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Current Waste Management Practices and Operations at Oak Ridge National Laboratory — 1982

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CURRENT WASTE MANAGEMENT PRACTICES AND OPERATIONS AT OAK RIDGE NATIONAL LABORATORY

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ABSTRACT

The need for efficient management of industrial chemical wastes, especially those considered hazardous or radioactive, is receiving increased attention in the United States. During the past five years, several federal laws have addressed the establishment of stronger programs for the control of hazardous and residual wastes. At a facility such as Oak Ridge National Laboratory (ORNL), an efficient waste management program is an absolute necessity to ensure protection of human health and compliance with regulatory requirements addressing the treatment and disposal of hazardous, nonhazardous, and radioactive wastes.

This report highlights the major regulatory requirements under which the Laboratory must operate and their impact on ORNL facilities. Individual waste streams, estimates of quantities of waste, and current waste management operations are discussed.

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1. INTRODUCTION

The management of hazardous, nonhazardous, and radioactive wastes generated at Oak Ridge National Laboratory (ORNL) requires careful planning to ensure compliance with all appropriate federal, state, and local regulations, with U.S. Department of Energy (DOE) requirements, and with Union Carbide Corporation, Nuclear Division guidelines. An efficient waste management program must include waste characterization and quantification, handling and storage, transportation, treatment, and final disposal. This report reviews the major laws and regulations affecting waste management at ORNL and discusses their potential impacts on operations, characterizes waste streams and estimated annual generation rates, and discusses onsite and offsite facilities currently used for treatment, storage, and disposal.

2. REGULATIONS

2.1 Resource Conservation and Recovery Act

New federal legislation on solid waste disposal became law on October 21, 1976, with the enactment of the Resource Conservation and Recovery Act (RCRA). Perhaps the most important aspect of the 1976 bill was the establishment of a federal permit program to regulate hazardous wastes. The major provisions of RCRA follow.[1]

2.1.1 Solid waste program

This program set forth guidelines for the Environmental Protection Agency (EPA) to establish an office of solid waste to administer the law and required all solid waste regulations to be reviewed and revised, if necessary, at least once every three years.

2.1.2 Hazardous waste program

This program required EPA, within 18 months of enactment of RCRA, to issue regulations defining the term hazardous waste and to prepare a list of specific hazardous wastes. Once the regulations were issued, all hazardous waste handlers (manufacturers, transporters, etc.) had an additional three months to notify EPA of their operations. The program also required EPA to issue regulations on safety standards for producers and transporters of hazardous waste and for operators of hazardous waste treatment, storage, and disposal facilities. The regulations were to include requirements for record keeping, reporting, storage, labeling, and disposal. Guidelines to help states set up hazardous waste programs were to be issued by EPA. States authorized by the agency could assume administration of the permits and safety regulations.

2.1.3 State and regional solid waste plans

These plans required EPA to publish guidelines for identifying areas with common solid waste management problems and appropriate regional

planning units and guidelines for state solid waste management plans. Also, a timetable was established for states to develop state or regional solid waste management plans that (1) phase out all open dumps within five years, (2) require that all solid waste be recycled or disposed of safely, and (3) provide for the closing or upgrading of existing open dumps.

In May 1980, EPA issued criteria for identifying the characteristics of hazardous waste and for listing the various types. These criteria considered toxicity, persistence, and degradability in nature; potential for accumulation in tissue; and related factors such as flammability, corrosiveness, reactivity, and other characteristics. The EPA also promulgated regulations identifying the characteristics of hazardous waste and listing particular hazardous wastes which, based on these criteria, shall be subject to the act. The act defines hazardous waste 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 of, or otherwise managed.[2]

As of November 19, 1980, any person generating or transporting hazardous waste or owning or operating a facility for its treatment, storage, or disposal shall file notification stating the location and general description of the activity and the identity of the hazardous waste(s) involved.[2] Failure to give the required notice renders unlawful the treatment, transportation, storage, or disposal of such wastes.

Under RCRA, ORNL currently holds an interim permit to transport and store RCRA-defined hazardous wastes. Under the Hazardous Waste Management System established by RCRA, EPA has promulgated the following standards or requirements to be met by generators and transporters of hazardous waste:

1. record-keeping systems concerning quantities of the waste generated, harmful constituents, and disposal;

2. container-labeling practices for storage, transport, or disposal;
3. use of appropriate containers;
4. furnishing of information on composition of the wastes to persons transporting, treating, storing, or disposing of such wastes; and
5. use of a manifest system to ensure that the waste will be placed in a facility to which a permit has been issued.

The EPA has also promulgated performance standards for facilities that treat, store, and dispose of hazardous waste. As a permitted facility, ORNL must comply with performance standards for generators and transporters and for treatment, storage, and disposal (TSD) facilities. These standards cover the following:

1. maintenance of records concerning wastes handled by the facility;
2. satisfactory operation of the manifest system;
3. use of operating methods approved by EPA;
4. proper location, design, and construction of facilities;
5. contingency plans to minimize unanticipated dangers;
6. quality of operation and financial responsibility; and
7. compliance with permit requirements.

2.2 Toxic Substances Control Act

The Toxic Substances Control Act of 1976 (TSCA) is the latest and most encompassing federal law on toxicology and safety to which industry must comply. The goal of this act is to protect human health and the environment from unreasonable risks. To achieve this goal, TSCA implementation activities emphasize not only control of specific problems under TSCA regulatory provisions but also use of TSCA authorities to support other governmental and nongovernmental programs to control toxic substances.

