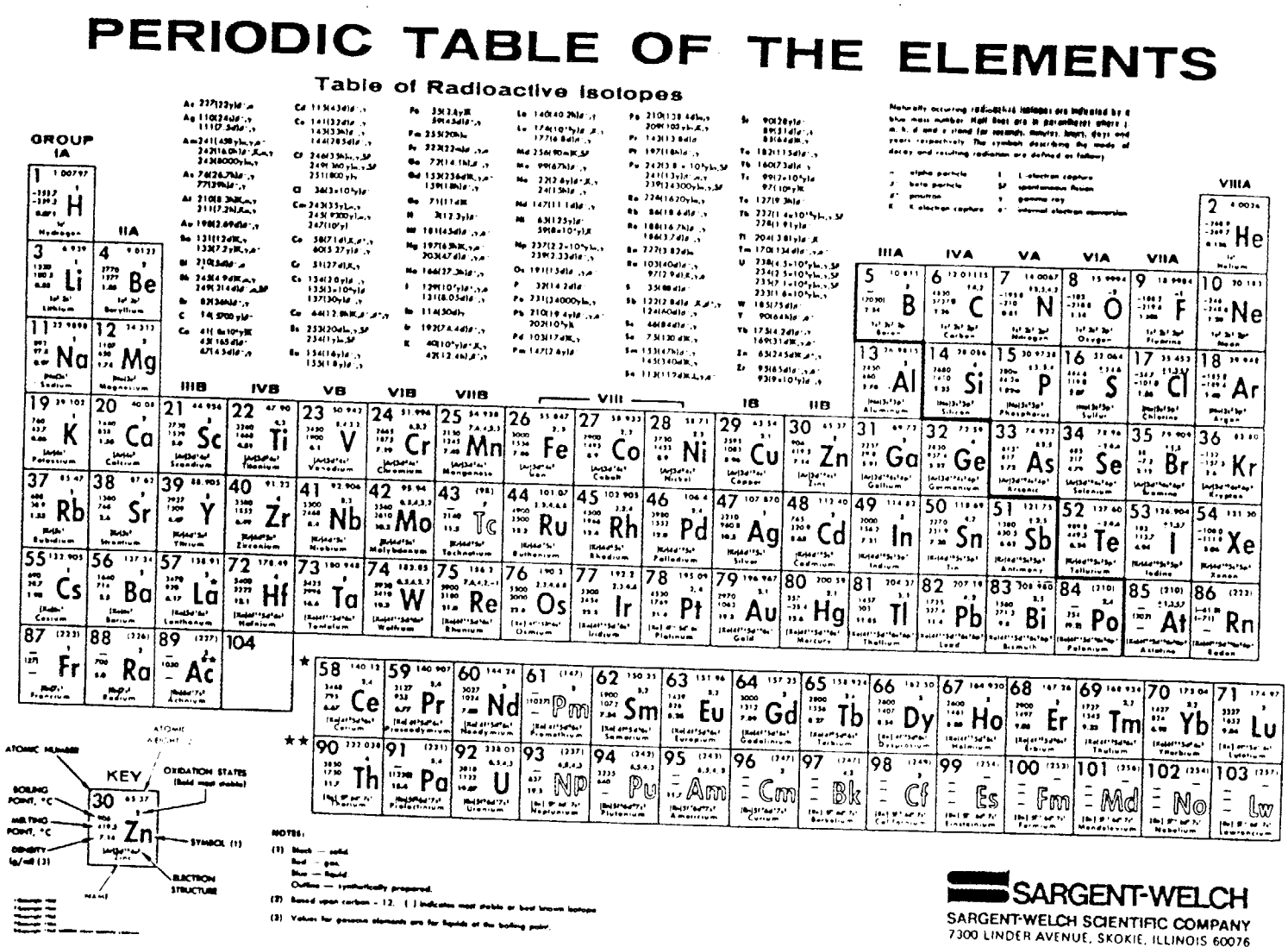


Fig. VI-1. Periodic table of the elements.

B. CHARACTER OF CHEMICALS

The following factors influence the rate of a chemical reaction:

- Nature of the material (a piece of phosphorus ignites spontaneously when exposed to air, but a strip of magnesium does not burn until exposed to an ignition source);
- Subdivision of the reactants (chunks of coal do not readily burn, but finely dispersed coal dust in the air can ignite spontaneously);
- State of aggregation (s, l, g);
- Concentration of reactants;
- Energy to initiate reaction;
- Temperature;
- Catalysis.

C. CHEMICAL HAZARDS AND SAFETY MEASUREMENTS

- Flammability;
- Corrosivity;
- Reactivity;
- Toxicity.

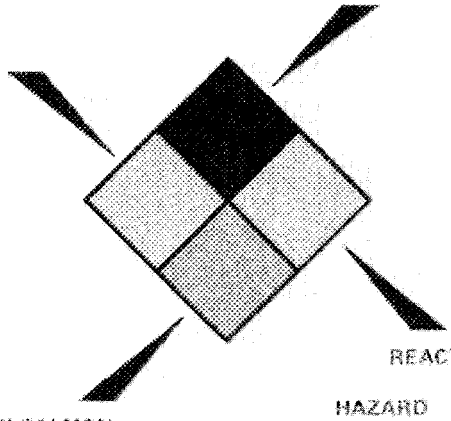
The National Fire Protection Association (NFPA) has a labeling system (704M System) which identifies hazards of health, flammability, chemical reactivity, and special hazards. Numbers 1 to 4 indicate increasing hazards (Figure VI-2). A radiation hazard, the letter "W" with a diagonal line drawn through its center to caution against the application of water, the letters OXY to indicate an oxidant, and other special hazards are indicated at the bottom quadrant.

HEALTH HAZARD DESIGNATED IN BLUE

HAZARD LEVEL	RELATIVE HEALTH HAZARD DESIGNATION (INCLUDES INHALATION, INJECTION, SKIN ABSORPTION, AND SKIN IRRITATION)
0	RELATIVELY HARMLESS
1	SLIGHTLY TOXIC
2	MODERATELY TOXIC
3	HIGHLY TOXIC
4	EXTREMELY TOXIC

FLAMMABILITY HAZARD DESIGNATED IN RED

HAZARD LEVEL	SUSCEPTIBILITY OF MATERIAL TO BURNING
0	MATERIAL WILL NOT BURN
1	PREHEATING REQUIRED BEFORE IGNITION, COMBUSTIBLE SOLIDS
2	MODERATE PREHEATING REQUIRED FOR IGNITION
3	LIQUIDS AND SOLIDS THAT IGNITE UNDER AMBIENT CONDITIONS
4	VERY FLAMMABLE GAS, READILY IGNITABLE



RATING

0 = NO HAZARD
1 = SLIGHT HAZARD
2 = HAZARD
3 = HIGH HAZARD
4 = EXTREME HAZARD

OTHER HAZARDS DESIGNATED IN SALMON

REACTIVITY HAZARD DESIGNATED IN YELLOW

HAZARD LEVEL	SUSCEPTIBILITY TO RELEASE OF ENERGY
0	MATERIAL IS NONREACTIVE
1	MATERIAL NORMALLY STABLE BUT UNSTABLE AT ELEVATED TEMPERATURE AND PRESSURE; MAY REACT WITH WATER
2	MATERIAL READILY UNDERGOES VIOLENT CHEMICAL CHANGE BUT NOT DETERIORATION; REACTS WITH WATER VIOLENTLY
3	MATERIAL CAPABLE OF DETONATION BUT REQUIRES STRONG INITIATING SOURCE; EXPLOSIVE REACTION WITH WATER
4	MATERIAL READILY CAPABLE OF DETONATION AT AMBIENT CONDITIONS

Fig. VI-2. Example and explanation of hazard rating scheme.

Chemical safety measures in general involve the following concerns:

- Recognizing chemical hazards involved at work;
- Fitting properly for personal protective gear;
- Using proper safety clothes, shoes, gloves;
- Knowing use of protective equipment correctly;
- Being trained in safety related courses such as CPR, fire response;
- Having labels on all chemical containers;
- Having safety signs posted in storage areas;
- Segregating chemicals according to their hazards during handling and storage;
- Having access to a telephone, two-way radio, or fire alarm to contact emergency personnel;
- Having access to safety equipment, safety shower, and eye wash fountains;
- Being familiar with the Material Safety Data Sheets on chemicals you use and being trained on interpreting information from them;
- Not eating, smoking, or drinking while working with chemicals;
- Knowing the response measures for emergencies;
- Being aware of signs of adverse effects; and
- Reinforcing safety sign compliance.

1. Flammability

a. Characteristics

Flammable materials are among the most common hazardous materials in the laboratories. Flammable materials, when mixed with air in the flammability range, catch fire and/or may cause explosions. Flammability depends on the ability of the substance to vaporize. Vapor phase explosions can result from flammable material in dust form (grain elevator dust) as well as by liquids that emit vapors (hexane, toluene, ether, acetone). The rate of evaporation increases with the increase in temperature. Since vapors are heavier than air, they settle downward and move hundreds of feet in distance. With any spark or flame in its path, vapors flash back to the liquid source. If the liquid is above fire point, it will catch fire.

Fires usually have three components:

- Fuel
  - Liquids (acetone, alcohol, ether, hexane, gasoline, kerosene);
  - Solids (plastics, fibers, wood/paper, dusts, pyrophoric metals);
  - Gases (acetylene, propane, carbon monoxide, hydrogen).

- Oxidizer
  - Gases (oxygen, fluorine, ozone, nitrous oxide);
  - Liquids (hydrogen peroxide, nitric acid, bromine, perchloric acid);
  - Solids (metallic peroxides and perchlorates, ammonium nitrate);

- Ignition Source (heat, static spark, energy hot plates, open flames, pilot lights, smoking materials, grinders, welding sparks from electrical tools)

Flash point is indicative of relative flammability. It is the lowest temperature at which a liquid releases enough vapor to start burning. Liquids are classified flammable and combustible by their flash point. The following classifications are used under DOT and EPA regulations:

Regulation	Flammable Liquid (Flash Point)	Combustible Liquid (Flash Point)
DOT	< 100°F (37.8°C)	100°F - 200°F
EPA (RCRA)	< 140°F (60°C)	> 140°F

At normal room temperature, flammable liquids are a much greater fire hazard than combustible liquids. Sprays of a flammable liquid can ignite below its flash point. Some of the common flammable liquids and gases are included as Appendix D.

Flash point is a function of the vapor pressure of the liquid and of the lower flammability limit. The fire point is obtained by continuing the flash point test until a temperature is reached at which a vapor-air mixture catches fire and burns for at least five seconds.

The autoignition temperature is a temperature at which a flammable substance will self-ignite and sustain combustion. The flammable limits or explosive limits is the range of the percentages of fuel vapor mixed with air that are capable of being ignited. They are measured at atmospheric pressure and room temperature. When a vapor and air mixture is below the range (below the lower flammability limit), it is too lean to burn. However, when vapor and air mixture is above the range (above the upper flammability limit), it is too rich to burn.

Class B fires are flammable or combustible liquid fires. Extinguishers labeled "B," "A-B," "B-C," or "A-B-C" can be used for class B fires. These may be:

- Foam extinguishers;
- Carbon dioxide extinguishers;
- Dry chemical extinguishers;
- Liquefied gas extinguishers (halogenated extinguishing systems).

Use of water is not recommended for flammable liquids having a flash point below 100°F.

b. Safety in Working with Flammables

When working with flammables, in addition to safety measures indicated at Section C, the following concerns should be remembered:

- Smoking and matches should not be permitted;
- Containers of flammable materials should be located in well-ventilated rooms;
- Fire walls should isolate large stills and pipelines;
- Welding and cutting should be done under careful supervision;
- Gas or oil fired heating units should be eliminated or isolated from areas where flammable solvents are used;
- Electrically powered heating and lighting units may also cause fire by generating sparks from static;

- Incompatible chemicals, such as oxidizers, should be separated from flammables;

- Personnel should be aware of the locations of fire extinguishers, fire blankets, and safety showers;

- Glass bottles containing flammables should be opened under the hood;

- Flammables should be placed in flammable liquid storage cabinets (NFPA-30) or in safety cans; and

- Personnel must be aware of emergency notification system as well as locations of emergency equipment;

2. Corrosivity

Corrosion is a chemical process which converts metals and minerals into unwanted products (e.g., rusting of iron) and attacks tissues. Their vapors can damage the respiratory tract and lungs severely. The common acids, bases, bromine, hydrogen peroxide are examples of corrosive materials.

The acidity or basicity is expressed by the concentration of the hydrogen ion. The expression "pH" is used as indicative of the degree of acidity/basicity. It ranges from 1 to 12. "1" is acidic, "12" is basic, and "7" is neutral.

a. Chemistry of Acids and Bases

Acids are compounds that yield hydrogen ions when dissolved in water.

- Inorganic (mineral) acids - Nonflammable;
- Organic acids - Can burn;

A diluted acid: A solution of a concentrated acid.

Strength of acids: Tendency of an acid to ionize and yield hydrated protons in solution. Strong acids ionize completely. Some of the examples for strong acids are hydrochloric, perchloric, sulfuric, nitric, phosphoric, and acetic acids. Acids can react with metals, bases, metallic oxides, carbonates, and undergo oxidation - reduction reactions.

Sulfuric acid (oil of vitriol) is a colorless, oily liquid: Sulfuric acid reactions have characteristics of:

- Heat evolution and self-ignition of materials;
- Hygroscopic hence removes water from elements;
- Explosive reactions with oxidizing agents containing chlorine and oxygen (sulfuric acid itself is a moderately strong oxidizing agent).

Nitric acid is a colorless, corrosive liquid. Fuming nitric acid is a powerful oxidizing agent containing excessive amounts of nitrogen dioxide dissolved in the pure acid.

Hydrochloric acid (muriatic acid) is a gaseous hydrogen chloride. It is strong smelling, colorless, and fumes in air. It is commercially available as the anhydrous compressed gas. Hydrogen chloride is exceedingly soluble in water.

Perchloric acid in anhydrous form is unstable. Do not store it near a source of heat. It is a strong oxidizing agent. It forms an explosive reaction with cellulosic materials and organic acids, alcohols, and ethers.

Hydrofluoric acid is a gaseous compound. Anhydrous hydrogen fluoride is an extremely powerful acid. It is a strong dehydrating agent. It dissolves in water to form hydrofluoric acid which is not a strong acid, however, it is corrosive and can dissolve glass (use polyethylene bottles). Inhalation of its vapor causes edema of the lungs.

Acetic acid is found in vinegar. Purification of acetic acid solution by freezing forms "glacial acetic acid". It reacts with oxidizing agents generating heat. Besides its corrosiveness, inhalation of its fumes is a major hazard.

Bases are materials that supply hydroxide ions when dissolved in water. They react with acids, metals, and salts.

Sodium hydroxide (lye, caustic soda) and potassium hydroxide (caustic potash, potash lye) are strong bases. They corrode zinc, lead, aluminum, but not other metals. Solid sodium hydroxide is hygroscopic. A concentrated solution reacts with living tissue, dissolves silk, wood, and animal tissue. They dissolve exotermically. Ammonia is a severe bronchial irritant.

b. Safety in Working with Corrosives

- Have eye glasses, face shield, laboratory coat, and gloves during transfer of corrosives;
- Use fume hood during transfer operations;
- Keep acids and bases separately during use or storage;
- Flush exposed areas promptly with water;
- Use safety devices, such as acid bottle carriers (buckets) during transport;

- Dike around bulk storage areas;
- Use proper equipment for the job, such as pumping, siphoning procedures;
- Segregate corrosives from other chemicals;
- Have spill control products available;
- Work in pairs;
- Never add water to concentrated acids (add the acid to the water);
- Use non-breakable containers;
- Use a catch-pan during transfer operations.

3. Reactivity

Highly reactive compounds are those that pose high risk under normal conditions and must be handled appropriately. Exothermic reactions are capable of boiling liquids and causing burns to tissues or generating flammable gases with sufficient heat to ignite the gases. Reactives are explosives, air- and water-reactive compounds, pyrophorics, organic peroxides, oxidizers, and others. Appendix E contains list of reactives.

a. Explosives (Shock-Sensitive Compounds)

An explosive is any chemical compound, mixture or device, usually containing nitrogen, whose primary purpose is to function by the instantaneous release of gas, heat, and energy. Depending on their class (A, B, C), they may detonate (picric acid, nitroglycerine, trinitrophenol) or burn by rapid combustion (flash powder, propellants).

- Compounds are suspected of being an explosive usually have the prefix picric-, nitro, per-, peroxy-, or the letters azo, azide, fulminate, acetylide in the name;

- Mixtures of common stable chemicals can form sensitive explosives (e.g., nitromethane and amines);

- The heavy metal azides (lead, silver, mercury) are extremely dangerous and compare in hazard to mercury fulminate or tetracine which are friction-, heat and shock-sensitive;

- The organic azo compounds and alkali metal azides (sodium, potassium) are explosives under certain conditions;

- Inorganic compounds such as ammonium nitrate is also an explosive;

- A few organic peroxides such as benzoyl peroxide can be detonated.

b. Peroxidizable Compounds

Many compounds react with air and moisture and change their composition. Heat, light, and impurities can catalyze the reactions. Ethers and other compounds react with air to form peroxides. In some cases, crystals of peroxide accumulate in the solution. Shelf-life play a major role in these reactions (see Module F, Table VII-1). Ethyl ether, tetrahydrofuran, methoxy and ethoxy compounds of low molecular weight are all peroxidizable. Many compounds packaged with oxidation inhibitors increase shelf-life.

c. Pyrophorics (Air - reactives)

These are highly reactive compounds. When pyrophorics contact air or its moisture, they undergo oxidation and/or hydrolysis at a high rate to cause ignition. Examples of these compounds are:

- Finely divided metals (calcium, titanium);
- Metal hydrides (potassium hydride, aluminum boro hydride);
- Partially or fully alkylated metal hydrides (diethylaluminum hydride and triethylbismuth);
- Alkylmetal derivatives (ethoxydiethyaluminum, dimethylbismuth chloride);
- Analogous derivatives of nonmetals (diborane, dimethylphosphine);
- Carbonylmetals (pentacarbonyliron, octacarbonyldicobalt).

d. Water-Reactive Compounds

These classes of compounds may react violently with water and burst into flames. Some examples are:

- Alkali and alkaline-earth metals (potassium, calcium);
- Anhydrous metal halides (aluminum tribromide, germanium);
- Anhydrous metal oxides (calcium oxide);
- Nonmetal halides (boron tribromide, phosphorus pentachloride);
- Nonmetal halide oxides (phosphoryl chloride, sulfuryl chloride);
- Nonmetal oxides (acid anhydrides, trioxides).

e. Endothermic Compounds

These are the compounds that absorb heat during reaction, forming energy-rich compounds that are thermodynamically unstable. Some

endothermic compounds such as benzene, toluene are not unstable, but others such as acetylene, vinylacetylene, hydrogen cyanide, mercury (II) cyanide, cadmium azide, chlorine dioxide are. Appendix E identifies highly reactive compounds.

f. Oxidizers

Oxidizers are very reactive substances. They can react with relatively inert compounds and release oxygen during reaction. Hence, they fuel a reaction by providing a self-contained source of energy. Oxidizers do not have to contain oxygen. In combination with other reactives such as reducers or flammables, they produce explosion or fire. Organic peroxides are a special class of oxidizers. They can react explosively during a fire. The majority of peroxides are diluted in a solvent (odorless mineral spirits, toluene, xylene, silicone oil). The concentrated pastes or pure substances may be shock and/or heat-sensitive.

g. Safety in Working with Reactives

- Explosives and reactive chemicals should be handled by an individual with training in explosives;
- Peroxides in ether should be destroyed before disposal or distillation;
- Compounds should be protected from heat, light, shock, and friction during transfer operations;
- Non-sparking tools should be used;
- Fire response measures should be known by users and handlers of these chemicals;
- They should be kept in non-leaking containers.

4. TOXICITY

a. Concept and Definitions

Toxicity is a measuring action of a given amount of a chemical on a living species or systems. Several elements essential to life in low concentrations (e.g., zinc, copper, arsenic, etc.) are toxic or lethal at higher concentrations. Toxicity is not a physical constant. It varies with:

- Concentration of chemical substance;
- Routes of exposure (inhalation, ingestion, and skin absorption);
- Target organs;
- Response of receiver to chemicals;
- particular living species and systems.

Acute exposure means exposure to chemicals absorbed by inhalation, dermally, or by ingestion with the duration of total exposure measured in seconds, minutes, or hours. As applied to ingestion, it means a single dose.

Chronic exposure means exposures of long duration and as applied to dermal and inhalation covers prolonged or repeated exposures with durations of days, months, or years. With ingestion, it means repeated doses of the chemical for days, months, or years.

Lethal Dose Fifty (LD_{50}) is a calculated dose of a substance which is expected to cause the death of 50% of an entire defined

experimental animal population. Lethal Concentration Fifty (LC_{50}) is a calculated concentration of a substance in air, exposure to which for a specified length of time is expected to cause the death of 50% of an entire experimental animal population.

Threshold Limit Values, TLVs (formerly known as Maximum Allowable Concentrations), are the highest level of exposure to toxic chemicals at which no deleterious effect is noted. TLVs refer to air concentration of a given chemical to which an individual can be repeatedly exposed for 8 hours per day, 5 days per week. (By the American Conference of Governmental Industrial Hygienists - ACGIH). The TLVs are expressed in ppm, indicating parts of gases or vapors per million parts of air. The TLVs for fumes, dust, and mists are given as milligrams per cubic meter (mg/m^3) or in mppcf meaning millions of particles per cubic foot of air.

The substances for which TLVs have been established may be classified as slightly, moderately, and highly toxic.

Permissible Exposure Level, PEL, are concentration limits that are found in 29 CFR 1910.1000

In Sax, Dangerous Properties of Industrial Materials, the toxicity rating system is indicated under Toxic Hazard Review (THR) and must be consulted for toxicity information. The following toxicity scale ranging from 1 to 3 is indicated in bold print in Sax:

1 - Low, slight toxicity
2 - Moderate toxicity
3 - High, severe toxicity

The NIOSH/OSHA Pocket Guide to Chemical Hazards should also be consulted for Permissible Exposure Limits.

EP Toxicity has been discussed earlier, using the Leachate test set by the EPA to check concentration of metals and pesticides.

b. Safety in Working with Toxics

- Recognize the symptoms of poisoning and contact ORNL Health Division (4-7431);
- Read labels carefully;
- Have as little direct contact as possible with toxic materials;
- Use protective gear in handling toxics;
- Make sure containers holding toxics are not leaking and tops are not loose;
- Rinse spills on the skin with large quantities of water;
- Be familiar with emergency response procedures;
- Read Material Safety Data Sheets carefully before handling toxic materials;
- Isolate the area if a spill takes place;
- Maintain proper ventilation in storage rooms and work places.

D. RADIATION HAZARDS AND SAFETY MEASURES

1. Characteristics

Radiation is energy in the form of waves and particles. This energy is emitted from the nucleus or electron shells of certain nuclides. A nuclide that spontaneously emits radiation from its nucleus is

called a radioactive nuclide. Different radioactive nuclides (natural, cosmic, or man-made) are found in the Chart of the Nuclides.

The principle types of radiation that come from the nucleus are: alpha particle, beta particle, neutron particle, and gamma rays. Table VI-1 outlines major types of radiation and their effects.

The principle types of radiation that come from the electron shells are: x-rays.

The half-life is the time required for a radioactive substance to lose 50% of its activity by decay. Each radionuclide has a unique half-life.

The biological half-life is the time required for the body to eliminate one-half of an internal dose of any substance by the regular process of elimination. For example, tritium (hydrogen 3) has a radioactive half-life of 12.26 years and the biological half-life of 12 days. Iodine-131 has a radioactive half-life of 8.05 days and a biological half-life of 138 days. The biological effect of radiation depends on the type of radiation and the dose received.

Some common radioisotopes used in industry are carbon 14, sodium 24, phosphorus 32, sulphur 35, chromium 51, and iodine 131. The organs affected by the various radionuclides vary. For example, phosphorus 32 affects the bone (hence bone is a target organ for phosphorus), sulphur 35 the testes, and iodine 131 the thyroid. Radioisotopes cobalt 60, iridium 192, and cesium 137 are widely used in industrial radiography applications.

2. Safety measures

- Keeping exposure to radiation as low as reasonably achievable (ALARA);
- Wearing the proper monitoring equipment;

Table VI-1. Radiation from the nucleus

Name	Symbol	Penetrating Power	Characteristics
Alpha	α	Stopped by thin sheet of paper (least penetrating)	+2 charge, dangerous internally
Beta	β	Stopped by thin sheet of metal or wood (more penetrating than alpha)	-1 charge
Neutron	η	Best shielded by hydrogeneous material such as water/paraffin	0 charge
Gamma ray/ x-ray	γ/x	Best shielded by dense material such as lead/ concrete (more penetrating than beta)	0 charge, no mass

- Surveying shoes, body, and hands if working at radioactive area;
- Utilizing proper protective measures: such as clothing, gloves, respiratory protection, and protective shields;
- Avoiding smoking and eating in areas with radioactive contamination;
- Labeling and isolating radioactive waste and equipment;
- Contacting radiation surveyors for help;
- Obeying radiation signs;
- Reporting any accidental exposure to supervisor; and
- Following decontamination measures promptly and properly if need arises.

E. Gases

1. Characteristics

A state of matter characterized by:

- low density and viscosity;
- great expansion and contraction with changes in pressure (P) and temperature (T):
- ability to diffuse readily into other gases;
- ability to occupy the whole of any container;
- they are compressed for easier transportation, storage, and use.

- Gases are used widely
  - carbon dioxide (extinguisher);
  - hydrogen (welding);
  - ammonia (fertilizer);
  - nitrous oxide (anesthetic);
  - sulfur dioxide (preservative, bleach);
  - chlorine (swimming pools).
- Units
  - psi: pounds per square inch (15);
  - psig: pounds per square inch gauge;
  - psia: pounds per square inch absolute (psig + 15).
- Compressed gases (DOT definition)
  - any material or mixture in a container at either 40 psia at 21.1°C (70°F) or 104 psia at 54.4°C (130°F) or both;
  - any liquid flammable material having a vapor pressure exceeding 40 psia at 37.8°C (100°F).
- Nonliquefied gases (see Figure VI-3)
  - have low boiling points, -101.1°C (150°F);
  - do not liquefy in containers under ordinary T and P (2000-2500 psig).

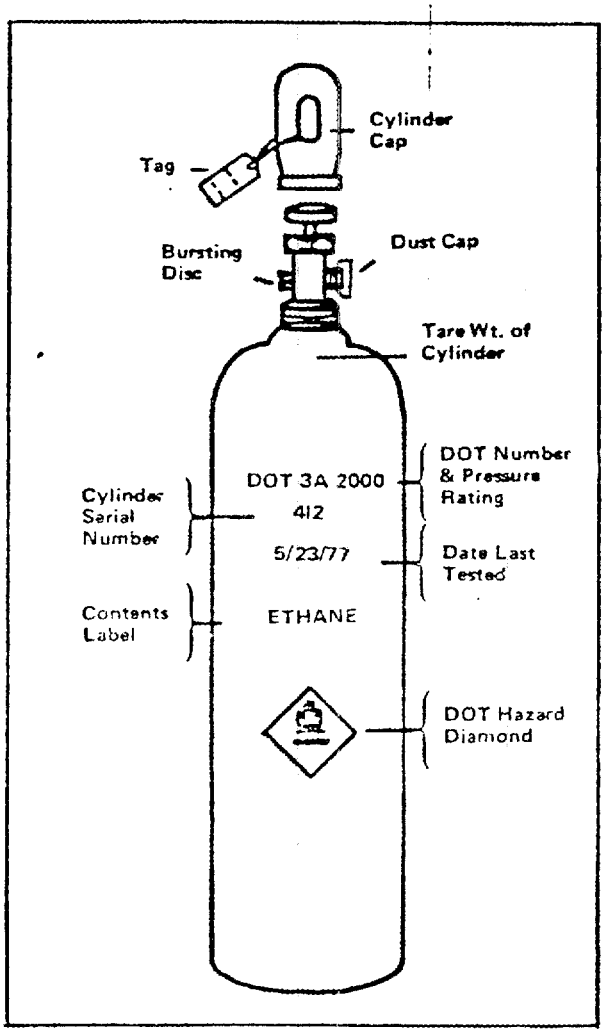


Fig. VI-3. Compressed gas cylinder (2000 indicates service pressure for which the cylinder is designed).

- Liquefy if cooled below their boiling points at extremely low cryogenic T, from - 273.16 to -150°C (-459.7 to -238°F) and are known as cryogenic fluids;

- Air, argon, carbon monoxide, ethylene, fluorine, helium, hydrogen, nitrogen;

- Some gases such as oxygen, helium, hydrogen are used both as nonliquefied and cryogenic fluids.

° Liquefied gases

- Have boiling points near atmospheric temperatures -90 to -4°C (-130 to 25°F);

- Become liquids in containers at ordinary T and at P from 25 to 2500 psig;

- Liquefied gases solidify at cryogenic temperatures (carbon dioxide);

- Chlorine, Anhydrous Ammonia, propane, carbon dioxide, hydrogen chloride, sulfur dioxide, boron trichloride.

° Hazardous properties of compressed gases

Anesthetic;
Corrosive;
Flammable;
Inert;
Toxic;
Explosive (unguided missiles, Bleve);
Radioactive;
Irritant.

2. Safety in Working With Compressed Gas Cylinders

a. Use

- Segregate gases according to their hazards;
- Maintain adequate ventilation. All gases can become asphyxiants by displacing the natural oxygen in the air;
- Use appropriate regulator for the particular gas;
- Keep approximately 30 psig or 45 psia in empty gas cylinders;
- Wear appropriate eye protection;
- Have warning labels on cylinders and storage areas;
- Keep large number of flammable cylinders outside work areas;
- Have automatic devices (monitors) to monitor gas concentration constantly and set off alarm if the concentration approaches a danger point;
- Be knowledgable and trained in hazards associated with gases;
- Be familiar with removal procedures for leaking gas cylinders;
- Have special equipment available for handling leaking gas cylinders and use proper IH recommended protective gear;
- Have special protective gear to respond to emergencies;
- Be prepared to contact emergency personnel during fires and other emergencies;
- Carbon dioxide and nitrogen which are inert, nonflammable, and do not present health hazards in low concentrations, can reduce oxygen content of air at high concentrations;

- Wear gas mask with full face piece and a canister when working with chlorine gas cylinders.

b. Transportation

- Keep cylinder valves closed tightly and installed on cylinders;
- Do not lift them by the protective cap;
- Do not drop cylinders or let them strike each other;
- Use appropriate lifting equipment (no magnets, ropes, chains, etc.);
- Do not drag or slide cylinders;
- Use suitable hand truck, fork truck, and secure the cylinder;
- Do not transport in closed vehicles;
- Cylinders should be chained in place during transportation;
- Do not permit cylinders to come in contact with "live" electrical equipment or grounding cables.

c. Storage

- Signs and identifications on cylinders must be readable;
- Full and empty cylinders must be segregated;
- Areas must be dry, cool, and ventilated, $T < 100°F$;
- No storage near flammable or combustible substances (oil, gasoline, waste) or near corrosive chemicals (rusting and valve sticking) should be allowed;

- Floor areas must be level;

- No storage near sharp objects, near elevators, gangways, heavy traffic areas, or heavy moving objects should be allowed;

- Valve caps should be kept on;

- Cylinders should be chained in place in upright position;

- All flammable compressed gases should be grounded;

- Store cylinders in covered areas to protect from extreme weather conditions or direct sunlight;

- Oxygen cylinders should not be stored near acetylene or other fuel gases;

- Carbon monoxide should not be stored longer than one year;

- The following gas cylinders must not be stored over 6 months due to corrosivity:

Boron trifluoride	Hydrogen bromide
Boron trichloride	Hydrogen chloride
Bromine chloride	Nitrosyl chloride
Chlorine	Phosgene
Fluorine	Sulfur tetrafluoride

- The following compounds should not be stored over 6 months due to polymerization:

  1,3-Butadiene
  Vinyl bromide
  Vinyl chloride
  Vinyl fluoride

- The following gases are potential sources of explosion:

Hydrogen cyanide	Ethylene
Acetylene	Hydrogen sulfide
Butane	Ethylmethyl ether

- The following gases are highly toxic:

Arsine	Cyanogen
Phosgene	Fluorine
Phosphine	Doborane
Chlorine	Hydrogen sulfide

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Pipitone, D. A., Safe Storage of Laboratory Chemicals, John Wiley & Sons, N.Y., 1984.

Hazardous Materials Safety Seminar, prepared by National Hazards Control Institute, 1978.

VII. HAZARDOUS WASTE OPERATIONAL TRAINING - MODULE F

Module F Outline

COURSE OBJECTIVES: To teach packaging, transportation, and storage practices at ORNL.

COURSE LENGTH: Two 3-hour session (20 minute breaks)

COURSE CONTENT:

A. Responsibilities of Hazardous Waste Handlers
B. Packaging
   1. Container Management
   2. Lab Packs
   3. Bulks
   4. Log Books/Inspections
C. Labels
D. Incompatibility
E. Storage Practices for Hazardous Materials
   1. Drum Storage
   2. Hazard Classes in Storage
F. Transportation Practices
G. Disposal Practices
   1. Disposal Categories
   2. Special Problems
H. On-the-Job Training Areas
I. Videotape Presentations:
   Title: Handling Hazardous Chemicals, by BNA Inc.
   Length: 20 minutes

   Title: A Hazardous Materials Incident, by the HAZMAT Resource, Inc.
   Length: 15 minutes
J. Quiz: Hazardous Waste Operations

INSTRUCTED BY: Person who has expertise in ORNL waste operations and regulations.

POTENTIAL PARTICIPANTS: Hazardous Waste Technicians
Hazardous Waste Supervisors
Chemical Operators

COURSE/MATERIALS NEEDED: Overhead projector
Transparencies
Quiz
Videotape
Videotape Recorder

MODULE F

Hazardous waste personnel involved in operational aspects of hazardous wastes must have thorough knowledge of ORNL waste management procedures, waste streams, and the disposal practices associated with them. Responsibilities of operational personnel and hands-on work involved will be clearly defined to the trainees. On-the-job training, which is identified at the end of the module, and the documentation of forms are an integral part of this training.

DOT packaging, transportation, storage, and disposal will be studied in detail in this module.

A. RESPONSIBILITIES OF HAZARDOUS WASTE HANDLERS

Hazardous waste handling responsibility areas can be outlined as follows:

- Familiarity with environmental regulations;
- Compliance with training;
- Interfacing with other ORNL departments and divisions;
- Identification/classification of hazardous wastes;
- Familiarity with sampling procedures;
- Knowledge of chemical hazards/segregation;
- Knowledge of waste handling procedures;
- Responding to chemical spills;
- Use of proper protective equipment;
- Requirements for hazardous waste shipments;
  - Shipping papers (manifest)
  - Container selection
  - Proper shipping name
  - Packaging
  - Marking
  - Labels
  - Placards
- On-site transportation requirements;

- Storage requirements;
- Disposal practices;
- Inspections;
- Recordkeeping.

The DEM of E&OS Division, WOG of OD, and the labor crew of P&E provide their services to meet these responsibilities.

B. PACKAGING

Hazardous waste packaging requirements can be outlined as follows:

Container: DOT Drum (open top, bung top) 49 CFR 178

Markings: 49 CFR 172, Subpart D (containers of 110 gal. or less)
- DOT Shipping Name
- DOT ID-Number (UN)
- ORNL Container Number (ORNL-#)
- "This End Up" sign

Labeling: 49 CFR, Subpart E
- EPA Hazardous Waste label
- On two sides and top of drum
- DOT Hazard class label

Placarding: 49 CFR 172, Subpart E
- 49 CFR 172.504, Table 1 (for any quantity)
- 49 CFR 172.504, Table 2 (1000 lbs. aggregate gross weight or more)
- On each end and on each side of vehicle

1. Container Management

The 49 CFR 178 provides construction and performance specifications for all shipping containers. Part 179 provides similar information for tank cars. Hazardous wastes are packaged in DOT specification drums.

The symbol DOT 17H-12-55-50 on a drum indicates the following:

17H	DOT Specification Number
12	12 Gauge Metal
55	Rated Capacity in Gallons
50	Year of Manufacture

The following selected DOT drums are used in ORNL hazardous waste management activities:

Name	DOT Code	ORNL Number
Bung poly-lined 55 gal. drum	DOT 37M	02-089-5885 (Y-12)
Bung 55 gal. drum	DOT 17E	02-089-6350
Open top, poly-lined 55 gal. drum	DOT 6D	02-089-6400
Open top 30 gal. drum	DOT 17H	02-089-6330
Open top 55 gal. drum	DOT 17H	02-089-6400
Bucket 5 gal.	DOT 37A-80	02-089-6205
Open top 55. gal. salvage drum (to overpack leaking drums)		

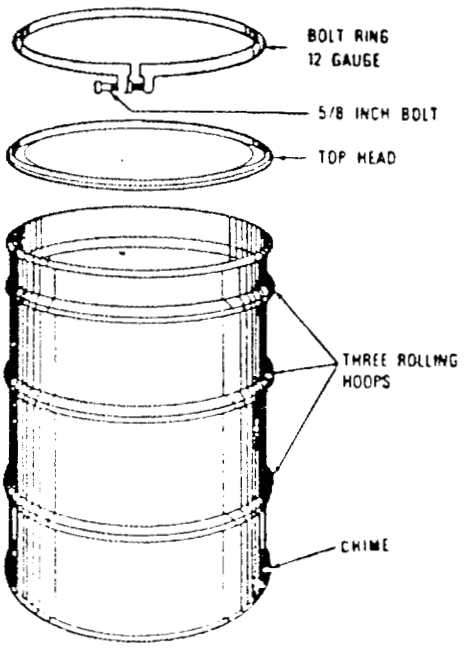
Figure VII-1 illustrates the most commonly used drums in ORNL operations. The correct installation of the locking ring for securing the drum lid to the drum is shown in Figure VII-2.

2. Lab Packs

Lab packs are prepared (see Figure VII-3) by placing chemical wastes, still in original containers, into the shipping container/drum. Original containers must have a bedding of absorbent all around them to prevent breakage and must not touch each other.

Waste chemicals for lab packaging are either packed by the WOG personnel or segregated and placed on metal shelves for packaging by an outside contractor.

TYPICAL DOT OPEN HEAD DRUMS
DOT-17C OR DOT 17H



55 GALLON

SPECIFICATION 17E, STEEL DRUM, SINGLE TRIP CONTAINER

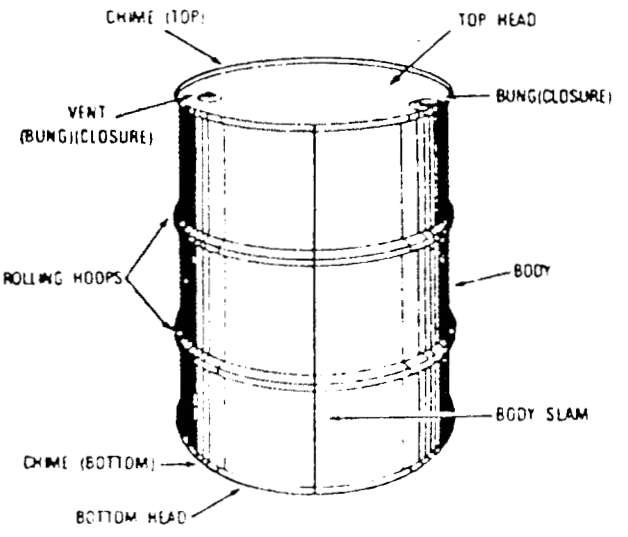
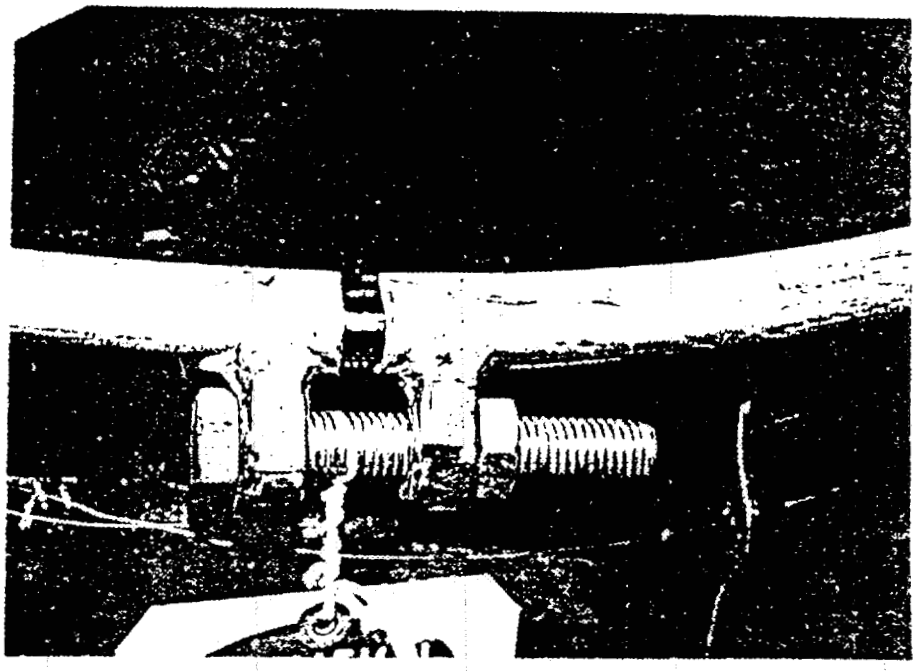
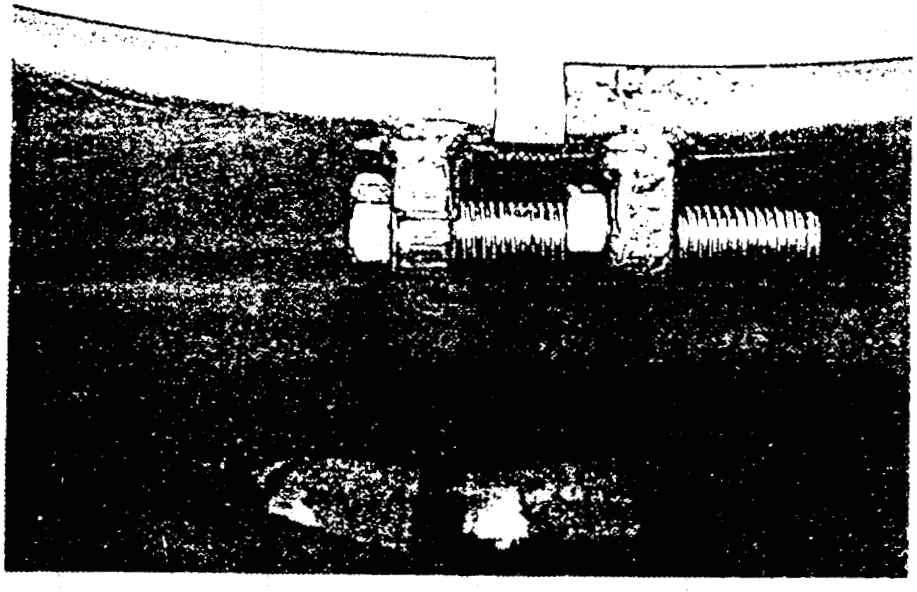


Fig. VII-1. Examples of DOT specification drums



Correct placement of jam nut



Improper placement of jam nut

Fig. VII-2. Locking ring installation

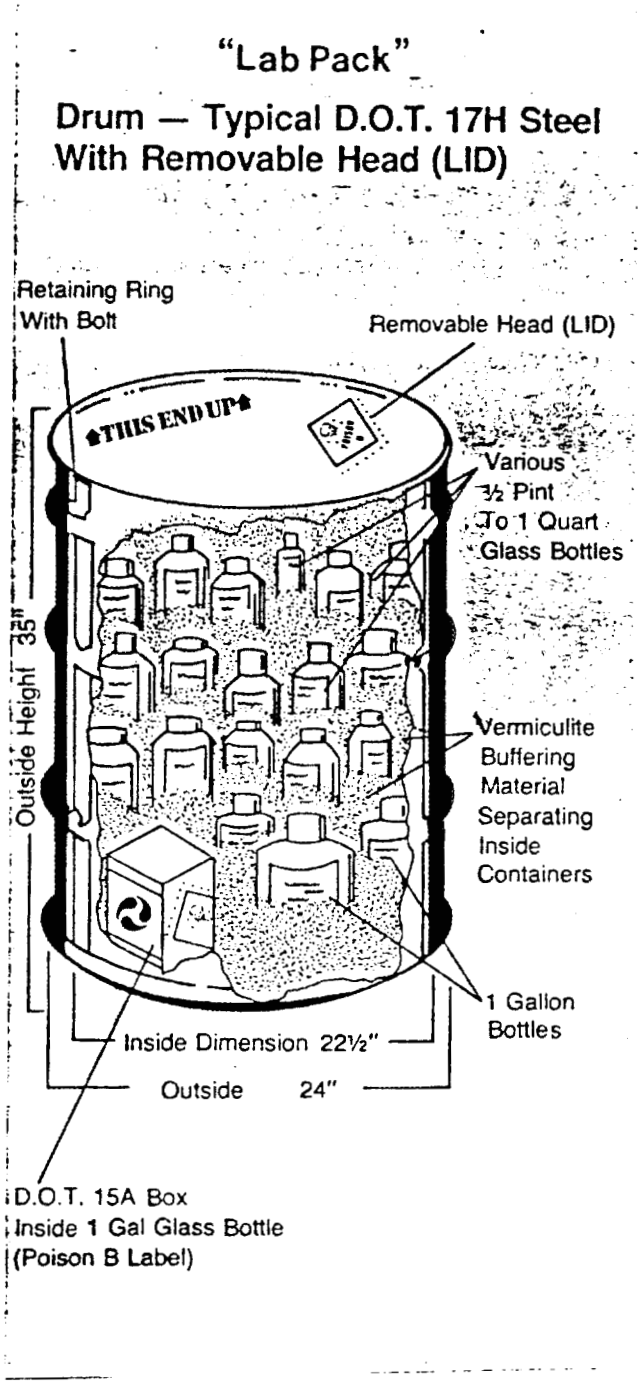


Fig. VII-3. Example of lab pack packaging

The following steps are recommended in the preparation of lab packs:

a. Acquire an open top, 55 gal. DOT marked drum (DOT 17H).
b. Assign ORNL container number (ORNL-#) on top of the drum.
c. Mark DOT proper shipping name on top (e.g., flammable liquid, n.o.s.) of the drum.
d. Mark DOT ID number (UN Number) on top of the drum.
e. Affix completed yellow "Hazardous Waste" label on the side of drum.
f. Affix hazard class label on top and two sides of drum.
g. Stick "This End Up" sign on the side of drum.
h. Write "Lab pack" on top of drum.
i. Use absorbing material at the bottom and top of drum and in between bottles.