The TSCA authorizes EPA to obtain from industry data on the production, use, health effects, and other matters concerning chemical substances and mixtures. If warranted, EPA may regulate the manufacture, processing, distribution in commerce, use, and disposal of a chemical substance or mixture. The major provisions of TSCA are as follows:

1. require chemical manufacturers and processors to test chemical substances and mixtures extensively,
2. require premarket notification to EPA of any significant new use of an existing substance,
3. require premarket notification to EPA of all new chemical substances,
4. delay manufacturing and marketing of a new product if sufficient information to evaluate the substance is not available and if there will be substantial human or environmental exposure,
5. ban or restrict the marketing of existing or new substances that pose an unreasonable risk to health or the environment, and
6. impose extensive record-keeping and reporting requirements.[3]

Perhaps the most significant impact of TSCA on ORNL has been the regulations dealing with polychlorinated biphenyls (PCBs). Section 6(3) of TSCA requires EPA to control the manufacture, processing, distribution in commerce, use, and disposal of PCBs. To implement this PCB-control program, EPA has:

1. banned the manufacture, distribution in commerce, and use of PCBs in other than a "totally enclosed manner";
2. set a regulatory cutoff point based on the concentration of PCBs (50 ppm);
3. established categories of transformers [e.g., PCB transformers (500 ppm), PCB-contaminated transformers (50–500 ppm), and nonPCB transformers (50 ppm)];
4. established criteria for the disposal of PCBs and PCB-contaminated materials in that (1) PCBs $\geqslant$ 500 ppm must be thermally destroyed in an EPA-approved incinerator (only two in the nation presently) or held in storage indefinitely and (2) PCBs 50–500 ppm may be disposed of in EPA-approved chemical waste landfills if they are not considered ignitable waste under RCRA (60°C flash point); and
5. established standards for the storage and spill prevention of PCBs and PCB-contaminated liquids and solids.

Recently, as a result of TSCA and court action by an intervenor group, EPA issued regulations on the use of PCBs in electrical equipment. These regulations require owners and users of transformers containing 50 ppm (if danger of exposure risk to food and food products) or 500 ppm of PCBs to inspect and maintain the equipment according to procedures outlined under the Interim Measures Program (IMP). The IMP became effective on May 11, 1980, and all PCB transformers meeting criteria outlined under IMP were to have received their first inspection by August 10, 1981. ORNL has identified 16 PCB transformers (500 ppm) that are included under IMP and that must meet specified regulations (e.g., quarterly visual inspections, recording of leaks, and records containing inspecting and servicing history).

2.3 Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), commonly known as "Superfund," was enacted on December 11, 1980. It established broad federal authority to respond to releases or threats of releases of hazardous substances from vessels and facilities. Some key issues of the act are:

1. Notification of hazardous substances sites. Individuals were required to notify EPA of sites known to contain hazardous substances. The primary emphasis of this notification program was to locate sites used for the storage, treatment, or disposal of industrial and commercial wastes.
2. Hazardous substances as defined by CERCLA. These are substances designated as hazardous or toxic under other federal environmental statutes, including Sect. 307(a) and Sect. 311 of the Clean Water Act, Sect. 112 of the Clean Air Act, Sect. 3001 of the RCRA, Sect. 6 of the TSCA, and other substances that may be added to the list by EPA.
3. Notification of a spill or release. Notification is required whenever a hazardous substance is released into the environment

in amounts equal to or greater than the reportable quantity in the comprehensive hazardous substance list.

4. Establishment of hazardous substance response fund. The fund is to total $1.6 billion and will come, in part, from taxes levied on crude oil and manufacturers and producers of certain chemicals.

2.4 Department of Transportation — Hazardous Materials Regulations

The movement of hazardous materials and wastes is governed by specific U.S. Department of Transportation (DOT) and EPA requirements. These regulations must be complied with regardless of the mode of transportation (i.e., roadways, water, or air). Under RCRA, EPA issued standards for hazardous waste transporters that prescribe procedures for record keeping, acceptance of waste, manifest system compliance, and delivery and spill cleanup. RCRA specifically notes that these standards are to be consistent with those developed by DOT under the Hazardous Materials Transportation Act of 1974. Although DOT regulations were not intended to govern transportation of hazardous wastes, but rather the shipment of pure, virgin, hazardous materials, EPA transporter regulations require that if a material is a hazardous waste as defined by EPA, DOT regulations must be followed for intrastate and interstate transportation of hazardous waste.

The transportation of hazardous materials and wastes between ORNL and other Oak Ridge Operations (ORO) facilities and to facilities outside the ORO area is governed by specific standard practice procedures as well as regulations set forth by DOE and EPA. Before a shipment of hazardous materials/wastes can be offered to a permitted transporter, the generator must identify the material. Once the material is identified, it is placed in the proper containers, and the appropriate hazard class and correct hazardous material shipping name is selected according to all applicable regulations. No further information is required if only hazardous materials are being transported. The vehicle is then labeled as to the type material it is carrying, and the required shipping papers accompany the shipment.[4]

The transport of EPA/RCRA-defined hazardous waste requires a more detailed manifest document. In addition to information needed for the shipment of hazardous materials (e.g., hazardous class, proper shipping name, etc.), the manifest must include information on the transporter or carrier and the TSD facility for which the waste is destined.

2.5 Nuclear Regulatory Commission — Licensing Requirements for Land Disposal of Radioactive Waste

The U.S. Nuclear Regulatory Commission (NRC) has proposed new regulations in 10 CFR. Part 61 will provide licensing procedures, performance objectives, and technical criteria for the licensing of facilities used for land disposal of radioactive wastes. The NRC feels that there is a substantial need for a comprehensive national program to provide standards and technical criteria for the disposal of radioactive waste. The idea of a national program was recently promulgated by EPA for the control of hazardous wastes. Some of the rules being considered under the NRC proposal are:

1. performance objectives for land disposal of waste;
2. technical requirements for the siting, design, operation, and closure activities for a near-surface disposal facility;
3. standards for determining which wastes are acceptable for disposal by near-surface methods and which wastes must be disposed of by other methods;
4. technical requirements concerning the waste form that waste generators must meet for the land disposal of waste;
5. criteria for waste classification (e.g., class A segregated waste, class B stable waste, and class C intruder waste) based on radiation protection considerations; and
6. administrative and procedural requirements for licensing a disposal facility.

Amendments to other parts of 10 CFR are proposed to govern certification and use of shipping manifests to track radioactive waste shipments in a manner similar to that currently used for shipments of hazardous wastes.

3. WASTE STREAMS AT ORNL

Because of the research-oriented mission of ORNL, waste streams generated at this facility are highly diverse. To examine these waste streams more effectively, three general categories of waste were formulated: nonhazardous, hazardous, and radioactive. Each general category is separated into specific waste streams indicating their generation sources, and an approximate annual quantity has been calculated for each.

3.1 Nonhazardous Waste

Waste streams listed in the nonhazardous category comprise ∿35% of the total waste annually generated at ORNL [17,100,000 kg (∿18,800 tons)]. Fossil fuel waste and construction material waste are the two largest groups in this category (Table 1). The generation sources for these wastes vary from laboratory wide to specific sources, such as cooling towers and steam plant operations (Fig. 1).