The following tips are necessary to remember in the preparation of lab packs:

a. Chemicals must have same DOT hazard class.
b. Chemicals must be sealed.
c. Chemicals may be in their original packaging or in a proper container.
d. Chemicals must be placed in an upright position, in layers with space between individual chemicals.
e. Use vermiculite for packaging solid chemicals and clay absorbent for packaging liquid chemicals.
f. There must be enough absorbent as a bottom layer (approximately 3 in.) and between the bottles to absorb chemicals in case of breakage.
g. Disposal Form UCN-13698 must be marked with the container number as soon as a chemical is placed in a certain drum.
h. Do not place a container larger than 5 gal. in a lab pack.
i. Enter the assigned ORNL container number in the "drum log book" (See Appendix F).

The DOT Hazardous Materials Table (49 CFR 172.101) is the source used in assigning a proper shipping name. One of the following shipping names usually define ORNL hazardous waste.

- Flammable Liquid, n.o.s.;
- Flammable Solid, n.o.s.;
- Corrosive Liquid, n.o.s.;
- Corrosive Solid, n.o.s.;
- Poison B, Liquid, n.o.s.;
- Poison B Solid, n.o.s.;
- Hazardous Substance, Liquid, n.o.s.;
- Hazardous Substance, Solid, n.o.s.;
- Oxidizing Material, Liquid, n.o.s.;
- Oxidizing Material, Solid, n.o.s.

3. Bulks

Large volume wastes are pumped or poured into shipping containers/ drums for storage and later disposal. Extreme caution should be used during transfer operations of drums. Bulk packaging in general involves the following:

a. Obtain open top or bung top DOT marked drum.
b. Assign ORNL container number (ORNL-#) on top of drum.
c. Mark DOT proper shipping name on top of drum.
d. Mark DOT ID number (UN number) on top of drum.
e. Affix yellow "Hazardous Waste" label (completed) on the side of drum.
f. Affix hazard class label on top and sides (e.g., flammable) of drum.
g. Stick "This End Up" sign on the side of drum.
h. Write "Bulk" on top of drum.

Bulk packaging should include the following tips:

a. Hazardous wastes that can safely be poured or pumped.
b. Hazardous waste containers larger than 5 gal. size.
c. Mix only same chemicals from same operations.
d. Enter assigned ORNL container number in "drum log book".
e. Place corrosives in a poly-lined drum.
f. PCB concentrations and the date that PCB item(s) arrives into storage are listed on the disposal Form UCN-13698 and on the top of the drum.
g. Enter assigned PCB container number in "drum log book" and "PCB log book" (See Appendix F).
h. Place yellow PCB label on the side and ORM-E label on the top and side of drums containing PCBs.

The following are some of the shipping names assigned to bulk chemicals:

° Corrosive Liquid, n.o.s.;
° Corrosive Solid, n.o.s.;
° Oxidizing material, solid, n.o.s.;
° Oxidizing material, liquid, n.o.s.;
° Flammable Liquid, n.o.s.;
° Flammable solid, n.o.s.;
° Combustible Liquid, n.o.s.;
° Poison B, Liquid, n.o.s.;
° Poison B, Solid, n.o.s.;
° Hazardous Substance, Liquid, n.o.s.;
° Hazardous Substance, Solids, n.o.s.;
° Polychlorinated Biphenyls, oil, #ppm;
° Polychlorinated Biphenyls, (solids: capacitors, ballasts, soil, clothes).

4. Log Book/Inspection

Operating personnel of the WOG must keep information on packed chemicals in the storage building. Information on all packed chemicals are entered into the drum log book and PCB log book. Copies of these log books are included as Appendix F. Another

important function is inspection of the hazardous waste storage areas. The WOG conducts periodic inspections of storage building 7507 for structural deterioration, discharges, and equipment malfunction. Forms used and kept as documents are included as Appendix G. In addition to these inspections, the DEM staff also makes periodic audit-type inspections.

C. LABELS

Proper labels to be used on a drum will be identified on the Request for Disposal of Hazardous Waste Materials form UCN-13698. This information obtained from column four of the DOT Hazardous Materials Table (Appendix B) will be included under the "Hazard Information" heading of the form UCN-13698. The proper DOT label and EPA hazardous waste label (see Figure IV-1 and IV-2) will be affixed on the drums.

D. INCOMPATIBILITY

Special care must be exercised in handling hazardous wastes that are incompatible. Adverse human health and environmental impacts can occur with the mixing of certain waste materials. Injury may result from effects such as:

- heat or pressure;
- fire or explosion;
- violent reaction;
- toxic dusts, mists, fumes or gases;
- flammable fumes or gases.

Appendix V of 40 CFR 264, categorizes incompatible groups of chemicals and the harmful consequences of mixing materials from one group with materials in another group. These groups are:

Group 1-A	Group 1-B
Acetylene Sludge	Acid sludge
Alkaline caustic liquids	Acid and water

Group 1-A	Group 1-B
Alkaline cleaner	Battery acid
Alkaline corrosive liquids	Chemical cleaners
Alkaline corrosive battery fluid	Electrolyte acid
Caustic wastewater	Etching acid liquid or solvent
Lime sludge and other corrosive alkalies	Pickling liquor and other corrosive acids
Lime wastewater	Spent acid
Lime and water	Spent mixed acid
Spent caustic	Spent sulfuric acid

Potential consequences: Heat generation; violent reaction.

Group 2-A	Group 2-B
Aluminum Beryllium Calcium Lithium Magnesium Potassium Sodium Zinc powder Other reactive metals and metal hydrides	Any waste in Group 1-A or 1-B

Potential consequences: Fire or explosion; generation of flammable hydrogen gas.

Group 3-A	Group 3-B
Alcohols Water	Any concentrated waste in Group 1-A or 1-B Calcium Lithium Metal hydrides Potassium SO_2Cl_2, $SOCl_2$, PCl_2, CH_3SiCl_3 Other water reactive waste

Potential consequences: Fire; explosion or heat generation; generation of flammable or toxic gases.

Group 4-A	Group 4-B
Alcohols	Concentrated Group 1-A or 1-B wastes
Aldehydes	Group 2-A wastes
Halogenated hydrocarbons	
Nitrated hydrocarbons	
Unsaturated hydrocarbons	
Other reactive organic compounds and solvents	

Potential consequences: Fire; explosion; or violent reaction.

Group 5-A	Group 5-B
Spent cyanide and sulfide solutions	Group 1-B wastes

Potential consequences: Generation of toxic hydrogen cyanide or hydrogen sulfide gas.

Group 6-A	Group 6-B
Chlorates	Acetic acid and other organic acids
Chlorine	Concentrated mineral acids
Chlorites	Group 2-A wastes
Chromic acid	Group 4-A wastes
Hypochlorites	Other flammable and combustible wastes
Nitrates	
Nitric acid, fuming	
Perchlorates	
Permanganates	
Peroxides	
Other strong oxidizers	

Potential consequences: Fire; explosion; or violent reaction.

The hazardous waste compatibility chart, Figure VII-4, is included to provide guidance. A partial list of incompatible chemicals are included as Appendix H.

To ensure that incompatibles are separated in storage, segregation must be implemented at the source where it is picked up, during transportation, and later during packaging and labeling. In addition to separation of waste materials by incompatibility, packaging materials and/or the lining of containers must also be compatible with contents. To prevent contact with residues of incompatible materials, only unused containers will be used for packaging.

E. STORAGE PRACTICES FOR HAZARDOUS MATERIALS

Safe chemical storage is very important. The main objective in storage is the wisest use of space to separate incompatible chemicals from each other. Environmental Protection Manual Procedure 12.0 provides ORNL personnel with storage practices. Storage of all hazardous materials are of concern at ORNL. The following are examples:

- Chemicals on laboratory shelves for use or reuse;
- Hazardous wastes waiting pickup;
- Hazardous chemicals in large containers for use (e.g., tanks);
- New chemicals in chemical stores;
- Hazardous wastes in storage waiting to be transported to an off-site commercial facility;
- Hazardous wastes stored for on-site disposal;
- Hazardous and radioactive-mixed wastes in storage that cannot be disposed.

It is important that these chemicals are stored in accordance with specified storage rules and regulations (federal, state, local, NFPA, and OSHA). Inventories of stored chemicals should be <u>as low as possible</u>. Though waste minimization is presently a voluntary EPA regulation, ORNL has a written Waste Minimization Program. Some of the following steps are utilized to assist in the program.

REACTIVITY GROUP NO	REACTIVITY GROUP NAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	101	102	103	104	105	106	107
1	Acids, Mineral, Non-oxidizing	1																																								
2	Acids, Mineral, Oxidizing		2																																							
3	Acids, Organic		G H	3																																						
4	Alcohols and Glycols	H	H F	H P	4																																					
5	Aldehydes	H P	H F	H P		5																																				
6	Amides	H	H GT				6																																			
7	Amines, Aliphatic and Aromatic	H	H GT	H		H		7																																		
8	Azo Compounds, Diazo Compounds and Hydrazines	H G	H GT	H G	H G	H			8																																	
9	Carbamates	H G	H GT						G H	9																																
10	Caustics	H	H	H		H				H G	10																															
11	Cyanides	GT GF	GT GF	GT GF					G			11																														
12	Dithiocarbamates	H GF	H GF	H GF		GI GT		U	H G				12																													
13	Esters	H	H F						H G		H			13																												
14	Ethers	H	H F												14																											
15	Fluorides, Inorganic	GT	GT	GT												15																										
16	Hydrocarbons, Aromatic		H F														16																									
17	Halogenated Organics	H GT	H F GT					H GT	H G		H GF	H						17																								
18	Isocyanates	H G	H F GT	H G	H P			H P	H G		H P G	H G	L						18																							
19	Ketones	H	H F						H G		H	H								19																						
20	Mercaptans and Other Organic Sulfides	GT GF	H GT						H G										H	H	H	20																				
21	Metals, Alkali and Alkaline Earth, Elemental	GI H	GF H F	GI H F	GF H F	GF H F	GF H	GF H	GF H	GF H	GF H	GF H	GF GT H	GF H					H E	GF H	GF H	GF H	21																			
22	Metals, Other Elemental & Alloys as Powders, Vapors, or Sponges	GF H F	GI H F	GF					H F GT	L	GF H								H E	GF H		H GF F		22																		
23	Metals, Other Elemental & Alloys as Sheets, Rods, Drops, Moldings, etc	GF H F	GF H F						H F G										H F						23																	
24	Metals and Metal Compounds, Toxic	S	S	S			S	S			S															24																
25	Nitrides	GF H	H F	H GF	GF H	GF H			L	H G	U	GF H	GF H	GF H					GF H	L	GF H	GF H	E				25															
26	Nitriles	H GT GF	H F GT	H							U												H P			S	GF H	26														
27	Nitro Compounds, Organic		H F GT			H					H E												H GF E				H GF E		27													
28	Hydrocarbons, Aliphatic, Unsaturated	H	H F			H																		H F						28												
29	Hydrocarbons, Aliphatic, Saturated		H F																												29											
30	Peroxides and Hydroperoxides, Organic	H G	H F		H F	H G		H GT	H F E	H F GT		H F GT	H F GT						H E	H	E	H F GT	H F	H G		H G	H GF E	H P GT		H P		30										
31	Phenols and Cresols	H	H F						H G											H P			GF H				GF H					H	31									
32	Organophosphates, Phosphothioates, Phosphodithioates	H GT	H GT						U		H E												H									U		32								
33	Sulfides, Inorganic	GT GF	HF GT	GT		H			E											H												H GT			33							
34	Epoxides	H P	H P	H P	H P	U		H P	H P		H P	H P	U									H P	H P	H P		H P	H P					H P	H P	U	H P	34						
101	Combustible and Flammable Materials, Miscellaneous	H G	H F GT																				H G E				H GF E					H F GT					101					
102	Explosives	H E	H E	H E					H E		H E			H E									H E	H E	H E	E	E					H E	H E		H E	H E	H E	102				
103	Polymerizable Compounds	P H	P H	P H					P H		P H	P H	U										P H	P H	P H	P H	P H					P H	P H		P H			H E	103			
104	Oxidizing Agents, Strong	H GT		H GT	H F	H F	H F GT	H F GT	H E	H F GT		H E GT	H F GT	H F	H F		H F	H GT	H F GT	H F	H F GT	H F E	H E	H F		H E	H F GT	H E	H F	H F	H G	H F	H F GT	H F GT	H F G	H F G	H E	H F GT	104		
105	Reducing Agents, Strong	H GF	H F GT	H GF	H GF F	GF H F	GF H	H GF	H G				H GT	H F					H E	GF H	GF H	GF H					H GF	H E				H E	GF H	GT GF H		H	GF H	H E	H P GF	H E	105		
106	Water and Mixtures Containing Water	H	H						G											H G			GF H	GF H		S	GF H								GT GF						GF GT	106	
107	Water Reactive Substances	← EXTREMELY REACTIVE! DO NOT MIX WITH ANY CHEMICAL OR WASTE MATERIAL! EXTREMELY REACTIVE! →																																								107

Reactivity Code	Consequences
H	Heat generation
F	Fire
G	Innocuous and non-flammable gas generation
GT	Toxic gas generation
GI	Flammable gas generation
E	Explosion
P	Violent polymerization
S	Solubilization of toxic substances
U	May be hazardous but unknown

Example

H F GT	Heat generation, fire, and toxic gas generation

Fig. VII-4. Hazardous waste compatibility chart

- Establishing purchasing control program;
- Resource and Recovery Program;
- "Quantity Limitations" (justifications for large requests);
- Sharing reagents by users;
- Donating unused chemicals to high schools and other institutions.

The following concerns should be included in storage practices.

- Having Material Safety Data Sheets (MSDS) for hazardous materials;
- Tracking "Shelf-Life";
- Limiting Storage Time;
- Keeping inventory lists for stored chemicals (name, quantity, location);
- Using proper identification procedures (DOT containers, markings, labeling);
- Using proper engineering methods for storage of containers and storage areas:
  - Dikes
  - Sumps
  - Weather protection

- Storing by hazard class and compatibility and not by ALPHABETIZING!;
- Applying NFPA minimum-distance rules and proper aisle space rules for drums;
- Having proper fire protection equipment (alarms, fire rated walls, fire sprinklers, non-sparking tools, extinguishers);
- Taking proper safety measures
  - Good housekeeping
  - Eye fountains
  - Safety showers
  - Ventilation fans
  - Hoods
  - Emergency alarms
  - Emergency contact numbers (phone, radio operator)
  - Room temperature
  - Warning signs
  - Warning labels

- Having self-contained breathing apparatus and an accessible lifeline;
- Having a Contingency Plan for accidental discharges;
- Having a spill cleanup material available near storage area;
- Conducting monitoring, inspections, and audits;
- Training personnel in storage, disposal, and emergency practices and in accompanied hazards.

1. Drum Storage

The following practices should be adopted for drum storage:

- Waste identification (DOT packaging, list of contents);
- Proper segregation;
- Shed roof or plastic cover must be provided against rain (rusting);
- Weather-resistant markings and labels;
- Pallets for drums which are left outside;
- Volatile liquids should be stored in light colored drums to reflect sun's radiation (if stored outside);
- "Head space" should be left in the container (approximately 10% air space) to prevent expansion/contraction;
- Materials that may freeze or expand should be kept inside to prevent drum seal failure;
- Time and temperature-sensitive chemicals (e.g., ethers, peroxides) must have special attention.

2. Hazard Classes in Storage

The National Fire Protection Association (NFPA) label which will be studied in Module E provides us with the rating scheme pertaining to the use and storage of chemicals.

The four basic hazard classes for storage are:

- Flammables;
- Toxics/Poisons;

- Corrosives;
- Reactives.

The storage guidelines for these four classes will be outlined.

Flammable Solvents

a. Storage areas should be cool and dry (between 55-80°F.).

b. Metal "Flammable Liquid" cabinets and "safety cans" should be used for storage.

c. Air exhausts should be near the floor since solvent vapors are heavier than air.

d. No smoking should be allowed in areas where flammables are used or stored.

e. Storage areas should have smoke and heat detection devices and a fire alarm system.

f. Portable fire extinguishers should be kept outside the storage room and near the entrance.

g. Special foam or halon extinguishing systems are recommended, where possible; if not available, an overhead sprinkling system is recommended.

h. Catch pans under containers can help to reduce the area spills that might occur.

i. Floor drains, unless connected to special sewer systems, should not be present.

j. Bulk solvent tanks should be parked so that their ends face vacant areas, such as fields or empty lots.

k. Flammable solvents should be isolated from:

- Oxidizers;
- Chemicals capable of spontaneous heating;
- Explosives;
- Air and water reactives;
- Compressed gases and cryogenic liquids.

l. Solvent storage rooms inside a building should always be on the ground level.

m. Explosion safe or explosion proof refrigerators should be used.

n. Storage shelves should have a raised lip to prevent spread of the liquid.

Corrosives

a. Storage areas should be cool, dry, well-ventilated, and away from direct sunlight (60-80°F).

b. Area should be constructed of non-corroding materials or metals covered with fume-resistant paint.

c. Corrosive liquids should be isolated from:
- Toxic chemicals;
- Other reactive corrosive liquids;
- Other reactive chemicals;
- Flammable liquids;
- Compressed gases and cryogenics.

d. Wherever possible, corrosive liquids should be stored in their original shipping container.

e. Glass containers should be transported in protective carriers.

f. An acid resistant or chemical resistant suit and chemical resistant footwear should be near the storage area.

g. Store corrosive liquids below eye level, and when possible, below four feet.

h. Lips or some other means of restraint should be used on shelves to reduce the possibility of breakage.

i. Storage areas should contain an automatic sprinkling system as well as having firefighting equipment close at hand.

j. Some acids, such as perchloric acid, fuming and red fuming nitric acid must be treated as strong oxidizers rather than acids.

k. Catch pans should be used under shelves or when transferring acids.

Toxics

a. The total quantity of toxics stored should be minimized.

b. Storage temperatures should be kept between 55-80°F.

c. No drains should be present where toxics are stored. This prevents seepage into sewage systems if a spill occurs.

d. Special chemical resistant suits should be readily accessible if needed. Suits may have to be gas proof.

e. The local Poison Control Center telephone number should be posted in prominent places wherever toxics are stored or used.

f. Toxics should be transferred in a working fume hood.

g. Containers should be inspected frequently for leaks or loose closures.

h. Keep toxics separate from:
   - Corrosives, especially acids and acid fumes;
   - Reactives;
   - Heat;
   - Moisture;
   - Flammables;
   - Explosives.

Reactive Chemicals

Water and Air Reactives

- Water and air reactive substances should be isolated from other chemicals;

- Water reactives should be stored in a cool (55-80°F) waterproof area;

- An air-free condition for storage should be obtained by keeping them in a nitrogen atmosphere;

- Reactive substances should be stored in limited quantities and away from fire hazards.

Acid Sensitives

Acid sensitive substances are those chemicals which, when in contact with acids or acid fumes, liberate flammable gases, such

as hydrogen, or toxic gases with heat. These chemicals should be stored to prevent contact with either acid or acid fumes.

A partial list of acid sensitive substances includes:

° Alkali metals;
° Alkaline hydroxides;
° Carbonates;
° Carbides;
° Nitrides;
° Arsenic;
° Most metals;
° Cyanides;
° Sulfides.

Explosives

Explosives must be stored in magazines to protect them from freezing, temperatures above 90°F, moisture, fire, lightning, theft and vandalism. Some chemical explosives such as dry picric acid, trinitrotoluene, and urea nitrate should be stored as short a period as possible. They should be inventoried and inspected periodically. They should be handled only by a person with explosives training.

Oxidizers (and reducers)

a. They must be stored separately in a cool, dry, well-ventilated area out of direct sunlight and protected from extreme temperatures and rapid temperature changes.
b. Containers should be tightly sealed and good ventilation provided.

Peroxide Forming Materials/Peroxides

Peroxides can form in ether over long storage periods. Peroxides in ether should be destroyed before disposal or transport. Isopropyl ether, diethyl ether, dioxane and tetrahydrofuran (THF) are among peroxide-forming chemicals. All

organic peroxides must be handled with care and stored according to manufacturer's suggestions.

See Table VII-1 for maximum storage of peroxide-forming compounds.

a. Shelf-life should be checked regularly

b. Storage should be apart from other non-peroxide chemicals, especially strong oxidizing and reducing agents.

c. Shelves should be restrained to reduce possible breakage.

d. Dry benzoyl peroxide, dry succinic peroxide, and pure acetyl peroxide are shock- and friction-sensitive. Their storage location should be chosen carefully.

Various locations at ORNL have stored hazardous materials (see Appendix I). Building 7507, hazardous waste storage room (Figure VII-5), is one of the critical storage areas. Packed waste chemicals are segregated by fire-proof walls and stored in accordance with their hazard class. General storage classes at 7507 are:

- Flammables;
- Combustibles;
- Toxics/Poisons;
- Corrosives;
- Oxidizers;
- Polychlorinated Biphenyls;
- Incompatibles;
- Reactives (explosives, air and water sensitive chemicals).

F. TRANSPORTATION PRACTICES

On ORNL grounds, hazardous waste is transported by the P&E Labor Crew under the supervision of the WOG.

Table VII-1. Peroxide-forming Compounds During Storage

Highest Hazard Maximum Storage	Maximum Storage	Maximum Storage
Three Months	Twelve Months	Twelve Months
Peroxide Hazard Generated During Storage	Peroxide Hazard on Concentration	Hazard Due to Peroxide Formation or Initiation of Spontaneous Polymerization
Divinyl acetylene	Acetyl	Butadiene
Isopropyl ether (chloroprene)	Cumene	Chlorobutadiene (chloroprene)
Potassium metal	Cyclohexene	Chlorotrifluoroethylene
Sodium amide	Decahydronaphtalene (Decalin)	Methyl methacrylate
Vinylidene chloride	Diacetylene	Styrene
	Dicyclopentadiene	Tetrafluoroethylene
	Dioxane	Vinyl acetate
	Ethyl ether	Vinyl acetylene
	Ethylene glycol diethyl ether (glyme)	Vinyl chloride
	Methylcyclopentane	Vinyl pyridine
	Methyl acetylene	
	Methyl i-butyl ketone	
	Tetrahydrofuran	
	Tetrahydronaphthalene (Tetralin)	
	Vinyl ethers	

Source: National Safety News, March 1976.

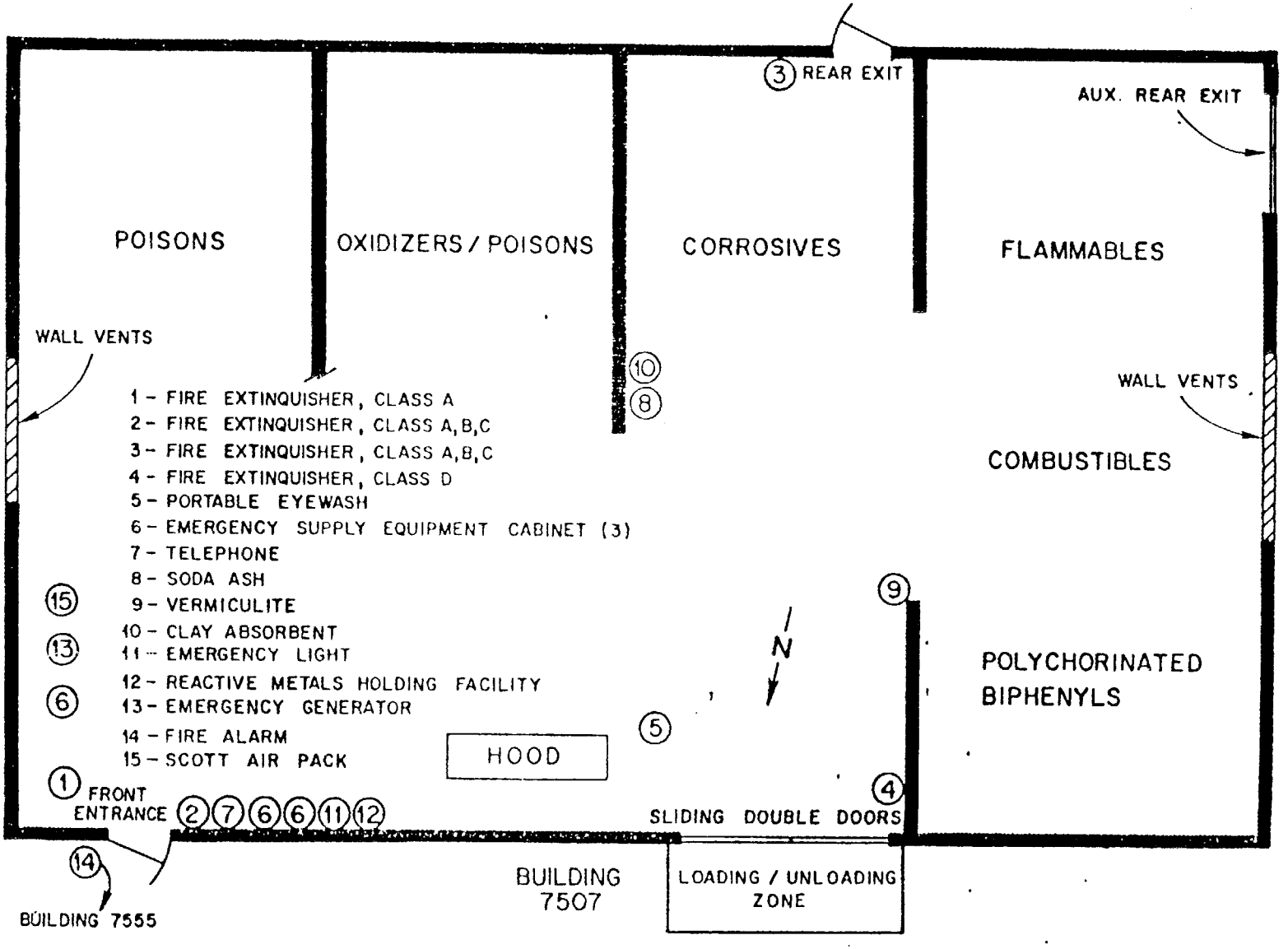


Fig. VII-5. Hazardous waste storage area, Bldg. 7507.

Various transportation activities include:

- Transport from waste generators to the truck;
  - on cart
  - by dolly
- Transport to the storage area;
- Transport of waste from ORNL facilities located at Y-12.

The following important points must be considered in waste handling:

- To be familiar with the properties of hazardous materials;
- To secure drums or boxes of chemicals during transport in the back of trucks;
- To be able to quickly identify the hazardous materials in transportation (labels, manifest, placards);
- To load and unload very carefully to avoid damage to the drums;
- WOG must follow waste transportation truck during transportation;
- After unloading drums, the truck bed must be examined for any sign of leakage;
- During transfer operations, drip pans must be used under the transfer pump and under each hose connection made;
- To be familiar with hazardous materials transportation incidents;
- To have a pre-emergency preparation process, contingency plan;
- To participate in drills;
- To have training in hazardous material properties and emergency preparedness;
- To have proper personal protective and spill response equipment.

The four major causes of hazardous materials transportation accidents are:

- Human error;
- Environmental conditions;
- Container flaws and failure;
- Vehicle or equipment failure.

Fire, explosion of the material, explosion of the container, and pollution (radioactivity with radioactive materials) are the most serious consequences of hazardous materials transportation incidents.

BLEVE (Boiling Liquid - Expanding Vapor Explosion) occurs due to failures of liquefied flammable gas containers. Liquefied gases are stored in containers at temperatures above their boiling points at normal temperature and pressure. Reduction of internal pressure to atmospheric level in a container results from structural failure of the container (flame contact, puncture).

The following agencies/information systems are sources of chemical information in transportation:

CHEMTREC (800-424-9300), The Chemical Transportation Emergency Center, makes technical information available and contacts manufacturers and industry representatives in case of emergencies.

NRC, National Response Center (800-424-8802), (a) receives spill reports, (b) operates as the focal point in notification of government authorities when pollution incidents occur, and (c) provides advice and assistance to users of the system via the CHRIS, OHMSTADS, and other systems.

CHRIS, The Coast Guard Chemical Hazard Response Information System is built on four manuals containing chemical-specific data and calculating estimates for hazard assessment based on a model. It is particularly useful for predicting air pollution and explosion problems. These four manuals are:

- A Condensed Guide to Chemical Hazards (Manual 1)
- Hazardous Chemical Data (Manual 2)
- Hazard Assessment Handbook (Manual 3)
- Response Methods Handbook (Manual 4)

OHMSTADS, The Oil and Hazardous Materials Technical Assistance Data System contains chemical, biological, and toxicological information. It is also part of NIH and EPA chemical information system (800-424-9600).

A toxicology database is maintained at Oak Ridge for the National Laboratory, Library of Medicine (615/574-7587).

G. DISPOSAL PRACTICES

1. Disposal Categories

Wastes at ORNL must be segregated before any disposal can be approved. Wastes first are classified into three categories. These categories are:

- Radioactive wastes;
- Mixed wastes; and
- Nonradioactive wastes.

Radioactive wastes are managed by the OD personnel. Depending on its physical state and amount of radioactivity, different disposal methods are utilized.

Mixed wastes contain RCRA-defined hazardous wastes and are contaminated with radioactivity. Most of the wastes are in the form of scintillation solutions or contaminated oils. They are kept in retrievable storage (Bldg. 7507 West Pad) until proper methods for their disposal are provided by regulations. Low-level wastes with small amounts of RCRA hazardous wastes also constitute mixed wastes.

Nonradioactive wastes are classified into two categories:

- Nonhazardous wastes;
- RCRA Hazardous wastes.

Nonradioactive and nonhazardous wastes produced every year at ORNL amount to approximately 17 million kg. Most of this waste stream is made up of fossil fuel waste and construction materials. Other wastes in this category are: (a) old tires, batteries, and scrap metal; (b) paper products; (c) cafeteria and office waste; and (d) cooling tower sludge. Some of these wastes (old tires, scrap metal, and paper products) are sold. Most, however, are buried in on-site landfills. The lists below indicate types of wastes accepted at Y-12 and ORNL Contractors' Landfill.

Y-12 Landfill

Animal bedding
Asphalt
Asphalt roofing materials
Block
Brick
Brush
Concrete
Empty Containers
Organic Garbage
Empty hazardous material containers
Empty pressurized gas cylinders
Empty paint cans
Empty aerosol cans
Empty pesticide containers
Glass
Fly ash
Coal pile runoff sludge
Paper and Cardboard
Plastics and Rubber
Rock
Rubble
Textile products
Tile
Wood
Other construction and demolition debris

Contractors' Landfill

Waste	Disposal Location
Non-asbestos insulation*	Non-asbestos insulation dumpster
Glass*	Glass dumpster
Paper*	Dumpster
Scrap metal*	Dumpster
Concrete blocks/masonry	

Roofing
Plastic
Fly-Ash
Pasteboard/Plaster
Paper and wood wastes
Non-contaminated soil
Electrical wiring
Piping

*Will be transported to Y-12 landfill for disposal.

Appendix J contains forms used to dispose waste at Y-12 landfill, Request for Disposal of Sanitary/Industrial Wastes and Spoil Materials, and at ORNL's Contractors' Landfill, Request for Disposal for Contractors' Landfill. Form UCN-12463, Request for Disposal of Waste Materials and Equipment (Appendix J) is used to transport scrap metal to K-25.

Nonradioactive RCRA hazardous wastes (see Figure V-2) are disposed in the following manner:

- Off-site shipments to an EPA approved commercial facilities;
- On-site disposal
  - Kerr Hollow Quarry
  - On-site detonation
  - Sandia site
  - Recycling/Recovery/Treatment

2. Special Problems

<u>PCBs</u>

a. PCB Regulations

- EPA: 40 CFR 761, Polychlorinated Biphenyls Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions

b. ORNL PCB Practices

- Review of EPM Procedure 4.0, PCBs;
- PCB Inventory;
- PCB Waste;
- Sampling;
- Disposal Procedures;
- Fluorescent light ballasts;
- Spills;
- Off-site disposal.

Asbestos

a. Asbestos Regulations

- OSHA: labels, containers, exposure limits, protective practices, 29 CFR 1910.1001 (IH Manual-1.10);

- DOT: Packaging specifications for transporting and storage containers (49 CFR 173.1090);

- CAA, 40 CFR 61, National Emission Standards for Hazardous Air Pollutants Demolition and Renovation;

- TSCA, 40 CFR 763, Reporting Requirements, Regulations for a) asbestos miners, manufacturers, primary or secondary processors and importers of asbestos, b) identifying friable asbestos-containing materials in schools.

b. ORNL Asbestos Practices

- Review of EPM Procedure 1.0 Asbestos and IH Procedure 1.10;
- Forms UCN-13385, Notice of Intention to Demolish or Renovate Friable Asbestos Material, and UCN-13386, Request for Disposal of Asbestos or Material Containing Asbestos, (Appendix J);

- Written notification to the DOE at least 15 days prior to beginning work on any project that involves removal of 80 m (260 ft.) or 15 m^2 (160 $ft.^2$) or more of asbestos;
- Asbestos disposal sites
  - radioactive (ORNL site)
  - nonradioactive (Y-12 site)

Reactive Materials

Reactive materials are identified in Appendix E. Various reactive wastes are disposed on-site. The following locations and procedures are utilized for disposal activities:

a. Y-12 Quarry
   - Preparation of Form UCN-2109, Request of Disposal of Hazardous Chemicals, Gases, and Radioactive Materials (Appendix J);
   - Review by Y-12 personnel;
   - Preparation of manifest.

b. Detonation trench at SWSA 6
   - Detonation must be conducted only by professionally trained personnel;
   - Review of EPM-21.0, Control of Explosives.

c. Wrecker at Sandia site
   - Preparation of Form UCN-13698

Gas Cylinders

Gas cylinders are handled by the following five categories:

a. Leaking gas cylinders
   - Transport to Sandia site and vent

b. Empty cylinders
   - Obtain Health Physics Radiation Survey tag;
   - Contact ORNL Receiving and Shipping Department;
   - Ship back to vendors.

c. Propane gas cylinders
   - Puncture each cylinder;
   - Place in a dumpster located at the Contractors' Landfill;
   - Ship to Y-12 Landfill.

d. Lecture bottles and small non-returnable gas cylinders
   - Empty cylinders;
   - Obtain Health Physics survey tag;
   - Complete Form UCN-2109;
   - Send inventory list to Y-12 for review;
   - Transport to Y-12 Landfill by OD personnel.

e. Non-returnable cylinders
   - Empty cylinders;
   - Complete Form UCN-2109;
   - Send inventory list to Y-12 for review;
   - Transport to Quarry by OD personnel;
   - Shooting of cylinders by Y-12 guards;
   - Transport cylinders to the scrap metal disposal facility at Y-12.

<u>Recycling/Recovery/Treatment</u>

a. Mercury purification (4500S, E-251)

b. Silver recovery from photographic waste solutions (storage tanks, Bldg. 7075 and silver recovery, Bldg. 7934)

c. Waste acids/bases (Neutralization Facility, Bldg. 3518)

H. ON-THE-JOB TRAINING AREAS

- Transfer of oils;
- Disposal of non-hazardous waste at contractor's landfill;
- Pickup and handling of radioactively contaminated hazardous waste;
- Waste verification, segregation, packaging, marking, and labeling of hazardous waste (lab packs & bulk, log book);
- Segregation and shelving of waste chemicals at the waste storage room;
- Observing disposal of reactives by detonation;
- Disposal of reactives at Quarry;
- Inspection of hazardous waste storage areas;
- Participation in off-site shipment of packed hazardous wastes (Y-12 included);
- Silver recovery operation (optional);
- Receiving mixed waste from outside generator.

REFERENCES:

ORNL Environmental Protection Manual, Procedures: 12.0; 4.0; and 1.0.

Industrial Hygiene Manual, Procedure: 1.10.

VIII. SAMPLING OF HAZARDOUS WASTE - MODULE G

Module G Outline

TITLE: Sampling of Hazardous Waste

COURSE OBJECTIVES: To acquaint trainees with hazardous waste sampling methods.

COURSE LENGTH: 3 hours (20 minute break)

COURSE CONTENT:

A. Waste Streams

B. Measurement Parameters

C. Sampling Techniques

1. Sample Containers
2. Sample Labeling
3. Sample Submission for Analytical Services
4. Samplers
5. Sampler Maintenance

D. Sampling Logistics

E. Safety Requirements

F. On-the-Job Training Areas

G. Quiz: Sampling of Hazardous Wastes

INSTRUCTED BY: Person who is responsible for environmental sampling and sampling procedures.

POTENTIAL PARTICIPANTS: Hazardous material sampling technicians.

COURSE/MATERIAL NEEDED: Overhead projector
Transparencies
Quiz

MODULE G

This module will outline basic sampling procedures and familiarize the trainee with sampling parameters and safety precautions. Sampling of hazardous waste streams is the responsibility of the DEM. Environmental technicians do the sampling.

A. WASTE STREAMS AND APPLICABLE TEST METHODS

A major portion of the wastes generated at ORNL consists of miscellaneous quantities of laboratory chemicals and some process chemical wastes. Because of the variation in the wastes (both liquids and solids) generated from the many research and development projects, it is difficult to estimate the many types of wastes. However, any of the items in the hazardous wastes listing of 40 CFR, Subpart D, Section 261.33, or any items exhibiting hazardous characteristics of 40 CFR, Subpart C, Section 261.21-24, and/or in the DOT hazard classes of Flammable Poison B, corrosive, oxidizer, etc., could be generated. Mixtures of various chemical wastes generated by laboratory bench-scale operations are not normally sampled since the constituents of the mixtures are known in most cases. Usually, those waste materials requiring sampling are unknown chemicals/mixtures, potentially incompatible waste material, and other waste streams where specific concentrations of certain constituents must be identified. Wastes to be sampled may be placed in five categories.

- Laboratory chemical reagents in less than 5-gallon size original containers;

- Bulk quantities of wastes normally in 55-gallon drums and/or in containers larger than 5-gallons;

- Polychlorinated biphenyl (PCB) liquids and solids (PCB-contaminated oils, PCB electrical equipment);

- Bulk quantities of waste oils contaminated with various halogenated solvents (e.g., perchloroethylene, 1,1,1-trichloroethane, etc.);

- Small volume laboratory chemicals and bulk quantities (liquid and solids) of potentially incompatible wastes (i.e., alkali metals, oxidizers, corrosive/alkaline liquids, hypochlorites, peroxides, cyanides, etc.);

- Unknown wastes.

Test methods for hazardous wastes are identified by the EPA in Section 6 of the Test Methods for Evaluating Solid Waste, (EPA, Office of Solid Waste and Emergency Response, SW-846). Appendix K lists methods used by ORNL to measure the analytical parameters.

B. MEASUREMENT PARAMETERS

Specific parameters have been set for waste oils and unknowns. Tables VIII-1 and VIII-2 lists detection limits for these parameters.

C. SAMPLING TECHNIQUES

Sampling of hazardous wastes is performed to obtain data for purposes of classifying, treating, recovering, recycling, or determining compatibility characteristics of the wastes.

In general, sampling of hazardous wastes requires the collection of adequate sized, representative samples of the body of wastes. Sampling situations vary widely for sampling different types of wastes in various states and containers.

Table VIII-1. Allowable limits for RCRA hazardous characteristics

Parameter	Limits
Flash Point	< 60°C (140°F) is an ignitable waste
pH	≤ 2.0 or > 12.5 is a corrosive waste
Reactivity	Reacts with air or water. Cyanide or sulfide bearing.
Arsenic*	5.00 mg/liter
Barium*	100.00 mg/liter
Cadmium*	1.00 mg/liter
Chromium*	5.00 mg/liter
Lead*	5.00 mg/liter
Mercury*	0.20 mg/liter
Selenium*	1.00 mg/liter
Silver*	5.00 mg/liter
Endrin*	0.02 mg/liter
Lindane*	0.40 mg/liter
Methoxychlor*	10.00 mg/liter
Toxaphene*	0.50 mg/liter
2,4-D*	10.00 mg/liter
2,4,5-TP Silvex	1.00 mg/liter

For allowable limits of suspected isotopes refer to Appendix A-13 of Health Physics Procedure Manual.

*EP toxicity leachate test method.

Table VIII-2. Allowable limits for specified parameters on waste oil

Parameter	Limits
PCB	< 2 ppm
Perchloroethylene	< 50 ppm
1,1,1 - trichloroethane	< 50 ppm
Trichloroethylene	< 50 ppm
Gross Beta	1.1×10^{-2} Bq/ml
Gross Gamma	1.1×10^{-2} Bq/ml
^{3}H	1.1×10^{3} Bq/ml
^{14}C	1.1×10^{2} Bq/ml

The procedures require planning to maximize safety of sampling personnel, minimize sampling time and cost, reduce errors in sampling, and protect the integrity of the samples after sampling. The following steps are considered in a plan of action:

- Research background information about the waste;
- Determine what should be sampled;
- Select the proper sampler;
- Select the proper sample container and closure;
- Design an adequate sampling plan that includes the following;
  - Choice of the proper sampling point.
  - Determination of the number of samples to be taken.
  - Determination of the volumes of samples to be taken.
- Observe proper sampling precautions;
- Handle samples properly;
- Identify samples and protect them from tampering;
- Record all sample information in a field notebook;
- Fill out chain of custody record;
- Fill out the sample analysis request sheet;
- Deliver the samples to the laboratory for analysis.

1. Sample Containers

Vial and containers used to secure a sample for analysis must be of the proper kind. The following criteria must be considered in the choice of containers.

- Containers must be clean;
- Containers and waste samples must be compatible;
- Containers must be resistant to breakage;
- Proper size containers must be used in relation to sample size;
- The opening of a container must be large enough to retrieve the sample for analysis;
- The cap of the container must also consist of a compatible material with the sample;
- The cap must fit properly to seal the sample.

2. Sample Labeling

A label must be affixed to each sample container. The information on the label must reflect the agreed upon notations, so that it can be interpreted uniformly throughout the sampling stages.

The sample label must contain the following information:

- ID Code;
- Date of Collection;
- Initials of the Collector.

ID Code is made up of numbers separated by dashes. It must not be more than ten digits. For example, "3871-1" or "3871-1-1".

The four digit number, such as 3871 stands for the "Form Number" which is assigned (at the top right corner) on Form UCN-13698 (submitted by the generator to dispose of waste chemicals).

"1" stands for the "item number" indicated on the same request form, UCN-13698.

"38761-1-1" and "3871-1-2" stands for multiple containers (samples of each) of the same hazardous waste. The numbers 1, 2 indicate different containers of the same item. In this case both samples originated from item 1.

"3871 - Comp" stands for composite sample from different containers of the same item.

3. Sample Analysis

Samples at ORNL are analyzed by the ORNL Analytical Chemistry Division (ACD). Sampled material must be brought to the ACD as soon as possible. Request for Analytical Services, Form UCN-13838, shown as Figure VIII-1 is used for this purpose. Various sections of the form are self explanatory.

01Y86 following the date is inserted. "01" stands for one-time sampling, "Y" stands for "yearly" (meaning yearly sampling), and "86" is for the calendar year.

Series No. "EHC" stands for the samples submitted by the DEM environmental technician.

REQUEST FOR ANALYTICAL SERVICES

THIS FORM IS TO BE USED ONLY FOR SAMPLES CONTAINING LESS THAN 50 MILLIGRAMS CONCENTRATION OF FISSIONABLE MATERIAL

REQUEST NO.

DATA REPORT TO: KENNY EDWARDS

BUILDING NO.: 4500 S

SERIES NO.: EHC

DATE SUBMITTED: 26 JAN 86

TELEPHONE NO.: 4-6675 01/86

CHARGE NO.: 3470-0001

LAB NUMBER	SAMPLE IDENTIFICATION	DESIRED ANALYSES	ESTIMATION OF CONCENTRATION	NATURE AND ESTIMATION OF ACTIVITY	CONCENTRATION OF ALL CONSTITUENTS IN SAMPLE
	3963-1-1	PCB			
	3963-1-2				
	3963-1-3				
	3963-1-4				
	3963-1-5				
	3963-1-6		IF PCB level is > 2 ppm		
			TEST Flash point		
			IF PCB level is < 2 ppm		
			CHECK Organics		

Sample(s) contain _____ g of Fissile Mtrl. (est)

Return to sender or dispose according to H.P. Manual

UCN-13838 (3 1-88)

REQUESTER: [signature]

Fig. VIII-1. Request for analytical services form

The desired analyses column might indicate PCB for oils. In this case "PCB > 2 Test for Flash Point," and "PCB < 2 Test for Organics" must be written on the form for unknown analysis.

For unknown analysis, desired parameters of analysis are indicated on Figure VIII-2.

In addition to the "Request for Analytical Services" form, the "DOE X-10 Plant Chain-of-Custody" form is submitted to the ACD with the sample (Figure VIII-3). This form must be signed by the person submitting the sample and the person receiving the sample. The date and time of transaction must be recorded on this form. When the sample is analyzed, analytical results are forwarded by a computer to DEM. The computer printout is in the format illustrated in Figure VIII-4.