Table 1. Estimated annual quantities of nonhazardous wastes at ORNL

Waste stream	Quantity
Miscellaneous	
Old tires	1,150 each
Old batteries	290 each
Scrap metal	276,000 kg (304 tons)
Paper products	118,000 kg (130 tons)
Construction material	3,628,739 kg (4,000 tons)
Cafeteria and office waste	1,700,917 kg (1,875 tons)
Cooling tower sludge	42.5 m^3 (1,500 ft^3)
Fossil fuel waste	
Fly ash	11,339,809 kg (12,500 tons)
Coal-pile runoff sludge	49,859 kg (55 tons)
Total	∿17,100,000 kg (∿18,800 tons)

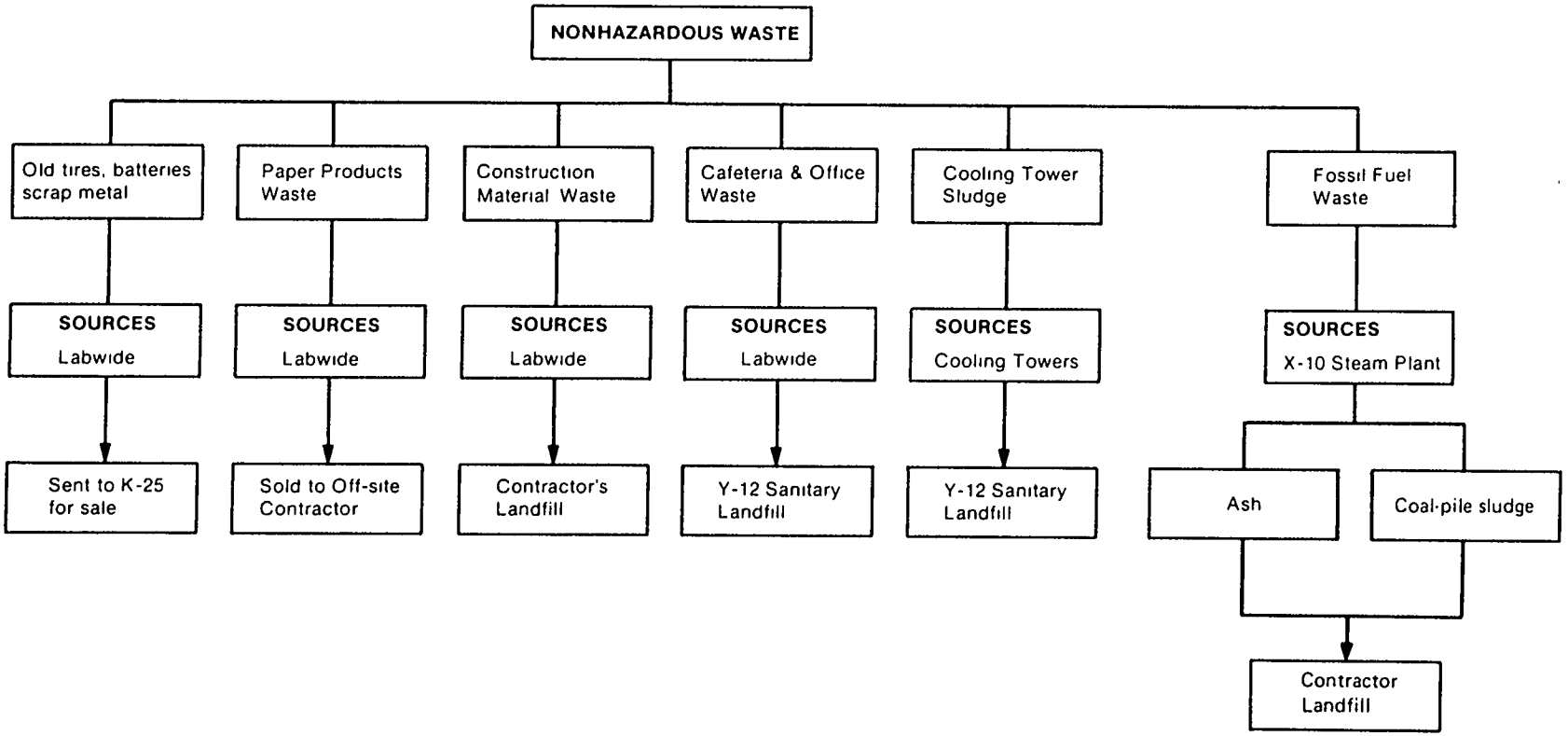

Fig. 1. Nonhazardous waste flow diagram.

3.2 Hazardous Waste

Proper management of hazardous waste is a major area of concern at the Laboratory. Special attention must be given these wastes for several reasons.

1. Recent regulations that control the hazardous waste category have sought to tighten management of these wastes and to correct their improper handling in the past. One goal of the Hazardous Waste Management System conceived by EPA/RCRA is to track these wastes from generation to ultimate disposal.

2. A large assortment of chemicals is used at the Laboratory. Many of these are defined as hazardous under RCRA, either because of some specific hazardous characteristic or because they appear on a list of known hazardous chemicals.

3. Many of the chemicals also appear on the CERCLA comprehensive hazardous substance list. In the event of spills, this list must be consulted to determine if the "reportable quantity" has been exceeded.

4. Special attention must be given to the storage, treatment, and disposal areas for hazardous wastes. A large amount of time is required for the staff to perform inspections of these areas, hazard classification of the wastes, transportation and manifest preparation, etc.

5. Because of unavailability of an onsite hazardous waste disposal site, the Laboratory must use an offsite commercial facility for disposal. More than 90% of the materials listed under the hazardous waste category are disposed of offsite. The Laboratory's waste generator must absorb these costs, which are steadily increasing.