4. Samplers

There are several EPA recommended samplers. The sample taken must be a representative sample. Section 1 of Test Methods for Evaluating Solid Waste (EPA, Office of Solid Waste and Emergency Response, SW-846) and Samplers and Sampling Procedures for Hazardous Waste Streams (EPA-600/2/80-018) provide information on samplers and sampling procedures.

Different types of samplers are required for sampling hazardous wastes. Some of these are:

- Coliwasa Sampler;
- Grain Sampler; and
- Trier Sampler.

REQUEST FOR ANALYTICAL SERVICES

THIS FORM IS TO BE USED ONLY FOR SAMPLES CONTAINING LESS THAN 50 MILLIGRAMS CONCENTRATION OF FISSIONABLE MATERIAL

REQUEST NO.

DATA REPORT TO: B. M. Eisenhower

BUILDING NO.: 4S00S

SERIES NO.:

DATE SUBMITTED:

TELEPHONE NO.: 4-6674

CHARGE NO.: 3195-

LAB NUMBER	SAMPLE IDENTIFICATION	DESIRED ANALYSES	ESTIMATION OF CONCENTRATION	NATURE AND ESTIMATION OF ACTIVITY	CONCENTRATION OF ALL CONSTITUENTS IN SAMPLE
		Flash Pt.		RCRA Testing	
		pH			
		React. - Air/Water			
		As		EP Toxicity	
		Ba			
		Cd			
		Cr			
		Pb			
		Hg			
		Se			
		Ag			
		Endrin			
		Lindane			
		Methoxychlor			
		Toxaphene			
		2,4-D			
		2,4,5-TP			

Sample(s) contain _____ g of Fissile Mtrl. (est)

Return to sender or dispose according to H.P. Manual.

UCN-13836 (3 1-60)

REQUESTER

Fig. VIII-2. Example of analytical request for unknown waste

DOE X-10 PLANT CHAIN OF CUSTODY

SAMPLER SIGNATURES	DEPARTMENT	BUILDING/PHONE	PROJECT	LOG BOOK NO. / PAGE
[illegible]	3195	4500 S 66825	Waste Oil	

SAMPLE I.D.	SAMPLE LOCATION	SAMPLING DATE	SAMPLING TIME	COMPOSITE	GRAB	NO. OF CONTAINERS	MEDIA	General Chemistry	Metals	Volatile Organics	[illegible]	[illegible]	[illegible]	[illegible]		
1W21-1 Comp	6000 Main	26 Nov		✓		1	Oil				✓	✓	✓	✓		

RELINQUISHED BY (Signature)	Date/Time	RECEIVED BY (Signature)	Date/Time	Dept.	Building	Phone
[illegible]	4 Dec 85	S. H. Trestwood	12-4-85 1055	3330	4500-S	67559
RELINQUISHED BY (Signature)	Date/Time	RECEIVED BY (Signature)	Date/Time	Dept.	Building	Phone
RELINQUISHED BY (Signature)	Date/Time	RECEIVED BY (Signature)	Date/Time	Dept.	Building	Phone

UCN-13640 (3 8-85)

RETURN TO: DEPARTMENT OF ENVIRONMENTAL MANAGEMENT, 4500S, G260, 4-6070

Fig. VIII-3. Chain of Custody Form

ANALYTICAL RESULTS - 12/10/85 PAGE 1 APPROVED:

CUSTOMER : M.A.TREVINO
ADDRESS : 4500S
PHONE : 01Y85
REQUEST : 53461
RECEIVED : 12/04/85
COMMENTS : *MG/L*

CHARGE : G3005EAA
SERIES : EHC
COMPLETED : 12/10/85

SAMPLE IDS	LAB #	PCB	CCL2:CCL2	CH3CCL3
1421-1	28371	<2 UG/G	<55 PPM	<50 PPM

Fig. VIII-4. Example of analytical result form

a. Liquid Waste Sampling

The Coliwasa sampler is a liquid sampler. It can obtain a representative sample from multiphase wastes with a wide range of viscosity, corrosivity, volatility, and solids content. It allows rapid collection of samples. Figure VIII-5 is a model of the Coliwasa. It is made up of three main parts: the sampling tube; the closure-locking mechanism; and the closure system. The sampling tube (1.52 m x 4.13 cm) is a translucent plastic pipe usually polyvinyl chloride (PVC) or borosilicate plumbing tube. The closure-locking mechanism consists of a chancelled aluminum bar, which serves as both a T-handle and lock for the sampler's closure system, attached to the sampler's stopper rod by an adjustable swivel. The closure system consists of a neoprene stopper attached to a 0.95cm polyvinyl or glass rod which is connected to the aluminum T-handle. The Coliwasa is designed to be semi-disposable. Parts of the device that become contaminated during sampling (i.e., the tube, the stopper rod, and the stopper mechanism) may be discarded at little expense.

There are two types of Coliwasa samplers, namely plastic or glass. The plastic Coliwasa is used to sample containerized liquid wastes that contain ketones, nitrobenzene, dimethyl foramide, mesityl oxide, and tetrahydrofuran. The glass Coliwasa is used to sample all other containerized liquid wastes except strong alkali and hydrofluoric acid solutions.

b. Procedure to Use Coliwasa Sampler

- Choose the plastic or glass Coliwasa for the liquid waste to be sampled;

- Make sure that the sampler is clean;

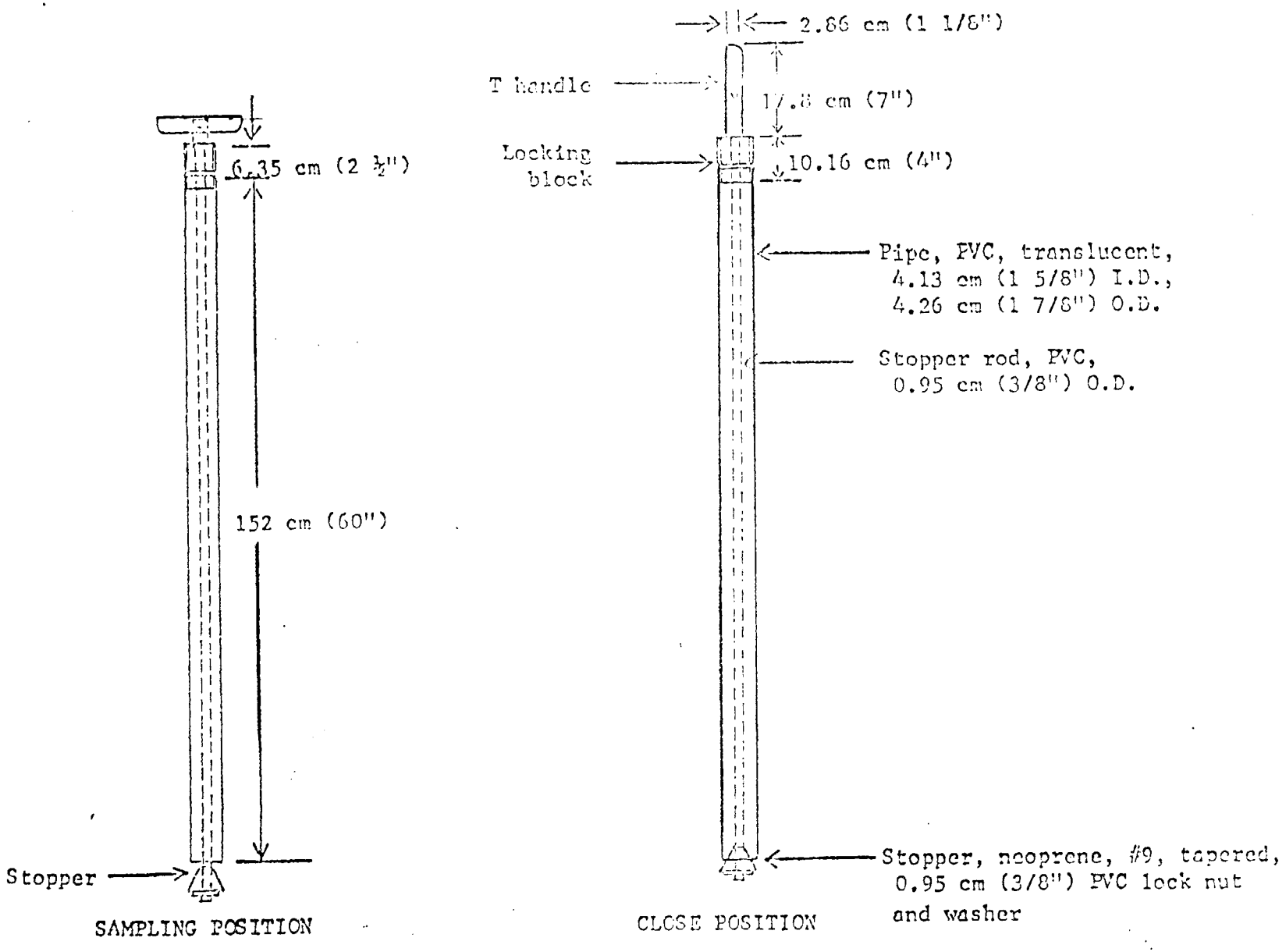


Fig. VIII-5. Composite liquid waste sampler (Coliwasa)

- Check to make sure the sampler is functioning properly. Adjust the lock mechanism if necessary to make sure the neoprene rubber stopper provides a tight closure;

- Wear necessary protective clothing and gear and observe required sampling precautions;

- Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod down until the handle sits against the sampler's locking block;

- Slowly lower the sampler into the liquid waste. Lower the sampler at a rate that permits the levels of the liquid inside and outside the sampler tube to be about the same. If the level of the liquid in the sampler tube is lower than that outside the sampler, the sampling rate is too fast and will result in a nonrepresentative sample;

- When the sampler stopper hits the bottom of the waste container, push the sampler tube downward against the stopper to close the sampler. Lock the sampler in the closed position by turning the T-handle until it is upright and one end rests on the locking block;

- Slowly withdraw the sampler from the waste container with one hand while wiping the sampler tube with a disposable cloth or rag with the other hand;

- Carefully discharge the sample into a suitable sample container by slowly opening the sampler. This is done by slowly pulling the lower end of the T-handle away from the locking block while the lower end of the sampler is positioned in a sample container;

- Unscrew the T-handle of the sampler and disengage the locking block. Clean sampler on-site or store the contaminated parts of the sampler in a plastic storage tube for subsequent cleaning. Store used rags in a plastic bag for disposal.

  At ORNL large containers/drums (30-55 gal. containing liquid wastes as well as small containers up to 5 gal.) containing liquid chemical wastes are sampled by Coliwasa sampler.

c. Solid Waste Sampling

Solid wastes can be sampled by several approved methods. Two special sampling devices used in solid sampling are the grain sampler and the trier sampler. Several samples must be taken when using both types of sampler to obtain a representative composite sample.

If the solid waste is granular or powdered, the grain sampler (Figure VIII-6) is used. The grain sampler is most useful when the solids are 0.6 cm in diameter or less. The grain sampler is 61-100 cm long and 1.27-2.54 cm in diameter. It consists of two brass or stainless steel slotted telescoping tubes. The outer tube has a conical pointed tip on one end that permits the sampler to penetrate the material. The sampler is opened and closed by rotating the inner tube.

If the solid waste is moist and/or sticky, soft or loosened, a sampling trier is used (Figure VIII-6). The sampling trier is a long tube, with a slot that extends almost its entire length, made of stainless steel with wooden handles. It is about 61-100 cm and 1.27-2.54 cm in diameter.

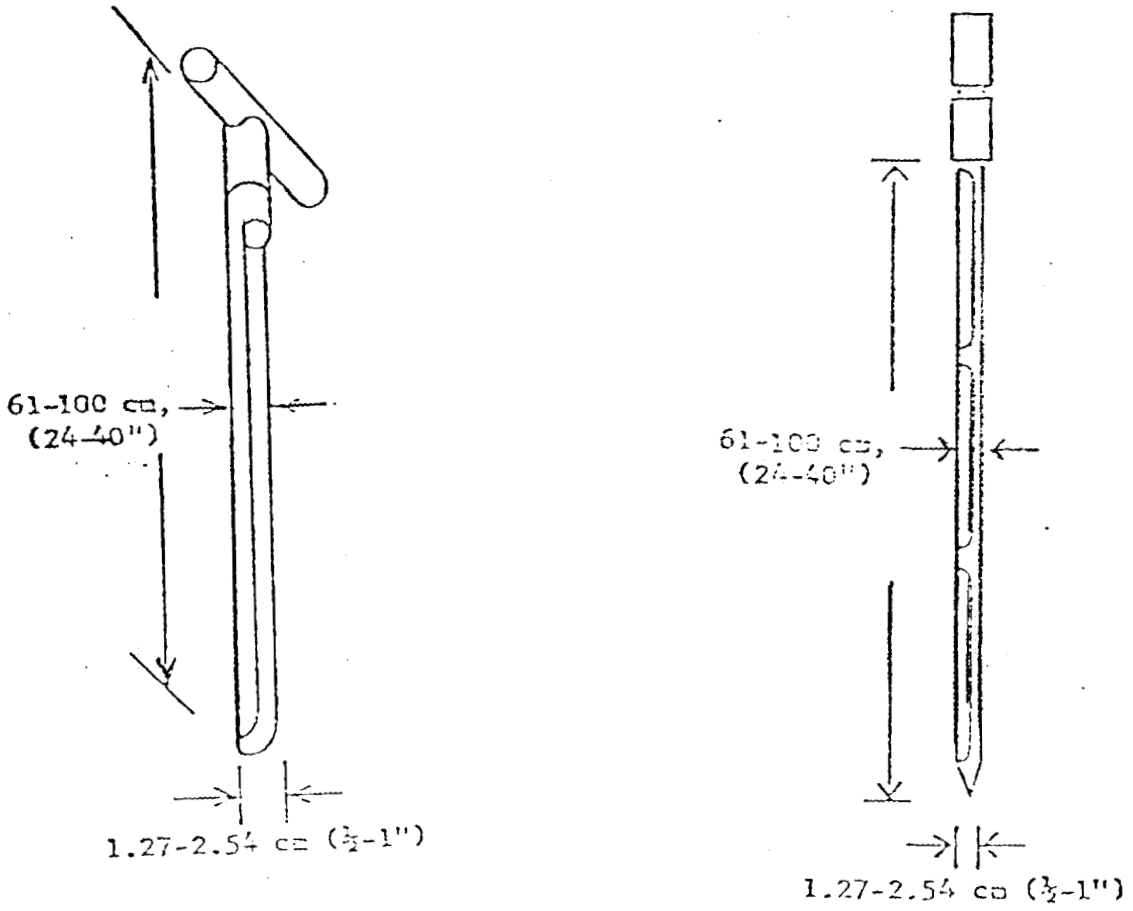


Fig. VIII-6. Grain and trier samplers

d. Procedure to use Grain Sampler

- Insert sampler in its closed position into waste material diagonally from point of entry;
- Rotate inner tube into open position;
- Allow material to enter the open slots by shaking, place sampler in close position and withdraw from the material;
- Place the sampler in a horizontal position with the slots facing upward, rotate and slide out the outer tube from the inner tube;
- Transfer the collected sample into proper container;
- Collect more core samples at different points, if necessary;
- Clean sampler or store it in plastic bag for later cleaning.

e. Procedure to Use Trier Sampler

- Insert sampler at 0° to 45° angle to minimize spillage and rotate the trier once or twice to cut a core of material;
- Slowly withdraw sampler with the slot facing upward;
- Transfer sample with spatula or brush into a proper container;
- Repeat sampling at different points;
- Clean sampler.

At ORNL, large and small containers containing solid unknown wastes are sampled using grain and/or trier sampler.

5. Sampler Maintenance

Used samplers must be cleaned thoroughly for reuse.

- Disassemble any part that will make decontamination easier;
- Wipe sampler with absorbent cloth if petroleum products and oil have been sampled;
- Following wiping, rinse equipment with an organic solvent such as petroleum naphtha or trichloroethane;
- Wash sampler with warm detergent solution (i.e, liquinox or alconox);
- Rinse several times with tap water;
- Use distilled water for final rinse;
- Drain excess water and dry;
- The washings from decontamination are treated as hazardous waste if the sample contained hazardous wastes and disposed of according to ORNL requirements.

D. SAMPLING LOGISTICS

- When Form UCN-13698, Request for Disposal of Hazardous Waste Material arrives at the DEM and sampling is necessary, DEM staff sample hazardous wastes on location before they are picked-up from the generator for disposal;
- Person who samples the waste, also labels the material;

- The same person completes two forms:

  - Form UCN-13838 - Request for Analytical Services
  - Form UCN-15840 - DOE X-10 Plant Chain-of-Custody

- After the Chain-of-Custody is signed by the ACD, the sampling person makes a copy of it;

  - The original copy of the custody form is attached to the original Request for Analytical Services form and left with the ACD.

  - A copy of the custody form is taken to the DEM to be attached to the original Request for Disposal Form.

- The Sampling person makes three (3) copies of the Request for Analytical Services form;

  - Original is submitted to the ACD with the sample.
  - A copy is provided to the person in charge of hazardous waste management.
  - A copy is submitted to the Environmental Analysis group for computer record.
  - A copy is attached to the Request for Disposal form.

- When ACD analyzes samples, the results are forwarded to the Environmental Analysis group through the computer system. The computer printout of sample analysis with EHC codes belong to hazardous waste samples. The analytical results are attached to the original Request for Disposal form;

- The Request for Disposal form with the Chain-of-Custody form, Analytical Services request form, and sample analysis results are submitted to the person in charge of hazardous waste coordination;

- The rest of the procedure follows the same steps as regular waste disposal process.

E. SAFETY REQUIREMENTS

The sampling plan must include safety of the sampling personnel. All established safety precautions must be followed. The minimum requirements for protecting personnel calls for:

- neoprene rubber gloves, safety goggles;
- protective clothing;
- respirator (in some cases).

When dealing with unknowns, the respirator will be replaced with a:

- self-contained breathing apparatus.

During sampling of unidentified waste material, two persons should always work together. Other proper sampling precautions include inspection of containers before sampling. The following precautions must be taken before sampling of liquid wastes:

- Inspection of containers;
- Be aware of bulging or caved in drums that might be under pressure or vacuum;
- Relieve pressure in containers carefully;
- Sampling of corroded or rusted drums should be done with caution against rupture and spillage of its contents;
- Open the bung of drums carefully to reduce the possibility of producing a spark that might detonate on explosive gas mixture in the drum;
- Closed drums or containers containing unknown or known hazardous materials should be opened only using remote controlled, spark-proof opening devices (e.g., remotely operated pneumatic wrench along with a brass fitted lug socket);

- The proper protective respirator, in addition to other protective gear, must also be worn when sampling dry, powdered or granular wastes in containers or drums. These wastes tend to generate airborne particles when the containers are disturbed.

The following precautions must be taken before sampling solid wastes:

- Containers must be positioned in upright position and opened slowly;
- Sample must be compatible with the sampler and the sample container;
- Table VIII-3 indicates best points to sample containers.

F. ON-THE-JOB TRAINING AREAS

- Visits to sampling equipment locations;
- Explanation and demonstration of sampling with Coliwasa sampler with trainee participation;
- Demonstration and training on grain and trier sampler;
- Labeling sample containers, preparation of forms, and submitting samples to ACD;
- Preparation of "Request for Analytical Services" form and submitting samples to ACD;
- Preparation of "Chain of Custody" form.

Table VIII-3. Sampling points recommended for most waste containers

Container Type	Sampling Point
Drum, bung on one end	Withdraw sample through the bung opening.
Drum, bung on side	Lay drum on side with bung up. Withdraw sample through the bung opening.
Barrell, fiberdrum, buckets, sacks, bags	Withdraw samples through the top of barrels, fiberdrums, buckets, and similar containers. Withdraw samples through fill openings of bags and sacks. Withdraw samples through the center of the containers and to different points diagonally opposite the point of entry.
Vacuum truck and similar containers	Withdraw sample through open hatch. Sample all other hatches.
Pond, pit, lagoons	Divide surface area into an imaginary grid. Take three samples, if possible: one sample near the surface, one sample at mid-depth or at center, and one sample at the bottom. Repeat the sampling at each grid over the entire pond or site.
Waste pile	Withdraw samples through at least three different points near the top of the pile to points diagonally opposite the point of entry.
Storage tank	Sample from the top through the sampling hole.
Soil	Divide the surface area into an imaginary grid. Sample each grid.

Source: Samplers and Sampling Procedures for Hazardous Waste Streams, EPA-600/2-80-018, January 1980.

REFERENCES:

Samplers and Sampling Procedures for Hazardous Waste Streams, EPA-600/2-80-018, Jan. 1980.

IX. HAZARDOUS WASTE IDENTIFICATION/CLASSIFICATION TRAINING - MODULE H

Module H Outline

COURSE OBJECTIVES: To instruct hazardous waste personnel in identification and classification of chemicals in accordance with regulations.

COURSE LENGTH: 3 hours (20 minute break)

COURSE CONTENT:

A. Responsibilities of Hazardous Waste Tracking Personnel

B. Hazardous Waste Disposal Form

C. Identification of Hazardous Waste

1. Assignment of EPA Hazardous Waste Number

D. DOT Classification of Hazardous Waste

1. Material Identification
2. Use of DOT Hazardous Materials Tables

E. Introduction to the Computerized Hazardous Waste Tracking System

F. Off-Site Shipments

G. On-the-Job Training Areas

H. Audiotape Presentation:

Title: Material Classification, by E. I. DuPont
Length: 15 Minutes

I. Quiz: Hazardous Waste Identification/Classification

INSTRUCTED BY: Person who is familiar with RCRA and DOT hazardous waste regulations and who has an understanding of hands-on operations.

POTENTIAL PARTICIPANTS:
Hazardous Waste Computer Technicians
Hazardous Waste Supervisors
Hazardous Waste Classification Personnel

COURSE/MATERIALS NEEDED:
Overhead Projector
Transparencies
Audioviewer
Slides and Tape
Quiz

MODULE H

This module is developed essentially for the hazardous waste tracking staff. Hazardous waste personnel trained with this module are those: (a) who are responsible for providing "Request for Disposal of Hazardous Waste Material," Form UCN-13698, and who later identify and classify each entry on this form in accordance with EPA and DOT regulations, and (b) who enter all hazardous waste data into the hazardous waste computer system. On-the-job training is an essential part of this training.

A. RESPONSIBILITIES OF HAZARDOUS WASTE TRACKING PERSONNEL

Hazardous waste tracking staff responsibilities can be outlined as following:

- Familiarity with environmental regulations;
- Compliance with training;
- Interfacing with other ORNL departments and divisions who share hazardous waste management responsibilities;
- Identification/classification of wastes;
- Knowledge of chemical hazards;
- Knowledge of requirements for hazardous waste shipments;
- Use of the DOT Hazardous Materials Tables;
- Familiarity with on-site and off-site disposal procedures;
- Recordkeeping.

Some of these responsibilities have been studied previously and later modules will cover others. This module will primarily concentrate on the topic of waste identification and classification.

B. HAZARDOUS WASTE DISPOSAL FORM

Hazardous waste disposal at ORNL is controlled and tracked. The initial step in disposing of a waste is taken by the generator of the waste in filling out Form UCN-13698 (Figure IX-1). Form UCN-13698 is a documentation of "chain-of-custody." It provides tracking of hazardous waste from the time waste is picked up from the generator, packaged, and stored for disposal at an off-site commercial facility or on-site treatment/disposal. Some important steps to check in reviewing the form are:

- It must be completed as fully as possible by the generator;
- Completing the last two columns is the responsibility of hazardous waste personnel (However, the generator must fill in hazard information to the best of his/her knowledge);
- The telephone number of the generator must be included (to provide a contact to clarify questionable areas);
- Each waste in a different size container must be entered as a separate item on the list (Figure IX-1);
- The bottom portion of the form is completed by the WOG personnel;

After reviewing the forms, the person classifying waste will:

- Call or make site visits to clarify problem situations, hazards, or entries with the generator. It is very important that the form includes a complete description of the material location and has a charge number;

No. 5876

REQUEST FOR DISPOSAL OF HAZARDOUS WASTE MATERIAL

ite 3/18/86			Page 1 of 1
ste Generator J.M. Smith		Bldg. 1000	Room No. 23
nt X-10	Employee No. 22789	Phone No. 6-001	Charge/Work Order No. 68893WEE
cation of Material 1000		Room or Area 32	

TEM NO.	DESCRIPTION OF MATERIAL *	QUANTITY	RADIOACTIVE/ NONRADIOACTIVE	HAZARD INFORMATION	EPA WASTE NO./ CONTAINER NO. **
1	Benzene	1 Gallon	Nonradioactive	Suspected Carcinogen	
2	Mixture of Organic Solvents	Acetone 1 Gallon Methanol 1 Gallon Xylene 1 Gallon	Nonradioactive	Flammable	
	Sodium Fluoride	1 X 1 Lb.	Nonrad.	Corrosive Solid	D002 / 6
	Sodium Fluoride	2 X 1/2 Lb.	Nonrad.	Corrosive Solid	D002 / 6

* IF THE WASTE IS A CHEMICAL MIXTURE OR AN ITEM SUCH AS CONTAMINATED CLOTHING, LIST EACH CHEMICAL AND APPROXIMATE AMOUNTS OF EACH. ALL FORMS NOT PROPERLY FILLED OUT WILL BE RETURNED!

TO BE COMPLETED BY THE DEPARTMENT OF ENVIRONMENTAL MANAGEMENT.

ORAGE LOCATION 7507		TOTAL WEIGHT/VOLUME
TE TO STORAGE 2/12/86	RECYCLE/DISPOSAL DATE	RECYCLE/DISPOSAL SITE

WHITE - DEM
CANARY - CONTAINER
BLUE - WASTE GENERATOR

** INFORMATION TO BE COMPLETED BY DEM

N-13698
8-821

Fig. IX-1. Example of request for disposal of hazardous waste material form.

- Report certain chemical packaging or chemicals that need special attention to waste handling personnel. For example reactives, explosives, etc. will be removed immediately by WOG;

- Fill out Column 6, "EPA waste number" information;

- Submit the form to the person who coordinates hazardous materials pickup;

- The waste disposal request form will accompany waste pickup and transportation. During packaging of waste "container number" information will be entered on the form. Then the form will be returned to the hazardous waste computer technician for entry into the waste tracking database.

C. IDENTIFICATION OF HAZARDOUS WASTE

First, hazardous waste on the Form UCN-13698 must be identified with respect to the absence or presence of radioactivity. This information may be obtained through the help of:

- A health physics surveyor;
- Laboratory analysis;
- The generator of waste;
- Familiarity with the location of waste.

Second, hazardous waste must be identified according to its RCRA classification. To decide if the waste item is RCRA hazardous waste, one consults the following procedures:

- Decide if the material is a RCRA "solid waste." This decision is based on Figure IX-2 (Appendix I of 40 CFR 260);

- Decide if the solid waste is a "hazardous waste." Figure IX-3 will guide one in decision making. Subpart C Characteristics of Waste and/or Subpart D Lists of Hazardous Wastes need to be consulted.

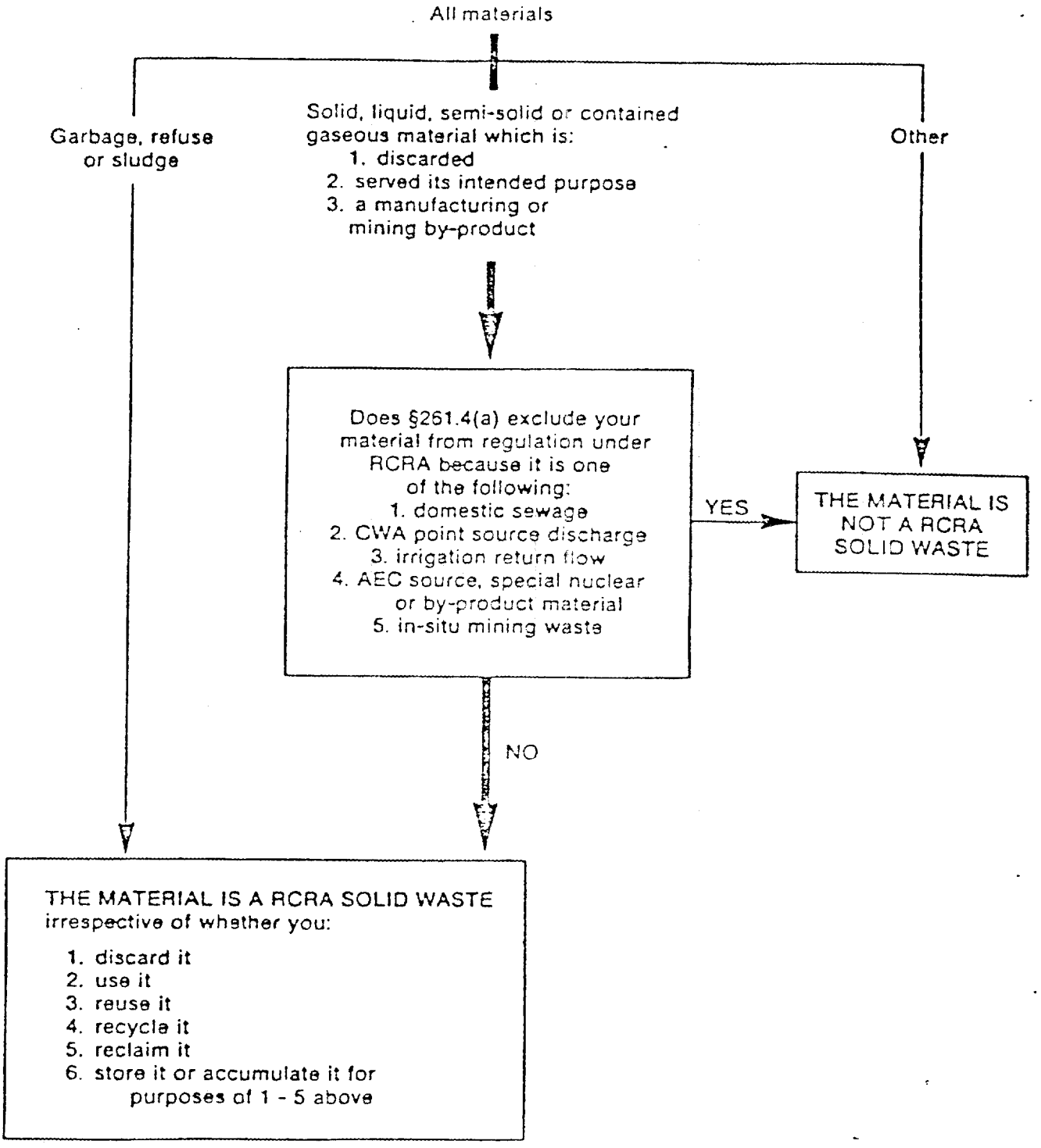


Fig. IX-2. Solid waste definition chart

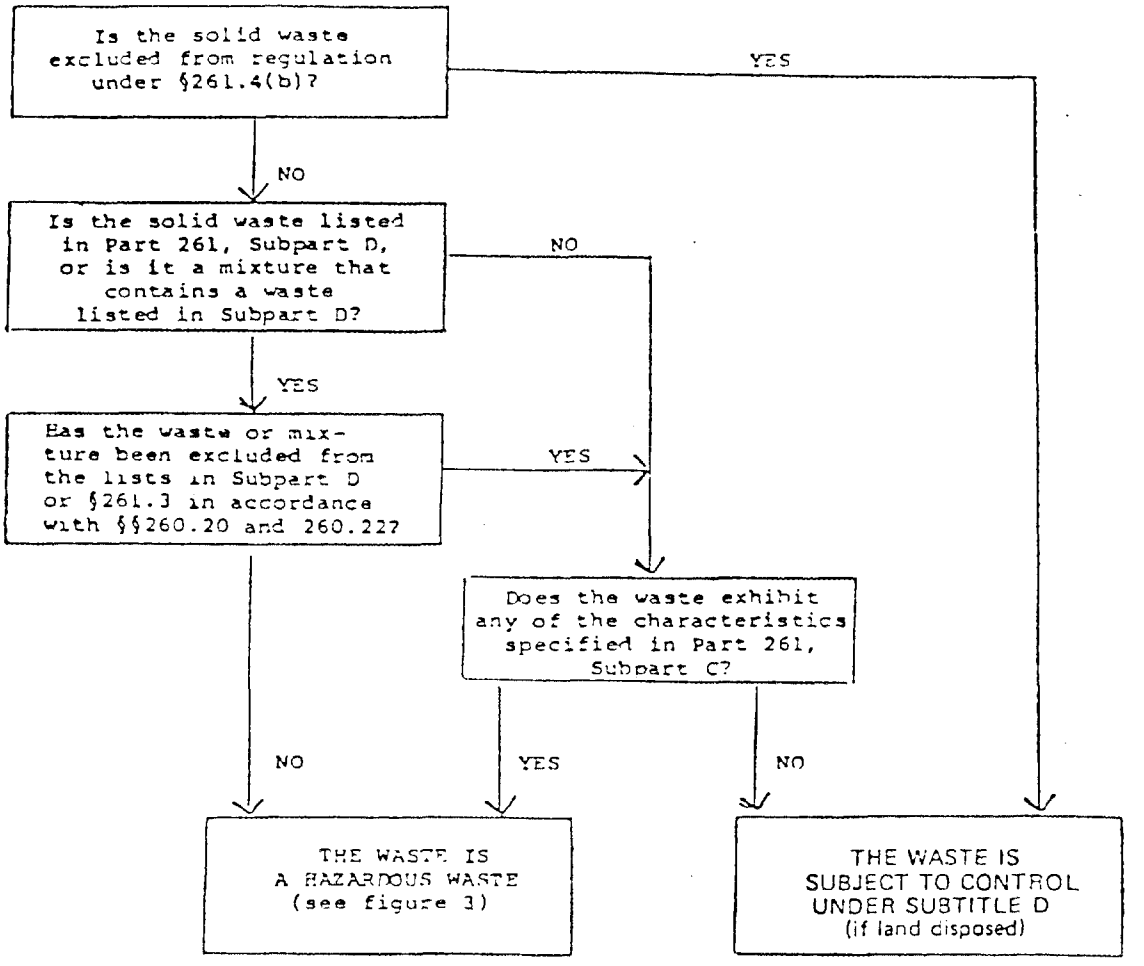


Fig. IX-3. Chart of hazardous waste definition

1. Assignment of EPA Waste Number

To identify and classify by EPA hazardous waste number, follow the procedure below:

- If you know the hazardous waste characteristics of the waste per Subpart C, then write matching EPA numbers D001-D017 (Appendix L);

- Check Figures IX-1 and IX-2 to decide if it is solid RCRA waste;

- Check F and K lists for sludges and processed wastes (Appendix L);

- Check 261.33 U and P listing for commercial chemicals and spilled materials (Appendix L);

- If you cannot find an EPA hazardous waste number for a specific substance, go to 49 CFR 172.101 and 172.102 tables and determine hazard class from the proper shipping name. From the hazard class, determine the matching EPA hazardous waste number by characteristics of hazardous waste. See the assignment below:

DOT Hazard Class	Form UCN-13698 Hazard Information (E Class)	EPA Hazardous Waste Number
Flammable liquid	Flammable	D001
Corrosive	Corrosive	D002
Combustible	Combustible	Not Assigned
Oxidizer	Oxidizer	D001
Flammable solid	Flammable solid	D001
Flammable solid	Water reactive (Dangerous when wet)	D003
Poison B	Poison B	Not Assigned
ORMs (go to literature to determine hazard class		Assign according to hazard:
	Flammable	D001
	Corrosive	D002
	Reactive	D003
	ORM-E	Not assigned

- When you cannot find the chemical listed in the DOT tables or other literature, list its shipping name as "hazardous substance" and hazard class as ORM-E. There will not be any EPA hazardous waste number for this waste;

- Unknown waste containing a single or a mixture of hazardous constituents will be analyzed for RCRA parameters to identify waste characteristics. Subsequently, proper EPA waste numbers will be assigned (D001-D017, Appendix L);

- Mixtures of waste materials with the same EPA character istics will be assigned corresponding to EPA waste numbers;

- Mixtures of processed waste corresponding to Table F will be assigned an F number;

- Assign code 600 for detonation and 700 for disposal at the Quarry for a container number.

Problems:

a. What is the EPA hazardous waste number for Arsenic III Oxide? _____

b. What is the EPA hazardous waste number for wastewater treatment sludges from the chemical conversion coating of aluminum? _____ What is the hazard code? _____ Why were these sludges listed?

D. DOT CLASSIFICATION OF HAZARDOUS WASTE

RCRA hazardous wastes, in addition to being classified under RCRA regulations, must also be classified in accordance with DOT

regulations; since during transportation all RCRA wastes are treated the same as DOT hazardous materials (49 CFR 173.2). In Module C, DOT hazard classes have been studied. When the material has more than one hazard, it must be classed according to the following order of hazards:

a. Radioactive Material (highest, number one hazard);
b. Poison A;
c. Flammable Gas;
d. Non-Flammable Gas;
e. Flammable Liquid;
f. Oxidizer;
g. Flammable Solid;
h. Corrosive Material (Liquid);
i. Poison B;
j. Corrosive Material (Solid);
k. Irritating Materials;
l. Combustible Liquids (exceeding 110 gallons);
m. ORM-B;
n. ORM-A;
o. Combustible Liquids (less than 110 gallons);
p. ORM-E.

There are exceptions to the above classification. These exceptions include:

- a material identified in 172.101;
- an explosive classed under 173.86 or blasting agent under 173.114a;
- an etiological agent identified in 173.386;
- an organic peroxide (172.101 & 173.151d).

1. Material Identification

It is necessary that the composition of the material to be shipped is known. Usually, labels or product names provide us with knowledge to identify the properties of the material. However, if the material is unknown, we can consult:

a. the user of the material;
b. the manufacturer;
c. laboratory analysis;
d. organizations which offer assistance. The following organizations might be contacted for consultation.

- CHEMTREC (202) 887-1255;
- OHM, Inc. (419) 423-3526;
- DOT - Technical Division (202) 426-2311;
- Bureau of Explosives (202) 835-9500;
- Communicative Disease Center (404) 329-3524;
- EPA - Technical Assistance (202) 426-9346;
- Office of Hazardous Materials Regulation (OHMR) Information Center (202) 426-2075;
- National Agricultural Chemical Association (202) 296-1585;
- National Response Center (800) 424-8802;

There are several publications that can be used (see Module D, Section B to help identify chemicals and wastes.

2. Use of DOT Hazardous Materials Tables

There are two DOT Hazardous Materials Tables:

- 40 CFR 172.101 titled Hazardous Materials Table.
- 40 CFR 172.102 titled Optional Hazardous Materials Table.

The Optional Hazardous Materials Table provides descriptions, classifications, labeling, and vessel stowage requirements which are used for international shipment. The Optional Table may be used to help us classify some compounds; however, this table is not a substitute for the 172.101 table and does not contain the same necessary information.

Hazardous Materials Table 172.101 is made up of seven columns to provide us with various hazardous materials information and shipment requirements (Appendix B). These seven columns will be studied here.

Column 2 - Proper Shipping Name

Trainee must be aware of certain rules listed below. Find each of the examples on the Hazardous Materials Table.

a. Only names in Roman Type are proper shipping names.
   Example: Crotonylene
   Cupric Cyanide

b. The name may be singular or plural.
   Example: Cosmetics, solid, n.o.s.

c. Letters may be either upper or lower case.
   Example: Propyl Alcohol
   PROPYL ALCOHOL

d. Words in Italic may be included in addition to the proper shipping name, which is always in Roman type.
Example: Propionyl Peroxide, not more than 28% in solution.

e. The word "Or" in italics indicates that the most appropriate term in the sequence of shipping names may be used alone, without listing all the other names in the sequence.
Example: Oxidizer, n.o.s., or oxidizing material, n.o.s.

f. The abbreviation "NOI" (not otherwise indexed) can be interchanged with "N.O.S." (not otherwise specified).
Example: Corrosive liquid, n.o.s.

g. Except for organic peroxides, when one entry in Column 2 in Roman type refers to another entry also in Roman type by the word "see" in italics, either shipping name is acceptable.
Example: Methyl sulfate. See Dimethyl Sulfate.

h. When a shipping name includes a concentration range, such as "Perchloric acid, not over 50% acid," you may enter the actual concentration, i.e., "Perchloric Acid, 40% acid."

i. If an appropriate technical name (e.g., a radioisotope of iron) is not listed in Column 2 of the table, the proper shipping name must be selected from the general descriptions of N.O.S. entries most closely corresponding to the hazardous properties and description of the material being shipped (i.e, Radioactive Material, N.O.S.).

Problems

1. Are these names proper shipping names? a) Moth balls? b) Caustic soda, liquid?

2. Which of the shipping names below provides the most accurate description? a) Corrosive liquid, n.o.s.; b) compound, cleaning liquid; c) potassium hydroxide, solution?

j. If the word "waste" is not included in the hazardous material description in the Table, the proper shipping name for a hazardous waste must include the word "waste" preceding the proper shipping name of the material. For example: Waste acetone.

k. If only the DOT hazard class "ORM E" applies, then the proper name is "Hazardous Waste, liquid (or solid), n.o.s." or "Hazardous Substance, liquid (or solid), n.o.s."

l. A mixture or solution comprised of a hazardous material identified in the Table by technical name and non-hazardous material may be described using the proper shipping name of the <u>hazardous material</u>, if

- The mixture or solution is not specifically identified in the table;

- The hazard class of the mixture or solution is the same as that of the hazardous material; and

- The qualifying word "mixture" or "solution", as appropriate, is added as part of the proper shipping name. For example, a solution of acetone, mineral oil, and water, meeting the definition of a flammable liquid, may be described as "Acetone solution, Flammable liquid, UN 1090."

m. Except for proper shipping names in the Table that are preceded by a plus (+)

- If it is specifically determined that a material meets the definition of a hazard class other than the class shown in association with the proper shipping name, the material must be described by an appropriate shipping name listed in association with the correct class for the material; or

- If an appropriate technical name is not shown in the Table, selection of a proper shipping name must be made from the general descriptions of n.o.s. entries corresponding to the specific hazard class of the material being shipped. The name that most appropriately describes the material must be used, e.g., an alcohol not listed by name in the Table must be shipped as "Alcohol, n.o.s." rather than "Flammable liquid, n.o.s." Some mixtures may be more appropriately described according to their application, such as "Compound, cleaning liquid" or "Compound rust removing," rather than by an n.o.s. entry, such as "Corrosive liquid, n.o.s.";

- If a material meets the definition of more than one hazard class and is not specifically identified in the Table, the hazard class of the material must be determined by using the precedence specified in 173.2.

Column 1 - Hazard Codes

This column provides hazard codes. The following information is pertinent to this column.

a. No entry means <u>all</u> modes.

b. A - Material is regulated only by air.

c. W - Material is regulated only by water
("A" and "w" has no significance if the material is a hazardous waste.)

d. E - Regulated by the EPA as a hazardous substance and subject to additional regulations regardless of the mode of transportation or hazard class.

e. + - The Material always uses the shipping name in Column 2 even though the materials may be diluted, less than 40 psia if a gas, or in a solution. It does <u>not</u> even have to meet the definition of the hazard class listed in Column 3. <u>Any</u> quantity of the material <u>must</u> be shipped with that proper shipping name, and meet all the packaging, marking, labeling, and placarding requirements for that named material, unless an alternate description has been specifically authorized.

Example: If phenol is diluted, it would still have the same shipping name and same hazard classification.

<u>Problem</u>: For the following materials/package, fill in the mode(s).

Material	Air	Water	All Modes
Benzyl Chloride 300 lbs.			
Malathion 25 lbs.			
Thiram 50 lbs.			
Calcium Oxide 100 lbs.			

Column 3 - Hazard Class and Identification Number

Column 3 is made up of two columns:

a. The first column contains either the Hazard Class of the material or the word "Forbidden." If the word "Forbidden" appears, then that material may neither be offered for transportation nor accepted, by any mode. (There are a few exceptions.)

b. The second column, 3A contains the Identification Number assigned to that material. "UN" (United Nations) numbers are appropriate for use on all shipments, either international or domestic. "NA" (North American) numbers are used only in the United Stated and Canada. After July 1, 1983, they must be marked on the outside of the package with the proper shipping name in addition to shipping papers.

Problem: Hazard class and identification numbers for the following materials are:

Material	Hazard Class	ID #
Vinyl Chloride		
Vinyl Acetate		
Paint thinner, Liquid		

Column 4 - Required Label

This column will provide us with information regarding the necessary label to be used on the container and/or with the exceptions to the use of a label. The DOT labels are illustrated in Module C, Figure IV-1 will be referred to this column. First the proper name must be found to be able to assign the proper label.

Labels might identify the hazard associated with the substance or provide information relative to shipping limitations (see Acrylonitrile). Labeling has been covered in Module C, Section C (4).

Problem: Identify labels for the following materials:

Material	Label
Pentane	
Phosphorus Oxychloride	
Fluorine	

Column 5 - Packaging

Column five consists of two separate columns. The columns specify the location (reference) of the packaging exceptions available (i.e., limited quantity provisions) and the packaging that should be used, specific requirements. The 49 CFR sections identifying requirements must be read carefully. Hazardous material shipments, unless otherwise authorized, must be packaged in containers whose design and construction have been approved for use. There are three levels of packaging requirements, These are general requirements, hazard class requirements, and materials specific requirements. Module C, Section 3 explained these three types of packaging.

Problem: List the packaging requirements for the following hazardous materials from the Hazardous Materials Table.