The hazardous waste category is comprised of four major groups: asbestos-containing material, gas cylinders, chemicals, and waste oils. These wastes are generated by a variety of sources. Some are treated or disposed of onsite, whereas others are shipped offsite for disposal or placed in retrievable storage (Fig. 2). Waste materials listed in the

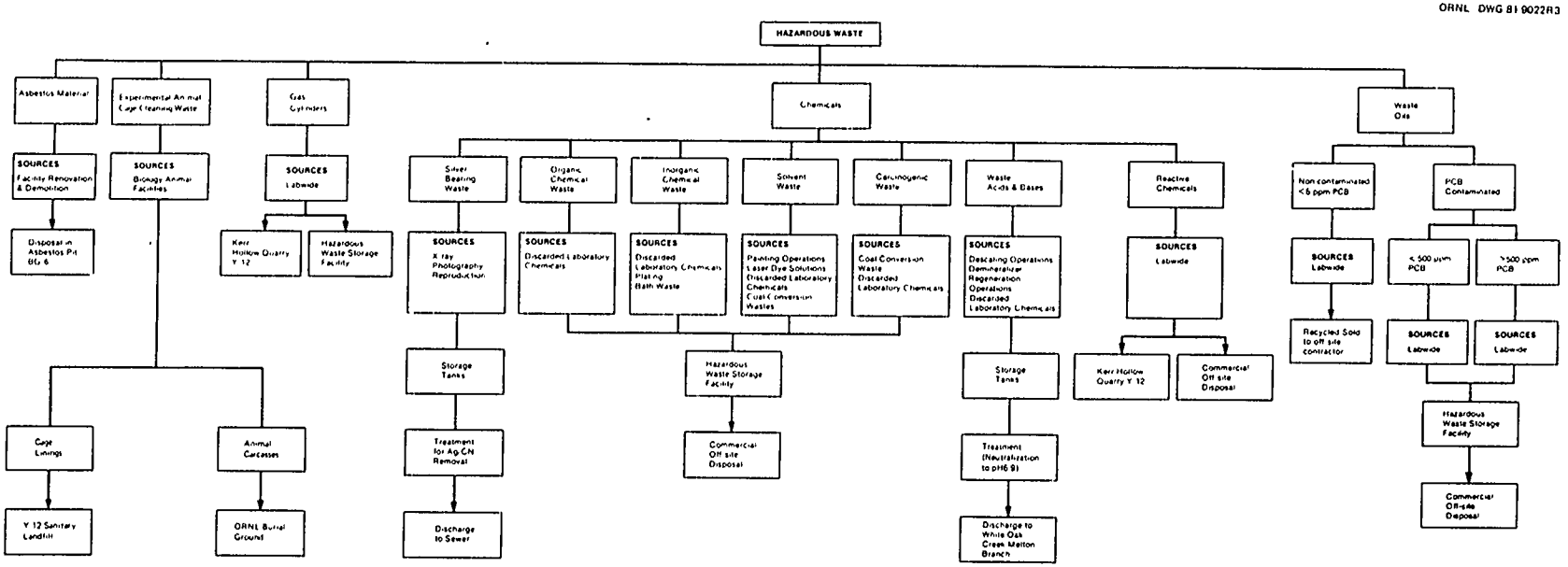

Fig. 2. Nonradioactive hazardous waste flow diagram.

chemical category (e.g., organics, inorganics, solvents, acids/bases, etc.) make up 21%, or 82,300 kg (91 tons), of this category (see Table 2). Because of reasons stated earlier, this category of wastes is most difficult to manage.

Table 2. Estimated annual quantities of nonradioactive hazardous wastes at ORNL

Waste stream	Quantity
Asbestos material	11,340 kg (12.5 tons)
Gas cylinders (ignitable, corrosive, reactive gases)	403 kg (0.44 ton)
Chemical waste	
Photographic waste	20.8 m^3 (5,500 gal)
Organic chemicals	27,216 kg (30 tons)
Inorganic chemicals	9,979 kg (11 tons)
Organic solvents	9,072 kg (10 tons)
Carcinogenic waste	34,473 kg (38 tons)
Acids/bases	4,536 kg (5 tons)
Reactives	36 kg (0.04 ton)
Oils	
Noncontaminated	80 m^3 (21,000 gal)
PCB-contaminated	
<500 ppm	9.2 m^3 (2,430 gal)
≥500 ppm	303 m^3[a] (80,000 gal)
Animal/bedding waste	1.5×10^5 kg (162 tons)
Total	$\sim 3.9 \times 10^5$ kg ($\sim$429 tons)

[a]Potential waste (PCB transformers).

Waste oils are included in the hazardous waste category because of the possibility of PCB and/or organic solvent contamination. The EPA has set a regulatory cutoff limit for PCB contamination at 50 ppm. However, UCC-ND has established a 5-ppm limit for waste oils that can be recycled. Also, under the RCRA "mixture rule," it is not permissible to mix waste materials [i.e., hazardous wastes (organic solvents)] with noncontaminated waste oils. All waste oils are checked for possible radioactivity, PCB, and organic solvent contamination. The Department of Environmental Management of the Industrial Safety and Applied Health

Physics Division and personnel from the Analytical Chemistry Division have established a quality-control program for testing waste oils for the above-mentioned contaminants. Waste oils that meet established criteria (i.e., <5 ppm PCB, <50 ppm of specific organic solvents, and nonradioactive) are sold to a commercial contractor for recycling. Currently, about 80 m^3 (21,000 gal) of waste oils are recycled annually.

Waste oils containing >5 ppm PCB are treated as PCB-contaminated liquids and are disposed of according to the specified TSCA criteria outlined in Sect. 2.2 of this report. At the present time, about 303 m^3 (80,000 gal) of oils with >5 ppm PCB are being used in various equipment at ORNL and ORNL facilities at Y-12.

3.3 Radioactive Waste

Radioactive wastes, which are generated from various sources, constitute a major portion (64%) of the total wastes generated at ORNL (Fig. 3). There are ten primary generators of radioactive waste: the Chemical Processing Pilot Plant (Building 3019), the Fission Product Development Laboratory (FPDL), the Radioisotope Processing Area, the Transuranium Processing Plant (TRU), and the six research reactors. There are 12 to 15 additional hot cell facilities and numerous laboratories that generated small quantities of waste in connection with other research and development programs.

Building 3019 is a fully contained facility having laboratories, heavily shielded cells, and fissile material storage areas for conducting research and development studies, solvent extraction reprocessing of ^{233}U, and laboratory analytical work. The facility, used to purify ^{233}U from ^{232}U daughter activity, serves as the official DOE receiving and dispensing facility of ^{233}U.

The FPDL has been used to recover kilocurie quantities of potentially useful fission products and fabricate them into various chemical and physical forms for radioisotope applications development work. At present the operations involve primarily separation and purification of ^{90}Sr and ^{137}Cs. Strontium-90 is received as a purified feedstock for conversion to appropriate source compounds.

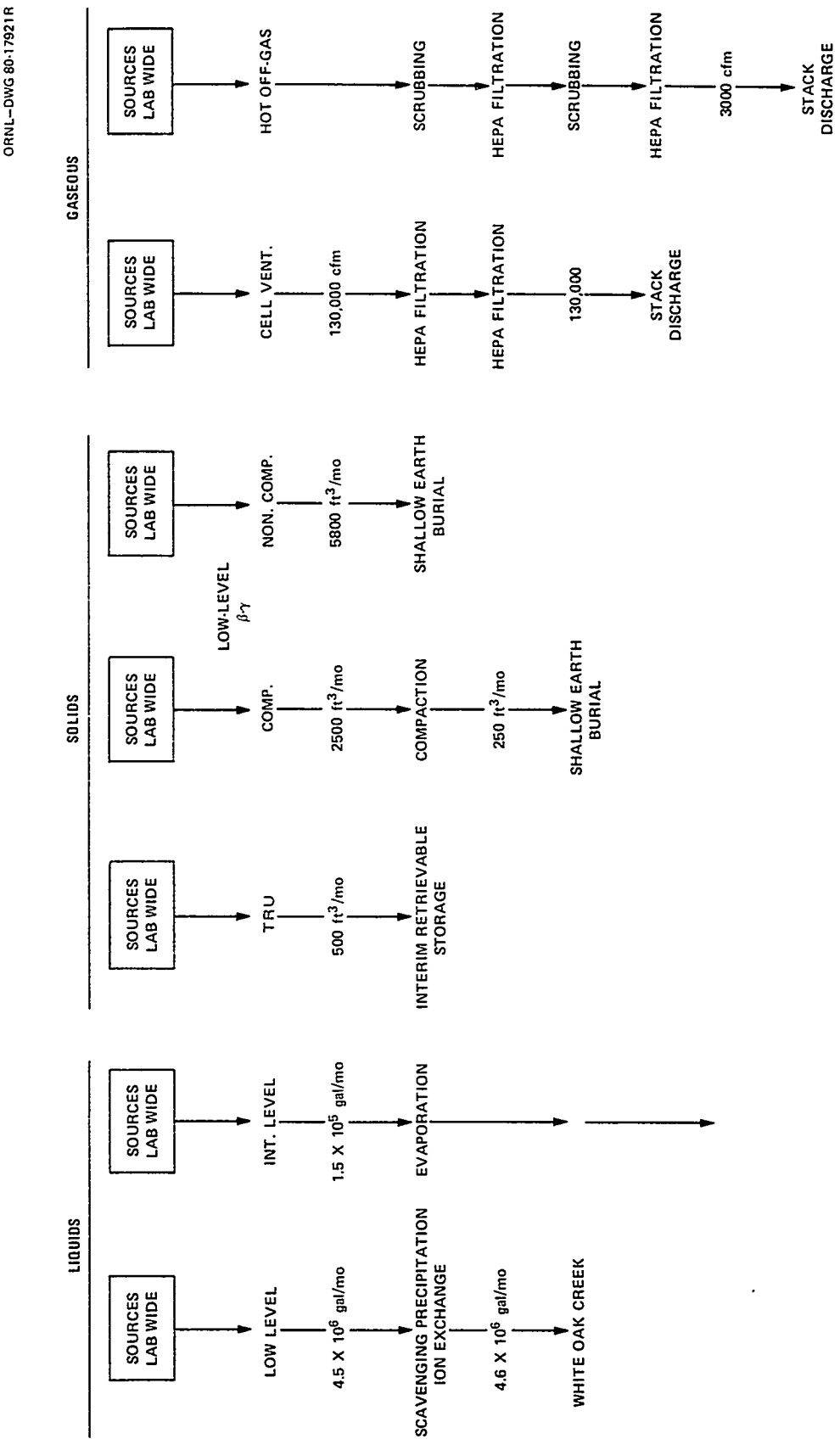

Fig. 3. Radioactive waste — generation rates and methods of disposal.

The Radioisotope Processing Area is a complex of ten small buildings housing heavily shielded cells and laboratory, office, and service facilities. A wide variety of radioisotopes, including both neutron-activation products and fission products, are separated from target materials, purified, converted to various chemical forms, and shipped to both domestic and foreign users for research, medical, and industrial uses. The products may be in solid, liquid, or gaseous form.

The TRU is a contained building housing process equipment for the dissolution of Savannah River and High-Flux Isotope Reactor (HFIR) targets and the separation of transuranium nuclides from contained fission products. This facility is the largest generator of long-lived alpha-bearing waste at ORNL.

Only two of the six research reactors — HFIR and the Oak Ridge Research Reactor (ORR) — produce significant quantities of wastes during routine and refueling operations. The Tower Shielding Facility, the Health Physics Research Reactor, and the two "swimming pool" reactors — the Bulk Shielding Reactor and the Pool Critical Assembly — operate intermittently or at much lower power and produce minor amounts of waste.

The methods used for treatment and disposal of radioactive wastes are shown in Fig. 3, which also lists typical generation rates for the various types of wastes. The majority of radioactive waste is regulated by agencies other than EPA. This has created confusion in regard to the treatment or disposal of wastes such as the so-called co-contaminated wastes. These are RCRA-defined hazardous wastes contaminated with low levels of radioactivity. This aspect will be discussed in greater detail later.

4. DESCRIPTION OF NONRADIOACTIVE WASTE FACILITIES

4.1 Gaseous Wastes

Nonradioactive gaseous wastes are released to the atmosphere as a result of numerous laboratory operations and support activities. These gases are released either through roof exhaust systems or through stacks constructed specifically for the discharge of gaseous wastes. Organic chemical compounds and gaseous chemicals (compressed gas cylinders) are typical nonradioactive gaseous releases.

Combustion products of the steam plant account for the major fraction of nonradioactive gas release. At average coal consumption rates, SO_2 and NO_x discharge rates are 44 g/s (250,000 lb/month) and 6.9 g/s (40,000 lb/month), respectively.