Material	Column (a)	Column (b)
Dimethyl sulfate		
Acrylic acid		
Fuming nitric acid		

Column 6 - Quantity Limitations

Column 6 identifies the maximum net quantity allowed in one package. Column 6A provides reference for transportation by passenger-carrying aircraft or passenger railcar. When net quantity of material per package exceeds the maximum quantity allowed on a passenger-carrying aircraft, the package must bear a "Cargo Aircraft Only" label, and must be so indicated on the shipping paper.

Column 6B provides references for transportation by cargo aircraft only. Any package exceeding the quantity allowed on a cargo-only aircraft is forbidden for transportation by air.

Problem: Indicate the maximum quantity per package allowed on a "passenger-carrying aircraft" and "cargo aircraft only" for the following hazardous materials.

Material	Passenger Carrying Aircraft	Cargo Aircraft Only
Lead cyanide		
Divinyl ether		
Phosphine		

Column 7 - Water Shipments

Three columns identify locations on board for (a) cargo vessel, (b) passenger vessel, and (c) other requirements.

Two exercises will be conducted here to reinforce the use of the Hazardous Materials Table and to classify hazardous waste on Form UCN-13698.

Exercise: ° Complete information for each relevant column for acetone, lithium nitride and ethyl alcohol on exercise sheets A-1, A-2, and A-3.

Exercise: ° Look up each chemical for its "Hazard Code" and "EPA number" on exercise sheet B.

(1) Shipping Name/Hazard Class Identification Number	(2) Regulated by 49CFR			(3) Packaging					(4) Marking
	(a)	(b)	(c)	(a)		(b)	(c)	(d)	
	As HM	By Mode	As HS	Pass. A/C	Cargo A/C	Except (5)(a)	Spec. (5)(b)	Gen. Pkg.	
6,750 lbs (825 gal) of Acetone which will be shipped to a customer									

(5) Labeling		(6) Shipping Papers			(7) Placarding
Table Label	Additional	Basic Description	Additional Description	Certification	

Exercise A-1

(1) Shipping Name/Hazard Class Identification Number	(2) Regulated by 49CFR			(3) Packaging					(4) Marking
	(a)	(b)	(c)	(a)		(b)	(c)	(d)	
	As HM	By Mode	As HS	Pass. A/C	Cargo A/C	Except (5)(a)	Spec. (5)(b)	Gen. Pkg.	
25 lbs of Lithium Nitride which will be shipped to a customer									

(5) Labeling		(6) Shipping Papers			(7) Placarding
Table Label	Additional	Basic Description	Additional Description	Certification	

Exercise A-2

(1) Shipping Name/Hazard Class Identification Number	(2) Regulated by 49CFR			(3) Packaging					(4) Marking
	(a)	(b)	(c)	(a)		(b)	(c)	(d)	
	As HM	By Mode	As HS	Pass. A/C	Cargo A/C	Except (5)(a)	Spec. (5)(b)	Gen. Pkg.	
55 gal. of Ethyl Alcohol which will be shipped to a disposal facility									

(5) Labeling		(6) Shipping Papers			(7) Placarding
Table Label	Additional	Basic Description	Additional Description	Certification	

Exercise A-3

No. 5876

REQUEST FOR DISPOSAL OF HAZARDOUS WASTE MATERIAL

te 3/18/86			Page 1 of 1
ste Generator J.M. Smith		Bldg. 1000	Room No. 23
nt -10	Employee No. 22789	Phone No. 6-001	Charge/Work Order No. 68893WEE
ation of Material 1000		Room or Area 32	

TEM NO.	DESCRIPTION OF MATERIAL *	QUANTITY	RADIOACTIVE/ NONRADIOACTIVE	HAZARD INFORMATION	EPA WASTE NO./ CONTAINER NO. **
1	Benzene	1 Gallon	Nonradioactive	Suspected Carcinogen	
2	Mixture of Organic Solvents	Acetone 1 Gallon Methanol 1 Gallon Xylene 1 Gallon	Nonradioactive	Flammable	
1	Sodium Bromate	1 X 1 Lb			
2	Cupric Chloride	11 X 1 Lb			
3	Sodium, metal	2 X 1 Lb			
4	Vanadium pentoxide	1 X 1/2 Lb			

* IF THE WASTE IS A CHEMICAL MIXTURE OR AN ITEM SUCH AS CONTAMINATED CLOTHING, LIST EACH CHEMICAL AND APPROXIMATE AMOUNTS OF EACH. ALL FORMS NOT PROPERLY FILLED OUT WILL BE RETURNED!

TO BE COMPLETED BY THE DEPARTMENT OF ENVIRONMENTAL MANAGEMENT.

RAGE LOCATION		TOTAL WEIGHT/VOLUME
E TO STORAGE	RECYCLE/DISPOSAL DATE	RECYCLE/DISPOSAL SITE

WHITE - DEM
CANARY - CONTAINER
BLUE - WASTE GENERATOR

** INFORMATION TO BE COMPLETED BY DEM

Exercise B

J-13698
8-82)

E. INTRODUCTION TO THE COMPUTERIZED HAZARDOUS WASTE TRACKING SYSTEM

To implement RCRA's "cradle to grave" motto, ORNL developed a computer tracking system for hazardous materials. This system is processed on the DECsystem-10 computer using System 1022 as the database management system and SCOPE as the system screen processor. With the information on this system, up-to-date inventories are kept on:

- Waste;
- Asbestos;
- PCBs;
- Spills.

The management information reports can be generated on:

- Monthly Billing;
- Manifest Inventory List;
- Asbestos Reports;
- PCB Inventory Reports;
- Annual Reports;
- Division Totals;
- Off-site Disposal Billing.

The ORNL/CSD/TM-236 entitled "ORNL Computerized Hazardous Materials Tracking System" will be provided to the trainee. Introduction and definitions of this report will be reviewed. Chapter 5 of the report describing program HMTS03 is of special interest. Command "DO WASTE" on the monitor level will access this program. The waste disposal menu (Figure IX-4) provides nine choices. Number 1, "data entry" is accessed to enter data from Form UCN-13698 to the computer. This data entry is consistent with entering information on two computer screens (Figure IX-5):

- "Waste Disposal Data Screen-Account Data"; and
- "Waste Disposal Data Screen-item Data".

```
*** WASTE DISPOSAL ***

   1. Data entry

   2. List a form     Form #: ______  Item: ___

   3. Edit a form     Form #: ______  Item: ___

   4. Monthly billing

   5. Annual report

   6. Manifest attachment

   7. Division totals     From: __/__/__ to __/__/__

   8. Offsite billing

   9. Exit

      Option?: _
```

Waste Disposal screen.

Fig. IX-4. Waste disposal screen

```
__________                WASTE DISPOSAL SYSTEM
*****************************************************************************
                1. Form Number: ______    2. Request Date: __/__/__

                              WASTE GENERATOR

                3. Badge No.: ______      4. Name: ____________________
                5. Plant: _  Building: ________ Room: ____  Phone: _____

                              ACCOUNT
                6. Work Order: ________    7. Charge: ____-____
                   Division: __
                   Dept.: ____________________________________________

                              AMOUNT

                8. Total Amount: _______.__  9. Unit: ______
                                 _______.__  ______
*****************************************************************************
EDITING?(Y/N): _  NUMBER?: _  DO YOU WISH TO SEE ANY ITEMS?(Y/N): _ THIS ONE?: _
DELETE THIS FORM/ALL ITEMS?(Y/N): _  ADD NEW ITEM?(Y/N): _          EXIT?(Y/N): _
```

Waste Disposal data screen—account data.

```
__________                WASTE DISPOSAL SYSTEM                ITEM ___ OF ___
*****************************************************************************
   Form Number : ______
                              ITEM INFORMATION
10. Item #: ___
11. Waste Desc.: ____________________________________________
12. Radioactive?: _    13. Type: ________________________
                       14. Level: ________________________
15. EPA #'s: ____________________________
16. Eclass: ____________________________________________
17. Item amount: _______.__  18. Item unit: ______ _______.__ ______  19. Chs/Gal: _
20. Storage Site: ___________          22. Disposal Site: ____________________
21. Storage Date: __/__/__             23. Disposal Date: __/__/__
                                       24. Disposal Ctr: ___
25. DOT: ____________________________________________________________________
*****************************************************************************
                         INDIVIDUAL CHEMICAL WASTE                    (__ of __)
26. Chem: ____________________________________________________________
27. Amount: _____.__      28. Unit: ______
*****************************************************************************
EDITING?(Y/N): _  FIELD #: __   DELETE?(Y/N): _    ANOTHER ITEM?(Y/N): _
THIS ONE?(Y/N): _   NEXT ONE?(Y/N): _  ANOTHER ITEM?(Y/N): _
ANOTHER FORM?(Y/N): _  ANOTHER MATL?(Y/N): _     EXIT?(Y/N): _
```

Waste Disposal data screen—item data.

Fig. IX-5. Waste disposal data screens

Four different files use this information for hazardous waste. These are:

- WACCT (general accounting information);
- WITEM (waste item file);
- WASTE (individual waste of a mixture);
- RADWST (radioactive waste information).

Exercise: Simulate entering information from Form UCN-13698, exercise sheet C, to computer screens; "Waste disposal data screen - account data" and "Waste disposal data screen - item data" on exercise sheet D-1 and D-2.

F. OFF-SITE SHIPMENTS

Hazardous wastes, unless treated or disposed of on-site at ORNL, are shipped to an off-site EPA approved, commercial facility. A manifest is prepared in accordance with the regulations for these shipments (Appendix A). The manifest inventory list, generated by the hazardous materials computer system, is a quick, dependable and integral part of the process. It is used for requisition orders to choose disposal facilities. It is also an attachment to the manifest when actual shipment takes place.

G. ON-THE-JOB TRAINING AREAS

- Completing fifteen (15) hazardous waste "EPA No." and "Hazard Information" on Form UCN-13698 with the help of a person who is responsible for identification/classification at DEM;

- Repeating the above task on fifteen (15) more hazardous waste entries without help;

- Observing data entry for Hazardous Materials Tracking System.

No. 5876

REQUEST FOR DISPOSAL OF HAZARDOUS WASTE MATERIAL

te 3/18/86			Page 1 of 1
ste Generator J.M. Smith		Bldg. 1000	Room No. 23
nt X-10	Employee No. 22789	Phone No. 6-001	Charge/Work Order No. 68893WEE
cation of Material 1000		Room or Area 32	

TEM NO.	DESCRIPTION OF MATERIAL *	QUANTITY	RADIOACTIVE/ NONRADIOACTIVE	HAZARD INFORMATION	EPA WASTE NO./ CONTAINER NO. **
1	Benzene	1 Gallon	Nonradioactive	Suspected Carcinogen	
2	Mixture of Organic Solvents	Acetone 1 Gallon Methanol 1 Gallon Xylene 1 Gallon	Nonradioactive	Flammable	
1	Sodium Hydroxide	1 X 1 Lt	Nonrad.	Corrosive Liq.	D002 / 1
2	Formaldehyde	1 X 1/2 Lt.	Nonrad.	ORM -A Flammable Liq.	U122 / 20

* IF THE WASTE IS A CHEMICAL MIXTURE OR AN ITEM SUCH AS CONTAMINATED CLOTHING, LIST EACH CHEMICAL AND APPROXIMATE AMOUNTS OF EACH. ALL FORMS NOT PROPERLY FILLED OUT WILL BE RETURNED!

TO BE COMPLETED BY THE DEPARTMENT OF ENVIRONMENTAL MANAGEMENT.

TORAGE LOCATION		TOTAL WEIGHT/VOLUME
ATE TO STORAGE	RECYCLE/DISPOSAL DATE	RECYCLE/DISPOSAL SITE

WHITE - DEM
CANARY - CONTAINER
BLUE - WASTE GENERATOR

Exercise C

** INFORMATION TO BE COMPLETED BY DEM

JCN-13698
3 8-82)

```
__________                WASTE DISPOSAL SYSTEM
*****************************************************************************
                1. Form Number: ______     2. Request Date: __/__/__

                              WASTE GENERATOR

                3. Badge No.: ______       4. Name: ____________________
                5. Plant: _  Building: _______ Room: ____  Phone: _____

                              ACCOUNT
                6. Work Order: ________    7. Charge: ____-____
                   Division: __
                   Dept.: ____________________________________________

                              AMOUNT

                8. Total Amount: _____.__  9. Unit: ______
                                 _____.__  ______
*****************************************************************************
EDITING?(Y/N): _  NUMBER?: _  DO YOU WISH TO SEE ANY ITEMS?(Y/N): _ THIS ONE?: _
DELETE THIS FORM/ALL ITEMS?(Y/N): _  ADD NEW ITEM?(Y/N): _          EXIT?(Y/N): _
```

Waste Disposal data screen—account data.

```
__________                WASTE DISPOSAL SYSTEM                ITEM ___ OF ___
*****************************************************************************
   Form Number : ______
                              ITEM INFORMATION
10. Item #: ___
11. Waste Desc.: ____________________________________________________
12. Radioactive?: _    13. Type: ________________________
                       14. Level: ________________________
15. EPA #'s: ____________________________
16. Eclass: ____________________________________________
17. Item amount: _____.__  18. Item unit: ______ _____.__ ______  19. Chs/Gal: _
20. Storage Site: ___________          22. Disposal Site: ____________________
21. Storage Date: __/__/__             23. Disposal Date: __/__/__
                                       24. Disposal Ctnr: ___
25. DOT: ____________________________________________________________________
*****************************************************************************
                         INDIVIDUAL CHEMICAL WASTE                    (__ of __)
26. Chem: ____________________________________________________________
27. Amount: _____.__      28. Unit: ______
*****************************************************************************
EDITING?(Y/N): _  FIELD #: __   DELETE?(Y/N): _    ANOTHER ITEM?(Y/N): _
THIS ONE?(Y/N): _   NEXT ONE?(Y/N): _  ANOTHER ITEM?(Y/N): _
ANOTHER FORM?(Y/N): _  ANOTHER MATL?(Y/N): _     EXIT?(Y/N): _
```

Waste Disposal data screen—item data.

Exercise D-1

```
__________                WASTE DISPOSAL SYSTEM
*****************************************************************************
                1. Form Number: ______     2. Request Date: __/__/__

                              WASTE GENERATOR

                3. Badge No.: ______       4. Name: ____________________
                5. Plant: _  Building: ________ Room: ____  Phone: _____

                              ACCOUNT
                6. Work Order: ________    7. Charge: ____-____
                   Division: __
                   Dept.: ____________________________________________

                              AMOUNT

                8. Total Amount: _____.__  9. Unit: ______
                                 _____.__  ______
*****************************************************************************
EDITING?(Y/N): _  NUMBER?: _  DO YOU WISH TO SEE ANY ITEMS?(Y/N): _ THIS ONE?:
DELETE THIS FORM/ALL ITEMS?(Y/N): _  ADD NEW ITEM?(Y/N): _          EXIT?(Y/N):
```

Waste Disposal data screen—account data.

```
__________                WASTE DISPOSAL SYSTEM                ITEM ___ OF ___
*****************************************************************************
   Form Number : ______
                              ITEM INFORMATION
10. Item #: ___
11. Waste Desc.: ____________________________________________
12. Radioactive?: _    13. Type: ________________________
                       14. Level: ________________________
15. EPA #'s: ____________________________
16. Eclass: ____________________________________________
17. Item amount: _____.__  18. Item unit: _____ _____.__ _____  19. Chs/Gal: _
20. Storage Site: ___________          22. Disposal Site: ____________________
21. Storage Date: __/__/__             23. Disposal Date: __/__/__
                                       24. Disposal Ctnr: ___
25. DOT: ____________________________________________________________________
*****************************************************************************
                         INDIVIDUAL CHEMICAL WASTE                    (__ of __)
26. Chem: ____________________________________________________________
27. Amount: _____.__      28. Unit: _____
*****************************************************************************
EDITING?(Y/N): _  FIELD #: __   DELETE?(Y/N): _    ANOTHER ITEMTYPE?(Y/N): _
THIS ONE?(Y/N): _   NEXT ONE?(Y/N): _  ANOTHER ITEM?(Y/N): _
ANOTHER FORM?(Y/N): _  ANOTHER MATL?(Y/N): _     EXIT?(Y/N): _
```

Waste Disposal data screen—item data.

Exercise D-2

- Reviewing the overall capabilities of the tracking database system;
- Entering data from Form UCN-13698 into computer file;
- Entering data to asbestos data file;
- Entering data to PCB data file;
- Generating monthly billing;
- Generating manifest inventory attachment;
- Generating asbestos reports;
- Generating PCB inventory lists;
- Generating off-site disposal billing.

Answers to Problems

3.4 (a) P012

3.4 (b) F019; Toxic waste; these sludges contain toxic hexavalent chromium and cyanide (complex) listed in 40 CFR 261, Appendix VII.

Column 2 (i) m:

1 (a) No
1 (b) Yes
2 Potassium hydroxide

Column 1 (e):

Material	Air	Water	All Modes
Benzyl Chloride 300 lbs.			X
Malathion 25 lbs.			X
Thiram 50 lbs.	X		
Calcium Oxide 100 lbs.	X	X	

Column 3 (b):

Material	Hazard Class	ID#
Vinyl Chloride	Flammable Gas	UN 1086
Vinyl Acetate	Flammable Liquid	UN 1301
Paint thinner, Liquid	Flammable Liquid (check flash point)	UN 1263

Column 4 (a):

Problem:

Material	Label
Pentane	Flammable Liquid
Phosphorus Oxychloride	Corrosive Material
Fluorine	Poison and Oxidizer

(h):

a. Corrosive and dangerous placards
b. Yes

Answers - Continued

Column 5:

Material	Column (a)	Column (b)
Dimethyl sulfate	None	173.255
Acrylic Acid	173.244	173.245
Fuming Nitric Acid	None	173.268

Column 6:

Material	Passenger Carrying Aircraft	Cargo Aircraft Only
Lead	25 lbs	No limit
Divinyl ether	Forbidden	10 gallons
Phosphine	Forbidden	Forbidden

Solutions to exercises in this module are included in the following pages.

(1) Shipping Name/Hazard Class Identification Number	(2) Regulated by 49CFR			(3) Packaging					(4) Marking
	(a)	(b)	(c)	(a)		(b)	(c)	(d)	
	As HM	By Mode	As HS	Pass. A/C	Cargo A/C	Except (5)(a)	Spec. (5)(b)	Gen. Pkg.	
ACETONE - shipping name Flammable Liquid - Hazard class UN 1090 - ID number	yes	all	no	1 qt.	10 gal.	173.118	178.119 Spec. DOT-17E or 17H Metal Drum 18 guage today	Yes	ACETONE - shipping name UN 1090 - ID number Consignee/consignor Name and address "this end up" or bung indicator end up

(5) Labeling		(6) Shipping Papers			(7) Placarding
Table Label	Additional	Basic Description	Additional Description	Certification	
Flammable Liquid		ACETONE - shipping name Flammable Liquid - Hazard Class UN 1090 - ID number 6,750 lbs. - weight 825 gal. - volume		Reference 172.204	Flammable

(1) Shipping Name/Hazard Class Identification Number	(2) Regulated by 49CFR			(3) Packaging					(4) Marking
	(a)	(b)	(c)	(a)		(b)	(c)	(d)	
	As HM	By Mode	As HS	Pass. A/C	Cargo A/C	Except (5)(a)	Spec. (5)(b)	Gen. Pkg.	
Lithium Nitride Flammable Solid UN 2806	Yes	All	No	For-bidden	25 lbs	None	173.206	173	Lithium Nitride UN 2806 Consignee/Consignor Name & Address

(5) Labeling		(6) Shipping Papers			(7) Placarding
Table Label	Additional	Basic Description	Additional Description	Certification	
Flammable Solid Dangerous When Wet		Lithium Nitride Flammable Solid UN 2806 25 lbs		172.204	Flammable Solid ~~W~~

(1) Shipping Name/Hazard Class Identification Number	(2) Regulated by 49CFR			(3) Packaging					(4) Marking
	(a)	(b)	(c)	(a)		(b)	(c)	(d)	
	As HM	By Mode	As HS	Pass. A/C	Cargo A/C	Except (5)(a)	Spec. (5)(b)	Gen. Pkg.	
Waste Ethyl Alcohol Flammable Liquid UN 1170	Yes	All	No	1 Qt	10 Gal	173.118	173.125	173	Ethyl Alcohol UN 1170 Consignee/Consignor Name & Address This End Up

(5) Labeling		(6) Shipping Papers			(7) Placarding
Table Label	Additional	Basic Description	Additional Description	Certification	
Flammable Liquid Hazardous Waste Label	None	Ethyl Alcohol Flammable Liquid UN 1170 55 Gal		172.204	Flammable

No. 5876

REQUEST FOR DISPOSAL OF HAZARDOUS WASTE MATERIAL

3/18/86				Page 1 of 1
e Generator: .M. Smith			Bldg. 1000	Room No. 23
-10	Employee No. 22789	Phone No. 6-001	Charge/Work Order No. 68893WEE	
tion of Material: 000		Room or Area: 32		

EM O.	DESCRIPTION OF MATERIAL *	QUANTITY	RADIOACTIVE/ NONRADIOACTIVE	HAZARD INFORMATION	EPA WASTE NO./ CONTAINER NO. **
1	Benzene	1 Gallon	Nonradioactive	Suspected Carcinogen	
2	Mixture of Organic Solvents	Acetone 1 Gallon Methanol 1 Gallon Xylene 1 Gallon	Nonradioactive	Flammable	
1	Sodium Bromate	1 X 1 Lb	Nonrad.	Oxidizer,solid	D001 / 9
2	Cupric Chloride	11 X 1 Lb	Nonrad.	Poison, solid	-- / 13
3	Sodium, metal	2 X 1 Lb	Nonrad.	Reactive metal	D003 / 6
4	Vanadium pentoxide	1 X 1/2 Lb	Nonrad.	ORM-E Poison	P120 / 11

* IF THE WASTE IS A CHEMICAL MIXTURE OR AN ITEM SUCH AS CONTAMINATED CLOTHING, LIST EACH CHEMICAL AND APPROXIMATE AMOUNTS OF EACH. ALL FORMS NOT PROPERLY FILLED OUT WILL BE RETURNED!

TO BE COMPLETED BY THE DEPARTMENT OF ENVIRONMENTAL MANAGEMENT.

RAGE LOCATION		TOTAL WEIGHT/VOLUME
E TO STORAGE	RECYCLE/DISPOSAL DATE	RECYCLE/DISPOSAL SITE

WHITE - DEM
CANARY - CONTAINER
BLUE - WASTE GENERATOR

** INFORMATION TO BE COMPLETED BY DEM

Exercise B

N 13698
8-82)

```
----------                    WASTE DISPOSAL SYSTEM
*****************************************************************************
                1. Form Number: 5876    2. Request Date: 03/18/86

                              WASTE GENERATOR

                3. Badge No.: 22789      4. Name: Smith, J. M.
                5. Plant: _  Building: 1000  Room: 32  Phone: _____

                              ACCOUNT
                6. Work Order: 68893WEE    7. Charge: ____-____
                   Division: __
                   Dept.: ____________________________________________

                              AMOUNT
                8. Total Amount: 15.__  9. Unit: ℓ
                                 ____.__  _____
*****************************************************************************
EDITING?(Y/N): _  NUMBER?: _  DO YOU WISH TO SEE ANY ITEMS?(Y/N): _ THIS ONE?: _
DELETE THIS FORM/ALL ITEMS?(Y/N): _  ADD NEW ITEM?(Y/N): _          EXIT?(Y/N): _
```

Waste Disposal data screen—account data.

```
----------                    WASTE DISPOSAL SYSTEM                ITEM ___ OF ___
*****************************************************************************
   Form Number : 5876
                              ITEM INFORMATION
10. Item #: 1
11. Waste Desc.: Sodium hydroxide
12. Radioactive?: N     13. Type: ____________________
                        14. Level: ___________________
15. EPA #'s: D002
16. Eclass: Corrosive Liquid
17. Item amount: 1.0   18. Item unit: ℓ   _____ ____ ____  19. Chs/Gal: _
20. Storage Site: 7507                  22. Disposal Site: ____________
21. Storage Date: 03/27/86              23. Disposal Date: __/__/__
                                        24. Disposal Ctnr: I9
25. DOT: ____________________________________________________________
*****************************************************************************
                         INDIVIDUAL CHEMICAL WASTE                  (__ of __)
26. Chem: ____________________________________________________
27. Amount: _____.__     28. Unit: _____
*****************************************************************************
EDITING?(Y/N): _  FIELD #: __   DELETE?(Y/N): _   ANOTHER ISOTOPE?(Y/N): _
THIS ONE?(Y/N): _   NEXT ONE?(Y/N): _  ANOTHER ITEM?(Y/N): _
ANOTHER FORMS?(Y/N): _  ANOTHER MATL?(Y/N): _     EXIT?(Y/N): _
```

Waste Disposal data screen—item data.

Exercise D-1

```
__________                WASTE DISPOSAL SYSTEM
*****************************************************************************
                1. Form Number: 5876__    2. Request Date: 03/18/86

                          WASTE GENERATOR

                3. Badge No.: 22789_      4. Name: Smith, J. M._____
                5. Plant: _  Building: 1000___ Room: 32__  Phone: _____

                          ACCOUNT
                6. Work Order: 68893WEE  7. Charge: ____-____
                   Division: __
                   Dept.: ____________________________________________

                          AMOUNT

                8. Total Amount: _0.5___  9. Unit: ℓ_____
                                 _______  ______
*****************************************************************************
EDITING?(Y/N): _  NUMBER?: _  DO YOU WISH TO SEE ANY ITEMS?(Y/N): _ THIS ONE?: _
DELETE THIS FORM/ALL ITEMS?(Y/N): _  ADD NEW ITEM?(Y/N): _          EXIT?(Y/N): _
```

Waste Disposal data screen—account data.

```
__________                WASTE DISPOSAL SYSTEM                ITEM ___ OF ___
*****************************************************************************
   Form Number :5876____
                          ITEM INFORMATION
10. Item #: _2
11. Waste Desc.: ____Formaldehyde_____________________________
12. Radioactive?: N    13. Type: _____________________
                       14. Level: _____________________
15. EPA #'s: U122_____________________
16. Eclass: ____Formaldehyde_____________________________
17. Item amount: ___0.5_____ 18. Item unit: ℓ_____ _______ ______  19. Chs/Gal: _
20. Storage Site: ____7507____          22. Disposal Site: ____________________
21. Storage Date: 03/27/86              23. Disposal Date: __/__/__
                                        24. Disposal Ctnr: 20

25. DOT: ____________________________________________________________________
*****************************************************************************
                     INDIVIDUAL CHEMICAL WASTE                      (__ of __)
26. Chem: ____________________________________________________________
27. Amount: _______      28. Unit: ______
*****************************************************************************
EDITING?(Y/N): _  FIELD #: __   DELETE?(Y/N): _   ANOTHER [SPTOPE?(Y/N): _
THIS ONE?(Y/N): _   NEXT ONE?(Y/N): _  ANOTHER ITEM?(Y/N): _
ANOTHER FORM?(Y/N): _  ANOTHER MATL?(Y/N): _     EXIT?(Y/N : _
```

Waste Disposal data screen—item data.

Exercise D-2

REFERENCES:

Radioactive Materials Transportation Workshop Attendee Workbook, prepared by U. S. Department of Energy.

REECO Hazardous Materials Handling Workshop, Reynolds Electrical and Engineering Co., Inc., Las Vegas, Nevada.

X. RCRA CONTINGENCY PLAN AND EMERGENCY PROCEDURES - MODULE I

Module I Outline

COURSE OBJECTIVES: To provide familiarity with emergency response procedures at ORNL and provide guidelines to respond to hazardous material spills.

COURSE LENGTH: 3 hours (20 minute break)

COURSE CONTENT:

A. Emergency Response at ORNL

   1. Responsibilities

B. ORNL Spill Prevention Control Countermeasures and Contingency (SPCCC) Plans

   1. Regulations
   2. Spill Plan
   3. Preparedness and Prevention Measures
   4. Observer's Response
   5. On-Scene Coordinator
   6. Spill Notification Chain
   7. Spill Report

C. Containment

D. Removal/Clean-up

E. Response to Hazardous Gas Incidents

F. Personnel Protection

   1. Levels of Protection
   2. Protective Clothing
   3. Respiratory Protection

G. Safety Precautions in Emergencies

H. Safety Equipment

I. On-the-Job Training Areas

J. Videotape Presentations:

   Title: Hazardous Materials Spill Management: Health Effects & Safety, by ITS Corp.
   Length: 20 minutes

X. RCRA CONTINGENCY PLAN AND EMERGENCY PROCEDURES - MODULE I (Cont.)

Title: Hazardous Materials Spill Management: Containment, Treatment, and Disposal, by ITS Corp.
Length: 15 minutes

K. Quiz: RCRA Contingency Plan and Emergency Procedures

INSTRUCTED BY: DEM spill response personnel, and supervisor of persons responding to chemical spills at ORNL.

POTENTIAL PARTICIPANTS: Chemical Operators
Hazardous Waste Technicians

COURSE/MATERIALS NEEDED: Overhead Projector
Transparencies
Videotape Recorder
Videotape
Quiz

MODULE I

A. EMERGENCY RESPONSE AT ORNL

The ORNL Emergency Manual, which can be obtained from the Laboratory Shift Supervisor's (LSS) office, outlines emergency procedures, responsibilities, and relevant information. The LSS on duty is the ORNL Emergency Director. This person on duty directs emergency service units and local emergency squads and is responsible for Laboratory-wide emergency planning.

The Laboratory Emergency Review and Advisory Committee meets periodically to review and assess Laboratory emergency plans and procedures and makes necessary recommendations. Response to chemical spills is the responsibility of the WOG. DEM oversees all environmental spills.

1. Responsibilities

a. Responsibilities of Division Heads and Other Supervisors

Division heads and other members of supervision have emergency and emergency planning responsibilities that correspond to their operational responsibilities. These include the following:

- Continually evaluate potential hazards;
- Determine corrective actions;
- Plan to prevent the occurrence of emergencies;
- Organize and train local emergency squads for all areas;
- Post lists of all emergency supervisors and squad members;

- Ensure that each employee is familiar with the local and Laboratory-wide emergency procedures, the method of reporting an emergency, and the course of action for each type of emergency;

- Ensure that the local emergency personnel are organized and thoroughly trained to handle potential types of emergency situations;

- Ensure that any facility under their supervision is placed on standby or in the safest condition following an emergency;

- Formulate shutdown procedures in the event of an evacuation.

b. Responsibilities of Local Emergency Personnel

A local emergency squad consists of a local emergency supervisor, wardens, searchers, and other squad members. The responsibilities of each are outlined below.

<u>Local Emergency Supervisor</u>

- Organizes and trains the local emergency squad;

- Ensures that the local plans are consistent with the overall Laboratory plans;

- In the event of a local emergency, directs his squad and ensures that:

  - personnel have been evacuated from the affected area;
  - the Laboratory Communications Center has been notified;

- emergency service units are met, briefed on the situation, and directed to the scene;
- equipment and processes are shut down as necessary for safety;
- the Laboratory Emergency Director is kept advised of the status of the emergency and of any needed assistance;

° In the event of a Laboratory-wide emergency, complies with instructions of the Laboratory Emergency Director, which may include:

- evacuation of personnel;
- shutting down of process and building equipment; and
- assembling his local emergency squad and dispatching it as directed.

Wardens

° Sound the local evacuation alarm;
° Direct employees from the emergency area to the local assembly point;
° Prevent re-entry;
° Check for safety of the assembly point and move if necessary;
° Account for all employees in the area after an evacuation;
° Have employees monitored for radioactivity, if need is indicated, before dismissing them;
° Direct employees to other assembly points as instructed over the public address system.

Searchers

° Search all areas of the building to make sure all employees have evacuated;
° Assist the wardens.

Other Squad Members

- Notify or summon assistance from the proper emergency service unit;
- Meet and orient the emergency service unit when it arrives;
- Make necessary operational changes;
- Combat the emergency as required.

c. Responsibilities of Emergency Service Units

These are various emergency service units made up of guards, radiation surveyors, electricians, chemical operators and other personnel (see Figure X-1).

All emergency service units will:

- Be prepared to accomplish the assigned responsibilities of the unit;

- Promptly report to the scene when notified;

- Anticipate any unusual requirements, in the early stages of an apparent prolonged emergency, for dry cell batteries, respiratory equipment, protective clothing, electronic parts, etc., so their procurement can be expedited on an emergency basis.

d. Responsibilities of Person Discovering an Emergency

The person takes immediate and appropriate action to protect personnel, prevent property damage, and bring the emergency under control. This applies to fire, radiation, explosion, personal injury, and any other emergency. The following measures should be taken during these emergencies:

LABORATORY EMERGENCY RESPONSE

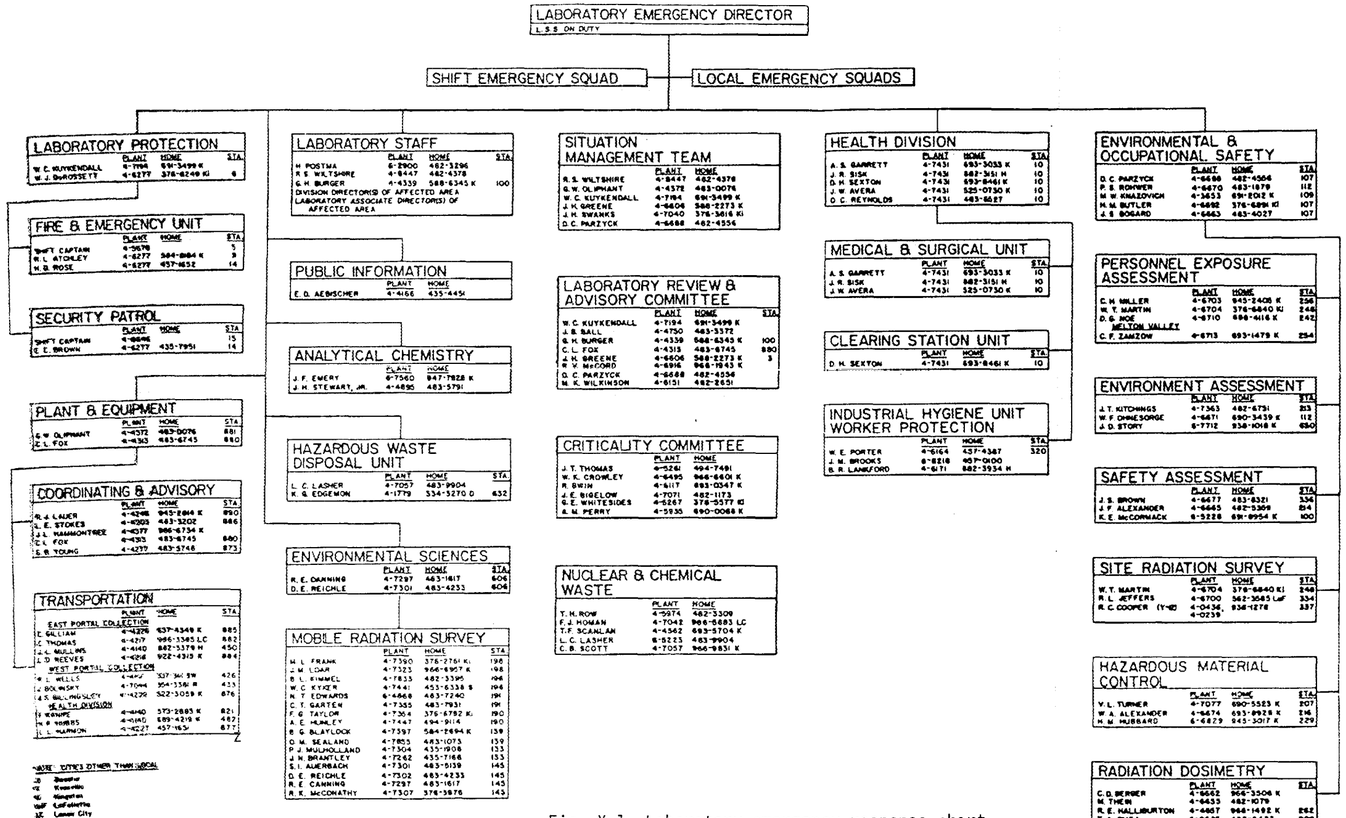


Fig. X-1. Laboratory emergency response chart

- Summon help immediately and proceed to handle the emergency if this can be done safely;

- Telephone 911 (Emergency Communications Center) for help;

- Pull the nearest fire alarm box;

- Call the local emergency supervisor, warden, local emergency squad member or anyone near;

- Sound the building evacuation alarm if necessary.

When a call is received by the Emergency Communications Center at 911, the LSS is simultaneously informed. After assessing the situation, the LSS dispatches emergency service units.

e. Responsibilities of All Employees

One of the most critical factors in combating emergencies is the ability of the person discovering an emergency to act immediately, Each employee should be thoroughly familiar with the following:

- Responsibilities of a person discovering an emergency;

- Location and use of fire fighting and other emergency equipment in the immediate area;

- Plans and assembly points for local and Laboratory-wide evacuations;

- Local and Laboratory-wide alarms and signals (e.g., fire, evacuation, etc.);

- Names of local emergency personnel in the immediate area.

In an emergency, directions of local emergency squad personnel and/or instructions over the public address system must be followed promptly. When instructed to evacuate by alarm or voice, the following procedures must be observed:

- Shut down equipment, if practicable;
- Leave the building or immediate area quickly;
- Proceed to the local assembly point;
- Stay there until otherwise instructed.

B. ORNL SPILL PREVENTION CONTROL COUNTERMEASURES AND CONTINGENCY PLANS

1. Regulations

Various environmental regulations refer to the Spill Prevention Control Countermeasures and Contingency (SPCCC) plans. These references are:

- Federal Water Pollution Act as amended by the Clean Water Act of 1977, Sec. 311 (prohibits discharge of oil and hazardous substance);

- 40 CFR 110, Harmful Discharge of Oil;

- 40 CFR 112, Oil Spill Prevention;

- 40 CFR 116, Designation of Hazardous Substances (Draft);

- 40 CFR 117, Determination of Reportable Quantity (RQ) Hazardous Substances;

- 40 CFR 125, Criteria and Standards for the National Pollutant Discharge Elimination System (NPDES);

- 40 CFR 151, Hazardous Substances Spill Prevention;

- 40 CFR 264.50 - 264.65, Contingency Plan and Emergency Procedures.

2. Spill Plan

The spill plan for a facility must include:

- Developing written SPCCC plans by the generator of hazardous waste, who stores waste prior to transportation;

- Taking preventive measures to limit environmental impacts of spills;

- Having personnel familiar with emergency response measures and equipment (emergency response drills);

- Reinforcing administrative controls (procedure, policies, inspections);

- Implementing physical controls and engineering reviews of new structures (tank, dike controls);

- Providing educational controls (training, knowledge, skills).

The ORNL report, ORNL-5946, The Spill Prevention Control Countermeasures and Contingency Plans for Oak Ridge National Laboratory has been prepared and distributed throughout the Laboratory.

3. Preparedness and Prevention Measures

Certain measures assist in preventing and, if necessary, responding to emergencies. Some of these considerations are:

- Design and operation of facility;

- Procedures for safe distribution of hazardous materials;

- Designated Emergency Coordinator;
- List of responsible emergency personnel;
- Required emergency equipment (extinguishers, respirators, vehicles, Self Contained Breathing Apparatus, SCBA);
- Testing and maintenance of equipment;
- Internal communications and alarm systems;
- Use of devices (telephone, two-way radio, emergency assistance);
- Water system (sprinkler system);
- Warning signs (labels, markings);
- Lists of hazardous materials inventories and material safety data sheets;
- Required aisle space for hazardous waste storage rooms;
- Arrangements with local authorities;
- Security;
- Inspections/audits;
- Training (hands-on training, drills, classroom training, presentations by emergency personnel).

4. Observer's Response

The following steps should be taken quickly by a person who sees a spill situation:

- Evaluate risks;

- Warn others in the area;

- Stop any further release if possible;

- Characterize the spill;

- Contain the spilled material if it can be done safely;

- Notify proper authorities:
  - Call 911
  - KIN 294 radio channel
  - LSS 4-6606
  - DEM 4-6670
  - Pull fire alarm box
  - Contact local emergency supervisor or warden

- Provide the following information on a spill upon notification:
  - Type and volume of spilled material
  - Location and extent (reaching stream) of spill
  - Observer's location and phone number

5. On-Scene Coordinator

Duties of the on-scene coordinator might include:

- Isolate the area;

- Consider wind direction;

- Find source of spill;

- Determine location of spill;

- Estimate volume of spill;
- Identify spilled material;
- Reduce the surface area of the spill;
- Take containment measures;
- Assess the possible hazards to human health (contact Industrial Hygiene Department) or the environment (contact DEM);
- Consider other hazards (fire, exposure);
- Read Material Safety Data Sheets (MSDS);
- Follow proper cleanup and disposal procedures;
- Follow contingency plan;
- Know evacuation plans;
- Notify plant personnel and surrounding population;
- Notify proper authorities;
- Prepare reports and records.

6. Spill Notification Chain

If a spill occurs, previously determined effective actions must be followed and previously identified responsibilities must be met. A detailed flow diagram describing actions to be taken during an emergency is presented in Figure X-2.

ORNL-DWG 83-11131R

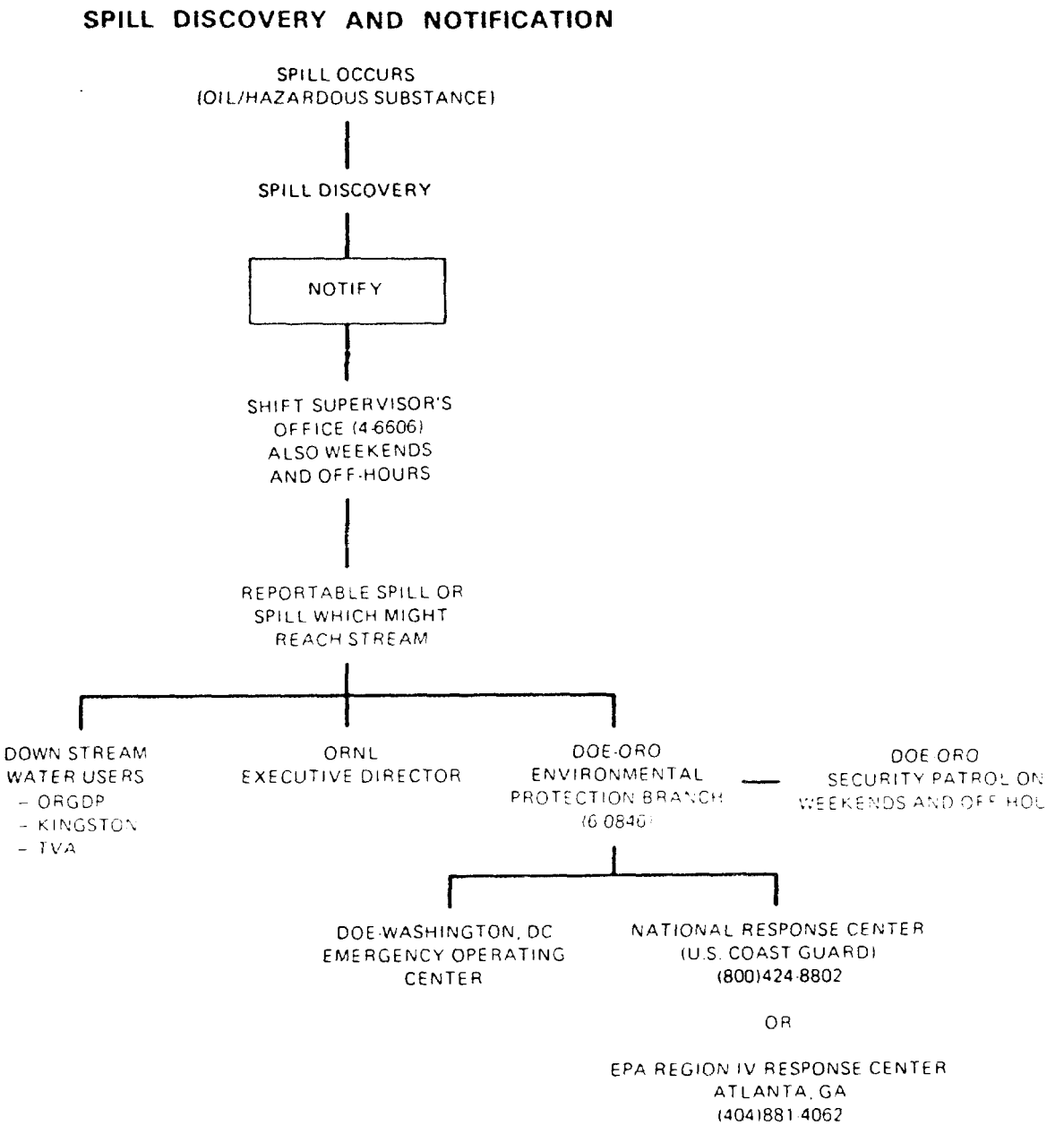


Fig. X-2 Spill discovery & notification

7. Spill Report

The following occurrences should be reported to DOE:

- One pound of all hazardous substances except those with reportable quantities already established under Section 311 of the Clean Water Act is a reportable quantity. Reportable quantities may be changed by regulations;

- An oil slick or sheen on the water surface;

- Fish kills and obvious chemical releases.

The following information should be included in a written report to the National Response Center. A similar report must be sent to EPA within fifteen (15) days. These reports are sent through DOE.

- Name and phone number of reporter;

- Name and address of facility;

- Time and type of incident;

- Name and quantity of material(s) involved;

- The extent of injuries;

- The possible hazards to human health or the environment outside the facility.

C. CONTAINMENT

Containment of hazardous material spills minimizes further damage to the surrounding environment. It also limits the potential exposure and contact with the public. Contained material furthermore needs treatment

and clean-up before its proper disposal. Various containment measures are taken on land and water to prevent vertical and horizontal movement of spills. It is important that the mode of entry and the physical characteristics of the material be considered fully. For example, liquids may float, dissolve slowly, assimilate into the environment, and sink to the bottom; solids may behave the same as liquids or can form suspensions in water; and gases may disperse or rise over the water and cover the surface of the water. Chemical information such as evaporation rates, vapor pressure, flash point, and exposure information such as threshold limit values are also important in assessing response measures. Spilled liquid hazardous materials under CHRIS are separated and treated into four classes according to their response in water. These response categories are: (a) vaporization, (b) floating, (c) sinking, and (d) dissolving.

Spills of liquid hazardous materials can be contained by:

- reducing evaporation rate by spraying the spilled area with a proper solution to form a thin film layer over the spilled material;
- applying sorbents to the spill;
- spraying a compatible foam over the spill;
- excavating or diking to prevent horizontal movement;
- filling narrow trenches with impermeable clay to stop lateral movement; and
- using inflatable bags to make barriers for pipes, storm sewers, and drainage ditches.

Spills of solid materials on land may be contained either by transferring the material into closed containers or covering the material against wind effects.

D. REMOVAL/CLEAN-UP

Depending on the situation, the following response measures may be considered:

- Vacuum or dredging for sunken materials;
- Skimming and booming to confine light insoluble materials and slightly soluble floating materials (especially oil spills);
- Precipitation if it can be removed effectively;
- Neutralization and complex formation when reaction can be controlled and is not a threat to water quality;
- Burial (caping) and excavation methods at the bottom of the water against sunken materials;
- Passing water through treatment system when a small body of water is involved;
- Flow augmentation applied by mechanical mixers to aid diffusion;
- Burn-off techniques, in limited cases where spill is confined to small area. However, toxicity, vaporization, and flash-back are concerns;
- Oxygen addition against spilled substances causing biological oxygen demand. Addition of oxygen to water maintains dissolved oxygen levels when hazardous material can be dispersed and degraded;
- Physical sorption (activated carbon) for acids, bases, metals, or toxic salts and ion exchange (exchange resins) for organic matter.

E. RESPONSE TO HAZARDOUS GAS INCIDENTS

- Evacuate all unauthorized personnel;
- Contact emergency authorities;
- Wear protective clothing and equipment;
- Stop all work and shut off machines;
- If open valve is source of leak, shut valve;
- Control flow of liquid gas with dikes;
- Control vapors with a mist of water. Avoid direct contact of water with liquid gas;
- Move gas cylinders carefully to an isolated area if it can be done safely;
- If fire is present, contact Fire Department.

Appendix I of the report, ORNL-5946, Spill Prevention Control and Countermeasures, dealing with large quantities of chemicals is included in Appendix M.

F. PERSONAL PROTECTION

1. Levels of Protection

In general, levels of protection can be studied at four levels.

a. The highest protective level: This level requires respiratory, eye, and contact protection. A fully encapsulating protective suit with its own self-contained breathing apparatus (SCBA) must be used.

b. Second highest level: The next level requires the highest level of respiratory protection, but a lower level of skin protection. It is the minimum level recommended on initial entries until the hazards have been further identified and defined by complete monitoring, sampling, and chemical analysis.

c. Third level: The third level requires air purifying respirators. Coveralls and other protective equipment may be required. This level is selected when types and concentrations of respirable materials are known to have adequate warning properties.

d. The least protective level: This level requires no respiratory protection. Basic work clothing should be worn when sites are identified as having no toxic hazards.

2. Protective Clothing

The following factors should be considers in choosing protective clothing:

- Material permeability;
- Strength of the material;
- Resistance to abrasion;
- Puncture resistance;
- Flexibility;
- Weather resistance;
- Flame resistance;
- Promote static electricity;
- Cost and construction details;
- Ease of decontamination.

3. Respiratory Protection

The Industrial Hygiene Department at ORNL is responsible for proper fitting and recommending proper use of respirators. Two broad categories of respirators are:

a. Air purifying (e.g., mechanical filter, chemical cartridge or combination of these two); and

b. Supplied air (e.g., air line respirator or SCBA). Trained personnel from the Fire Department and the Industrial Hygiene Department would be welcome speakers during this chapter discussion. Trainees will have on-the-job training for use of SCBA.

G. SAFETY PRECAUTIONS IN EMERGENCIES

° Read MSDS;

° Know the response measures;

° Avoid risk;

° Work as a team;

° Know the communication numbers (telephone, health facility);

° Know the location of the emergency equipment (respirators, fire extinguishers, eye wash fountains, showers);

° Know how and when to use the protective and emergency equipment;

- Be aware of wind direction;

- Be aware of adverse effects:

  - Change in complexion, skill discoloration;
  - Headaches;
  - Dizziness;
  - Blurred vision;
  - Cramps;
  - Irritation (eyes, skin, respiratory tract).

- Participate in practice drills.

H. SAFETY EQUIPMENT

There is various emergency equipment at different locations within ORNL. The most up-to-date list of emergency equipment is included in Table X-1. Trainees will became familiar with equipment locations during hands-on training.

I. ON-THE-JOB TRAINING AREAS

- Safety and emergency equipment locations at ORNL;

- SCBA (Scott Air Packs) Training;

- Spill response and cleanup for chemical (liquid and solid) spills;

- Response to leaking light ballasts;

- Responding to leaking gas cylinders;

- Participation in simulated drill (whenever LSS's office implements these exercises).

Table X-1. ORNL emergency equipment

Building 7507 - Hazardous Chemical Waste Storage Building
(Note: We try to keep amounts shown as a minimum stock)

Description	Quantity on Hand
Vermiculite	30 bags
Clay absorbol	20 bags
Soda ash	5 bags
Oil absorbent pads (5/pkg)	500 pads
Absorbent boom (4 booms/bale)	1 bale
DOT 17H open top drums (55 gal.)	20
DOT 17H open top drums (30 gal.)	10
DOT 17E bung top drums (55 gal.)	10
DOT 6D lined drums (55 gal.)	10
Over packs	10
Coveralls (paper)	20 pair
Gloves (all types)	20 pair
Boots	10 pair
Shoecovers	1 box
Goggles	10 pair
Scott air pack	1
Respirators & cartridges (to fit 6 people)	minimum
Emergency generator	2
Drum pumps	2
Acid suit	1
Hg vacuum cleaner	1
Drum liners (55 gal.)	25
Chlorine cylinder emergency kit "A" (for 100 & 150 lb. cylinders)	1
Hazardous Material Response Kits	1 Series "E"
Extension cords	2
Fire blanket	1
Inflatable drain plugs - 4"-11" line	2
Inflatable drain plugs - 8"-24" line	2
Leak seal cushion - 27.5" x 14" (for leaking drums, tanks, trucks, etc.)	1

Table X-1. ORNL emergency equipment (cont.)

Truck 7831

(Note: This truck is parked at the west gate on off shifts, the key will be kept in the fire captain's office in Building 2500)

Description	Quantity on Hand
Fire extinguisher (met-L-X for Class D fires)	1
Fire extinguisher (ABC)	2
Fire blanket	1
Scott air pack	1
Extra cylinder for air pack	1
Vermiculite	1 bag*
Clay absorbol	1 bag
Soda ash	20 lbs*
Rags in 5-gal. container	1 (full)
Acid suit	1
Protective clothing:	
Coveralls	
Boots	
Gloves (all types)	
Shoecovers	
Goggles	
Respirators & cartridges to outfit 3 people (Note: full & half face - all types cartridges and canister)	minimum
Emergency response guidebook	1
Bung wrench (Fits all types of drums)	1
Hand tools - Sockets & drive (fits bolts in 55 gal. drums), pipe wrench, hammer, etc.	
GM meter	1
Sample equipment - Bottles (all sizes)	
Miscellaneous small items - ropes, flashlights, batteries, etc.	

*Approximation.

Table X-1. ORNL emergency equipment (cont.)

Spill Trailer

(Note: This trailer is parked next to Building 7057)

Description	Quantity on Hand
Booms	8
Oil absorbent pads (500/bale)	1,000
Drums 30 gal. open top	1
Drums 55 gal. open top	2
Clay absorbol	1 bag
Vermiculite	2
Miscellaneous items:	
Sample bottles	
Coveralls	
Gloves	
Shoecovers, etc.	

Oil Spill Response Trailer

(Note: This trailer is located on the south side of Building 7070, and contains flotation devices for discharge lines and all connections. Tools needed to put equipment in use are also stored on the trailer.)

Description	Quantity on Hand
Boom	1,000 ft.
Floating skimmer pump (This is used only for very large spills and/or recovery from large areas of water.)	1

Table X-1. ORNL emergency equipment (cont.)

Steam Plant

Description	Quantity on Hand
Bladders, 50,000 gal. (These are stored at Reservoir #1. The integrity of these tanks is unknown at this time.)	3

Spill Response Cabinet

(Note: This cabinet is located outside H-251 in the 4500S Building)

Description	Quantity on Hand
Assorted respirators and cartridges (Full and half face, all types)	
Protective clothing:	
Gloves (all types)	
Coveralls	
Goggles	
Shoecovers	
Scott air packs	2
Extra cylinders - for Scott air packs	2
Polaroid camera	1

Truck E6714

(Note: This vehicle is parked at 7065 Oil Tank, 7000 Area)

This is an 1,100 gallon capacity truck with a PTO pump.

Source: Letter from K. G. Edgemon to H. J. Greene, dated October 25, 1985.

REFERENCES:

J. S. Robinson, Hazardous Chemical Spill Cleanup, Noyes Data Corp., Park Ridge, NJ, 1979.

Emergency Manual, Oak Ridge National Laboratory.

The Spill Prevention Control Countermeasures and Contingency Plans for Oak Ridge National Laboratory, ORNL-5946, Sept. 1, 1985.

APPENDIX A

UNIFORM HAZARDOUS WASTE MANIFEST

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved OMB No 2000-0404 Expires 7-31-86

UNIFORM HAZARDOUS WASTE MANIFEST

21. Generator's US EPA ID No | Manifest Document No | 2. Page 1 of | Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address

4. Generator's Phone ( )

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name | 6. US EPA ID Number

C. State Transporter's ID

D. Transporter's Phone

7. Transporter 2 Company Name | 8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address | 10. US EPA ID Number

G. State Facility's ID

H. Facility's Phone

GENERATOR

11. US DOT Description (Including Proper Shipping Name, Hazard Class and ID Number)	HM	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.						
b.						
c.						
d.						

J. Additional Descriptions for Materials Listed Above

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

Unless I am a small quantity generator who has been exempted by statute or regulation from the duty to make a waste minimization certification under Section 3002(b) of RCRA, I also certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and I have selected the method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment.

Printed/Typed Name | Signature | Month Day Year

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month Day Year

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name | Signature | Month Day Year

Style F15R-6 Labelmaster, Div. of American Labelmark Co. Inc. 60646

EPA Form 8700-22 (Rev. 4-85) Previous edition is obsolete

ORIGINAL RETURN TO GENERATOR

Please print or type (Form designed for use on elite (12-pitch) typewriter.) Form Approved OMB No. 2000-0404 Expires 7-31-86

UNIFORM HAZARDOUS WASTE MANIFEST *(Continuation Sheet)*	21. Generator's US EPA ID No.	Manifest Document No.	22. Page	Information in the shaded areas is not required by Federal law.

23. Generator's Name	L. State Manifest Document Number
	M. State Generator's ID
24. Transporter ____ Company Name / 25. US EPA ID Number	N. State Transporter's ID
	O. Transporter's Phone
26. Transporter ____ Company Name / 27. US EPA ID Number	P. State Transporter's ID
	Q. Transporter's Phone

28. US DOT Description *(Including Proper Shipping Name, Hazard Class, and ID Number)*	29. Containers No.	Type	30. Total Quantity	31. Unit Wt/Vol	R. Waste No.
a.					
b.					
c.					
d.					
e.					
f.					
g.					
h.					
i.					

S. Additional Descriptions for Materials Listed Above	T. Handling Codes for Wastes Listed Above

32. Special Handling Instructions and Additional Information

GENERATOR

TRANSPORTER			
33. Transporter ____ Acknowledgement of Receipt of Materials			Date
Printed/Typed Name	Signature		Month Day Year
34. Transporter ____ Acknowledgement of Receipt of Materials			Date
Printed/Typed Name	Signature		Month Day Year

FACILITY

35. Discrepancy Indication Space

EPA Form 8700-22A (3-84)

BILLING CODE 6560-50-C

APPENDIX B

HAZARDOUS MATERIALS TABLE 172.101

§ 172.101 Hazardous Materials Table

(1)	(2)	(3)	(3A)	(4)	(5)		(6)		(7)		
					Packaging		Maximum net quantity in one package		Water shipments		
+/E/A/W	Hazardous materials descriptions and proper shipping names	Hazard class	Identification number	Label(s) required (if not excepted)	(a) Exceptions	(b) Specific requirements	(a) Passenger-carrying aircraft or railcar	(b) Cargo aircraft only	(a) Cargo vessel	(b) Passenger vessel	(c) Other requirements
	Accumulator, pressurized *(pneumatic or hydraulic), containing nonflammable gas*	Nonflammable gas	NA1956	Nonflammable gas	173.306		No limit	No limit	1,2	1,2	
	Acetal	Flammable liquid	UN1088	Flammable liquid	173.118	173.119	1 quart	10 gallons	1,3	4	
E	**Acetaldehyde** (*ethyl aldehyde*) (*RQ-1000/454*)	Flammable liquid	UN1089	Flammable liquid	None	173.119	Forbidden	10 gallons	1,3	5	
EA	**Acetaldehyde ammonia** (*RQ-1000/454*)	ORM-A	UN1841	None	173.505	173.510	No limit	No limit	1,2	1,2	
E	**Acetic acid (aqueous solution)** (*RQ-1000/454*)	Corrosive material	UN2790	Corrosive	173.244	173.245	1 quart	10 gallons	1,2	1,2	Stow separate from nitric acid or oxidizing materials
E	**Acetic acid, glacial** (*RQ-1000/454*)	Corrosive material	UN2789	Corrosive	173.244	173.245	1 quart	10 gallons	1,2	1,2	Stow separate from nitric acid or oxidizing materials
E	**Acetic anhydride** (*RQ-1000/454*)	Corrosive material	UN1715	Corrosive	173.244	173.245	1 quart	1 gallon	1,2	1,2	
	Acetone	Flammable liquid	UN1090	Flammable liquid	173.118	173.119	1 quart	10 gallons	1,3	4	
E	**Acetone cyanohydrin** (*RQ-10/4.54*)	Poison B	UN1541	Poison	None	173.346	Forbidden	55 gallons	1	5	Shade from radiant heat. Stow away from corrosive materials
	Acetone oil	Flammable liquid	UN1091	Flammable liquid	173.118	173.119	1 quart	10 gallons	1,2	1	
	Acetonitrile	Flammable liquid	NA1648	Flammable liquid	173.118	173.119	1 quart	10 gallons	1	4	Shade from radiant heat
	Acetyl acetone peroxide, *in solution with not more than 9% by weight active oxygen. See* **Organic peroxide, liquid or solution, n.o.s.**		UN2080								
	Acetyl acetone peroxide with more than 9% by weight active oxygen	Forbidden									
	Acetyl benzoyl peroxide, *not more than 40% in solution. See* **Acetyl benzoyl peroxide solution,** *not over 40% peroxide*		UN2081								
	Acetyl benzoyl peroxide solid or more than 40% in solution	Forbidden									
	Acetyl benzoyl peroxide solution, *not over 40% peroxide*	Organic peroxide	UN2081	Organic peroxide	None	173.222	Forbidden	1 quart	1,2	1	
E	**Acetyl bromide** (*RQ-5000/2270*)	Corrosive material	UN1716	Corrosive	173.244	173.247	1 quart	1 gallon	1	1	Keep dry. Glass carboys not permitted on passenger vessels
E	**Acetyl chloride** (*RQ-5000/2270*)	Flammable liquid	UN1717	Flammable liquid	173.244	173.247	1 quart	1 gallon	1	1	Stow away from alcohols. Keep cool and dry. Separate longitudinally by an intervening complete compartment or hold from explosives
	Acetyl cyclohexanesulfonyl peroxide, more than 82%, wetted with less than 12% water	Forbidden									
	Acetyl cyclohexanesulphonyl peroxide, *not more than 82%, wetted with not less than 12% water. See* **Organic peroxide, solid, n.o.s.**		UN2082								
	Acetyl cyclohexanesulphonyl peroxide, *not more than 32% in solution. See* **Organic peroxide, liquid or solution, n.o.s.**		UN2083								
	Acetylene	Flammable gas	UN1001	Flammable gas	None	173.303	Forbidden	300 pounds	1	1	Shade from radiant heat
	Acetylene (liquid)	Forbidden									
	Acetylene silver nitrate	Forbidden									
A	**Acetylene tetrabromide**	ORM-A	UN2504	None	173.505	173.510	10 gallons	55 gallons			
	Acetyl iodide	Corrosive material	UN1898	Corrosive	173.244	173.247	1 quart	1 gallon	1	1	Keep dry. Glass carboys not permitted on passenger vessels
	Acetyl peroxide, *not more than 25% in solution. See* **Acetyl peroxide solution,** *not over 25% peroxide*		UN2084								
	Acetyl peroxide, solid, or more than 25% in solution	Forbidden									
	Acetyl peroxide solution, *not over 25% peroxide*	Organic peroxide	UN2084	Organic peroxide	173.153	173.222	Forbidden	1 quart	1,2	1	
	Acid butyl phosphate	Corrosive material	UN1718	Corrosive	173.244	173.245	1 quart	5 gallons	1,2	1,2	Glass carboys in hampers not permitted under deck
	Acid carboy, empty. *See* **Carboy, empty**										
	Acid, liquid, n.o.s.	Corrosive material	NA1760	Corrosive	173.244	173.245	1 quart	5 pints	1	4	Keep cool
+E	**Acrolein, inhibited** (*RQ-1/0.454*)	Flammable liquid	UN1092	Flammable liquid and Poison	None	173.122	Forbidden	1 quart	1,2	5	Keep cool. Stow away from living quarters

§ 172.101 Hazardous Materials Table—*Continued*

(1)	(2)	(3)	(3A)	(4)	(5)		(6)		(7)		
					Packaging		Maximum net quantity in one package		Water shipments		
+/E/A/W	Hazardous materials descriptions and proper shipping names	Hazard class	Identification number	Label(s) required (if not excepted)	(a) Exceptions	(b) Specific requirements	(a) Passenger-carrying aircraft or railcar	(b) Cargo aircraft only	(a) Cargo vessel	(b) Passenger vessel	(c) Other requirements
	Acrylic acid	Corrosive material	UN2218	Corrosive	173.244	173.245	1 quart	5 pints	1	1	
E	Acrylonitrile (*RQ-100/45.4*)	Flammable liquid	UN1093	Flammable liquid and Poison	None	173.119	Forbidden	1 quart	1.2	5	Keep cool
	Actuating cartridge, explosive(*fire extinguisher, or valve*)	Class C explosive		Explosive C	173.114		50 pounds	150 pounds	1.2	1.2	Keep cool and dry
	Adhesive	Combustible liquid	UN1133	None	173.118a	None	No limit	No limit	1.2	1.2	
	Adhesive	Flammable liquid	UN1133	Flammable liquid	173.118	173.132	1 quart	10 pounds			
E	Adipic acid (*RQ-5000/2270*)	ORM-E	NA9077	None	None	173.510	No limit	No limit	1.2	1.2	
	Aerosol product. See Compressed gas, n.o.s.										
	Air, compressed	Nonflammable gas	UN1002	Nonflammable gas	173.306	173.302	150 pounds	300 pounds	1.2	1.2	
	Air conditioning machine. *See* Refrigerating machine										
	Aircraft rocket engine (*Commercial*)	Flammable solid	NA2791	Flammable solid	None	173.238	Forbidden	550 pounds	1.3	5	
	Aircraft rocket engine igniter (*Commercial*)	Flammable solid	UN2792	Flammable solid	None	173.238	Forbidden	25 pounds	1.3	5	
	Airplane flare. See Fireworks, special										
	Alcoholic beverage	Flammable liquid	UN1170	Flammable liquid	173.118	173.125	See 173.118(C)	10 gallons	1.2	1	
	Alcoholic beverage	Combustible liquid	UN1170	None	173.118a	None	No limit	No limit	1.2	1.2	
	Alcohol, n.o.s.	Flammable liquid	UN1987	Flammable liquid	173.118	173.125	1 quart	10 gallons	1.2	1	
	Alcohol, n.o.s.	Combustible liquid	UN1987	None	173.118a	None	No limit	No limit	1.2	1.2	
E	Aldrin (*RQ-1/0.454*)	Poison B	NA2761	Poison	173.364	173.376	50 pounds	200 pounds	1.2	1.2	
EA	Aldrin, cast solid (*RQ-1/0.454*)	ORM-A	NA2781	None	173.505	173.510	No limit	No limit	1.2	1.2	
E	Aldrin mixture, dry (*with more than 65% aldrin*) (*RQ-1/0.454*)	Poison B	NA2761	Poison	173.364	173.376	50 pounds	200 pounds	1.2	1.2	
EA	Aldrin mixture, dry, with 65% or less aldrin (*RQ-1/0.454*)	ORM-A	NA2761	None	173.505	173.510	No limit	No limit	1.2	1.2	
E	Aldrin mixture, liquid (*with more than 60% aldrin*) (*RQ-1/0.454*)	Poison B	NA2762	Poison	173.345	173.361	1 quart	55 gallons	1.2	1.2	If flash point less than 141 deg F segregation same as for flammable liquids
EA	Aldrin mixture, liquid, with 60% or less aldrin (*RQ-1/0.454*)	ORM-A	NA2762	None	173.505	173.510	No limit	No limit	1.2	1.2	
	Alkaline liquid, n.o.s.	Corrosive material	NA1719	Corrosive	173.244	173.249	1 quart	5 gallons	1.2	1.2	
	Alkanesulfonic acid	Corrosive material	UN2584	Corrosive	173.244	173.245	5 pints	1 gallon	1.2	1	
	Alkyl aluminum halides. See Pyrophoric liquid, n.o.s.	ORM-A									
A	Allethrin	NA2902	None	173.505	173.510	No limit	No limit				
E	Allyl alcohol (*RQ-100/45.4*)	Flammable liquid	UN1098	Flammable liquid and Poison	None	173.119	1 quart	10 gallons	1.2	1	
	Allyl bromide	Flammable liquid	UN1099	Flammable liquid	173.118	173.119	Forbidden	10 gallons	1.2	1	
E	Allyl chloride (*RQ-1000/454*)	Flammable liquid	UN1100	Flammable liquid	None	173.119	Forbidden	10 gallons	1.3	5	
	Allyl chlorocarbonate	Flammable liquid	UN1722	Flammable liquid	None	173.288	Forbidden	5 pints	1	5	Keep dry. Separate longitudinally by an intervening complete hold or compartment from explosives. Segregation same as for corrosive materials
	Allyl chloroformate. *See* Allyl chlorocarbonate										
	Allyl trichlorosilane	Corrosive material	UN1724	Corrosive	None	173.280	Forbidden	10 gallons	1	1	Keep dry
	Aluminum alkyl. *See* Pyrophoric liquid, n.o.s.										
	Aluminum bromide, anhydrous	Corrosive material	UN1725	Corrosive	173.244	173.245b	25 pounds	100 pounds	1.2	1.2	Keep dry
	Aluminum dross, wet or hot. See 173.173	Forbidden									
	Aluminum hydride	Flammable solid	UN2463	Flammable solid and Dangerous when wet	None	173.206	Forbidden	25 pounds	1.2	5	Segregation same as for flammable solid labeled Dangerous When Wet
	Aluminum, metallic, powder	Flammable solid	UN1396	Flammable solid	173.232	173.232	25 pounds	100 pounds	1.2	1.2	Keep dry. Segregation same as for flammable solids labeled dangerous when wet

§ 172.101 Hazardous Materials Table—*Continued*

(1)	(2)	(3)	(3A)	(4)	(5)		(6)		(7)		
					Packaging		Maximum net quantity in one package		Water shipments		
+/E/A/W	Hazardous materials descriptions and proper shipping names	Hazard class	Identification number	Label(s) required (if not excepted)	(a) Exceptions	(b) Specific requirements	(a) Passenger-carrying aircraft or railcar	(b) Cargo aircraft only	(a) Cargo vessel	(b) Passenger vessel	(c) Other requirements
	Aluminum nitrate	Oxidizer	UN1438	Oxidizer	173.153	173.182	25 pounds	100 pounds	1,2	1,2	
	Aluminum phosphate solution	Corrosive material	NA1760	Corrosive	173.244	173.245	1 quart	10 gallons	1,2	1,2	
	Aluminum phosphide	Flammable solid	UN1397	Flammable solid and Dangerous when wet	None	173.154	Forbidden	25 pounds	1,2	1,2	Stow away from acids and oxidizing materials
E	**Aluminum sulfate, solid** (*RQ-5000/2270*)	ORM-E	NA9078	None	None	173.510	No limit	No limit	1,2	1,2	
EA	**Aluminum sulfate solution** (*RQ-5000/2270*)	ORM-B	NA1760	None	173.505	173.510	25 pounds	100 pounds	1,2	1,2	
	Amatol. See **High explosive**										
	a-Methylglucoside tetranitrate	Forbidden									
	a-Methylglycerol trinitrate	Forbidden									
	2-(2-Aminoethoxy) ethanol	Corrosive material	NA1760	Corrosive	173.244	173.245	1 quart	10 gallons	1,2	1,2	
	N-Aminoethylpiperazine	Corrosive material	UN2815	Corrosive	173.244	173.245	1 quart	10 gallons	1,2	1,2	
	Aminopropyldiethanolamine	Corrosive material	NA1760	Corrosive	173.244	173.245	1 quart	10 gallons	1,2	1,2	
	N-Aminopropylmorpholine	Corrosive material	NA1760	Corrosive	173.244	173.245	1 quart	10 gallons	1,2	1,2	
E	**Ammonia, anhydrous** (*RQ-100/45.4*)	Nonflammable gas	UN1005	Nonflammable gas	173.306	173.304 173.314 173.315	Forbidden	300 pounds	1,2	4	Stow in well ventilated space
E	**Ammonia solution** (*containing more than 44% ammonia*) (*RQ-1000/454*)	Nonflammable gas	UN2073	Nonflammable gas	173.306	173.304 173.314 173.315	Forbidden	300 pounds	1,2	4	Stow in well ventilated space
	Ammonia solution (containing 44% or less ammonia in water). See **Ammonium hydroxide**										
E	**Ammonium acetate** (*RQ-5000/2270*)	ORM-E	NA9079	None	None	173.510	No limit	No limit	1,2	1,2	
	Ammonium arsenate, solid	Poison B	UN1546	Poison	173.364	173.365	50 pounds	200 pounds	1,2	1,2	Stow away from alkaline corrosives
	Ammonium azide	Forbidden									
E	**Ammonium benzoate** (*RQ-5000/2270*)	ORM-E	NA9080	None	None	173.510	No limit	No limit	1,2	1,2	
E	**Ammonium bicarbonate** (*RQ-5000/2270*)	ORM-E	NA9081	None	None	173.510	No limit	No limit	1,2	1,2	
E	**Ammonium bifluoride, solid or solution.** *See* **Ammonium hydrogen fluoride, solid or solution**										
EA	**Ammonium bisulfite, solid** (*RQ-5000/2270*)	ORM-B	NA2693	None	173.505	173.510	25 pounds	100 pounds	1,2	1,2	
E	**Ammonium bisulfite solution** (*RQ-5000/2270*)	Corrosive material	NA2693	Corrosive	173.244	173.245	1 quart	5 gallons	1,2	1,2	
	Ammonium bromate	Forbidden									
EA	**Ammonium carbamate** (*RQ-5000/2270*)	ORM-A	NA9083	None	173.505	173.510	50 pounds	No limit	1,2	1,2	Keep away from heat
EA	**Ammonium carbonate** (*RQ-5000/2270*)	ORM-A	NA9084	None	173.505	173.510	50 pounds	No limit	1,2	1,2	Keep away from heat, acids, alum and salts of iron or zinc
	Ammonium chlorate	Forbidden									
E	**Ammonium chloride** (*RQ-5000/2270*)	ORM-E	NA9085	None	None	173.510	No limit	No limit	1,2	1,2	
E	**Ammonium chromate** (*RQ-1000/454*)	ORM-E	NA9086	None	None	173.510	No limit	No limit	1,2	1,2	
E	**Ammonium citrate, dibasic** (*RQ-5000/2270*)	ORM-E	NA9087	None	None	173.510	No limit	No limit	1,2	1,2	
E	**Ammonium dichromate** (*ammonium bichromate*) (*RQ-1000/454*)	Oxidizer	UN1439	Oxidizer	173.153	173.154 173.235	25 pounds	100 pounds	1,2	1,2	
EA	**Ammonium fluoborate** (*RQ-5000/2270*)	ORM-B	NA9088	None	173.505	173.510	25 pounds	100 pounds	1,2	1,2	
EA	**Ammonium fluoride** (*RQ-5000/2270*)	ORM-B	UN2505	None	173.505	173.800	25 pounds	100 pounds	1,2	1,2	
	Ammonium fulminate	Forbidden									
E	**Ammonium hydrogen fluoride, solid** (*RQ-5000/2270*)	Corrosive material	UN1727	Corrosive	173.244	173.245b	25 pounds	100 pounds	1,2	1,2	Keep dry
E	**Ammonium hydrogen fluoride solution** (*RQ-5000/2270*)	Corrosive material	UN2817	Corrosive	173.244	173.245	1 quart	5 gallons	1,2	1,2	Keep dry
A	**Ammonium hydrogen sulfate**	ORM-B	UN2506	None	173.505	173.800	25 pounds	100 pounds			
A	**Ammonium hydrosulfide solution**	ORM-A	NA2683	None	173.505	173.605	10 gallons	55 gallons			
E	**Ammonium hydroxide** (*containing not less than 12% but not more than 44% ammonia*) (*RQ-1000/454*)	Corrosive material	NA2672	Corrosive	173.244	173.245	2 gallons	2 gallons	1	4	
EAW	**Ammonium hydroxide** (*containing less than 12% ammonia*) (*RQ-1000/454*)	ORM-A	NA2672	None	173.505	173.510	10 gallons	55 gallons	1	1	

§ 172.101 Hazardous Materials Table—*Continued*

(1)	(2)	(3)	(3A)	(4)	(5)		(6)		(7)		
					Packaging		Maximum net quantity in one package		Water shipments		
+/E/A/W	Hazardous materials descriptions and proper shipping names	Hazard class	Identification number	Label(s) required (if not excepted)	(a) Exceptions	(b) Specific requirements	(a) Passenger-carrying aircraft or railcar	(b) Cargo aircraft only	(a) Cargo vessel	(b) Passenger vessel	(c) Other requirements
E	**Ammonium hydroxide** (*containing not less than 12% but not more than 44% ammonia*) (*RQ-1000/454*)	Corrosive material	NA2672	Corrosive	173.244	173.245	2 gallons	2 gallons	1	4	
	Ammonium nitrate-carbonate mixture	Oxidizer	UN2068	Oxidizer	173.153	173.182	25 pounds	100 pounds	1,2	1,2	
	Ammonium nitrate fertilizer, *containing no more than 0.2% carbon*	Oxidizer	UN2067	Oxidizer	173.153	173.182	25 pounds	100 pounds	1,2	1,2	
	Ammonium nitrate - fuel oil mixture (*containing only prilled ammonium nitrate and fuel oil*)	Blasting agent		Blasting agent	None	173.114a	Forbidden	100 pounds	1,2	1,2	
	Ammonium nitrate - fuel oil mixture. See **High explosive**										
	Ammonium nitrate mixed fertilizer	Oxidizer	UN2069	Oxidizer	173.153	173.182	25 pounds	100 pounds	1,2	1,2	
	Ammonium nitrate (**no organic coating**)	Oxidizer	UN1942	Oxidizer	173.153	173.182	25 pounds	100 pounds	1,2	1,2	
	Ammonium nitrate (**organic coating**)	Oxidizer	NA1942	Oxidizer	173.153	173.182	25 pounds	100 pounds	1,2	1,2	
	Ammonium nitrate-phosphate	Oxidizer	UN2070	Oxidizer	173.153	173.182	25 pounds	100 pounds	1,2	1,2	
	Ammonium nitrate, solution (*containing not less than 15% water*). *See 173.154(a)(17) and 173.154(a)(18)*	Oxidizer	UN2426	Oxidizer							
	Ammonium nitrite	Forbidden									
EA	**Ammonium oxalate** (*RQ-5000/2270*)	ORM-A	NA2449	None	173.505	173.510	50 pounds	200 pounds	1,2	1,2	
	Ammonium perchlorate	Oxidizer	UN1442	Oxidizer	173.153	173.239a	25 pounds	100 pounds	1,2	4	Stow away from powdered metals
	Ammonium perchlorate. *See* **High explosive**										
	Ammonium permanganate	Oxidizer	NA9190	Oxidizer	None	173.154	Forbidden	Forbidden	1,2	1,2	Separate from ammonium compounds and hydrogen peroxide. This material may be forbidden in water transportation by certain countries
	Ammonium picrate, dry. See **High explosive**										
	Ammonium picrate, wet (*with 10% or more water*)	Flammable solid	UN1310	Flammable solid	173.192		1 pound	1 pound	1	4	Stow away from heavy metals and their compounds
	Ammonium picrate, wet, with 10% or more water, over 16 ounces in one outside packaging. See **High explosive**										
A	**Ammonium polysulfide solution**	ORM-A	UN2818	None	173.505	173.605	10 gallons	55 gallons			
EA	**Ammonium silicofluoride** (*RQ-1000/454*)	ORM-B	UN2854	None	173.505	173.510	25 pounds	100 pounds	1,2	1,2	
E	**Ammonium sulfamate** (*RQ-5000/2270*)	ORM-E	NA9089	None	None	173.510	No limit	No limit	1,2	1,2	
W	**Ammonium sulfate nitrate**	ORM-C	NA1477	None	173.505	173.910			1,2	1,2	Must not be accepted for transportation while hot. Separate by an intervening hold or compartment from Class A explosives. Separate from other explosives, corrosive materials, flammable solids, liquids, or gases, oxidizing materials, organic peroxides, or organic materials
E	**Ammonium sulfide solution** (*RQ-5000/2270*)	Flammable liquid	UN2683	Flammable liquid	173.118	173.119	1 quart	10 gallons	1,2	1,2	
E	**Ammonium sulfite** (*RQ-5000/2270*)	ORM-E	NA9090	None	None	173.510	No limit	No limit	1,2	1,2	
E	**Ammonium tartrate** (*RQ-5000/2270*)	ORM-E	NA9091	None	None	173.510	No limit	No limit	1,2	1,2	
E	**Ammonium thiocyanate** (*RQ-5000/2270*)	ORM-E	NA9092	None	None	173.510	No limit	No limit	1,2	1,2	
E	**Ammonium thiosulfate** (*RQ-5000/2270*)	ORM-E	NA9093	None	None	173.510	No limit	No limit	1,2	1,2	
	Ammunition, chemical (containing a Poison A liquid or gas). See **Chemical ammunition, nonexplosive** (*containing a Poison A material*)										
	Ammunition, chemical (containing a Poison B material). See **Chemical ammunition, nonexplosive** (*containing a Poison B material*)										
	Ammunition, chemical (containing an irritating liquid or solid). See **Chemical ammunition, nonexplosive** (*containing an irritating material*)										
	Ammunition, chemical, explosive, with irritant	Class A explosive		Explosive A and Irritant	None	173.59	Forbidden	Forbidden	6	5	No other cargo may be stowed in the same hold with these items
	Ammunition, chemical, explosive, with Poison A material	Class A explosive		Explosive A and Poison gas	None	173.59	Forbidden	Forbidden	6	5	No other cargo may be stowed in the same hold with these items

§ 172.101 Hazardous Materials Table—*Continued*

(1)	(2)	(3)	(3A)	(4)	(5)		(6)		(7)		
					Packaging		Maximum net quantity in one package		Water shipments		
+/ E A/ W	Hazardous materials descriptions and proper shipping names	Hazard class	Identification number	Label(s) required (if not excepted)	(a) Exceptions	(b) Specific requirements	(a) Passenger-carrying aircraft or railcar	(b) Cargo aircraft only	(a) Cargo vessel	(b) Passenger vessel	(c) Other requirements
	Ammunition, chemical, explosive, with Poison B material	Class A explosive		Explosive A and Poison	None	173.59	Forbidden	Forbidden	6	5	No other cargo may be stowed in the same hold with these items
	Ammunition for cannon with empty projectile	Class B explosive		Explosive B	None	173.89	Forbidden	Forbidden	1,2	5	
	Ammunition for cannon with explosive projectile	Class A explosive		Explosive A	None	173.54	Forbidden	Forbidden	6	5	
	Ammunition for cannon with gas projectile	Class A explosive		Explosive A	None	173.54	Forbidden	Forbidden	6	5	
	Ammunition for cannon with illuminating projectile	Class A explosive		Explosive A	None	173.54	Forbidden	Forbidden	6	5	
	Ammunition for cannon with incendiary projectile	Class A explosive		Explosive A	None	173.54	Forbidden	Forbidden	6	5	
	Ammunition for cannon with inert loaded projectile	Class B explosive		Explosive B	None	173.89	Forbidden	Forbidden	1,2	5	
	Ammunition for cannon without projectile	Class B explosive		Explosive B	None	173.89	Forbidden	Forbidden	1,2	5	
	Ammunition for cannon with smoke projectile	Class A explosive		Explosive A	None	173.54	Forbidden	Forbidden	6	5	
	Ammunition for cannon with solid projectile	Class B explosive		Explosive B	None	173.89	Forbidden	Forbidden	1,2	5	
	Ammunition for cannon with tear gas projectile	Class A explosive		Explosive A	None	173.54	Forbidden	Forbidden	6	5	
	Ammunition for cannon with tear gas projectile	Class B explosive		Explosive B	None	173.89	Forbidden	Forbidden	1,2	5	
	Ammunition for small-arms with explosive projectile	Class A explosive		Explosive A	None	173.58	Forbidden	Forbidden	6	5	
	Ammunition for small-arms with incendiary projectile	Class A explosive		Explosive A	None	173.58	Forbidden	Forbidden	6	5	
	Ammunition, non-explosive. See 173.55										
	Ammunition, rocket. See Rocket ammunition with ...										
	Ammunition, small-arms. *See* Small-arms ammunition										
E	Amyl acetate (*RQ-1000/454*)	Flammable liquid	UN1104	Flammable liquid	173.118	173.119	1 quart	10 gallons	1,2	1,2	
	Amyl acid phosphate	Corrosive material	UN2819	Corrosive	173.244	173.245	1 quart	10 gallons	1,2	1,2	
	Amylamine	Flammable liquid	UN1106	Flammable liquid	173.118	173.119	1 quart	10 gallons	1,2	1	
	Amyl chloride	Flammable liquid	UN1107	Flammable liquid	173.118	173.119	1 quart	10 gallons	1,2	1	
	Amylene, *normal*	Flammable liquid	UN1108	Flammable liquid	173.118	173.119	1 quart	10 gallons	1,3	1,3	
	Amyl formate	Flammable liquid	UN1109	Flammable liquid	173.118	173.119	1 quart	10 gallons	1,2	1	
	Amyl mercaptan	Flammable liquid	UN1111	Flammable liquid	None	173.141	Forbidden	10 gallons	1,2	1	
	Amyl nitrite	Flammable liquid	UN1113	Flammable liquid	173.118	173.119	1 quart	10gallons	1,3	4	
	tert-Amyl peroxy-2-ethylhexanoate, *technically pure. See* Organic peroxide, liquid or solution, n.o.s.		UN2898								
	tert- Amyl peroxyneodecanoate, *not more than 75% with phlegmatizer. See* Organic peroxide, liquid or solution, n.o.s.		UN2891								
	Amyl trichlorosilane	Corrosive material	UN1728	Corrosive	None	173.280	Forbidden	10 gallons	1	5	Keep dry
E	Anhydrous ammonia. *See* Ammonia, anhydrous										
	Anhydrous hydrazine. *See* Hydrazine, anhydrous										
E	Anhydrous hydrofluoric acid. *See* Hydrogen fluoride										
	Aniline oil drum, empty *See 173.347(a)*	Poison B							1,2	1	Do not accept unless returnable package notice is on drum and the instructions thereon have been carried out
- E	Aniline oil, liquid (*RQ-1000/454*)	Poison B	UN1547	Poison	None	173.347	Forbidden	55 gallons	1,2	1,2	Stow away from oxidizing materials and acids
	Anisoyl chloride	Corrosive material	UN1729	Corrosive	173.244	173.279	1 quart	1 quart	1	1	Keep dry
E	Antimonous chloride. *See* Antimony trichloride										
A	Antimony lactate, solid	ORM-A	UN1550	None	173.505	173.510	No limit	No limit			

§ 172.101 Hazardous Materials Table—*Continued*

(1)	(2)	(3)	(3A)	(4)	(5)		(6)		(7)		
					Packaging		Maximum net quantity in one package		Water shipments		
+/E/A/W	Hazardous materials descriptions and proper shipping names	Hazard class	Identification number	Label(s) required (if not excepted)	(a) Exceptions	(b) Specific requirements	(a) Passenger-carrying aircraft or railcar	(b) Cargo aircraft only	(a) Cargo vessel	(b) Passenger vessel	(c) Other requirements
E	Antimony pentachloride (*RQ-1000/454*)	Corrosive material	UN1730	Corrosive	None	173.247	1 quart	1 quart	1	1	Keep dry. Glass carboys not permitted on passenger vessels
E	Antimony pentachloride solution (*RQ-1000/454*)	Corrosive material	UN1731	Corrosive	173.244	173.245	1 quart	5 pints	1	1	Keep dry. Glass carboys not permitted on passenger vessels
	Antimony pentafluoride	Corrosive material	UN1732	Corrosive	None	173.246	Forbidden	25 pounds	1	5	Keep dry
EA	Antimony potassium tartrate, solid (*RQ-1000/454*)	ORM-A	UN1551	None	173.505	173.510	No limit	No limit	1,2	1,2	
	Antimony sulfide and a chlorate, mixtures of	Forbidden									
A	Antimony sulfide, solid	ORM-A	NA1325	None	173.505	173.510	No limit	No limit			
E	Antimony tribromide, solid (*RQ-1000/454*)	Corrosive material	NA1549	Corrosive	173.244	173.245b	25 pounds	100 pounds	1,2	1,2	Keep dry
E	Antimony tribromide solution (*RQ-1000/454*)	Corrosive material	NA1549	Corrosive	173.244	173.245	1 quart	5 pints	1	1	Keep dry
E	Antimony trichloride, solid (*RQ-1000/454*)	Corrosive material	UN1733	Corrosive	173.244	173.245b	25 pounds	100 pounds	1,2	1,2	Keep dry
E	Antimony trichloride solution (*RQ-1000/454*)	Corrosive material	UN1733	Corrosive	173.244	173.245	1 quart	5 pints	1	1	Keep dry
E	Antimony trifluoride, solid (*RQ-1000/454*)	Corrosive material	NA1549	Corrosive	173.244	173.245b	25 pounds	100 pounds	1,2	1,2	Keep dry
E	Antimony trifluoride solution (*RQ-1000/454*)	Corrosive material	NA1549	Corrosive	173.244	173.245	1 quart	5 pints	1	1	Keep dry
E	Antimony trioxide (*RQ-5000/2270*)	ORM-E	NA8201	None	None	173.510	No limit	No limit	1,2	1,2	
E	Aqua ammonia solution (*containing 44% or less ammonia*). *See* Ammonium hydroxide										
	Argon *or* Argon, compressed	Nonflammable gas	UN1006	Nonflammable gas	173.306	173.302 173.314	150 pounds	300 pounds	1,2	1,3	
	Argon, refrigerated liquid (*cryogenic liquid*)	Nonflammable gas	UN1951	Nonflammable gas	173.320	173.316 173.318	100 pounds	300 pounds	1,3	1,3	
	Arsenic acid, solid	Poison B	UN1554	Poison	173.364	173.366	50 pounds	200 pounds	1,2	1,2	
	Arsenic acid solution	Poison B	UN1553	Poison	173.345	173.348	1 quart	55 gallons	1,2	1,2	
	Arsenical compound, liquid, *n.o.s.*, *or* Arsenical mixture, liquid, n.o.s.	Poison B	UN1556	Poison	173.345	173.346	1 quart	55 gallons	1,2	1,2	
	Arsenical compound, solid, n.o.s., *or* Arsenical mixture, solid, n.o.s.	Poison B	UN1557	Poison	173.364	173.367	50 pounds	200 pounds	1,2	1,2	Keep dry
	Arsenical dip, liquid (*sheep dip*)	Poison B	NA1557	Poison	173.345	173.346	1 quart	55 gallons	1,2	1,2	
	Arsenical dust	Poison B	UN1562	Poison	173.364	173.368	50 pounds	200 pounds	1,2	1,2	
	Arsenical pesticide, liquid, n.o.s. (*compounds and preparations*)	Flammable liquid	UN2760	Flammable liquid	173.118	173.119	1 quart	10 gallons	1,2	1	
	Arsenical pesticide, liquid, n.o.s. (*compounds and preparations*)	Poison B	UN2759	Poison	173.345	173.346	1 quart	55 gallons	1,2	1,2	
	Arsenical pesticide, solid, n.o.s. (*compounds and preparations*)	Poison B	UN2759	Poison	173.364	173.367	50 pounds	200 pounds	1,2	1,2	
	Arsenic bromide, solid	Poison B	UN1555	Poison	173.364	173.365	50 pounds	200 pounds	1,2	1,2	
E	Arsenic chloride, liquid. *See* Arsenic trichloride										
E	Arsenic disulfide. *See* Arsenic sulfide, solid										
	Arsenic iodide, solid	Poison B	NA1557	Poison	173.364	173.365	50 pounds	200 pounds	1,2	1,2	
E	Arsenic pentoxide, solid (*RQ-5000/2270*)	Poison B	UN1559	Poison	173.364	173.365	50 pounds	200 pounds	1,2	1,2	
	Arsenic, solid	Poison B	UN1558	Poison	173.364	173.366	50 pounds	200 pounds	1,2	1,2	
	Arsenic sulfide and a chlorate, mixtures of	Forbidden									
E	Arsenic sulfide, solid (*RQ-5000/2270*)	Poison B	NA1557	Poison	173.364	173.365	50 pounds	200 pounds	1,2	1,2	Keep dry
E	Arsenic trichloride, liquid (*RQ-5000/2270*)	Poison B	UN1560	Poison	173.345	173.346	1 quart	55 gallons	1,2	1,2	
E	Arsenic trioxide, solid (*RQ-5000/2270*)	Poison B	UN1561	Poison	173.364	173.366 173.368	50 pounds	200 pounds	1,2	1,2	
E	Arsenic trisulfide (*RQ-5000/2270*)	Poison B	NA1557	Poison	173.364	173.365	50 pounds	200 pounds	1,2	1,2	
E	Arsenic, white, solid. *See* Arsenic trioxide, solid										
E	Arsenious acid, solid. *See* Arsenic trioxide, solid										
	Arsenious and mercuric iodide solution	Poison B	NA2810	Poison	173.345	173.348	1 quart	55 gallons	1,2	1,2	
	Arsine	Poison A	UN2188	Poison gas and Flammable gas	None	173.328	Forbidden	Forbidden	1	5	Segregation same as for flammable gases
	Asbestos	ORM-C		None	173.1090	173.1090	No limit	No limit	1,2	1,2	Stow and handle to avoid airborne particles

APPENDIX C

HEALTH PHYSICS RADIATION SURVEY TAGS

UCN-14
(23 5-59)

HEALTH PHYSICS
MATERIAL TRANSFER
CLEARANCE

DATE _____

DESCRIPTION OF MAT'L. _____

_____

_____ PROPERTY # _____

FROM _____
NAME AND DEPT.