4.2 Liquid Wastes

Operation of various plant facilities generate sufficient heat to require its rejection to the environment. Most of the reject heat is transferred to once-through cooling or dissipated to the atmosphere using wet-evaporative, mechanical-draft cooling towers. Blowdown from all cooling towers is discharged to the storm sewer system; except for those towers operating at CFRF, DOSAR, and TSF, the effluents reach the Clinch River by way of White Oak Creek.

Storm drainage from ORNL facilities flows from numerous open ditches, culverts, and storm sewers into White Oak Creek or into small tributary streams flowing through the developed areas. Runoff from 7500- and 7900-area facilities flows into the Melton Branch, which joins White Oak Creek near SWSA 5. Runoff from CFRF area enters the Clinch River at Gallaher Bend.

5. DESCRIPTION OF RADIOACTIVE WASTE TREATMENT AND STORAGE FACILITIES

5.1 Gaseous Waste

Waste gas streams are classified either as building and cell-ventilation air or as process off-gas. The former originates in areas such as building containment zones, hoods, and cells and accounts for a very large fraction of the total waste gas volume but very little of the radioactivity. The latter, originating from chemical process vessels and similar operating equipment, is of very low volume but contains most of the activity.

Particulates are removed from these gases by passing them through filters and scrubbers and then releasing them to the atmosphere through one of six exhaust stacks. Four stacks are located in Bethel Valley, the main exclusion area of the Laboratory. Included is the one at the Oak Ridge Electron Linear Accelerator (6010), one at the High-Radiation-Level Analytical Laboratory (2026), one at the Chemical Processing Pilot Plant (3020), and one near the Isotope Area (3039). The last-mentioned stack is the primary gas disposal facility, serving most of the chemical and research facilities [the radioisotope processing area, the ORR, Intermediate-Level Liquid Waste (ILW) storage and processing facilities, and the central research and administration complex]. Two stacks are in Melton Valley: one serves the HFIR, TRU, and Thorium-Uranium Recycle Facility (TURF) buildings and the other serves the Molten-Salt Reactor Experiment. All stacks except that at Building 6010 have standby steam-driven blowers that can be actuated by either loss of electrical power or loss of vacuum.

5.2 Intermediate-Level Liquid Waste

The ILW system at ORNL collects, neutralizes, concentrates, and stores aqueous radioactive waste solutions from various sources. The system is designed to accommodate waste solutions having an activity content as high as 0.20 TBq/L (20 Ci/gal). The sources of these waste

solutions are hot sinks and drains in research and development laboratories, radiochemical pilot plants, and nuclear reactors located in Bethel Valley and Melton Valley.

The waste solutions drain or are discharged from the source buildings to 23 collection tanks; one such tank is located conveniently to each source building. Each collection tank is equipped with a sampling device, liquid-level instrumentation, and a filtered vent to the atmosphere or to the off-gas system of the facility it serves.

The waste solutions that accumulate in the collection tanks are periodically transferred to one of two 189-m^3 (50,000-gal) stainless steel storage tanks near the evaporator annex. These tanks are enclosed in underground stainless-steel-lined concrete vaults. A network of 0.05- and 0.08-m (2- and 3-in.) stainless steel lines buried directly in the ground connects the collection tanks to a 0.15 m (6-in.) double-contained stainless steel collection header which directs the flow to the two storage tanks. Wastes are transferred by pumps or steam jets.

Waste from the storage tanks is transferred to one of two evaporators where the aqueous solution is concentrated by a factor of 20 or 30. Condensate from the evaporator is directed to the Process Waste (low-level) System. When the specific gravity reaches a predetermined point, the evaporator is shut down and its contents are cooled and transferred to a third 189-m^3 (50,000-gal) stainless steel receiving tank.

The concentrate stored at the evaporator is periodically pumped to one of eight 189-m^3 (50,000-gal) stainless steel storage tanks located in Melton Valley near the hydrofracture site. Transfer from the evaporator tank to the waste storage tanks in Melton Valley is through a doubly contained stainless steel line. This line is buried underground in a specially prepared bed of select clay and is cathodically protected.

The concentrate stored in Melton Valley is eventually disposed of by the hydrofracture process. In this process, the concentrated waste solution is combined with cement, fly ash, and clay to form a grout, which is then pumped about 305 m (1000 ft) underground into a shale formation underlying the ORNL site. The pumping pressure is high enough to cause the shale to fracture in a horizontal plane, and the grout

spreads out in the form of a thin, roughly circular layer in the rock. The cementitious grout then solidifies, permanently emplacing the waste within the rock structure.

5.3 Low-Level (Process) Liquid Waste

Low-contamination-level liquid waste streams, called process waste, are primarily streams that contain no radioactivity under normal operating conditions but could become contaminated as a result of equipment failure or human error. Process waste includes steam condensate from heating coils in vessels containing radioactive solutions, vessel cooling water, rainwater runoff from potentially contaminated areas, and condensate from the ILW evaporator. The only routine discharge of radioactivity into the process waste systems comes from the ILW evaporator overheads (condensate) and drainage from contaminated areas.

The average flow rate of process waste is about 0.005 m^3/s (80 gpm), but during short periods of heavy rainfall, flows in excess of 0.013 m^3/s (200 gpm) sometimes occur. The principal radioactive contaminants are ^{137}Cs and ^{90}Sr. The waste streams from various areas of the Laboratory flow into the Equalization Basin, an earthen basin that acts as a surge volume to equalize the flow to the Process Waste Treatment Plant.

At the Process Waste Treatment Plant the waste solution is pumped through an ion exchange process to remove radioactive contaminants. The effluent is then adjusted back to a neutral pH and discharged to the Clinch River via White Oak Creek. Any radioactivity adsorbed on the ion exchange resin is periodically removed by treating the resin with dilute nitric acid. This solution is then concentrated in an evaporator and sent to the ILW system for further treatment and disposal.

5.4 Solid Waste

Solid radioactive wastes are generated in a number of ways at ORNL. The largest volume consists of radwaste or "laboratory trash" (glassware, paper, rags, or other miscellaneous material) that is either contaminated or suspected to be contaminated. Other sources include solid residues

from various physical and chemical processes. Frequently, contaminated items of equipment, machinery, tools, tanks, valves, and pipes that cannot be economically decontaminated to a level sufficiently low for conventional disposal are disposed of as waste. An additional potentially high-volume source of solid waste is soil, concrete, and various types of building materials that have become contaminated.