TO _____
NAME AND DEPT.

REMARKS _____

_____

_____

_____

_____

INSPECTED BY _____
HEALTH PHYSICS DEPT.

WCH-278S
(3 10-67)

RADIATION HAZARD

RADIATION SURVEY READINGS

EXTERNAL DOSE RATE

Beta _____ mrem/hr at _____
_____ mrem/hr at _____
Gamma _____ mrem/hr at _____
_____ mrem/hr at _____
Neutron _____ mrem/hr at _____

TOTAL DOSE RATE	_____ MREM/HR at	_____
	_____ MREM/HR at	_____

SURFACE CONTAMINATION

ALPHA (MAX)	PROBE	_____	d/m/100 cm^2
	SMEAR	_____	d/m/100 cm^2
BETA-GAMMA (MAX)	PROBE	_____	mrad/hr
	SMEAR	_____	d/m/100 cm^2

Surveyed by _____ Date _____

MATERIAL TRANSFER—SEE OTHER SIDE

HEALTH PHYSICS
RESTRICTION TAG

Date _____

DESCRIPTION

TO

FROM

REMARKS: THIS EQUIPMENT WAS NOT CHECKED FOR RADIOACTIVITY ON INSIDE.

THIS TAG INDICATES THAT ONLY THE OUTSIDE SURFACES HAVE BEEN CHECKED AND FOUND FREE OF CONTAMINATION.

H.P. REPRESENTATIVE

IN THE EVENT THIS EQUIPMENT IS TO BE WORKED ON IT MUST BE REMOVED TO AN APPROVED AREA AND PROVISIONS MADE TO GAIN ACCESS TO THE INSIDE SURFACES FOR RADIOACTIVITY CHECK PRIOR TO ITS USE.

UCN-2491
(3 12-74)

APPENDIX D

A LIST OF PROPERTIES OF SOME COMMON FLAMMABLE LIQUIDS AND GASES

Common Flammable Liquids and Gases

Chemical Name	Flash Point °C-CC	Auto-ignition Temperature °C	Boiling Point °C	Flammability Limits-25°C Volume %	NFPA Rating
Acetaldehyde	-38	175	20	1.6-10	2-4-2
Acetic Acid	40	465	118	5.4*-16*	2-2-1
Acetone	-18	465	57	2.6-13	1-3-0
Acetylene	-15	305	-84	2.5-100	1-4-3
Acetonitrile	6		82	4.4-16	2-3-1
Ammonia		651	-2	15-28	3-1-0
Aniline	76	615	185	1.2**-8.3**	3-2-0
Benzene	-11	560	80	1.3-7.1	2-3-0
Carbon Disulfide	-30	100	46	1.3-50	2-3-0
Carbon Monoxide		609	-191	12.5-74	2-4-0
Cresol (mixed)	88	559	195	1.3	3-2-0
Cumene	44	424	153	0.9-6.5	2-3-0
Cyclohexane	-17	245	82	1.3-7.8	1-3-0
Decalin	58	250	195	0.74*-4.9*	
Diethyl Ether	-45	160	35	1.9-36	2-4-0
N,N-Dimethylformamide	57	435	153	1.8*-14*	1-2-0
Ethyl Acetate	-4	427	77	2.2-11	1-3-0
Ethyl Alcohol	13	365	88	3.3-12	0-3-0
Ethylene		490	-104	2.7-36	1-4-2
Ethylenimine	-11	320	56	3.6-46	3-3-3
Ethylene Oxide	18	429	10	3.6-100	2-4-3
Formaldehyde		275	-19	7-73	2-4-0
Gasoline	-43	280-456	38-204	1.4-7.6	1-3-0
n-Hexane	-26	225	69	1.2-7.4	1-3-0

Common Flammable Liquids and Gases

Chemical Name	Flash Point °C-CC	Auto-ignition Temperature °C	Boiling Point °C	Flammability Limits-25°C Volume %	NFPA Rating
Hydrazine	93	20-270	113	4.7-100	3-3-2
Hydrogen		400	-252	4.0-75	0-4-0
Methyl Alcohol	12	430	64	6.7-28	1-3-0
Methyl Ethyl Ketone	-5	516	80	1.9-10	1-3-0
Methylene Chloride		615	40	16-66 (100% O_2)	2-0-0
n-Pentane	-40	260	36	1.4-7.8	1-4-0
Phenol	80	715	181		3-2-0
Propane		450	-44	2.1-9.5	1-4-0
Propyl Alcohol	25	440	97	2.1-14	1-3-0
Propylene Oxide	-37		35	2.8-37	2-4-2
Pyridine	20	482	115	1.8-12	2-3-0
Styrene (monomer)	32	490	146	1.1-6.1	2-3-2
Tetrahydrofuran	-14	321	66	2.0-12	2-3-1
Tetralin	71	385	207	0.84*-5.2*	1-2-0
Toluene	85	480	111	1.2*-7.1*	2-3-0
1,1,2-Trichloroethane		500	114		2-1-0
Xylene (mixed)	25	530	140	1.1*-6.4*	2-3-0

*Measurement made at 100°C

**Measurement made at 140°C

All Flash Point Data Closed Cup

NFPA Ratings are for the 704M System. The numbers represent health, fire, and reactivity hazards, respectively.

Source: J. T. Baker Chemical Co., Safety Seminar

APPENDIX E

EXAMPLES OF HIGHLY REACTIVE COMPOUNDS

IDENTIFICATION OF HIGHLY REACTIVE MATERIALS

The following is an alphabetical list of the most common highly reactive materials. The list includes explosives, dangerous when wet chemicals, pyrophorics and organic peroxides. Do not attempt to handle these high risk materials through normal packed laboratory procedures.

The list includes abbreviations which denote the hazard associated with the material. This list is not intended to be all inclusive. All chemicals must be handled with respect and every effort made to understand their nature.

Abbreviations	Hazard
EXP	Explosive - may detonate as a result of shock or heat
PF	Peroxide Former - fire or explosive hazard as a result of peroxide formation
PY	Pyrophoric - ignites spontaneously in dry or moist air at or below 130°F
FS	Flammable Solid - material which is liable to cause fires through friction, absorption of moisture or spontaneous chemical changes
DWW	Flammable Solid, Dangerous When Wet - severe fire and/or explosion hazard in contact with water
OP	Organic Peroxide - strong oxidizing agent, fire or explosion hazard in contact with combustible materials and unstable if heated to Self Accelerating Decomposition Temperatures (SADT)
POL	Polymerizable - temperature sensitive materials

A

Acetal PF
Acetyl benzoyl peroxide EXP
Acetyl cyclohexyl sulforyl peroxide OP
Acetyl peroxide EXP
Acetylides EXP
Aluminum borohydride PY
Aluminum hydride DWW
Aluminum phosphide DWW
Ammonium nitrate (contaminated) EXP
Ammonium picrate EXP
Azo benzene FS
2,2'-azonaphthalene FS

B

Benzoyl peroxide OP
Bis (2-chloroisopropyl) ether PF
Bis (2-ethoxyethyl) ether PF
Bis (trinitroethyl) carbonate EXP
Bis (trinitroethyl) nitramine EXP
Black powder FS
Boron dust PY
Butadiene PF
1,3,4-Butanetrioltrinitrate EXP
t-Butoxycarbonyl azide EXP
t-Butyl hydroperoxide OP
oo-t-Butyl-o-isopropyl monoperoxy-carbonate OP
n-Butyl lithium PY, PF
s-Butyl lithium PY, PF
t-Butyl peracetate OP
t-Butyl perbenzoate OP
t-Butyl per -2- ethyl hexoate OP
t-Butyl perivalate OP
t-Butyl perneodecanoate OP
t-Butyl perocatoate OP
t-Butyl peroxydicarbonate OP
t-Butyl peroxyacetate OP
t-Butyl peroxybenzoate OP
t-Butyl peroxy -2- ethylhexanoate OP
t-Butyl peroxyisobutyrate OP
t-Butyl peroxymaleic acid OP
t-Butyl peroxy neodecanoate OP
t-Butyl peroxypivalate OP
Butyl tetryl EXP

C

Calcium carbide DWW
Calcium hydride DWW
Calcium metal DWW
Calcium phosphide DWW
Cesium metal DWW
Chlorobutadiene PF
Chloroperoxy benzoic acid OP
Chlorotrifluoroethylene PF
Copper acetylide EXP
Cumene OP
Cumene hydroperoxide OP
Cyanuric triazide OP
Cyanuric triazide EXP
Cyclohexene PF
Cyclohexanone peroxide OP
Cyclopentadiene PF
Cyclotetramethylene oxide OP
Cyclotetramethylene tetranitramine EXP
Cyclotrimethylene trinitramine (RDX) EXP

D

Decaborane FS
Decanoyl peroxide OP
Diacetylene PF
Diazomethane EXP
Di-t-butyl diperoxy phthalate OP
Di-t-butyl perbenzoate OP
Di-t-butyl peroxide OP
1,1-Di(t-butyl peroxy) cyclohexane OP
Di-s-butyl peroxy dicarbonate OP
1,1-Di-(t-butyl peroxy)-3,3,5-trimethyl cyclohexane OP
Dicanoyl peroxide OP
Dicetyl peroxy dicarbonate OP
2,4-Dichlorobenzoyl peroxide OP
Dicumyl peroxide OP

Dicyclohexyl peroxydicarbonate OP
Dicyclopentadiene PF
Diethyl aluminum chloride PY
Diethyl aluminum hydride PY
Diethylene oxide PF
Diethyl ether PF
Di-2-ethyl hexyl peroxydicarbonate OP
Diethyl zinc PY
2,5-Dihydroperoxy-2,5-dimethyl-hexane OP
Diisobutyryl peroxide OP
Diisononanoyl peroxide OP
Diisopropylbenzene hydroperoxide OP
Diisopropyl peroxydicarbonate OP
2,5-Dimethyl-di(benzoylperoxy) Hexane OP
2,5-Dimethyl-2,5-di(t-butylperoxy) Hexane OP
2,5-Dimethyl-2,5-di(t-butylperoxy) Hexane OP
2,5-Dimethyl-2,5-di(ethylhexanoyl-peroxy) Hexane OP
Dinitroethylene urea EXP
Dinitroglycerine EXP
Dinitrophenol FS, EXP
Dinitrophenolates FS, EXP
Dinitroresorcinol EXP
Dioxane PF
Dipicrylamine EXP
Dipicryl sulfide EXP
Dipicryl sulfone EXP
Di-(n-propyl) peroxydicarbonate OP
Divinyl acetylene PF

E

Ether PF
Ethylene glycol dimethyl ether PF
Ethyl ether PF

F

Fulminate of mercury EXP
Fulminate of silver EXP
Fulminates EXP
Fulminating gold EXP
Fulminating mercury EXP
Fulminating platinum EXP
Fulminating silver EXP

H

Heavy metal azides EXP
Hexanitrodiphenylamine EXP
Hexanitrodiphenyl sulfide EXP
Hexanitrostilbene EXP
Hydrazinium nitrate EXP
Hydrazoic acid EXP
Hydrogen peroxide (over 60%) EXP

I

Isopropenyl acetylene FS
Isopropyl ether PF

L

Lauroyl peroxide OP
Lead azide EXP
Lead mannite EXP
Lead mononitroresorcinate EXP
Lead picrate EXP
Lead styphnate EXP
Lead trinitroresorcinate EXP
Lithium aluminum hydride DWW
Lithium amide FS
Lithium borohydride DWW
Lithium ferrosilicone DWW
Lithium hydride DWW, PY
Lithium metal DWW
Lithium nitride DWW
Lithium silicon DWW

M

Magnesium aluminum phosphide DWW
Magnesium metal DWW
Mannitol hexanitrate EXP
Mercuric fulminiate EXP
Mercury oxalate EXP
Mercury tartrate EXP
Methyl acetylene PF
Methyl cyclopentane PF
Methyl ethyl ketone peroxide OP
Methyl isobutyl ketone PF
Methyl lithium PY, PF

N

Nitrocellulose (dry) EXP
Nitrogen trichloride EXP
Nitrogen triiodide EXP
Nitroglycerine EXP
Nitroglycide EXP
Nitromethane (contaminated) EXP
Nitroparrifins (contaminated) EXP
Nitrostarch EXP
Nitrourea EXP

O

Organic peroxides OP

P

2,4-Pentanedione peroxide OP
Perisobutyric acid OP
1-Phenylazo-2-naphthol EXP
Phenyl lithium PY,PF
Phosphorous (white, yellow) PY,FS
Phosphorous (red) FS
Phosphorous pentasulfide DWW
Phosphorous sesquisulfide DWW
Picramates EXP
Picramide EXP
Picratol EXP
Picric acid (dry) EXP
Picryl chloride EXP
Picryl fluoride EXP
Potassium azide (old) EXP
Potassium borohydride FS
Potassium t-butoxide FS
Potassium metal DWW, PF

R

Rubidium metal DWW

S

Silver acetylide EXP
Silver azide EXP
Silver fulminate EXP
Silver picrate EXP
Silver styphnate EXP
Silver tetrazene EXP
Smokeless powder FS
Sodamide DWW, PF
Sodium aluminum hydride DWW,PY
Sodium amide DWW,PF
Sodium azide (old) EXP
Sodium borohydride DWW
Sodium dithionite FS
Sodium hydride DWW
Sodium hydrosulfite FS
Sodium metal DWW
Sodium methoxide FS
Sodium methylate (dry) FS
Sodium phosphide DWW
Sodium picramate EXP
Sodium potassium alloy DWW
Stannic phosphide DWW
Styphenates EXP
Styphnic acid EXP
Styrene PF
Succinic acid peroxide OP
Sulfur/zinc mixtures FS

T

Tetrafluorethylene PF
Tetrahydrofuran PF
Tetrahydronaphthalene PF
1,1,3,3-Tetramethyl-butyl hydroperoxide OP
Tetranitrocarbazole EXP
Tetranitromethane EXP,FS
Thermite FS
Titanium dichloride PY
Titanium trichloride PY
1-0-Tolyazo-2-napthol EXP
Triaminotrinitrobenzene EXP
Tributyl aluminum PY
Tri-n-butyl borane PY
Trichlorotrinitrobenzene EXP
Triethyl boron PY
Triethyl aluminum PY
Triethyl aluminum chloride PY
Triethyl borane PY
Triisobutyl aluminum PY

Trinitroanisole EXP
Trinitrobenzene EXP
Trinitrobenzoic acid EXP
Trinitrocresol EXP
Trinitronaphthalene EXP
Trinitrophenol (picric acid) EXP
Trinitroresorcinol EXP
Trinitrotoluene (TNT) EXP

U

Urea nitrate EXP

V

Vinyl acetate PF
Vinyl acetylene PF
Vinylbenzene POL
Vinyl ether PF
Vinyl ethyl ether POL
Vinylidene chloride PF
Vinyl isobutyl ether POL
Vinyl methyl ether POL
Vinyl methyl ketone POL
Vinyl pyridine PF

Z

Zinc/sulfur mixtures FS
Zirconium hydride DWW
Zirconium metal FS,EXP
Zironcium picramate EXP

NOTE: This list is not intended to be all inclusive. All chemicals must be handled with respect and every effort made to understand their nature.

Source: J. T. Baker, Chemical Co., The Management of Disposal of Chemical Wastes, 1983

APPENDIX F

EXAMPLES OF "DRUM LOG BOOK" and "PCB LOG BOOK"

DRUM#	HAZARD CLASS	LIQ/SOL	LAB PACK/BULK	DRUM SIZE	DATE FILLED	PCB	NOTES

POLYCHLORINATED BIPHENYL

DRUM#	LIQUID/SOLID*	CAPACITOR/BALLAST/OIL*	CONC*	DATE TO STORAGE

APPENDIX G

HAZARDOUS WASTE STORAGE AREA INSPECTION FORMS

General Inspection Schedule
Bldg. 7507

Activity to be Inspected	Frequency	Potential Problems
I. Container Storage Area		
a. Container placement	W	Must be able to walk around drums in bin and down a center aisle.
b. Container labeling	W	Hazard labels, EPA waste labels and numbers, DOT names and numbers, date to storage, or accumulation date.
c. Container condition	W	Corrosion, leaks, pressure, or structural defects.
d. Segregation of waste classes	W	Storage of incompatible wastes in same area.
e. Building security	W	Warning signs in place, all entrance locks intact.
f. Base/foundation	W	Cracks, uneven settlement, wet spots, erosion.
g. Containment dike	W	Cracks, deterioration of dike wall or joints between curbing and dike wall.
h. Ramps	W/after each use	Cracks, uneven settlement, erosion.
i. Loading/unloading areas	W/daily when in use	Spills, leaks, chemical residues, glass, unnecessary items.
j. Storage area identification	W	Proper waste class signs in place for each storage area.
k. Reactive metal storage	When in use	Check presure gauge and gas volume remaining, spare cyclinder, and condition of reactives in drum.

General Inspection Schedule (Continued)

Activity to be Inspected	Frequency	Potential Problems
II. Packing Area		
a. Storage of incompatible wastes	D	Segregated storage, identification, double containment of bulk liquids.
b. Containers	D	All wastes in glass or metal containers - no combustibles, paper, fiber drums, or cardboard.
c. Unpacked chemical wastes	D	Wastes must be packaged within 24 hours of delivery to building.
III. Safety and Emergency Equipment		
a. Standard industrial absorbents vermiculite, clay absorbent, soda ash	M	Minimum stock: vermiculite 20 bags clay 10 bags soda 5 bags
b. Absorbent boom	M	1 bale (4 booms) In spill trailer outside building.
c. Absorbent pads	M	200 pads
d. 55 gallon drums, overpacks 30 gallon drums, bulk drums	M	DOT 17H 20 DOT 17E 10 DOT 6D 10 Overpacks 10
e. Eye wash	M	Leaking, loss of pressure.
f. Goggles, gloves, disposable coveralls, boots, shoe covers	M	Broken or dirty equipment, low inventory: coveralls 20 each gloves 20 pair boots 10 pair shoecovers 1 box
g. Respirators and cartridges	M	Broken bags, low inventory, color changes.
h. Self-contained breathing apparatus	M	Needs recharging reserve tanks, moisture in tanks.
i. Reactive metal storage	When in use	Check pressure gauge, volume of gas remaining, spare cylinder, and

General Inspection Schedule (Continued)

Activity to be Inspected	Frequency	Potential Problems
i. Fire extinguishers	M	Does it need recharging?
j. Fire blankets	As used	Minimum stock, accessibility.
k. Sprinkler system	M	Power failure, accessibility, operability.
l. Telephone system	W	Power failure, accessibility, operability.
m. Generators	As used	Operability, fuel supply, oil.

Daily Inspection Schedule
Building 7507

Inspector: Date:

Activity to be Inspected	Potential Problems
I. Packing area	
a. Storage of incompatible wastes	Segregated storage, identification, double containment of bulk liquids. Note: Bulk incompatibles, (i.e., acids, bases, etc.), must be double contained and identified by a large red circle painted on the side of drum.
b. Containers	All waste chemicals in glass or metal containers, no combustibles, paper, fiber drums, or cardboard.
c. Unpacked chemical wastes	All must be packaged within 24 hours of delivery to building.
d. Reactive metal storage (when in use)	Check presure gauge and gas volume remaining, spare cyclinder, and condition of reactives in drum

COMMENTS OR CORRECTIVE ACTIONS TAKEN

Weekly Inspection Schedule
Building 7507

Inspector: Date:

Activity to be Inspected	Potential Problems
I. Container Storage Area	
a. Container placement	Must be able to walk around drums in each storage area and down center aisle.
b. Container labeling	Hazard labels, EPA waste labels and numbers, DOT names and numbers, date to storage or accumulation date.
c. Container condition	Corrosion, leaks, pressure, or structural defects.
d. Segregation of waste classes	Storage of incompatible wastes in same area.
e. Building security	Warning signs in place, all entrance locks intact.
f. Base/foundation	Cracks, uneven settlement, wet spots, erosion.
g. Containment dike	Cracks, deterioration of dike wall or joints between curbing and dike wall.
h. Ramps	Cracks, uneven settlement, erosion.
i. Loading/unloading areas	Spills, leaks, chemical residues, glass, unnecessary items.
j. Storage area identification	Proper waste class signs in place for each storage area.
II. Safety Equipment	
a. Telephone system	Power failure, accessibility, operability.

Weekly Inspection Schedule (Continued)

Inspector: Date:

Activity to be Inspected	Potential Problems
b. Fire blankets	Minimum stock, good accessibility.
c. Generators	Operability, fuel supply, oil.

COMMENTS OR CORRECTIVE ACTIONS TAKEN

Monthly Inspection Schedule
Building 7507

Inspector: Date:

Activity to be Inspected	Potential Problems
I. Safety and Emergency Equipment	
a. Standard industrial absorbents vermiculite, clay abosrbent, soda ash	Minimum stock: vermiculite 20 bags clay 10 bags soda ash 5 bags
b. Absorbent pads	200 pads 2 pkg.
c. Absorbent boom	1 bale (4 booms). In spill trailer outside building.
d. 55 gal drums, 30 gal overpacks, bulk	DOT 17H (55 gal) 20 DOT 17E (30 gal) 10 DOT 60 (bulk) 10 Overpacks 10
e. Eye wash	Leaking, loss of pressure.
f. Goggles, gloves, disposable coveralls, boots, shoe covers	Broken or dirty equipment, low inventory: coveralls 20 each gloves 20 pair boots 10 pair shoecovers 1 box goggles 10 pair
g. Respirators and cartridges	Low inventory: broken bags or seals, color changes (minimum to outfit 6 people).
h. Self-contained breathing apparatus	Needs recharging, reserve tanks, moisture in tanks.
i. Fire extinguishers	Needs recharging.

Monthly Inspection Schedule (Continued)

Inspector: Date:

Activity to be Inspected	Potential Problems
j. Sprinkler system	Power failure, accessibility, operability.
k. Fire alarm (on building opposite 7507)	Power failure, accessibility, operability.

COMMENTS OR CORRECTIVE ACTION TAKEN

APPENDIX H

PARTIAL LIST OF INCOMPATIBLE CHEMICALS

PARTIAL LIST OF INCOMPATIBLE CHEMICALS (Reactive Hazards)

DO NOT accidentally contact these:	With these:
Acetic acid	Chromic acid, nitric acid, peroxides and permanganates.
Acetic anhydride	Hydroxyl-containing compounds, ethylene glycol, perchloric acid.
Acetone	Concentrated nitric and sulphuric acid mixtures.
Acetylene	Chlorine, bromine, copper, silver, fluorine, and mercury.
Alkali and alkaline earth metals, such as sodium, potassium, lithium, magnesium, calcium, and powdered aluminium	Carbon dioxide, carbon tetrachloride and other chlorinated hydrocarbons. (Also prohibit water, foam, and dry chemical on fires involving these metals-dry sand should be available.)
Ammonia (anhyd.)	Mercury, chlorine, calcium hypochlorite, iodine, bromine, and hydrogen fluoride.
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrites, sulphur, finely divided organics, or combustibles.
Aniline	Nitric acid, hydrogen peroxide.
Bromine	Ammonia, acetylene, butadiene, butane, and other petroleum gases, sodium carbide, turpentine, benzene, and finely divided metals.
Calcium oxide	Water.
Carbon, activated	Calcium hypochlorite, other oxidants.
Chlorates	Ammonium salts, acids, metal powders, sulphur, finely divided organics, or combustibles.
Chromic acid and chromium trioxide	Acetic acid, naphthalene, camphor, glycerol, turpentine, alcohol, and other flammable liquids.

(Cont.)

DO NOT accidentally contact these:	With these:
Chlorine	Ammonia, acetylene, butadiene, butane, and other petroleum gases, hydrogen, sodium carbide, turpentine, benzene, and finely divided metals.
Chlorine dioxide	Ammonia, methane, phosphine, and hydrogen sulphide.
Copper	Acetylene, hydrogen peroxide.
Fluorine	Isolate from everything.
Hydrazine	Hydrogen peroxide, nitric acid, any other oxidant.
Hydrocarbons (benzene, butane, propane, gasoline, turpentine, etc.)	Fluorine, chlorine, bromine, chromic acid, peroxides.
Hydrocyanic acid	Nitric acid, alkalies.
Hydrofluoric acid, anhyd. (hydrogen fluoride)	Ammonia, aqueous, or anhydrous.
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, any flammable liquid, combustible materials, aniline, nitromethane.
Hydrogen sulfide	Fuming nitric acid, oxidizing gases.
Iodine	Acetylene, ammonia (anyhd. or aqueous).
Mercury	Acetylene, fulminic acid*, ammonia.
Nitric acid (conc.)	Acetic acid, acetone, alcohol, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, and nitratable substances.
Nitroparaffins	Inorganic bases, amines.

(Cont.)

DO NOT accidentally contact these:	With these:
Oxalic acid	Silver, mercury.
Oxygen	Oils, grease, hydrogen, flammable liquids, solids, or gases.
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils.
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold.
Phosphorus (white)	Air, oxygen.
Potassium chlorate	Acids (see also chlorates).
Potassium perchlorate	Acids (see also perchloric acid).
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulphuric acid.
Silver	Acetylene, oxalic acid, tartaric acid, fulminic acid*, ammonium compounds.
Sodium	See alkali metals (above).
Sodium nitrite	Ammonium nitrate and other ammonium salts.
Sodium peroxide	Any oxidizable substance, such as ethanol, methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerol, ethylene glycol, ethyl acetate, methyl acetate, and furfural.
Sulfuric acid	Chlorates, perchlorates, permanganates.

* Produced in nitric acid-ethanol mixtures.

PARTIAL LIST OF INCOMPATIBLE CHEMICALS (Toxic Hazards).

Substances in the left hand column should be stored and handled so that they cannot accidentally contact corresponding substances in the center column, because toxic materials (right hand column) would be produced.

Arsenical materials	Any reducing agent*	Arsine
Azides	Acids	Hydrogen azide
Cyanides	Acids	Hydrogen cyanide
Hypochlorites	Acids	Chlorine or hypochlorous acid
Nitrates	Sulfuric acid	Nitrogen dioxide
Nitric acid	Copper, brass, any heavy metals	Nitrogen dioxide (nitrous fumes)
Nitrites	Acids	Nitrous fumes
Phosphorus	Caustic alkalies or reducing agents	Phosphine
Selenides	Reducing agents	Hydrogen selenide
Sulfides	Acids	Hydrogen sulfide
Tellurides	Reducing agents	Hydrogen telluride

*Arsine has been produced by putting an arsenical alloy into a wet galvanized bucket.

APPENDIX I

HAZARDOUS SUBSTANCES STORAGE LOCATIONS

Division	Location	ID	Material	Quantity (Gal.)	Person Responsible	Remarks
Operations	2519		Sulfuric Acid	2,500	Jim Elrod	SW corner outside
Operations	2519		Sulfuric Acid	70	Jim Elrod	SE corner outside
Operations	2536		Chlorine-Gas Bottles	5 x 150 lbs	Jim Elrod	
Operations	2643		Chlorine-Gas Bottles	5 x 150 lbs	Jim Elrod	
Plant & Equipment	3004		Sodium hydroxide	750	T. P. Hamrick	Inside
Plant & Equipment	3004		Sodium hydroxide	1,000	T. P. Hamrick	5% make-up tank
Plant & Equipment	3004		Nitric acid	500	T. P. Hamrick	North side
Chemical Technology	3019	P69	5% Disecondary Bunyl phenol Phosphenate 95% diethyl benzene	225	R. E. Leuze	Cell 6&7
Chemical Technology	3019	T10	Sodium carbonate	300	R. E. Leuze	Cell 6&7
Chemical Technology	3019	M1	Sodium hydroxide (50%)	75	R. E. Leuze	Room 302
Chemical Technology	3019	M2	Nitric Acid (12 m)	450	R. E. Leuze	Room 302
Chemical Technology	3019	M18	Aluminum Nitrate	575	R. E. Leuze	Room 302

Division	Location	ID	Material	Quantity (Gal.)	Person Responsible	Remarks
Chemical Technology	3019	M19	Aluminum nitrate	80	R. E. Leuze	Room 302
Chemical Technology	3019	M25	Sodium carbonate	440	R. E. Leuze	Room 302
Chemical Technology	3019	M4	Nitric acid	500	R. E. Leuze	Outside-not currently in service
Chemical Technology	3019	P16	Sodium hydroxide (50%)	1150	R. E. Leuze	Not currently in service
Plant & Equipment (Operations)	3103		Sulfuric acid	1000	T. P. Hamrick	
Operations	3117		Sulfuric Acid	900	E. D. Lance	
Metals & Ceramics	3505		Sodium hydroxide	5,000	L. C. Lasher	Not in use
Metals & Ceramics	3505		Nitric Acid	5,000	L. C. Lasher	Not in use
Metals & Ceramics	3505		Coal-Oil Mix	2,000	A. J. Moorehead	Outside
Operations	3544	M3A	Sodium hydroxide (3N)	300	L. C. Lasher	
Operations	3544	M1	Sodium hydroxide	1,000	L. C. Lasher	
Operations	3544	M2	Nitric acid	500	L. C. Lasher	
Operations	3544	M8	Sulfuric acid	100	L. C. Lasher	
Operations	3544	M8A	Sulfuric acid	300	L. C. Lasher	

Division	Location	ID	Material	Quantity (Gal.)	Person Responsible	Remarks
Operations	3544		Sodium hydroxide	100	L. C. Lasher	
Operations	3544		Nitric acid	5000	L. C. Lasher	Outside-not in use, being installed
Operations	7075		Photo reproduction Waste	3000	W. A. Alexander	
Operations	7075		Photo reproduction Waste	2000	L. C. Lasher	
Operations	7075		Waste oil	4200	L. C. Lasher	Underground
Operations	7009E		Waste oil	5000	L. C. Lasher	Underground
Fuel Recycle	7601	90F25	Sodium carbonate	200	David Moser	
Fuel Recycle	7601	90F05	Dilute gadolinium nitrate	60	David Moser	
Fuel Recycle	7601	90F29	10M nitric acid	925	David Moser	

Division	Location	ID	Material	Quantity (Gal.)	Person Responsible	Remarks
Fuel Recycle	7601	90F01	Gadolinium Acid			
Fuel Recycle	7601	12F07	Nitric acid (3.5 m)	450	David Moser	Make up Tank
Fuel Recycle	7601	12F05	Nitric acid (3.5 m)			
Fuel Recycle	7601	12F17	Nitric acid	2500	David Moser	
Fuel Recycle	7601		Sodium hydroxide	900	Waldo Evans	
Fuel Recycle	7601	F-18	Nitric acid (High molar)	2500	Waldo Evans	Empty
Fuel Recycle	7601	M2	Nitric acid	2500	Waldo Evans	Empty
Fuel Recycle	7602	32F44	Low molar Waste acid	1500	Waldo Evans	Collection Tank in basement sump
Fuel Recycle	7602	32F50	Low molar Waste acid	13000	Waldo Evans	Underground
Fuel Recycle	7602	32F42	High molar Waste acid	1500	Don Dunning	
Operations	7860S		Radioactive Contaminated Oil	4,500	L. C. Lasher	Underground
Operations	7830W		Radioactive Contaminated Oil	5,000	L. C. Lasher	
Operations	7900 N		Nitric acid	1,500	B. L. Corbett	66% Solution
Operations	7900 N		Sodium hydroxide	5,000	B. L. Corbett	50% Solution

Division	Location	ID	Material	Quantity (Gal.)	Person Responsible	Remarks
Operations	7900 NE		Nitric acid (5%)	1,200	B. L. Corbett	inside
Operations	7900 NE		Sodium hydroxide (5%)	1,200	B. L. Corbett	inside
Operations	7903 W		Sulfuric acid	5,000	B. L. Corbett	93% Solution
Operations	7903		Sulfuric acid	1000	J. W. Paul	
Operations	7916		Corrosion Inhibitor-ENCOR 4632 or Calgon CL-144	4,000		
Plant & Equipment	2567		Herbicide	200	L. L. Harmon	E5113 out of service during winter
Fuel Recycle	7601		Low Molar Waste Acid	2000	W. T. Bostic	E7711
Environmental and Occupational Safety	7030E		Waste oil	1400	W. A. Alexander	E06714
Operations	3544		Sodium Hydroxide	3000	L. C. Lasher	Transfer vehicle outside bldg.

APPENDIX J

DISPOSAL FORMS USED FOR Y-12 LANDFILL AND CONTRACTORS' LANDFILL

Request for Disposal of Sanitary/Industrial Wastes and Spoil Materials

(1) Generating Plant
☐ ORNL ☐ ORGDP ☐ Y-12

(2) Waste Category (check one or more)

- ☐ Animal Bedding
- ☐ Asphalt
- ☐ Asphalt Roofing Materials
- ☐ Block
- ☐ Brick
- ☐ Brush
- ☐ Concrete
- ☐ Empty Containers
- ☐ Organic Garbage
- ☐ Paper and Cardboard
- ☐ Plastics and Rubber
- ☐ Rock
- ☐ Rubble
- ☐ Textile Products
- ☐ Tile
- ☐ Wood
- ☐ Other Construction and Demolition Debris
- ☐ Other _____
- ☐ Empty Hazardous Material Containers
- ☐ Empty Aerosol Cans and Pressurized Gas Cylinders
- ☐ Empty Paint Cans
- ☐ Empty Pesticide Containers
- ☐ Glass
- ☐ Fly Ash
- ☐ Coal Pile Runoff Sludge

(3) HP Surveyed or Sampled for Radiation
Yes ☐ No ☐

If yes, tag must be attached.
If no, and the waste is from ORNL, does it come from a clean area as described in the H.M. Butler letter of 6/5/86 Yes ☐ No ☐

(4) Container Types	Container Quantity
(5) Net Volume (cubic feet)	Net Weight (lbs)

(6) Person(s) to Contact	Building No.	Room No.	Phone No.

(7) Authorized Generator Signature

WTSD Department Facility Operator Completes This Section

Date Waste Received	Facility Name	Operator's Signature

Comments: _____

REQUEST FOR DISPOSAL FOR CONTRACTOR'S LANDFILL

Generator's Name:	Badge No.:
Charge/Work Order No.:	Date:

Permissible Waste (Please check type of waste):

- ☐ Concrete Blocks/Masonary
- ☐ Roofing
- ☐ Plastic
- ☐ Fly Ash
- ☐ Paste Board/Plaster (NOTE: This is Construction Debris Only)
- ☐ Paper and Wood
- ☐ Non-Contaminated Soil
- ☐ Electrical Wiring
- ☐ Piping

Generation Site (Bldg. No. or Area):

HP Surveyed:

☐ Yes ☐ No (Only noncontaminated waste will be accepted)

Construction Engineer:	Phone No.:
Generator's Signature:	Phone No.:

TO BE COMPLETED BY CONTRACTOR'S LANDFILL PERSONNEL

Date Received:	Time Received:	Truck Lic. No.:

Load Reject: ☐ Yes ☐ No Reason for Reject:

Operator's Signature:

Request Made for Blanket Form: ☐ Yes ☐ No

Approved By:

COMMENTS:

REQUEST FOR DISPOSAL OF WASTE MATERIALS AND EQUIPMENT

№ 12196

Material to be disposed *(One material per sheet — Must be identified by Requester)*

Date	Location of Material (Bldg.)	Room or Area

Type of Container *(If cylinder, give cylinder number)*

Condition of Container

Number of Items

Approx. weight or volume

Hazards in Handling and Disposal:

Suggested Method and Location of Disposal:

CHECK APPROPRIATE BLOCKS

☐ Classified ☐ Unclassified

HAZARDOUS

NO	YES	UNKNOWN

☐ Radioactive ☐ Nonradioactive

Nuclides	Curies

TECHNICAL CONTACTS			PROTECTIVE EQUIPMENT REQUIRED
DEPARTMENT	PERSON CONTACTED	DATE	
Safety			
Health Physics			
Criticality Safety			
Fire Protection			
Industrial Hygiene			
Other			

Signed: *(Requisitioner)*	Date	Charge No.	Dept.	Building	Mail Stop	Phone

INFORMATION BELOW THIS LINE TO BE FILLED IN BY WASTE DISPOSAL COORDINATOR ONLY

ADDITIONAL INSTRUCTIONS FOR DISPOSAL:

DISPOSAL AREAS

- ☐ ORGDP Classified Burial Ground, Section:
- ☐ K-1407-A Neutralizing Pit
- ☐ K-1407-B Holding Pond
- ☐ K-1407-C Retention Basin
- ☐ K-1302 Cylinder Venting
- ☐ K-901 Landfill
- ☐ K-901-A Lagoon
- ☐ K-722 Powerhouse Area
- ☐ ORGDP Contractors' Burial Ground
- ☐ ORNL Burial Ground
- ☐ Bethel Valley Quarry
- ☐ Y-12 Burial Ground Sta. No.
- ☐ Other

Plant Waste Disposal Co-ordinator: *(Signature)*

Date

Disposal Completed by: *(Signature)*

Date	Department

Distribution after Disposal:

White Copy - Plant Disposal Coordinator
Blue Copy - Security Department (If marked Classified)
Green Copy - Requester
Yellow Copy - To be retained by the Disposer

UCN-12463
(1 5-78)

NOTICE OF INTENTION TO DEMOLISH OR RENOVATE FRIABLE ASBESTOS MATERIAL

1. ADDRESS OR BUILDING NUMBER OF THE STRUCTURE OR FACILITY INVOLVED

2. DESCRIPTION OF THE BUILDING TO BE DEMOLISHED OR RENOVATED, INCLUDING THE SIZE, AGE, AND PRIOR USE OF THE STRUCTURE

3. APPROXIMATE AMOUNT OF FRIABLE ASBESTOS INVOLVED IN DEMOLITION OR RENOVATION IN LINEAR METER (LINEAR FEET) OR SQUARE METER (SQUARE FEET)

4. SCHEDULED DATES OF DEMOLITION OR RENOVATION	STARTING	COMPLETION

5. NATURE OF PLANNED DEMOLITION OR RENOVATION AND METHOD(S) TO BE EMPLOYED (WETTING PROCESSES) ETC.

SUPERVISOR OR PROJECT MANAGER (PRINT AND SIGN NAME)	DATE
ENVIRONMENTAL COORDINATOR	DATE
INDUSTRIAL HYGIENE	DATE

UCN-13385
(3 2-85)

REQUEST FOR THE DISPOSAL OF ASBESTOS OR MATERIAL CONTAINING ASBESTOS

REQUESTER COMPLETES

DATE	REQUESTER'S NAME AND BADGE NO.	ORIGIN OF WASTE (BLDG.)		
REQUESTER'S SIGNATURE		PHONE NO.	ROOM NO.	BLDG. NO.
ACCOUNT NO.	TOTAL VOLUME IN LINEAR METER (LINEAR FEET) OR SQUARE METER (SQUARE FEET)		WEIGHT (LBS.)	

STORAGE AREA FOREMAN COMPLETES AND SENDS TO ENVIRONMENTAL COORDINATOR'S OFFICE

☐ WASTE ☐ BURIED ☐ OTHER

LOCATION

DATE	DATE UCN-13385 WAS SIGNED

WAS MATERIAL PACKAGED ACCORDING TO PROCEDURE? ☐ YES ☐ NO

WAS DISPOSED MATERIAL COVERED WITH EARTH? ☐ YES ☐ NO

COMMENTS FROM SWSA FOREMAN REGARDING WASTE AND/OR OPERATION

FOREMAN'S SIGNATURE

ENVIRONMENTAL COORDINATOR'S OFFICE COMPLETES

HAS DOE BEEN NOTIFIED?	☐ Yes ☐ No		
IF YES, DOE NOTIFICATION BY	☐ Phone ☐ Letter	DATE	FILE NO.
EPA NOTIFIED?	☐ Yes ☐ No	IF YES, DATE APPROVED	

COMMENTS FROM ENVIRONMENTAL COORDINATOR'S OFFICE

UCN-13386
(3 2-85)

REQUEST FOR DISPOSAL OF HAZARDOUS CHEMICALS, GASES AND RADIOACTIVE MATERIALS

MATERIAL TO BE DISPOSED *(One Material To The Sheet - Material Must Be Identified By Requester)*

LOCATION *(Building)*	ROOM OR AREA	DATE

TYPE OF CONTAINER *(If Cylinder, Give Cylinder Number)*	CONDITION OF CONTAINER
NUMBER OF CONTAINERS	WEIGHT OR VOLUME

PERSON TO CONTACT *(Name)*	ROOM NO.	PHONE NO.

HAZARDS IN HANDLING AND DISPOSAL

SIGNED *(Authorized Signature)*	DEPT.	BLDG.	PHONE

INFORMATION BELOW THIS LINE NOT TO BE FILLED IN BY ORIGINATOR

SUGGESTED ACTION FOR DISPOSAL:

PROTECTIVE EQUIPMENT REQUIRED	DISPOSAL AREAS
	☐ Y-12 BUR. GR. "A" STA. #
	☐ Y-12 BUR. GR. "B" STA. #
	☐ Y-12 BUR. GR. "C" STA. #
	☐ ISOLATION AREA
	☐ Y-12 WALK IN PIT
	☐ ACID POND
	☐ KERR HOLLOW QUARRY
	☐ BETHEL VALLEY QUARRY
TECHNICAL CONTACTS	☐ ORNL BURIAL GROUND
PERSON CONTACTED / DATE	☐ OTHER
	PLANT DISPOSAL COORDINATOR / DATE

DISPOSAL COMPLETED: DATE _____ 19 _____

BY:	DEPARTMENT

DISTRIBUTION: White, Blue, and Yellow copies to Plant Disposal Coordinator
Green copy retained by Originator

UCN-2109
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APPENDIX K

WASTE ANALYSIS PLAN

Waste Analysis Plan

Hazardous Waste Type	Parameter	Rationale	Test Method	Test Reference	Sampling Method	Sampling Reference	Description of Sampling
Spent halogenated solvent mixtures	Flash point Spent waste	Ignitable waste per Subpart C, Section 261.21; hazardous wastes from nonspecific sources per Subpart D, Section 261.31	Pensky-Martens closed cup Pensky-Martens open cup	ASTM D93-79 ASTM D1310-72	Sampling of containerized liquid - COLIWASA	Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods, EPA-SW-846	Representative composite from top to bottom of container. Refer to Waste Handling Procedure for details.
Spent nonhalogenated solvent mixtures	Flash point Spent waste	Ignitable waste per Subpart C, Section 261.21; hazardous wastes from nonspecific sources per Subpart D, Section 261.31	Pensky-Martens closed cup Pensky-Martens open cup	ASTM D93-79 ASTM D1310-72	Sampling of containerized liquid - COLIWASA	Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods, EPA-SW-846	Representative composite from top to bottom of container. Refer to Waste Handling Procedure for details.
Waste mixtures containing cyanides, arsenic	Total cyanides and arsenic	Hazardous wastes from nonspecific sources per Subpart D, Section 261.31 and/or EP toxic wastes per Subpart C, Section 261.24	EP toxicity procedures spectroscopy and atomic absorption	Test Methods for Evaluation of solid waste, physical/ chemical methods, EPA-SW-846 UCC-ND Environmental and Effluent Analysis Manual: Procedures EC-127 and EC-104	Sampling of containerized liquid - COLIWASA	Test Methods for Evaluation of Solid Waste, Physical/ Chemical Methods, EPA-SW-846	Representative composite from top to bottom of container. Refer to Waste Handling Procedure for details.

(Cont.)

Hazardous Waste Type	Parameter	Rationale	Test Method	Test Reference	Sampling Method	Sampling Reference	Description of Sampling
Waste mixtures containing hexavalent chromium, lead, cadmium	Concentrations of toxic heavy metals	Hazardous wastes from nonspecific sources per Subpart D, Section 261.31 and/or EP toxic wastes per Subpart C, Section 261.24	EP Toxicity Procedure, Spectroscopy Atomic Absorption	Test Methods for Evaluation of Solid Waste, Physical/ Chemical Methods, EPA-SW-846 Environmental and Effluent Analysis Manual: Procedures EC-127, EC-104, EC-118 and EC-140	Sampling of containerized liquid - COLIWASA	Test Methods for Evaluation of Solid Waste, Physical/ Chemical Methods, EPA-SW-846	Representative composite from top to bottom of container. Refer to Waste Handling Procedure for details.
Waste oils and halogenated solvents	Flash point Solvent concentration	Per RCRA mixture rule, these wastes must be handled as hazardwaste because of listed hazardous constituents (e.g., perchloroethylene, 1,1,1-trichloroethane)	Gas chromatography	Test Methods for Evaluation of Solid Waste, Physical/ Chemical Methods, EPA-SW-846, Method 8.01	Sampling of containerized liquid - COLIWASA	Test Methods for Evaluation of Solid Waste, Physical/ Chemical Methods, EPA-SW-846	Representative composite from top to bottom of container. Refer to Waste Handling Procedure for details.

(Cont.)

Hazardous Waste Type	Parameter	Rationale	Test Method	Test Reference	Sampling Method	Sampling Reference	Description of Sampling
PCB-contaminated liquids	Flash point PCB concentration	The waste is listed as a hazardous constituent in Appendix VIII, Subpart D. Although PCB materials are regulated by the Toxic Substance Control Act, this waste is handled by offsite facilities licensed under RCRA.	Gas chromatography	Environmental and Effluent Analysis Manual: Procedure EC-550	Sampling of containerized liquid - COLIWASA	Test Methods for Evaluation of Solid Waste, Physical/ Chemical Methods, EPA-SW-846	Representative composite from top to bottom of container. Refer to Waste Handling Procedure for details.
PCB-contaminated solids (i.e., soil concrete, disposable clothing)	Flash point PCB concentration	The waste is listed as a hazardous constituent in Appendix VIII, Subpart D. Although PCB materials are regulated by the Toxic Substance Control Act, this waste is handled by offsite facilities licensed under RCRA.	Gas chromatography	Environmental and Effluent Analysis Manual: Procedure EC-550	ASTM D364-75	Test Methods for Evaluation of Solid Waste, Physical/ Chemical Methods, EPA-SW-846 and Section 3.2.4	Representative composite from top to bottom of container. Refer to Waste Handling Procedure for details.

(Cont.)

Hazardous Waste Type	Parameter	Rationale	Test Method	Test Reference	Sampling Method	Sampling Reference	Description of Sampling
Bulk quantities of mixtures of listed wastes, (e.g., mixture of acetone, pyridine, benzene, chloroform, coal oil, water)	Flash point Reactivity pH EP Toxicity	Many waste streams generated which are mixtures of hazardous wastes listed under Subpart D, Section 261.33	Pensky-Martens open and/or closed cup Sulfides-Titrimetric Method 376.1/ Colorimetric Method 376.2 Electro-chemical EP Toxicity Procedure	ASTM D93-79 ASTM D1310-72 Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020 Test Methods for Evaluation of Solid Waste, Physical/ Chemical Methods, EPA-SW-846	Sampling of containerized liquid - COLIWASA	Test Methods for Evaluation of Solid Waste, Physical/ Chemical Methods, EPA-SW-846	Representative composit from top to bottom of container. Refer to Waste Handling Procedur for details.
Chemical waste with unknown constituents (small quantities)	Flash point Reactivity pH EP Toxicity	Identify constituents characteristics of waste to determine how it shall be handled	Pensky-Martens open and/or closed cup Sulfides-Titrimetric Method 376.1/ Colormetric Method 376.2 Electro-chemical EP Toxicity Procedure	ASTM D93-79 ASTM D1310-72 Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020 Test Methods for Evaluation of Solid Waste, Physical/ Chemical Methods, EPA-SW-846	Sampling of containerized liquid - COLIWASA	Test Methods for Evaluation of Solid Waste, Physical/ Chemical Methods, EPA-SW-846	24-inch COLIWASA type sampler for takin representative sample in small containers. Refer to Waste Handlin Procedure for details.

APPENDIX L

TABLES FROM 40 CFR 261, SUBPART C AND SUBPART D

under procedures set forth in §§260.20 and 260.21.

[261.21(a)(1) amended by 46 FR 35247, July 7, 1981]

(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 is 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 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.

§ 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:

[261.22(a)(1) and (2) amended by 46 FR 35247, July 7, 1981]

(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.

§ 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 ($C_{10}H_{10}Cl_8$, 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

Subpart D—Lists of Hazardous Wastes

[Interim final]

§ 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 Hazardous 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 recordkeeping and reporting requirements under Parts 262 through 265 and Part 270 of this Chapter.

[261.30(c) amended by 48 FR 14153, April 1, 1983]

(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: EPA Hazardous Wastes Nos. FO20, FO21, FO22, FO23, FO26, and FO27.

[261.30(d) revised by 45 FR 74890, November 12, 1980; 50 FR 1999, January 14, 1985]

§261.31 Hazardous waste from nonspecific sources.

The following solid wastes are listed hazardous wastes from non-specific sources unless they are excluded under §§260.20 and 260.22 and listed in Appendix XI.

[261.31 introductory text added by 49 FR 37070, September 21, 1984]

Industry and EPA hazardous waste No.	Hazardous waste	Hazard code
Generic:		
F001	The following spent halogenated solvents used in degreasing: tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; all spent solvent mixtures/blends used in degreasing containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004 and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	(T)
F002	The following spent halogenated solvents: tetrachloroethylene, methylene chloride, trichloroethylene, 1, 1, 1-trichloroethane, chlorobenzene, 1, 1, 2-trichloro-1, 2, 2-trifluoroethane, orthodichlorobenzene, trichlorofluoromethane, and 1, 1, 2-trichloroethane; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those listed in F001, F004, or F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	(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; all spent solvent mixtures/blends containing, before use, only the above spent non-halogenated solvents; and all spent solvent mixtures/blends containing, before use, one or more of the above non-halogenated solvents, and, a total of ten percent or more (by volume) of one or more of those solvents listed in F001, F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	(I)*
F004	The following spent non-halogenated solvents: cresols and cresylic acid, and nitrobenzene; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	(T)
F005	The following spent non-halogenated solvents: toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, or F004; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	(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 basis) 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 milling of aluminum.	(T)
F019	Wastewater treatment sludges from the chemical conversion coating of aluminum	(T)
F007	Spent Cyanide plating bath solutions from electroplating operations.	(R, T)
F008	Plating sludges from the bottom of plating baths from electroplating operations where cyanides are used in the process	(R, T)
F009	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process.	(R, T)
F010	Quenching bath residues from oil baths from metal heat treating operations where cyanides are used in the process.	(R, T)
F011	Spent cyanide solutions from salt bath pot cleaning from metal heat treating operations.	(R, T)
F012	Quenching wastewater treatment sludges from metal heat treating operations where cyanides are used in the process.	(T)
F024	Wastes, including, but not limited to, distillation residues, heavy ends, tars, and reactor cleanout 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 dessicants, wastewater, wastewater treatment sludges, spent catalysts, and wastes listed in §261.32].	(T)
F020	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tri- or tetrachlorophenol, or of intermediates used to produce their pesticide derivatives. (This listing does not include wastes from the production of Hexachlorophena from highly purified 2,4,5-trichlorophenol.).	(H)
F021	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of pentachlorophenol, or of intermediates used to produce its derivatives.	(H)
F022	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra-, penta-, or hexachlorobenzenes under alkaline conditions.	(H)
F023	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tri- and tetrachlorophenols. (This listing does not include wastes from equipment used only for the production or use of Hexachlorophene from highly purified 2,4,5-trichlorophenol.).	(H)
F026	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra-, penta-, or hexachlorobenzene under alkaline conditions.	(H)
F027	Discarded unused formulations containing tri-, tetra-, or pentachlorophenol or discarded unused formulation containing compounds derived from these chlorophenols. (This listing does not include formulations containing Hexachlorophene synthesized from prepurified 2,4,5-trichlorophenol as the sole component.).	(H)
F028	Residues resulting from the incineration or thermal treatment of soil contaminated with EPA Hazardous Waste Nos. F020, F021, F022, F023, F026, and F027.	(T)

*(I, T) should be used to specify mixture containing ignitable and toxic constituents.

[261.31 amended by 45 FR 47833, July 16, 1980, revised by 45 FR 74890, November 12, 1980, 46 FR 4617, January 16, 1981, 46 FR 27476, May 20, 1981, 49 FR 5312, February 10, 1984; 50 FR 661, January 4, 1985; 50 FR 1999, January 14, 1985; 50 FR 53319, December 31, 1985; corrected by 51 FR 2702, January 21, 1986; amended by 51 FR 6541, February 25, 1986]

§261.32 Hazardous waste from specific sources.

The following solid wastes are listed hazardous wastes from specific sources unless they are excluded under §§260.20 and 260.22 and listed in Appendix IX.

[261.32 introductory text added by 49 FR 37070, September 21, 1984]

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)
K093	Distillation light ends from the production of phthalic anhydride from ortho-xylene	(T)
K094	Distillation bottoms from the production of phthalic anhydride from ortho-xylene	(T)
K025	Distillation bottoms from the production of nitrobenzene by the nitration of benzene	(T)
K026	Stripping still tails from the production of methy 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)
K083	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)
K105	Separated aqueous stream from the reactor product washing step in the production of chlorobenzenes.	(T)

[K111 through K116 added by 50 FR 42942, October 23, 1985]

K111	Product washwaters from the production of dinitrotoluene via nitration of toluene	(C,T)
K112	Reaction by-product water from the drying column in the production of toluenediamine via hydrogenation of dinitrotoluene.	(T)
K113	Condensed liquid light ends from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.	(T)
K114	Vicinals from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.	(T)
K115	Heavy ends from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.	(T)
K116	Organic condensate from the solvent recovery column in the production of toluene diisocyanate via phosgenation of toluenediamine.	(T)
K117	Wastewater from the reactor vent gas scrubber in the production of ethylene dibromide via bromination of ethene.	(T)
K118	Spent adsorbent solids from purification of ethylene dibromide in the production of ethylene dibromide via bromination of ethene.	(T)
K136	Still bottoms from the purification of ethylene dibromide in the production of ethylene dibromide via bromination of ethene.	(T)

[K117, 118 and 136 added by 51 FR 5330, February 13, 1986]

Industry and EPA hazardous waste No.	Hazardous waste	Hazard code
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)
K106	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)
K097	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)
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)

[K123 through 126 added by 51 FR 37728, October 24, 1986]

K123	Process wastewater (including supernates, filtrates, and washwaters) from the production of ethylenebisdithiocarbamic acid and its salt.	(T)
K124	Reactor vent scrubber water from the production of ethylenebisdithiocarbamic acid and its salts	(C, T)
K125	Filtration, evaporation, and centrifugation solids from the production of ethylenebisdithiocarbamic acid and its salts.	(T)
K126	Baghouse dust and floor sweepings in milling and packaging operations from the production or formulation of ethylenebisdithiocarbamic acid and its salts.	(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 (leaded) 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 generated by steel finishing operations of facilities within the iron or steel industry (SIC Codes 331 and 332).	(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:		
K060	Ammonia still lime sludge from coking operations	(T)
K087	Decanter tank tar sludge from coking operations	(T)

[261.32 amended by 45 FR 47833, July 16, 1980; 45 FR 72039, October 30, 1980; revised by 45 FR 74980, November 12, 1980; 46 FR 4617, January 16, 1981; 46 FR 27476, May 20, 1981; 50 FR 42942, October 23, 1985; 51 FR 5330, February 13, 1986; 51 FR 19322, May 28, 1986; corrected by 51 FR 33612, September 22, 1986; amended by 51 FR 37728, October 24, 1986]

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

[261.33 revised by 45 FR 78541, November 25, 1980]

The following materials or items are hazardous wastes if and when they are discarded or intended to be discarded, when they are mixed with waste oil or used oil or other material and applied to the land for dust suppression or road treatment, or when, in lieu of their original intended use, they are produced for use as (or as a component of) a fuel, distributed for use as a fuel, or burned as a fuel.

[261.33 introductory text amended by 49 FR 37070, September 21, 1984; 50 FR 661, January 4, 1985; 50 FR 28742, July 15, 1985]

(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:

(1) The container or inner liner has been triple rinsed using a solvent capable of removing the commercial chemical product or manufacturing chemical intermediate; or

(2) The container or inner liner has been cleansed by another method that has been shown in the scientific literature, or by tests conducted by the generator, to achieve equivalent removal; or

(3) In the case of a container, the inner liner that prevented contact of the commercial chemical product or manufacturing chemical intermediate with the container, has been removed.

[261.33(c) revised by 45 FR 78541, November 25, 1980; 46 FR 27476, May 20, 1981]

(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.]

[261.33(d) amended by 46 FR 27476, May 20, 1981]

(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:

[261.33(e) amended by 46 FR 27476, May 20, 1981; corrected and revised by 51 FR 28297, August 6, 1986]

[*Editor's note:* EPA August 6, 1986, corrected the existing listings in 261.33(e) and concurrently revised the listing in its entirety (51 FR 28297). However, in revising the listing, the agency did not include the corrections.

EPA told BNA that the corrections erroneously were omitted from the revised listing and that a corrected version will be published.

In the meantime, however, both the corrections to the existing listings and the revised listings are published for the convenience of our subscribers.]

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-[(methylcarbamoyl)oxy]thio-, methyl ester
P001	3(alpha-Acetonyl-benzyl)-4-hydroxycoumarin and salts
	[P001 amended by 49 FR 19923, May 10, 1984; corrected by 51 FR 28297, August 6, 1986]
P002	1-Acetyl-2-thiourea
P003	Acrolein
P070	Aldicarb
P004	Aldrin
P005	Allyl alcohol
P006	Aluminum phosphide (R, T)
	[P006 corrected by 51 FR 28297, August 6, 1986]
P007	5-(Aminomethyl)-3-isoxazolol
P008	4-alpha-Aminopyridine
	[P008 corrected by 51 FR 28297, August 6, 1986]
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	Aziridine
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
P028	Benzyl chloride
P015	Beryllium dust
P016	Bis(chloromethyl) ether
P017	Bromoacetone
P018	Brucine
P021	Calcium cyanide
P123	Camphene, octachloro-
P103	Carbamimidoselenoic acid
P022	Carbon bisulfide
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
P039	O,O-Diethyl S-[2-(ethylthio)ethyl] phosphorodithioate
P041	Diethyl-p-nitrophenyl phosphate
P040	O,O-Diethyl O-pyrazinyl phosphorothioate
P043	Diisopropyl fluorophosphate
P044	Dimethoate
P045	3,3-Dimethyl-1-(methylthio)-2-butanone, O-[(methylamino)carbonyl] oxime
P071	O,O-Dimethyl O-p-nitrophenyl phosphorothioate
P082	Dimethylnitrosamine
P046	alpha, alpha-Dimethylphenethylamine
P047	4,6-Dinitro-o-cresol and salts
P034	4,6-Dinitro-o-cyclohexylphenol
P048	2,4-Dinitrophenol
P020	Dinoseb
P085	Diphosphoramide, octamethyl-
P039	Disulfoton
P049	2,4-Dithiobiuret
P109	Dithiopyrophosphoric acid, tetraethyl ester
P050	Endosulfan
P088	Endothall
P051	Endrin
P042	Epinephrine
P046	Ethanamine, 1,1-dimethyl-2-phenyl-
P084	Ethenamine, N-methyl-N-nitroso-
P101	Ethyl cyanide
P054	Ethylenimine
P097	Famphur
P056	Fluorine
P057	Fluoroacetamide
P058	Fluoroacetic acid, sodium salt
P065	Fulminic acid, mercury(II) salt (R,T)
P059	Heptachlor
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
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-demethanonaphthalene
P060	1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-endo, endo-dimethanonaphthalene
P004	1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-endo,exo-dimethanonaphthalene
P060	Hexachlorohexahydro-endo, endo-dimethanonaphthalene
	[P060 corrected by 57 FR 28297, August 6, 1986]
P062	Hexaethyl tetraphosphate
P116	Hydrazinecarbothioamide
P068	Hydrazine, methyl-
P063	Hydrocyanic acid
P063	Hydrogen cyanide
P096	Hydrogen phosphide
P064	Isocyanic acid, methyl ester
P007	3(2H)-Isoxazolone, 5-(aminomethyl)-
P092	Mercury, (acetato-O)phenyl-
P065	Mercury fulminate (R,T)
P016	Methane, oxybis(chloro-
P112	Methane, tetranitro- (R)
P118	Methanethiol, trichloro-
P059	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-
P066	Methomyl
P067	2-Methylaziridine
P068	Methyl hydrazine
P064	Methyl isocyanate
P069	2-Methyllactonitrile
P071	Methyl parathion
P072	alpha-Naphthylthiourea
P073	Nickel carbonyl
P074	Nickel cyanide
P074	Nickel(II) cyanide
P073	Nickel tetracarbonyl
P075	Nicotine and salts
P076	Nitric oxide
P077	p-Nitroaniline
P078	Nitrogen dioxide
P076	Nitrogen(II) oxide
P078	Nitrogen(IV) oxide
P081	Nitroglycerine (R)
P082	N-Nitrosodimethylamine
P084	N-Nitrosomethylvinylamine
P050	5-Norbornene-2,3-dimethanol, 1,4,5,6,7,7-hexachloro, cyclic sulfite
P085	Octamethylpyrophosphoramide
P087	Osmium oxide
P087	Osmium tetroxide
P088	7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
P089	Parathion
P034	Phenol, 2-cyclohexyl-4,6-dinitro-
P048	Phenol, 2,4-dinitro-
P047	Phenol, 2-methyl-4,6-dinitro and salts
	[P047 corrected by 51 FR 28297, August 6, 1986]
P020	Phenol, 2,4-dinitro-6-(1-methylpropyl)-
P009	Phenol, 2,4,6-trinitro-, ammonium salt (R)
P036	Phenyl dichloroarsine
P092	Phenylmercuric acetate
P093	N-Phenylthiourea
P094	Phorate
P095	Phosgene
P096	Phosphine
P041	Phosphoric acid, diethyl p-nitrophenyl ester
P044	Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl]ester
P043	Phosphorofluoridic acid, bis(1-methylethyl ester
	[P043 corrected by 51 FR 28297, August 6, 1986]
P094	Phosphorothioic acid, O,O-diethyl S (ethylthio)methyl ester
P089	Phosphorothioic acid, O,O-diethyl O-(p-nitrophenyl) ester
	[P089 corrected by 51 FR 28297, August 6, 1986]
P040	Phosphorothioic acid, O,O-diethyl O- pyrazinyl ester
P097	Phosphorothioic acid, O,O-dimethyl O-[p-[(dimethylamino)-sulfonyl]phenyl]ester
P110	Plumbane, tetraethyl-
P098	Potassium cyanide
P099	Potassium silver cyanide
P070	Propanal, 2-methyl-2-(methylthio)-, [(methylamino)carbonyl]oxime

[Sec. 261.33(e)]

Hazardous waste No.	Substance
P101	Propanenitrile
P027	Propanenitrile, 3-chloro-
P069	Propanenitrile, 2-hydroxy-2-methyl-
P081	1,2,3-Propanetriol, trinitrate- (R)
P017	2-Propanone, 1-bromo-
P102	Propargyl alcohol
P003	2-Propenal
P005	2-Propen-1-ol
P067	1,2-Propylenimine
P102	2-Propyn-1-ol
P008	4-Pyridinamine
P075	Pyridine, (S)-3-(1-methyl-2-pyrrolidinyl)-, and salts
P111	Pyrophosphonic acid, tetraethyl ester
P103	Selenourea
P104	Silver cyanide
P105	Sodium azide
P106	Sodium cyanide
P107	Strontium sulfide
P108	Strychnidin-10-one, and salts
P018	Strychnidin-10-one, 2,3-dimethoxy-
P108	Strychnine and salts
P115	Sulfuric acid, thallium(I) salt
P109	Tetraethyldithiopyrophosphate
P110	Tetraethyl lead
P111	Tetraethylpyrophosphate
P112	Tetranitromethane (R)
P062	Tetraphosphonic acid, hexaethyl ester
P113	Thallic oxide
P113	Thallium(III) oxide
P114	Thallium(I) selenide
	[P114 corrected by 51 FR 28297, August 6, 1986]
P115	Thallium(I) sulfate
P045	Thiofanox
P049	Thioimidodicarbonic diamide
P014	Thiophenol
P116	Thiosemicarbazide
P026	Thiourea, (2-chlorophenyl)-
P072	Thiourea, 1-naphthalenyl-
P093	Thiourea, phenyl-
P123	Toxaphene
P118	Trichloromethanethiol
P119	Vanadic acid, ammonium salt
P120	Vanadium pentoxide
P120	Vanadium(V) oxide
P001	Warfarin, when present at concentrations greater than 0.3%.
	[P001 amended by 49 FR 19923, May 10, 1984]
P121	Zinc cyanide
P122	Zinc phosphide, when present at concentrations greater than 10%.
	[P122 amended by 49 FR 19923, May 10, 1984]

[261.33(e) revised by 51 FR 28297, August 6, 1986]

Hazardous waste No.	Chemical abstracts No.	Substance
P023	107-20-0	Acetaldehyde, chloro-
P002	591-08-2	Acetamide, N-(aminothioxomethyl)-
P057	640-19-7	Acetamide, 2-fluoro-
P058	62-74-8	Acetic acid, fluoro-, sodium salt
P066	16752-77-5	Acetimidic acid, N-[(methylcarbamoyl)oxy]thio-, methyl ester
P002	591-08-2	1-Acetyl-2-thiourea
P003	107-02-8	Acrolein
P070	116-06-3	Aldicarb
P004	309-00-2	Aldrin
P005	107-18-6	Allyl alcohol
P006	20859-73-8	Aluminum phosphide (R,T)
P007	2763-96-4	5-(Aminomethyl)-3-isoxazolol
P008	504-24-5	4-alpha-Aminopyridine
P009	131-74-8	Ammonium picrate (R)
P119	7803-55-6	Ammonium vanadate
P010	7778-39-4	Arsenic acid
P012	1327-53-3	Arsenic oxide As_2O_3
P011	1303-28-2	Arsenic oxide As_2O_5
P011	1303-28-2	Arsenic pentoxide
P012	1327-53-3	Arsenic trioxide
P038	692-42-2	Arsine, diethyl
P036	696-28-6	Arsonous dichloride, phenyl-
P054	151-56-4	Aziridine
P013	542-62-1	Barium cyanide
P024	106-47-8	Benzenamine, 4-chloro-
P077	100-01-6	Benzenamine, 4-nitro-
P028	100-44-7	Benzene, (chloromethyl)-
P042	51-43-4	1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-, (R)-
P046	122-09-8	Benzeneethanamine, alpha,alpha-dimethyl-
P014	108-98-5	Benzenethiol
P001	[1] 81-81-2	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenylbutyl)-, and salts
P028	100-44-7	Benzyl chloride
P015	7440-41-7	Beryllium dust
P016	542-88-1	Bis(chloromethyl) ether
P017	598-31-2	Bromoacetone
P018	357-57-3	Brucine
P021	592-01-8	Calcium cyanide
P022	75-15-0	Carbon bisulfide
P022	75-15-0	Carbon disulfide
P095	75-44-5	Carbonic dichloride
P023	107-20-0	Chloroacetaldehyde
P024	106-47-8	p-Chloroaniline
P029	544-92-3	Copper cyanide
P030		Cyanides (soluble cyanide salts), not otherwise specified
P031	460-19-5	Cyanogen
P033	506-77-4	Cyanogen chloride
P034	131-89-5	2-Cyclohexyl-4,6-dinitrophenol
P036	696-28-6	Dichlorophenylarsine
P037	60-57-1	Dieldrin
P038	692-42-2	Diethylarsine
P041	311-45-5	Diethyl-p-nitrophenyl phosphate
P040	297-97-2	O,O-Diethyl O-pyrazinyl phosphorothioate
P043	55-91-4	Diisopropyl fluorophosphate (DFP)
P004	309-00-2	1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-, (1alpha,4alpha,4abeta,5alpha,8alpha,8abeta)-
P060	465-73-6	1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-, (1alpha,4alpha,4abeta,5beta,8beta,8abeta)-
P037	60-57-1	2,7:3,6-Dimethanonaphth[2,3b]oxirane, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1aalpha,2beta,2aalpha,3beta,6beta,6aalpha,7beta,7aalpha)-
P051	72-20-8	2,7:3,6-Dimethanonaphth[2,3b]oxirane, octahydro-, (1aalpha,2beta,2abeta,3alpha,6alpha,6abeta,7beta,7aalpha)-
P044	60-51-5	Dimethoate
P045	39196-18-4	3,3-Dimethyl-1-(methylthio)-2-butanone, O-[(methylamino)carbonyl] oxime
P046	122-09-8	alpha, alpha-Dimethylphenethylamine
P047	[1] 534-52-1	4,6-Dinitro-o-cresol and salts
P048	51-28-5	2,4-Dinitrophenol
P020	88-85-7	Dinoseb

[Sec. 261.33(e)]

Hazardous waste No	Chemical abstracts No	Substance
P085	152-16-9	Diphosphoramide, octamethyl-
P039	298-04-4	Disulfoton
P049	541-53-7	2,4-Dithiobiuret
P050	115-29-7	Endosulfan
P088	145-73-3	Endothal
P051	72-20-8	Endrin
P042	51-43-4	Epinephrine
P101	107-12-0	Ethyl cyanide
P054	151-56-4	Ethyleneimine
P097	52-85-7	Famphur
P056	7782-41-4	Fluorine
P057	640-19-7	Fluoroacetamide
P058	62-74-8	Fluoroacetic acid, sodium salt
P065	628-86-4	Fulminic acid, mercury(2+)salt (R,T)
P059	76-44-8	Heptachlor
P062	757-58-4	Hexaethyltetraphosphate
P116	79-19-6	Hydrazinecarbothioamide
P068	60-34-4	Hydrazine, methyl-
P063	74-90-8	Hydrocyanic acid
P063	74-90-8	Hydrogen cyanide
P096	7803-51-2	Hydrogen phosphide
P064	624-83-9	Isocyanic acid, methyl ester
P060	465-73-6	Isodrin
P007	2763-96-4	3(2H)-Isoxazolone, 5-(aminomethyl)-
P092	62-38-4	Mercury, (acetato-O)phenyl-
P065	628-86-4	Mercury fulminate (R,T)
P082	62-75-9	Methamine, N-methyl-N-nitroso-
P016	542-88-1	Methane, oxybis[chloro-
P112	509-14-8	Methane, tetranitro- (R)
P118	75-70-7	Methanethiol, trichloro-
P050	115-29-7	6,9-Methano-2,4,3-benzodioxathiepan, 6,7,8,9,10,10-hexachloro- 1,5,5a,6,9,9a-hexahydro-, 3-oxide
P059	76-44-8	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-
P066	16752-77-5	Methomyl
P067	75-55-8	2-Methylaziridine
P068	60-34-4	Methyl hydrazine
P064	624-83-9	Methyl isocyanate
P069	75-86-5	2-Methyllactonitrile
P071	298-00-0	Methyl parathion
P072	86-88-4	alpha-Naphthylthiourea
P073	13463-39-3	Nickel carbonyl
P073	13463-39-3	Nickel carbonyl, (T-4)-
P075	54-11-5	Nicotine and salts
P076	10102-43-9	Nitric oxide
P077	100-01-6	p-Nitroaniline
P078	10102-44-0	Nitrogen dioxide
P076	10102-43-9	Nitrogen oxide NO
P078	10102-44-0	Nitrogen oxide NO_2
P081	55-63-0	Nitroglycerine (R)
P082	62-75-9	N-Nitrosodimethylamine
P084	4549-40-0	N-Nitrosomethylvinylamine
P074	557-19-7	Nickel cyanide
P085	152-16-9	Octamethylpyrophosphoramide
P087	20816-12-0	Osmium oxide
P087	20816-12-0	Osmium tetroxide
P088	145-73-3	7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
P089	56-38-2	Parathion
P034	131-89-5	Phenol, 2-cyclohexyl-4,6-dinitro-
P048	51-28-5	Phenol, 2,4-dinitro-
P047	534-52-1	Phenol, 2-methyl-4,6-dinitro- and salts
P020	88-85-7	Phenol, 2-(1-methylpropyl)-4,6-dinitro-
P009	131-74-8	Phenol, 2,4,6-trinitro-, ammonium salt (R)
P092	62-38-4	Phenylmercury acetate
P093	103-85-5	Phenylthiourea
P094	298-02-2	Phorate
P095	75-44-5	Phosgene
P096	7803-51-2	Phosphine
P041	311-45-5	Phosphoric acid, diethyl 4-nitrophenyl ester
P039	298-04-4	Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester
P094	298-02-2	Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester
P044	60-51-5	Phosphorodithioic acid, O,O-dimethyl S[2-(methylamino)-2-oxoethyl] ester
P043	55-91-4	Phosphorofluoric acid, bis(1-methylethyl)- ester
P089	56-38-2	Phosphorothioic acid, O,O-diethyl O-(4-nitrophenyl) ester
P040	297-97-2	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester
P097	52-85-7	Phosphorothioic acid, O-[4-[(dimethylamino)sulfonyl]phenyl] O,O-dimethyl ester
P071	298-00-0	Phosphorothioic acid, O,O-dimethyl O-(4-nitrophenyl) ester
P110	78-00-2	Plumbane, tetraethyl-
P098	151-50-8	Potassium cyanide
P099	506-61-6	Potassium silver cyanide
P070	116-06-3	Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino)carbonyl]oxime
P101	107-12-0	Propanenitrile
P027	542-76-7	Propanenitrile, 3-chloro-
P069	75-86-5	Propanenitrile, 2-hydroxy-2-methyl-

[Sec. 261.33(e)]

Hazardous waste No	Chemical abstracts No	Substance
P081	55-63-0	1,2,3-Propanetriol, trinitrate (R)
P017	598-31-2	2-Propanone, 1-bromo-
P102	107-19-7	Propargyl alcohol
P003	107-02-8	2-Propenal
P005	107-18-6	2-Propen-1-ol
P067	75-55-8	1,2-Propylenimine
P102	591-08-2	2-Propyn-1-ol
P008	504-24-5	Pyridinamine
P075	[1] 54-11-5	Pyridine, (S)-3-(1-methyl-2-pyrrolidinyl)-, and salts
P111	107-49-3	Pyrophosphonic acid, tetraethyl ester
P103	630-10-4	Selenourea
P104	506-64-9	Silver cyanide
P105	26628-22-8	Sodium azide
P106	143-33-9	Sodium cyanide
P107	1314-96-1	Strontium sulfide
P108	[1] 57-24-9	Strychnidin-10-one, and salts
P018	357-57-3	Strychnidin-10-one, 2,3-dimethoxy-
P108	[1] 57-24-9	Strychnine and salts
P115	10031-59-1	Sulfuric acid, thallium(I) salt
P109	3689-24-5	Tetraethyldithiopyrophosphate
P110	78-00-2	Tetraethyl lead
P111	107-49-3	Tetraethylpyrophosphate
P112	509-14-8	Tetranitromethane (R)
P062	757-58-4	Tetraphosphoric acid, hexaethyl ester
P113	1314-32-5	Thallic oxide
P113	1314-32-5	Thallium(III) oxide
P114	12039-52-0	Thallium(I) selenite
P115	10031-59-1	Thallium(I) sulfate
P109	3689-24-5	Thiodiphosphoric acid, tetraethyl ester
P045	39196-18-4	Thiofanox
P049	541-53-7	Thioimidodicarbonic diamide
P014	108-98-5	Thiophenol
P116	79-19-6	Thiosemicarbazide
P026	5344-82-1	Thiourea, (2-chlorophenyl)-
P072	86-88-4	Thiourea, 1-naphthalenyl-
P093	103-85-5	Thiourea, phenyl-
P123	8001-35-2	Toxaphene
P118	75-70-7	Trichloromethanethiol
P119	7803-55-6	Vanadic acid, ammonium salt
P120	1314-62-1	Vanadium(V) oxide
P084	4549-40-0	Vinylamine, N-methyl-N-nitroso-
P001	81-81-2	Warfarin
P121	557-21-1	Zinc cyanide
P122	1314-84-7	Zinc phosphide (R,T)

[1] CAS Number given for parent compound only

(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 generator exclusion defined in §261.5 (a) and (g).

[261.33(f) introductory paragraph amended by 51 FR 10174, March 24, 1986]

[*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:

[261.33(f) amended by 46 FR 27476, May 10, 1984; 50 FR 1999, January 14, 1985; 50 FR 42942, October 23, 1985; corrected and revised by 51 FR 28297, August 6, 1986]

[*Editor's note:* EPA August 6, 1986, corrected the existing listing in 261.33(f) and concurrently revised the listing in its entirety (51 FR 28297). However, in revising the listing, the agency did not include the corrections.

EPA told BNA that the corrections erroneously were omitted from the revised listing and that a corrected version will be published.

In the meantime, however, both the corrections to the existing listings and the revised listing are published for the convenience of our subscribers.]

Hazardous Waste No.	Substance
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)
U004	Acetophenone
U005	2-Acetylaminofluorene
U006	Acetyl chloride (C,R,T)
U007	Acrylamide
U008	Acrylic acid (I)
U009	Acrylonitrile
U150	Alanine, 3-[p-bis(2-chloroethyl)amino] phenyl-, L-
U248	1-(alpha-Acetonylbenzyl)-4-hydroxycoumarin and salts, when present at concentrations of 0.3% or less
	[U248 added by 49 FR 19923, May 10, 1984]
U328	2-Amino-1-methylbenzene
U353	4-Amino-1-methylbenzene

[U328 and U353 added by 50 FR 42942, October 23, 1985]

U011	Amitrole
U012	Aniline (I,T)
U014	Auramine
U015	Azaserine
U010	Azirino(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-,
U157	Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-
U016	Benz[c]acridine
U016	3,4-Benzacridine
U017	Benzal chloride
U018	Benz[a]anthracene
U018	1,2-Benzanthracene
U094	1,2-Benzanthracene, 7,12-dimethyl-
U012	Benzenamine (I,T)
U014	Benzenamine, 4,4'-carbonimidoylbis(N,N-dimethyl-
U049	Benzenamine, 4-chloro-2-methyl-
U093	Benzenamine, N,N-dimethyl-4-(phenylazo)-
	[U093 corrected by 51 FR 28297, August 6, 1986]
U158	Benzenamine, 4,4'-methylenebis(2-chloro-
U222	Benzenamine, 2-methyl-, hydrochloride
U181	Benzenamine, 2-methyl-5-nitro
U019	Benzene (I,T)
U038	Benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-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)

Hazardous Waste No.	Substance
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-2,4-dinitro-
	[U105 corrected by 51 FR 28297, August 6, 1986]
U106	Benzene, 1-methyl-2,6-dinitro-
U203	Benzene, 1,2-methylenedioxy-4-allyl-
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, pentachloronitro-
	[U185 corrected by 51 FR 28297, August 6, 1986]
U020	Benzenesulfonic acid chloride (C,R)
U020	Benzenesulfonyl chloride (C,R)
U207	Benzene, 1,2,4,5-tetrachloro-
U023	Benzene, (trichloromethyl)-(C,R,T)
U234	Benzene, 1,3,5-trinitro- (R,T)
	[0234 corrected and redesignated as U0234 by 51 FR 28297, August 6, 1986]
U021	Benzidine
U202	1,2-Benzisothiazolin-3-one, 1,1-dioxide, salts
	[U202 corrected by 51 FR 28297, August 6, 1986]
U120	Benzo[j,k]fluorene
U022	Benzo[a]pyrene
U022	3,4-Benzopyrene
U197	p-Benzoquinone
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-
	[U035 corrected by 51 FR 28297, August 6, 1986]
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
U238	Carbamic acid, ethyl ester
U178	Carbamic acid, methylnitroso-, ethyl ester
U176	Carbamide, N-ethyl-N-nitroso-
U177	Carbamide, N-methyl-N-nitroso-
U219	Carbamide, thio-
U097	Carbamoyl chloride, dimethyl-
U215	Carbonic acid, dithallium(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	Chlordane, technical
U026	Chlornaphazine
U037	Chlorobenzene
U039	4-Chloro-m-cresol
U041	1-Chloro-2,3-epoxypropane
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	Cresylic 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-D, salts and esters
	[U240 corrected by 51 FR 28297, August 6, 1986]
U059	Daunomycin
U060	DDD
U061	DDT
U142	Decachlorooctahydro-1,3,4-metheno-2H-cyclobuta[c,d]-pentalen-2-one
U062	Diallate
U133	Diamine (R,T)
U221	Diaminotoluene
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	Dibutyl phthalate
U062	S-(2,3-Dichloroallyl) diisopropylthiocarbamate
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-Dichloropropene
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-pyridazinedione
	[U148 corrected by 51 FR 28297, August 6, 1986]
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
	[U111 corrected by 51 FR 28297, August 6, 1986]
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-Ethanedylbiscarbamodithioic 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-methoxyphenyl).
U227	Ethane, 1,1,2-trichloro-
U043	Ethene, chloro-
U042	Ethene, 2-chloroethoxy-
U078	Ethene, 1,1-dichloro-
U079	Ethene, trans-1,2-dichloro-
U210	Ethene, 1,1,2,2-tetrachloro-
U173	Ethanol, 2,2'-(nitrosoimino)bis-
U004	Ethanone, 1-phenyl-
U006	Ethanoyl chloride (C,R,T)
U359	2-Ethoxyethanol
	[U359 added by 51 FR 6541, February 25, 1986]
U112	Ethyl acetate (I)
U113	Ethyl acrylate (I)
U238	Ethyl carbamate (urethan)
U038	Ethyl 4,4'-dichlorobenzilate
U114	Ethylenebis(dithiocarbamic acid, salts and esters
	[U114 corrected by 51 FR 28297, August 6, 1986]
U067	Ethylene dibromide
	[U067 corrected by 51 FR 28297, August 6, 1986]
U077	Ethylene dichloride
U359	Ethylene glycol monoethyl ether
	[U359 added by 51 FR 6541, February 25, 1986]
U115	Ethylene oxide (I, T)
	[U115 corrected by 51 FR 28297, August 6, 1986]
U116	Ethylene thiourea
U117	Ethyl ether (I)
U076	Ethylidene dichloride
U118	Ethyl methacrylate
	[U118 corrected by 51 FR 28297, August 6, 1986]
U119	Ethyl methanesulfonate
U139	Ferric dextran
U120	Fluoranthene
U122	Formaldehyde
U123	Formic acid (C,T)
U124	Furan (I)
U125	2-Furancarboxaldehyde (I)
U147	2,5-Furandione
U213	Furan, tetrahydro- (I)
U125	Furfural (I)
U124	Furfuran (I)
U206	D-Glucopyranose, 2-deoxy-2(3-methyl-3-nitrosoureido)-
U126	Glycidylaldehyde
U163	Guanidine, N-nitroso-N-methyl-N'-nitro-
	[U163 corrected by 51 FR 28297, August 6, 1986]
U127	Hexachlorobenzene
U128	Hexachlorobutadiene
U129	Hexachlorocyclohexane (gamma isomer)
U130	Hexachlorocyclopentadiene
U131	Hexachloroethane
U132	Hexachlorophene
U243	Hexachloropropene
U133	Hydrazine (R,T)
U086	Hydrazine, 1,2-diethyl-
U098	Hydrazine, 1,1-dimethyl-
U099	Hydrazine, 1,2-dimethyl-
U109	Hydrazine, 1,2-diphenyl-
U134	Hydrofluoric acid (C,T)
U134	Hydrogen fluoride (C,T)
U135	Hydrogen sulfide
U096	Hydroperoxide, 1-methyl-1-phenylethyl- (R)
U136	Hydroxydimethylarsine oxide
U116	2-Imidazolidinethione
U137	Indeno[1,2,3-cd]pyrene
U139	Iron dextran
U140	Isobutyl alcohol (I,T)
U141	Isosafrole
U142	Kepone
U143	Lasiocarpine
U144	Lead acetate
U145	Lead phosphate
U146	Lead subacetate
U129	Lindane
U147	Maleic anhydride
U148	Maleic hydrazide
U149	Malononitrile

[Sec. 261.33(f)]

Hazardous Waste No.	Substance
U150	Melphalan
U151	Mercury
U152	Methacrylonitrile (I,T)
U092	Methanamine, N-methyl- (I)
U029	Methane, bromo-
U045	Methane, chloro- (I,T)
U046	Methane, chloromethoxy-
U068	Methane, dibromo-
U080	Methane, dichloro-
U075	Methane, dichlorodifluoro-
U138	Methane, iodo-
U119	Methanesulfonic acid, ethyl ester
U211	Methane, tetrachloro-
U121	Methane, trichlorofluoro-
U153	Methanethiol (I,T)
U225	Methane, tribromo-
U044	[illegible] trichloro-
U121	[Deleted by 51 FR 28297, August 6, 1986]
U123	Methanoic acid (C,T)
U036	4,7-Methanoindan, 1,2,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-
U154	Methanol (I)
U155	Methapyrilene
U247	Methoxychlor.
U154	Methyl alcohol (I)
U029	Methyl bromide
U186	1-Methylbutadiene (I)
U045	Methyl chloride (I,T)
U156	Methyl chlorocarbonate (I,T)
U226	Methylchloroform
U157	3-Methylcholanthrene
U158	4,4'-Methylenebis(2-chloroaniline)
U132	2,2'-Methylenebis(3,4,6-trichlorophenol)
U068	Methylene bromide
U080	Methylene chloride
U122	Methylene oxide
U159	Methyl ethyl ketone (I,T)
U160	Methyl ethyl ketone peroxide (R,T)
U138	Methyl iodide
U161	Methyl isobutyl ketone (I)
U162	Methyl methacrylate (I,T)
U163	N-Methyl-N'-nitro-N-nitrosoguanidine
U161	4-Methyl-2-pentanone (I)
U164	Methylthiouracil
U010	Mitomycin C
U059	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-
U165	Naphthalene
U047	Naphthalene, 2-chloro-
U166	1,4-Naphthalenedione
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
U166	1,4-Naphthoquinone
	[U166 corrected by 51 FR 28297, August 6, 1986]
U167	1-Naphthylamine
U168	2-Naphthylamine
U167	alpha-Naphthylamine
U168	beta-Naphthylamine
U026	2-Naphthylamine, N,N-bis(2-chloroethyl)-
	[U026 corrected by 51 FR 28297, August 6, 1986]
U169	Nitrobenzene (I,T)
U170	Nitrophenol
U171	2-Nitropropane (I, T)
	[U171 amended by 51 FR 6541, Februray 25, 1986]
U172	N-Nitrosodi-n-butylamine
U173	N-Nitrosodiethanolamine
U174	N-Nitrosodiethylamine
U111	N-Nitrosodi-n-propylamine
	[U111 corrected by 51 by 28297, August 6, 1986]
U176	N-Nitroso-N-ethylurea
U177	N-Nitroso-N-methylurea
U178	N-Nitroso-N-methylurethane
U179	N-Nitrosopiperidine
U180	N-Nitrosopyrrolidine
U181	5-Nitro-o-toluidine
U193	1,2-Oxathiolane, 2,2-dioxide
U058	2H-1,3,2-Oxazaphosphorine, 2-[bis(2-chloroethyl)amino]-tetrahydro, 2-oxide
	[U058 corrected by 51 FR 28297, August 6, 1986]
U115	Oxirane (I,T)
U041	Oxirane, 2-(chloromethyl)-
U182	Paraldehyde
U183	Pentachlorobenzene
U184	Pentachloroethane
U185	Pentachloronitrobenzene
See FO27	Pentachlorophenol
U186	1,3-Pentadiene (I)
U187	Phenacetin
U188	Phenol
U048	Phenol, 2-chloro-
U039	Phenol, 4-chloro-3-methyl-
U081	Phenol, 2,4-dichloro-
U082	Phenol, 2,6-dichloro-
U101	Phenol, 2,4-dimethyl-
U170	Phenol, 4-nitro-
See FO27	Phenol, pentachloro-
Do	Phenol, 2,3,4,6-tetrachloro-
Do	Phenol, 2,4,5-trichloro-
Do	Phenol, 2,4,6-trichloro-
U137	1, 10-(1,2-Phenylene)pyrene
	[U137 corrected by 51 FR 28297, August 6, 1986]
U145	Phosphoric acid, lead salt
	[U145 corrected by 51 FR 28297, August 6, 1986]
U087	Phosphorodithioic acid, 0,0-diethyl-, S-methyl-ester
	[U087 corrected by 51 FR 28297, August 6, 1986]
U189	Phosphorus sulfide (R)
	[U189 corrected by 51 FR 28297, August 6, 1986]
U190	Phthalic anhydride
U191	2-Picoline
U192	Pronamide
U194	1-Propanamine (I,T)
U110	1-Propanamine, N-propyl- (I)
U066	Propane, 1,2-dibromo-3-chloro-
U149	Propanedinitrile
U171	Propane, 2-nitro- (I, T)
	[U171 amended by 51 FR 6541, February 25, 1986]
U027	Propane, 2,2'oxybis[2-chloro-
U193	1,3-Propane sultone
U235	1-Propanol, 2,3-dibromo-, phosphate (3:1)
U126	1-Propanol, 2,3-epoxy-
U140	1-Propanol, 2-methyl- (I,T)
U002	2-Propanone (I)
U007	2-Propenamide
U084	Propene, 1,3-dichloro-
U243	1-Propene, 1,1,2,3,3,3-hexachloro-
U009	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)
See FO27	Propionic acid, 2-(2,4,5-trichlorophenoxy)-
U194	n-Propylamine (I,T)
U083	Propylene dichloride
U196	Pyridine
U155	Pyridine, 2-[(2-(dimethylamino)ethyl]-2-phenyla-mino-
	[U155 corrected by 51 FR 28297, August 6, 1986]
U179	Pyridine, hexahydro-N-nitroso-
U191	Pyridine, 2-methyl-
U164	4(1H)-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-
U180	Pyrrole, tetrahydro-N-nitroso-
U200	Reserpine
U201	Resorcinol
U202	Saccharin and salts
U203	Safrole
U204	Selenious acid
U204	Selenium dioxide
U205	Selenium disulfide (R,T)
U015	L-Serine, diazoacetate (ester)
See FO27	Silvex
U089	4,4'-Stilbenediol, alpha,alpha'-diethyl-
U206	Streptozotocin
U135	Sulfur hydride
U103	Sulfuric acid, dimethyl ester
U189	Sulfur phosphide (R)
U205	Sulfur selenide (R,T)
See FO27	2,4,5-T
U207	1,2,4,5-Tetrachlorobenzene
U208	1,1,1,2-Tetrachloroethane
U209	1,1,2,2-Tetrachloroethane
U210	Tetrachloroethylene
See FO27	2,3,4,6-Tetrachlorophenol
U213	Tetrahydrofuran (I)
U214	Thallium(I) acetate
U215	Thallium(I) carbonate
U216	Thallium(I) chloride
U217	Thallium(I) nitrate
U218	Thioacetamide
U153	Thiomethanol (I,T)
U219	Thiourea
U244	Thiram
U220	Toluene
U221	Toluenediamine
U223	Toluene diisocyanate (R,T)
U222	o-Toluidine hydrochloride
	[U222 corrected by 51 FR 28297, August 6, 1986]
U328	o-Toluidine
U353	p-Toluidine
	[U328 and U353 added by 50 FR 42942, October 23, 1985]
U011	1H-1,2,4-Triazol-3-amine

[*Editor's note:* EPA corrected U232 2,4,5-Trichloroacetic acid to read "2,4,5-Trichloroacetic acid, salts and esters" (51 FR 28297). However, this hazardous substance was never added to 261.33(f).]