Low-radiation-level (<200 mrem/h) beta- and gamma-contaminated solid wastes are segregated at the source into compactible and noncompactible fractions. All solid wastes are collected in suitable containers and periodically transported to one of the solid waste storage areas. There the compactible wastes are compacted into bales before disposal.

5.5 Description of Waste Storage Facilities

Solid wastes contaminated with radioactive materials are disposed of by storage or shallow land burial at one of the designated waste storage areas. The levels of radioactivity and the physical characteristics of the wastes dictate the methods of disposal (Fig. 4). Of the six solid-waste storage areas (SWSAs) located in the vicinity of ORNL, four are inactive. The status of the areas is given in Table 3. The remaining acreage in SWSA 5 is unsuitable for waste burial except 14,146 m^2 (3.5 acres), which are reserved for retrievable storage of transuranium-contaminated wastes.

Low-level (<200 mrem/h) beta- and gamma-contaminated wastes are buried in open trenches at SWSA 6. Bales of compactible waste are buried two layers deep in a specially designated trench. Other low-level wastes are buried directly, without further packaging or processing. Terrain and soil conditions determine the type of trench for each location; excavations are controlled so that trench bottoms are at least 0.6 m (2 ft) above the water table. An ideal trench will be 3 m (10 ft) wide, 4 m (14 ft) deep, and up to 15 m (50 ft) long. Excavated material is placed adjacent to the trench to simplify backfilling. The trenches are backfilled to cover the waste with at least 9 m (3 ft) of earth.

Low-level wastes contaminated with transuranium nuclides are placed in 0.21- and 189-m^3 (30- and 55-gal) drums and stored in the cells of a

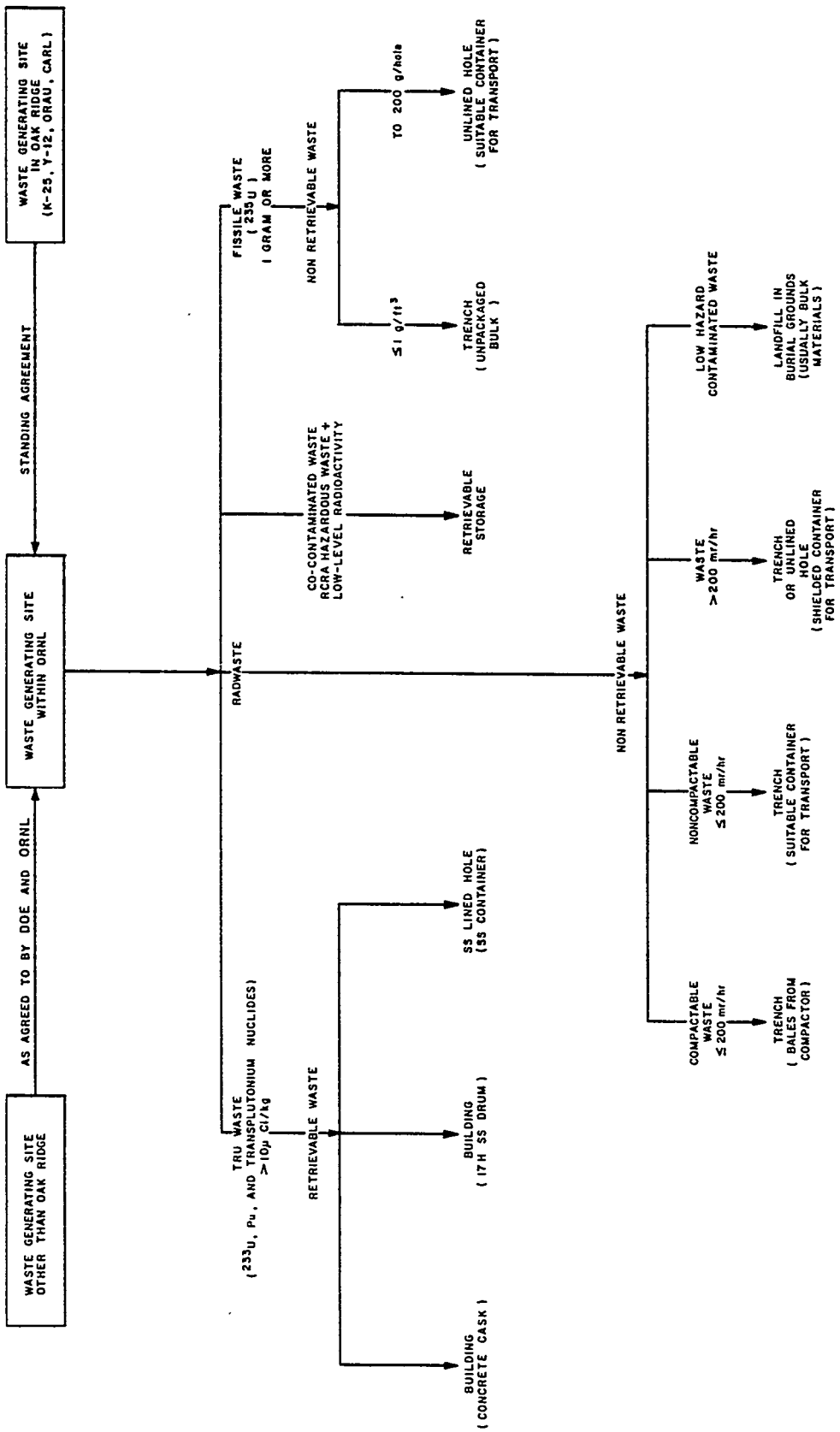

Fig. 4. Radioactive waste disposal operations.

Table 3. Operational status of ORNL solid-waste storage areas (SWSAs)

SWSA	Operating dates	Status	Size [m^2 (acres)]
1 and 2	1943–1946	Closed	20,234 (5)
3	1946–1951	Closed	28,328 (7)
4	1951–1959	Closed	93,078 (23)
5	1959–present	Operating	133,547 (33)
6	1969–present	Operating	275,187 (68)

retrievable storage facility in SWSA 5. This facility has 24 concrete cells that are accessible through concrete covers; the cells are deep enough so that five tiers of drums may be stacked. High-radiation-level retrievable TRU wastes are placed in concrete casks and stored in the bays of a new reinforced concrete facility that is below grade except for the side that provides access for adding or removing casks. Other special wastes are placed in auger wells, which vary from 0.15 to 0.76 m (6 to 30 in.) in diameter. The wells are generally unlined and are 6.1 m (20 ft) deep. Packaged waste is placed in the well and covered with earth until the radiation is reduced to a safe level. As the well is filled to within 0.6 m (2 ft) of the surface, it is capped with concrete and marked with a plaque showing the well number and type of material.