U226	1,1,1-Trichloroethane
U227	1,1,2-Trichloroethane
U228	Trichloroethene
U226	Trichloroethylene
U121	Trichloromonofluoromethane
See FO27	2,4,5-Trichlorophenol
U231	2,4,6-Trichlorophenol
Do	2,4,5-Trichlorophenoxyacetic acid

[*Editor's note:* EPA corrected U233 2,4,5-Trichlorophenoxypropionic acid to read "2,4,5-Trichlorophenoxypropionic acid, salts and esters (51 FR 28297). However, this hazardous substance was never added to 261.33(f).]

U234	sym-Trinitrobenzene (R,T)
U182	1,3,5-Trioxane, 2,4,6-trimethyl-
	[U182 corrected by 51 FR 28297, August 6, 1986]
U235	Tris(2,3-dibromopropyl) phosphate
U236	Trypan blue
U237	Uracil, 5-[bis(2-chloroethyl)-amino]-
	[U237 corrected by 51 FR 28297, August 6, 1986]
U237	Uracil mustard
U043	Vinyl chloride
U248	Warfarin, when present at concentrations of 0.3% or less.
U239	Xylene (I)
U200	Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[(3,4,5-trimethoxy-benzoyl)oxy]-methyl ester.
U249	Zinc phosphide, when present at concentrations of 10% or less.
	[U249 added by 49 FR 19923, May 10, 1984]

[261.33(f) revised by 51 FR 28297, August 6, 1986]

Hazardous waste No	Chemical abstracts No	Substance
U001	75-07-0	Acetaldehyde (I)
U034	75-87-6	Acetaldehyde, trichloro-
U187	62-44-2	Acetamide, N-(4-ethoxyphenyl)-
U005	53-96-3	Acetamide, N-9H-fluoren-2-yl-
U112	141-78-6	Acetic acid, ethyl ester (I)
U144	301-04-2	Acetic acid, lead salt
U214	563-68-8	Acetic acid, thallium (1 +) salt
U232	93-76-5	Acetic acid, (2,4,5-trichlorophenoxy)-
U002	67-64-1	Acetone (I)
U003	75-05-8	Acetonitrile (I,T)
U004	98-86-2	Acetophenone
U005	53-96-3	2-Acetylaminofluorene
U006	75-36-5	Acetyl chloride (C,R,T)
U007	79-06-1	Acrylamide
U008	79-10-7	Acrylic acid (I)
U009	107-13-1	Acrylonitrile
U011	61-82-5	Amitrole
U012	62-53-3	Aniline (I,T)
U014	492-80-8	Auramine
U015	115-02-6	Azaserine
U010	50-07-7	Azirino(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-
U157	50-49-5	Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-
U016	225-51-4	3,4-Benzacridine
U017	98-87-3	Benzal chloride
U192	23950-58-5	Benzamide, 3,5-dichloro-N-(1,1-dethyl-2-propynyl)-
U018	56-55-3	Benz[a]anthracene
U094	57-97-6	Benz[a]anthracene, 7,12-dimethyl-
U012	62-53-3	Benzenamine (I,T)
U014	492-80-8	Benzenamine, 4,4'-carbonimidoylbis[N,N-dimethyl-
U049	3165-93-3	Benzenamine, 4-chloro-2-methyl-
U093	60-11-7	Benzenamine, N,N-dimethyl-4-(phenylazo)-
U328	95-53-4	Benzenamine, 2-methyl-
U353	106-49-0	Benzenamine, 4-methyl-
U158	101-14-4	Benzenamine, 4,4'-methylenebis[2-chloro-
U222	636-21-5	Benzenamine, 2-methyl-, hydrochloride
U181	99-55-8	Benzenamine, 2-methyl-5-nitro-
U019	71-43-2	Benzene
U038	510-15-6	Benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy, ethyl ester
U030	101-55-3	Benzene, 1-bromo-4-phenoxy-
U035	305-03-3	Benzenebutanoic acid, 4-[bis(2-chloroethyl)amino]-
U037	108-90-7	Benzene, chloro-
U221	25376-45-8	Benzenediamine, ar-methyl-
U028	117-81-7	1,2-Benzenedicarboxylic acid, bis(2-ethylhexy) ester
U069	84-74-2	1,2-Benzenedicarboxylic acid, dibutyl ester
U088	84-66-2	1,2-Benzenedicarboxylic acid, diethyl ester
U102	131-11-3	1,2-Benzenedicarboxylic acid, dimethyl ester
U107	117-84-0	1,2-Benzenedicarboxylic acid, di-n-octyl ester
U070	95-50-1	Benzene, 1,2-dichloro-
U071	541-73-1	Benzene, 1,3-dichloro-
U072	106-46-7	Benzene, 1,4-dichloro-
U060	72-54-8	Benzene, 1, 1'-(2,2-dichloroethylidene)bis[4-chloro-
U017	98-87-3	Benzene, (dichloromethyl)-
U223	26471-62-5	Benzene, 1,3-diisocyanatomethyl- (R,T)
U239	1330-20-7	Benzene, dimethyl- (I,T)
U201	108-46-3	1,3-Benzenediol
U127	118-74-1	Benzene, hexachloro-
U056	110-82-7	Benzene, hexahydro- (I)
U220	108-88-3	Benzene, methyl-
U105	121-14-2	Benzene, 1-methyl-2,4-dinitro-
U106	606-20-2	Benzene, 2-methyl-1,3-dinitro-
U055	98-82-8	Benzene, (1-methylethyl)- (I)
U169	98-95-3	Benzene, nitro- (I,T)
U183	608-93-5	Benzene, pentachloro-
U185	82-68-8	Benzene, pentachloronitro-
U020	98-09-9	Benzenesulfonic acid chloride (C,R)
U020	98-09-9	Benzenesulfonyl chloride (C,R)
U207	95-94-3	Benzene, 1,2,4,5-tetrachloro-
U061	50-29-3	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4-chloro-
U247	72-43-5	Benzene, 1,1'-(2,2,2-trichloroethylidene)[4-methoxy-
U023	98-07-7	Benzene, (trichloromethyl)- (C,R,T)
U234	99-35-4	Benzene, 1,3,5-trinitro- (R,T)
U021	92-87-5	Benzidine
U202	181-07-2	1,2-Benzisothiazol-3-(2H)-one, 1,1-dioxide and salts
U203	94-59-7	1,3-Benzodioxole, 5-(2-propenyl)-
U141	120-58-1	1,3-Benzodioxole, 5-(1-propenyl)-
U090	94-58-6	1,3-Benzodioxole, 5-propyl-
U064	189-55-9	Benzo[rst]pentaphene
U022	50-32-8	Benzo[a]pyrene
U197	106-51-4	p-Benzoquinone
U023	98-07-7	Benzotrichloride (C,R,T)
U085	1464-53-5	2,2'-Bioxirane (I,T)
U021	92-87-5	[1,1'-Biphenyl]-4,4'-diamine
U073	91-94-1	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-
U091	119-90-4	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethoxy-
U095	119-93-7	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-
U027	39638-32-9	Bis(2-chloroisopropyl) ether
U024	111-91-1	Bis(2-chloromethoxy) ethane
U028	117-81-7	Bis(2-ethylhexyl) phthalate.

[Sec. 261.33(f)]

Hazardous waste No.	Chemical abstracts No.	Substance
U225	75-25-2	Bromoform
U030	101-55-3	4-Bromophenyl phenyl ether
U128	87-68-3	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-
U172	924-16-3	1-Butanamine, N-butyl-N-nitroso-
U031	71-36-3	1-Butanol (I)
U159	78-93-3	2-Butanone (I,T)
U160	1338-23-4	2-Butanone peroxide (R,T)
U053	4170-30-3	2-Butenal
U074	764-41-0	2-Butene, 1,4-dichloro- (I,T)
U143	303-34-4	2-Butenoic acid, 2-methyl-, 7-[(2,3-dihydroxy-2-(1-methoxyethyl)-3-methyl-1-oxobutoxy)methyl]-2,3,5,7a-tetrahydro-1-pyrrolizin-1-yl ester, [1S-[1alpha(Z),7(2S, 3R), 7aalpha]]-
U031	71-36-3	n-Butyl alcohol (I)
U136	75-60-5	Cacodylic acid
U032	13765-19-0	Calcium chromate
U238	51-79-6	Carbamic acid, ethyl ester
U178	615-53-2	Carbamic acid, methylnitroso-, ethyl ester
U097	79-44-7	Carbamic chloride, dimethyl-
U114	[1] 111-54-6	Carbamodithioic acid, 1,2-ethanediylbis-,salts and esters
U062	2303-16-4	Carbamothioic acid, bis(1-methylethyl)-S-(2,3-dichloro-2-propenyl) ester
U215	6533-73-9	Carbonic acid, dithallium(1+) salt
U033	353-50-4	Carbonic difluoride
U156	79-22-1	Carbonochloridic acid, methyl ester (I,T)
U033	353-50-4	Carbon oxyfluoride (R,T)
U211	56-23-5	Carbon tetrachloride
U034	75-87-6	Chloral
U035	305-03-3	Chlorambucil
U036	12789-03-6	Chlordane
U026	494-03-1	Chlornaphazine
U037	108-90-7	Chlorobenzene
U039	59-50-7	p-Chloro-m-cresol
U041	106-89-8	1-Chloro-2,3-epoxypropane
U042	110-75-8	2-Chloroethyl vinyl ether
U044	67-66-3	Chloroform
U046	107-30-2	Chloromethyl methyl ether
U047	91-58-7	beta-Chloronaphthalene
U048	95-57-8	o-Chlorophenol
U049	3165-93-3	4-Chloro-o-toluidine, hydrochloride
U032	13765-19-0	Chromic acid, calcium salt
U050	218-01-9	Chrysene
U051	8021-39-4	Creosote
U052	1319-77-3	Cresols (Cresylic acid)
U053	4170-30-3	Crotonaldehyde
U055	98-82-8	Cumene (I)
U246	506-68-3	Cyanogen bromide
U197	106-51-4	2,5-Cyclohexadiene-1, 4-dione
U056	110-82-7	Cyclohexane (I)
U057	108-94-1	Cyclohexanone (I)
U130	77-47-4	1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro
U058	50-18-0	Cyclophosphamide
U240	[1] 94-75-7	2,4-D, salts and esters
U059	20830-81-3	Daunomycin
U060	72-54-8	DDD
U061	50-29-3	DDT
U062	2303-16-4	Diallate
U063	53-70-3	Dibenz[a,h]anthracene
U064	189-55-9	Dibenzo[a,i]pyrene
U066	96-12-8	1,2-Dibromo-3-chloropropane
U069	84-74-2	Dibutyl phthalate
U070	95-50-1	o-Dichlorobenzene
U071	541-73-1	m-Dichlorobenzene
U072	106-46-7	p-Dichlorobenzene
U073	91-94-1	3,3'-Dichlorobenzidine
U074	764-41-0	1,4-Dichloro-2-butene (I,T)
U075	75-71-8	Dichlorodifluoromethane
U078	75-35-4	1,1-Dichloroethylene
U079	156-60-5	1,2-Dichloroethylene
U025	111-44-1	Dichloroethyl ether
U081	120-83-2	2,4-Dichlorophenol
U082	87-65-0	2,6-Dichlorophenol
U240	[1] 94-75-7	2,4-Dichlorophenoxyacetic acid, salts and esters
U083	78-87-5	1,2-Dichloropropane
U084	542-75-6	1,3-Dichloropropene
U085	1464-53-5	1,2:3,4-Diepoxybutane (I,T)
U108	123-91-1	1,4-Diethyleneoxide
U096	1615-80-1	N,N-Diethylhydrazine
U087	3288-58-2	O,O-Diethyl-S-methyl-dithiophosphate
U088	84-66-2	Diethyl phthalate
U089	56-53-1	Diethylstilbestrol
U090	94-58-6	Dihydrosafrole
U091	119-90-4	3,3'-Dimethoxybenzidine
U092	124-40-3	Dimethylamine (I)
U093	60-11-7	Dimethylaminoazobenzene
U094	57-97-6	7,12-Dimethylbenz[a]anthracene
U095	119-93-7	3,3'-Dimethylbenzidine
U096	80-15-9	alpha,alpha-Dimethylbenzylhydroperoxide (R)
U097	79-44-7	Dimethylcarbamoyl chloride
U098	57-14-7	1,1-Dimethylhydrazine
U099	540-73-8	1,2-Dimethylhydrazine
U101	105-67-9	2,4-Dimethylphenol
U102	131-11-3	Dimethyl phthalate
U103	77-78-1	Dimethyl sulfate
U105	121-14-2	2,4-Dinitrotoluene

Hazardous waste No	Chemical abstracts No	Substance
U106	606-20-2	2,6-Dinitrotoluene
U107	117-84-0	Di-n-octyl phthalate
U108	123-91-1	1,4-Dioxane
U109	122-66-7	1,2-Diphenylhydrazine
U110	142-84-7	Dipropylamine (I)
U111	621-64-7	Di-n-propylnitrosamine
U001	75-07-0	Ethanal (I)
U174	55-18-5	Ethanamine, N-ethyl-N-nitroso-
U155	91-80-5	1,2-Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'-(2-thienylmethyl)-
U067	106-93-4	Ethane, 1,2-dibromo-
U076	75-34-3	Ethane, 1,1-dichloro-
U077	107-06-2	Ethane, 1,2-dichloro-
U131	67-72-1	Ethane, hexachloro-
U024	111-91-1	Ethane, 1,1'-[methylenebis(oxy)]bis[2-chloro-
U117	60-29-7	Ethane, 1,1'-oxybis- (I)
U025	111-44-4	Ethane, 1,1'-oxybis[2-chloro-
U184	76-01-7	Ethane, pentachloro-
U208	630-20-6	Ethane, 1,1,1,2-tetrachloro-
U209	79-34-5	Ethane, 1,1,2,2-tetrachloro-
U218	62-55-5	Ethanethioamide
U227	110-80-5	Ethanol, 2-ethoxy-
U359	79-00-5	Ethane, 1,1,2-trichloro-
U173	1116-54-7	Ethanol, 2,2'-(nitrosoimino)bis-
U004	98-86-2	Ethanone, 1-phenyl-
U043	75-01-4	Ethene, chloro-
U042	110-75-8	Ethene, (2-chloroethoxy)-
U078	75-35-4	Ethene, 1,1-dichloro-
U079	156-60-5	Ethene, 1,2-dichloro-, (E)-
U210	127-18-4	Ethene, tetrachloro-
U228	79-01-6	Ethene, trichloro-
U112	141-78-6	Ethyl acetate (I)
U113	140-88-5	Ethyl acrylate (I)
U238	51-79-6	Ethyl carbamate
U038	510-15-6	Ethyl 4,4'-dichlorobenzilate
U114	111-54-6	Ethylenebisdithiocarbamic acid, salts and este
U067	106-93-4	Ethylene dibromide
U077	107-06-2	Ethylene dichloride
U359	110-80-5	Ethylene glycol monoethyl ether
U115	75-21-8	Ethylene oxide (I,T)
U116	96-45-7	Ethylene thiourea
U117	60-29-7	Ethyl ether (I)
U076	75-34-3	Ethylidene dichloride
U118	97-63-2	Ethyl methacrylate
U119	62-50-0	Ethylmethanesulfonate
U120	206-44-0	Fluoranthene
U122	50-00-0	Formaldehyde
U123	64-18-6	Formic acid (C,T)
U124	110-00-9	Furan (I)
U125	98-01-1	2-Furancarboxaldehyde (I)
U147	108-31-6	2,5-Furandione
U213	109-99-9	Furan, tetrahydro- (I)
U125	98-01-1	Furfural (I)
U124	110-00-9	Furfuran (I)
U206	18883-66-4	D-Glucopyranose, 2-deoxy-2(3-methyl-3-nitrosoureido)-
U126	765-34-4	Glycidylaldehyde
U163	70-25-7	Guanidine, N-methyl-N'-nitro-N-nitroso-
U127	118-74-1	Hexachlorobenzene
U128	87-68-3	Hexachlorobutadiene
U129	58-88-9	Hexachlorocyclohexane (gamma isomer)
U130	77-47-4	Hexachlorocyclopentadiene
U131	67-72-1	Hexachloroethane
U132	70-30-4	Hexachlorophene
U243	1888-71-7	Hexachloropropene
U133	302-01-2	Hydrazine (R,T)
U086	1615-80-1	Hydrazine, 1,2-diethyl-
U098	57-14-7	Hydrazine, 1,1-dimethyl-
U099	540-73-8	Hydrazine, 1,2-dimethyl-
U109	122-66-7	Hydrazine, 1,2-diphenyl-
U134	7664-39-3	Hydrofluoric acid (C,T)
U134	7664-39-3	Hydrogen fluoride (C,T)
U135	7783-06-4	Hydrogen sulfide
U096	80-15-9	Hydroperoxide, 1-methyl-1-phenylethyl- (R)
U136	75-60-5	Hydroxydimethylarsine oxide
U116	96-45-7	2-Imidazolidinethione
U137	193-39-5	Indeno[1,2,3cd]pyrene
U139	9004-66-4	Iron dextran
U190	85-44-9	1,3-Isobenzofurandione
U140	78-83-1	Isobutyl alcohol (I,T)
U141	120-58-1	Isosafrole
U142	143-50-0	Kepone
U143	303-34-4	Lasiocarpine
U144	301-04-2	Lead acetate
U146	1335-32-6	Lead, bis(acetato-O)tetrahydroxytri-
U145	7446-27-7	Lead phosphate
U146	1335-32-6	Lead subacetate
U129	58-89-9	Lindane
U147	108-31-6	Maleic anhydride
U148	123-33-1	Maleic hydrazide
U149	109-77-3	Malononitrile
U150	148-82-3	Melphalan
U151	7439-97-6	Mercury
U152	126-98-7	Methacrylonitrile (I,T)

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Hazardous waste No.	Chemical abstracts No.	Substance
U092	124-40-3	Methanamine, N-methyl- (I)
U029	74-83-9	Methane, bromo-
U045	74-87-3	Methane, chloro- (I,T)
U046	107-30-2	Methane, chloromethoxy-
U068	74-95-3	Methane, dibromo-
U080	75-09-2	Methane, dichloro-
U075	75-71-8	Methane, dichlorodifluoro-
U138	74-88-4	Methane, iodo-
U119	62-50-0	Methanesulfonic acid, ethyl ester
U211	56-23-5	Methane, tetrachloro-
U153	74-93-1	Methanethiol (I,T)
U225	75-25-2	Methane, tribromo-
U044	67-66-3	Methane, trichloro-
U121	75-69-4	Methane, trichlorofluoro-
U123	64-18-6	Methanoic acid (C,T)
U154	67-56-1	Methanol (I)
U155	91-80-5	Methapyrilene
U142	143-50-0	1,3,4-Metheno-2H-cyclobuta[cd]pentalen-2-one, 1,1a,3,3a,4,5,5,5a,5b,6-decachloroctahydro-
U247	72-43-5	Methoxychlor
U154	67-56-1	Methyl alcohol (I)
U029	74-83-9	Methyl bromide
U186	504-60-9	1-Methylbutadiene (I)
U045	74-87-3	Methyl chloride (I,T)
U156	79-22-1	Methylchlorocarbonate (I,T)
U226	71-55-6	Methylchloroform
U157	56-49-5	3-Methylcholanthrene
U158	101-14-4	4,4'-Methylenebis(2-chloroaniline)
U068	74-95-3	Methylene bromide
U080	75-09-2	Methylene chloride
U159	78-93-3	Methyl ethyl ketone (MEK) (I,T)
U160	1338-23-4	Methyl ethyl ketone peroxide (R,T)
U138	74-88-4	Methyl iodide
U161	108-10-1	Methyl isobutyl ketone (I)
U162	80-62-6	Methyl methacrylate (I,T)
U163	70-25-7	N-Methyl-N'-nitro-N-nitrosoguanidine
U161	108-10-1	4-Methyl-2-pentanone (I)
U164	56-04-2	Methylthiouracil
U010	50-07-7	Mitomycin C
U059	20830-81-3	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-
U165	91-20-3	Naphthalene
U047	91-58-7	Naphthalene, 2-chloro-
U166	130-15-4	1,4-Naphthalenedione
U236	72-57-1	2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'dimethyl-(1,1'biphenyl)-4,4'-diyl)]-bis(azo)bis(5-amino-4-hydroxy)-, tetrasodium salt
U166	130-15-4	1,4-Naphthoquinone
U167	134-32-7	alpha-Naphthylamine
U168	91-59-8	beta-Naphthylamine
U026	494-03-1	2-Naphthylamine, N,N'-bis(2-chloromethyl)-
U167	134-32-7	1-Naphthylenamine
U168	91-59-8	2-Naphthylenamine
U217	10102-45-1	Nitric acid, thallium(1+) salt
U169	98-95-3	Nitrobenzene (I,T)
U170	100-02-7	p-Nitrophenol
U171	79-46-9	2-Nitropropane (I,T)
U172	924-16-3	N-Nitrosodi-n-butylamine
U173	1116-54-7	N-Nitrosodiethanolamine
U174	55-18-5	N-Nitrosodiethylamine
U176	759-73-9	N-Nitroso-N-ethylurea
U177	684-93-5	N-Nitroso-N-methylurea
U178	615-53-2	N-Nitroso-N-methylurethane
U179	100-75-4	N-Nitrosopiperidine
U180	930-55-2	N-Nitrosopyrrolidine
U181	99-55-8	5-Nitro-o-toluidine
U193	1120-71-4	1,2-Oxathiolane, 2,2-dioxide
U058	50-18-0	2H-1,3,2-Oxazaphosphorin-2-amine, N,N-bis(2-chloroethyl)tetrahydro-, 2-oxide
U115	75-21-8	Oxirane (I,T)
U126	765-34-4	Oxiranecarboxyaldehyde
U041	106-89-8	Oxirane, (chloromethyl)-
U182	123-63-7	Paraldehyde
U183	608-93-5	Pentachlorobenzene
U184	76-01-7	Pentachloroethane
U185	82-68-8	Pentachloronitrobenzene (PCNB)
U242	87-86-5	Pentachlorophenol
U186	504-60-9	1,3-Pentadiene (I)
U187	62-44-2	Phenacetin
U188	108-95-2	Phenol
U048	95-57-8	Phenol, 2-chloro-
U039	59-50-7	Phenol, 4-chloro-3-methyl-
U081	120-83-2	Phenol, 2,4-dichloro-
U082	87-65-0	Phenol, 2,6-dichloro-
U089	56-53-1	Phenol, 4,4'-(1,2-diethyl-1,2-ethanediyl)bis-, (E)-
U101	105-67-9	Phenol, 2,4-dimethyl-
U052	1319-77-3	Phenol, methyl-
U132	70-30-4	Phenol, 2,2'-methylenebis[3,4,6-trichloro-
U170	100-02-7	Phenol, 4-nitro-
U242	87-86-5	Phenol, pentachloro-
U212	58-90-2	Phenol, 2,3,4,6-tetrachloro-
U230	95-94-4	Phenol, 2,4,5-trichloro-
U231	88-06-2	Phenol, 2,4,6-trichloro-
U150	148-82-3	L-Phenylalanine, 4-[bis(2-chloroethyl)amino]-
U145	7446-27-7	Phosphoric acid, lead salt
U087	3288-58-2	Phosphorodithioic acid, O,O-diethyl-, S-methyl-, ester
U189	108-95-2	Phosphorous sulfide (R)
U190	85-44-9	Phthalic anhydride
U191	109-06-8	2-Picoline
U179	100-75-4	Piperidine, 1-nitroso-

[Sec. 261.33(f)]

Hazardous waste No.	Chemical abstracts No.	Substance
U192	23950-58-5	Pronamide
U194	107-10-8	1-Propanamine (I,T)
U111	621-64-7	1-Propanamine, N-nitroso-N-propyl-
U110	142-84-7	1-Propanamine, N-propyl- (I)
U066	96-12-8	Propane, 1,2-dibromo-3-chloro-
U149	109-77-3	Propanedinitrile
U171	79-46-9	Propane, 2-nitro- (I,T)
U027	39638-32-9	Propane, 2,2'-oxybis[2-chloro-
U193	1120-71-4	1,3-Propane sultone
U235	126-72-7	1-Propanol, 2,3-dibromo-, phosphate (3:1)
U140	78-83-1	1-Propanol, 2-methyl- (I,T)
U002	67-64-1	2-Propanone (I)
U084	542-75-6	1-Propene, 1,3-dichloro-
U152	126-98-7	2-Propenenitrile, 2-methyl- (I,T)
U007	79-06-1	2-Propenamide
U243	1888-71-7	1-Propene, hexachloro-
U009	107-13-1	2-Propenenitrile
U008	79-10-7	2-Propenoic acid (I)
U113	140-88-5	2-Propenoic acid, ethyl ester (I)
U118	97-63-2	2-Propenoic acid, 2-methyl-, ethyl ester
U162	80-62-6	2-Propenoic acid, 2-methyl-, methyl ester (I,T)
U233	93-72-1	Propionic acid, 2-(2,4,5-trichlorophenoxy)-
U194	107-10-8	n-Propylamine (I,T)
U083	78-87-5	Propylene dichloride
U148	123-33-1	3,6-Pyridazinedione, 1,2-dihydro-
U196	110-86-1	Pyridine
U191	109-06-8	Pyridine, 2-methyl-
U237	66-75-1	2,4(1H,3H)-Pyrimidinedione, 5-[bis(2-chloroethyl)amino]-
U164	56-04-2	4-(1H)-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-
U180	930-55-2	Pyrrolidine, 1-nitroso-
U200	50-55-5	Reserpine
U201	108-46-3	Resorcinol
U202	81-07-2	Saccharin and salts
U203	94-59-7	Safrole
U204	7783-00-8	Selenious acid
U204	7783-00-8	Selenium dioxide
U205	7446-34-6	Selenium sulfide (R,T)
U015	115-02-6	L-Serine, diazoacetate (ester)
U233	93-72-1	Silvex
U206	18883-66-4	Streptozotocin
U103	77-78-1	Sulfuric acid, dimethyl ester
U189	1314-80-3	Sulfur phosphide (R)
U232	93-76-5	2,4,5-T
U207	95-94-3	1,2,4,5-Tetrachlorobenzene
U208	630-20-6	1,1,1,2-Tetrachloroethane
U209	79-34-5	1,1,2,2-Tetrachloroethane
U210	127-18-4	Tetrachloroethylene
U212	58-90-2	2,3,4,6-Tetrachlorophenol
U213	109-99-9	Tetrahydrofuran (I)
U214	15843-14-6	Thallium(I) acetate
U215	6533-73-9	Thallium(I) carbonate
U216	7791-12-0	Thallium chloride
U217	10102-45-1	Thallium(I) nitrate
U218	62-55-5	Thioacetamide
U153	74-93-1	Thiomethanol (I,T)
U244	137-26-8	Thioperoxydicarbonic diamide, tetramethyl-
U219	62-56-6	Thiourea
U244	137-26-8	Thiuram
U220	108-88-3	Toluene
U221	25376-45-8	Toluenediamine
U223	26471-62-5	Toluene diisocyanate (R,T)
U328	95-53-4	o-Toluidine
U353	106-49-0	p-Toluidine
U222	636-21-5	o-Toluidine hydrochloride
U011	61-82-5	1H-1,2,4-Triazol-3-amine
U226	71-55-6	1,1,1-Trichloroethane
U227	79-00-5	1,1,2-Trichloroethane
U228	79-01-6	Trichloroethylene
U121	75-69-4	Trichloromonofluoromethane
U230	95-95-4	2,4,5-Trichlorophenol
U231	88-06-2	2,4,6-Trichlorophenol
U234	99-35-4	sym-Trinitrobenzene (R,T)
U182	123-63-7	1,3,5-Trioxane, 2,4,6-trimethyl-
U235	126-72-7	Tris (2,3-dibromopropyl) phosphate
U236	72-57-1	Trypan blue
U237	66-75-1	Uracil mustard
U176	759-73-9	Urea, N-ethyl-N-nitroso-
U177	684-93-5	Urea, N-methyl-N-nitroso-
U043	75-01-4	Vinyl chloride
U248	81-81-2	Warfarin, when present at concentrations of 0.3% or less
U239	1330-20-7	Xylene (I)
U200	50-55-5	Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[(3,4,5-trimethoxybenzoyl)oxy]-, methyl ester
U249	1314-84-7	Zinc phosphide, when present at concentrations of 10% or less

[1] CAS Number given for parent compound only.

(The reporting and recordkeeping requirements contained in this section were approved by OMB under control number 2050-0047.)

[Added by 50 FR 28742, July 15, 1985] [Sec. 261.33(f)]

APPENDIX M

SPILL PREVENTION CONTROL AND COUNTERMEASURES PLANS FOR BULK CHEMICALS (APPENDIX I OF ORNL-5946)

SPCC Plan For:

Chemical Name: Chlorine - Cl_2
CAS #: 7782505
Reportable Quantity: 10 lbs.

Storage Location (Bldg.)	Quantity (lbs.)
2536	750
2643	750

In the event of a release of chlorine gas from the above storage locations, the following actions will be initiated:

1. The area would be evacuated immediately, with personnel remaining upwind of the release.

2. Isolate area and deny entry except to emergency personnel.

3. Immediately notify Laboratory Shift Supervisor (4-6606) and/or Environmental Management personnel (4-6670).

4. Keep all combustibles (wood, paper, oil, etc.) away from spilled material.

5. Water should not be used on the cylinder except in a fire situation. Water spray can be used to reduce vapors in area if necessary.

6. Personnel responding to spill will wear full body, impervious suits and self-contained breathing apparatus.

7. If possible, rotate leaking cylinder so that only gas is escaping and not the liquid.

8. Personnel outfitted with appropriate equipment will attempt to stop repairable leaks.

9. Any personnel exposed to the gas will be transported to ORNL medical Department for treatment.

SPCC Plan For:

Chemical: Sodium hydroxide - NaOH
CAS #: 1310732
Reportable Quantity: 1,000 lbs.

Storage Location (Bldg.)	Quantity (Gals.)
3004	750
3004	1,000
3019 M-1	75
3019 P-18	1,150
3505	5,000
3544 M-3A	300
3544 M-1	1,000
3544	100
3544	3,000 (Transfer Vehicle)
7601	900
7900 N	5,000
7900 NE	1,200

In the event of a large release of sodium hydroxide from any of the above storage locations, the following actions will be initiated:

1. Personnel will be evacuated out of the low areas, staying upwind of the release.

2. Isolate area and deny entry except to emergency personnel.

3. Immediately notify Laboratory Shift Supervisor (4-6606) and/or Environmental Management personnel (4-6670).

4. Upon arrival at the scene, the Emergency Director would take charge of the situation.

5. If the release is a small leak, corrective action would be taken as appropriate, with personnel wearing face shield, monogoggles, rubber gloves, apron and other protective equipment as needed.

6. A water spray would be used to reduce vapors if necessary.

7. Personnel responding to a large spill will wear full body, impervious suits and self-contained breathing apparatus.

8. Spilled material contained in the diked area would be pumped into a steel tank or lined drums using a corrosive-resistant pump and either reused or promptly treated at the neutralization facility.

9. The material would be pumped into one of the emergency tankers available from Environmental Management and/or Plant and Equipment and transported to the neutralization facility. All facility equipment would be available to the Emergency Director for forming dikes, pumping sumps, and containment dikes or other actions deemed to be necessary.

10. For material spilled outside of diked areas, the Emergency Director would exercise one or more of these possible options, depending on the particular circumstances of the release.

    a. The base could be roughly neutralized with citric acid powder or neutrasorb and flushed down the nearest storm drain. (Any material already in the storm drains would be "chased" with copious amounts of water.)

    b. An attempt could be made to contain any material which had not already entered a storm drain. Sandbags would be used to block storm drains and the material should be contained in as small an area as possible.

    c. The material could be directed to the nearest storm drain with fire hoses and flushed with large amounts of water.

11. Any personnel exposed to the solution would be deluged immediately with water and taken to ORNL Medical Department for further treatment.

SPCC Plan for:

Chemical Name: Sulfuric acid H_2SO_4
CAS #: 7664939
Reportable Quantity: 1,000 lbs.

Storage Locations (Bldg.)	Quantity (gals.)
2519	2500
2519	70
3103	1000
3117	900
3544 M-8	100
3544 M-8A	300
7903 W	5000
7903	1000

In the event of a large release of sulfuric acid from any of the above listed storage locations, the following actions would be initiated:

1. Personnel will be evacuated out of the low areas, staying upwind of the release.

2. Isolate area and deny entry except to emergency personnel.

3. Immediately notify Laboratory Shift Supervisor (4-6606) and/or Environmental Management personnel (4-6670).

4. Upon arrival at the scene, the Emergency Director would take charge of the situation.

5. If the release is a small leak, corrective action would be taken as appropriate, with personnel wearing face shield, monogoggles, rubber gloves, apron and other protective equipment as needed.

6. A water spray would be used to reduce vapors if necessary.

7. Personnel responding to a large acid spill will wear full body, impervious suits and self-contained breathing apparatus.

8. Spilled material contained in the diked area would be pumped into a stainless steel tank or lined drums using a corrosive-resistant pump and either reused or promptly treated at the neutralization facility.

9. The acid would be pumped into one of the emergency tankers available from Environmental Management and/or Plant and Equipment and transported to the neutralization facility. All facility equipment would be available to the Emergency Director for forming dikes, pumping sumps and containment dikes or other actions deemed to be necessary.

10. For acid spilled outside of diked areas, the Emergency Director would exercise one or more of these possible options, depending on the particular circumstances of the release.
    a. The acid could be roughly neutralized with slaked lime and/or soda ash and flushed down the nearest storm drain. (Any acid already in the storm drains would be "chased" with copious amounts of water.)
    b. An attempt could be made to contain any acid which had not already entered a storm drain. Sandbags would be used to block storm drains and the material should be contained in as small an area as possible.
    c. The acid could be directed to the nearest storm drain with fire hoses and flushed with large amounts of water.

11. Any personnel exposed to the solution would be deluged immediately with water and taken to ORNL Medical Department for further treatment.

SPCC Plan for:

Chemical Name: Nitric acid HNO_3
CAS #: 7697373
Reportable Quantity: 1,000 lbs.

Storage Locations (Bldg.)	Quantity (gals.)
3004	1000
3004	500
3019 M-2	450
3019 M-4	500
3505	5000
3544 M-2	500
3544 L-14	5000
7601 90F-29	925
7601 12F-17	2500
7601 12F-07	450
7601 F-18	2500
7601 M-2	2500
7900N	1500
7900NE	1200

In the event of a large release of nitric acid from any of the above listed storage locations, the following actions would be initiated:

1. Personnel will be evacuated out of the low areas, staying upwind of the release.

2. Isolate area and deny entry except to emergency personnel.

3. Immediately notify Laboratory Shift Supervisor (4-6606) and/or Environmental Management personnel (4-6670).

4. Upon arrival at the scene, the Emergency Director would take charge of the situation.

5. If the release is a small leak, corrective action would be taken as appropriate, with personnel wearing face shield, monogoggles, rubber gloves, apron and other protective equipment as needed.

6. A water spray would be used to reduce vapors if necessary.

7. Personnel responding to a large acid spill will wear full body, impervious suits and self-contained breathing apparatus.

8. Spilled material contained in the diked area would be pumped into a steel tank or lined drums using a corrosive-resistant pump. This material is either reused or promptly treated at the neutralization facility.

9. The acid would be pumped into one of the emergency tankers available from Environmental Management and/or Plant and Equipment and transported to the neutralization facility. All facility equipment would be available to the Emergency Director for forming dikes, pumping sumps and containment dikes or other actions deemed to be necessary.

10. For acid spilled outside of diked areas, the Emergency Director would exercise one or more of these possible options, depending on the particular circumstances of the release.
    a. The acid could be roughly neutralized with slaked lime and/or soda ash and flushed down the nearest storm drain. (Any acid already in the storm drains would be "chased" with copious amounts of water.)
    b. An attempt could be made to contain any acid which had not already entered a storm drain. Sandbags would be used to block storm drains and the material should be contained in as small an area as possible.
    c. The acid could be directed to the nearest storm drain with fire hoses and flushed with large amounts of water.

11. Any personnel exposed to the solution would be deluged immediately with water and taken to ORNL Medical Department for further treatment.

SPCC Plan for:

Process Acid Wastes

Storage Locations (Bldg.)	Quantity (gals.)
7601 12F-17	2500
7601 F-14	1000
7601	5000 (underground)
7603 F-16	500
7601	2000 (transfer vehicle)

In the event of a large release of acid waste from any of the above listed storage locations, the following actions would be initiated:

1. Personnel will be evacuated out of the low areas, staying upwind of the release.

2. Isolate area and deny entry except to emergency personnel.

3. Immediately notify Laboratory Shift Supervisor (4-6606) and/or Environmental Management personnel (4-6670).

4. Upon arrival at the scene, the Emergency Director would take charge of the situation.

5. If the release is a small leak, corrective action would be taken as appropriate, with personnel wearing face shield, monogoggles, rubber gloves, apron and other protective equipment as needed.

6. A water spray would be used to reduce vapors if necessary.

7. Personnel responding to a large acid spill will wear full body, impervious suits and self-contained breathing apparatus.

8. Spilled material contained in the diked area would be pumped into plastic lined bulk containers or lined drums using a corrosive-resistant pump and either reused or promptly treated at the neutralization facility.

9. The acid would be pumped into one of the emergency tankers available from Environmental Management and/or Plant and Equipment and transported to the neutralization facility. All facility equipment would be available to the Emergency Director for forming dikes, pumping sumps and containment dikes or other actions deemed to be necessary.

10. For acid spilled outside of diked areas, the Emergency Director would exercise one or more of these possible options, depending on the particular circumstances of the release.

a. The acid could be roughly neutralized with slaked lime and/or soda ash and flushed down the nearest storm drain. (Any acid already in the storm drains would be "chased" with copious amounts of water.)
b. An attempt could be made to contain any acid which had not already entered a storm drain. Sandbags would be used to block storm drains and the material should be contained in as small an area as possible.
c. The acid could be directed to the nearest storm drain with fire hoses and flushed with large amounts of water.

11. Any personnel exposed to the solution would be deluged immediately with water and taken to ORNL Medical Department for further treatment.

SPCC Plan for:

Herbicides, Insecticides, and Pesticides

Storage Area

Building 2567

A variety of herbicides, insecticides, and pesticides are utilized by Plant & Equipment personnel at ORNL. The items are stored in a posted and secured area at Building 2567 with only authorized personnel having access. Some of the materials stored here are:

Vap 25
Chlordane
Pramitol
Round-up
Bolt
2,4-D
Treflan
Malathion
Dursban

The quantities of these materials in storage is kept at a minimum at all times. In the event of a spill/release, the following actions will be initiated:

1. The area would be evacuated immediately, with personnel remaining upwind of release.

2. Isolate area and deny entry except to emergency personnel.

3. Immediately notify Laboratory Shift Supervisor (4-6606) and/or Environmental Management personnel (4-6670).

4. Personnel responding to spill will wear full body, impervious suits, and self-contained breathing apparatus.

5. Spilled materials will be absorbed onto clay absorbent and disposed of as hazardous waste.

6. Area will be decontaminated with an appropriate wash solution. Decontamination wastes will be disposed of as hazardous wastes.

7. Any personnel exposed to the materials will be transported to ORNL Medical Department for treatment.

SPCC Plan For:

Chemical: Aluminum nitrate - $Al(NO_3)_3$
CAS #: 13473900

Storage Location (Bldg.)	Quantity (Gals.)
3019 - M19	80
3019 - M18	575

In the event of a release of the above chemical from the above storage locations, the following actions will be initiated:

1. The spill area will be isolated, allowing entry only to emergency personnel.

2. If possible keep all combustibles (wood, paper, oil, etc.) and other flammable materials away from spilled material.

3. Personnel entering spill area will wear self-contained breathing apparatus and full protective clothing.

4. Prevent spilled material from making its way to storm drain if possible.

5. Dike around spill area perimeter for containment and clean up spilled material with sand or earth.

6. All waste materials will be collected and packaged by the Department of Environmental Management for off-site disposal.

7. Any personnel exposed to the spilled material will be transported immediately to ORNL Medical Department.

SPCC Plan For:

Substance: Coal-Oil Mixture

Storage Location (Bldg.)	Quantity (Gals.)
3505	2,000

In the event of a release of the above substance, the following actions will be initiated:

1. Use sandbags and oil absorbent to contain spilled material and prevent its reading storm drains.

2. Containment booms will be deployed in appropriate downstream locations to reduce the escape of the spilled material which reaches storm drains. If large quantities of oil are released and successfully contained, residues will be pumped into a tanker for recovery operations.

3. In small releases and to clean up oily residues, use a suitable oil absorbent material such as clay absorbent and/or "oil-sorb" pads for clean up.

SPCC Plan For:

Substance: Waste Oils

Storage Location (Bldg.)	Quantity (Gals.)
7065	5,000
7075	4,200

These underground tanks are utilized for storage of noncontaminated waste oils which are recycled by off-site contractors. All oils are analyzed for polychlorinated biphenyls, chlorinated solvent, and radioactivity prior to placement in tanks. The 7075 location also consists of a concrete, diked storage pad for drum quantities. The likelihood of spills, which would result in a release of waste oil into the environment, is low.

SPCC Plan For:

Substance: Photoreproduction Waste

Storage Location (Bldg.)	Quantity (Gals.)
7075	2,000
	3,000

Photoreproduction wastes containing recoverable silver are stored in this location prior to treatment/recovery processing. The tanks are located on a diked concrete pad equipped with a sump. The total capacity of the pad and sump is 3000 gallons. In the event of a major release from one or both of these tanks, drums, pumps and a generator are available at the facility for recovery operations.

SPCC Plan For:

Substance: Polychlorinated biphenyls (PCBs)

There are 44 PCB and non-PCB transformers in use at ORNL. These transformers represent approximately 17,500 gallons of PCB contaminated oil. Refer to Appendix F for a complete listing of PCB equipment, location, gallons of oil, PCB concentration, etc. Containment has been provided for all PCB transformers.

In the event of a PCB spill/release the following actions will be initiated.

1) The Laboratory Shift Supervisor (4-6606) and the Department of Environmental Management (4-6670) should be notified immediately.

2) The immediate spill area would be evacuated and personnel involved in cleanup operations will wear rubber gloves (Vicon), aprons, boots and full-face combination canister respirators.

3) Sandbags and/or clay absorbent would be used to contain PCBs in as small an area as possible.

4) Liquid wastes will be transferred into DOT-17E drums and transported to storage.

5) Residual PCBs would be covered with clay absorbent, scooped up and placed in DOT 17-H drums. All other solid PCB contaminated wastes would be placed in DOT-17H drums and transported to storage.

6) Contaminated soil would be removed until PCB concentrations had reached background levels.

7) Department of Environmental Management personnel will provide proper storage and disposal of all PCB waste materials generated.

SPCC Plan For:

Substance: Mixed Radioactive Hazardous Waste

Storage Location (Bldg.)	Quantity (Gals.)
7507W	∿ 14,000

There are approximately three hundred 30- and 55-gallon size DOE drums of mixed radioactive-RCRA waste stored on this pad. This uncovered concrete waste pad (40 ft by 40 ft) has a four inch elevation difference between the middle and the edge of the pad. The middle of the pad contains a sump to catch escaping liquids. The drums are placed on pallets leaving a walkway space for emergency personnel and equipment.

Most of the waste consists of scintillation fluids, oils, and liquid organic mixtures. In the event of a spill/release, personnel will wear appropriate personal protective equipment to prevent any possible radiation hazard. Released material will be contained and the area will be decontaminated.

SPCC Plan For:

Substance: Radioactive-contaminated Waste Oils

Storage Location (Bldg.)	Quantity (Gals.)
7860S	4,500
7830W	5,000

These tanks provide for storage of waste oils contaminated with low levels of radioactivity. The 7830W tank is located in a shielded containment area and any spills would be contained within the building. The 7860S tank is an underground tank and is not contained.

In the event of a spill/release, personnel will wear appropriate personal protective equipment for any possible radiation hazard. Cleanup and decontamination operations will be initiated and proceed to background levels of decontamination.

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