A computer tabulating card is prepared for every load of radioactive waste buried, thereby providing a monthly computer printout of a permanent burial ground log. To supplement the computer records, a periodic survey establishes coordinates of trench boundaries and auger-well locations. This information is transferred to a plot of the burial site, and usage of the acreage is computed. This log was initiated in 1971.

6. EXISTING FACILITIES AT ORNL

6.1 Sanitary and Nonhazardous Waste

6.1.1 Sewage treatment plant

The Sewage Treatment Plant is located in the southwest quadrant of the Laboratory and consists of two aerated lagoons and a chlorine contact chamber (Figs. 5 and 6). Each lagoon has a capacity of 3785 m^3 (one million gal); the plant's retention time is about 10 days. Two hundred thousand gallons of wastewater are discharged daily from the chlorine contact chamber into White Oak Creek. The wastewater originates from sanitary sources and from inleakage and infiltration. Some sewage from rest room facilities is indirectly transported to the Sewage Treatment Plant. Waste from the 7900 area is collected and hauled to the Sewage Treatment Plant by truck. Sewage from other buildings is deposited into a septic tank equipped with drain fields. The sewage system wastewater from all areas (except those in which the sewage is deposited into septic tanks) is treated and then discharged into White Oak Creek.

6.1.2 Contractors' landfill

The ORNL Department of Environmental Management is responsible for ensuring that this facility is operated according to guidelines in the ORNL Environmental Protection Procedures, EPM 14 (Appendix D). Individuals authorized to use this facility must comply with requirements in EPM 14. The landfill has been designated as an area for the disposal of construction spoils and can only be used as such (Fig. 6). Fly ash generated at the ORNL Steam Plant is disposed of in this area also.

6.2 Hazardous Waste

6.2.1 Neutralization facility

Many of the noncontaminated inorganic acid wastes generated at the Laboratory, except chromic and hydrofluoric acids, are taken to this facility for treatment and disposal (Fig. 6). Treatment consists of

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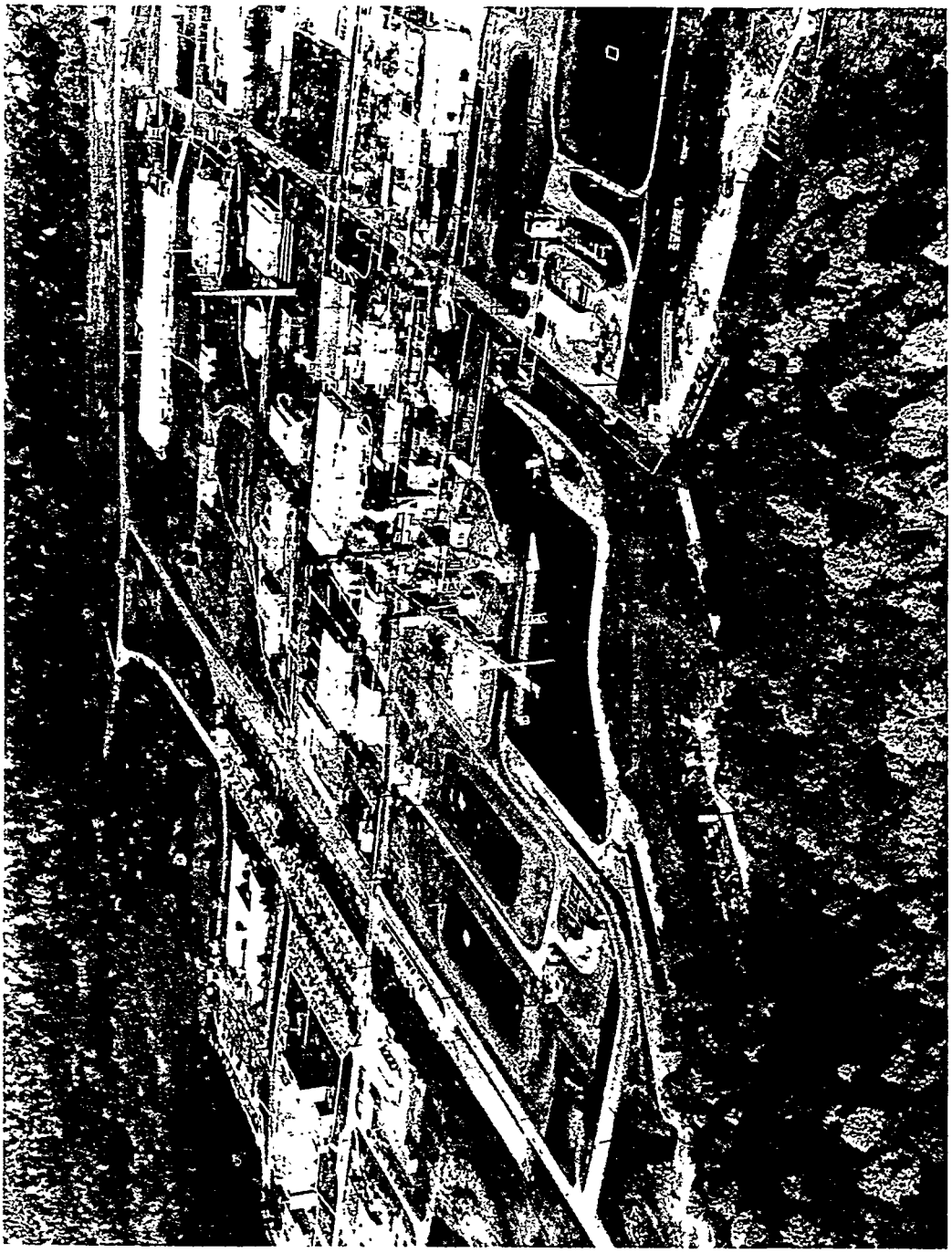


Fig. 5. ORNL Sewage Treatment Plant.

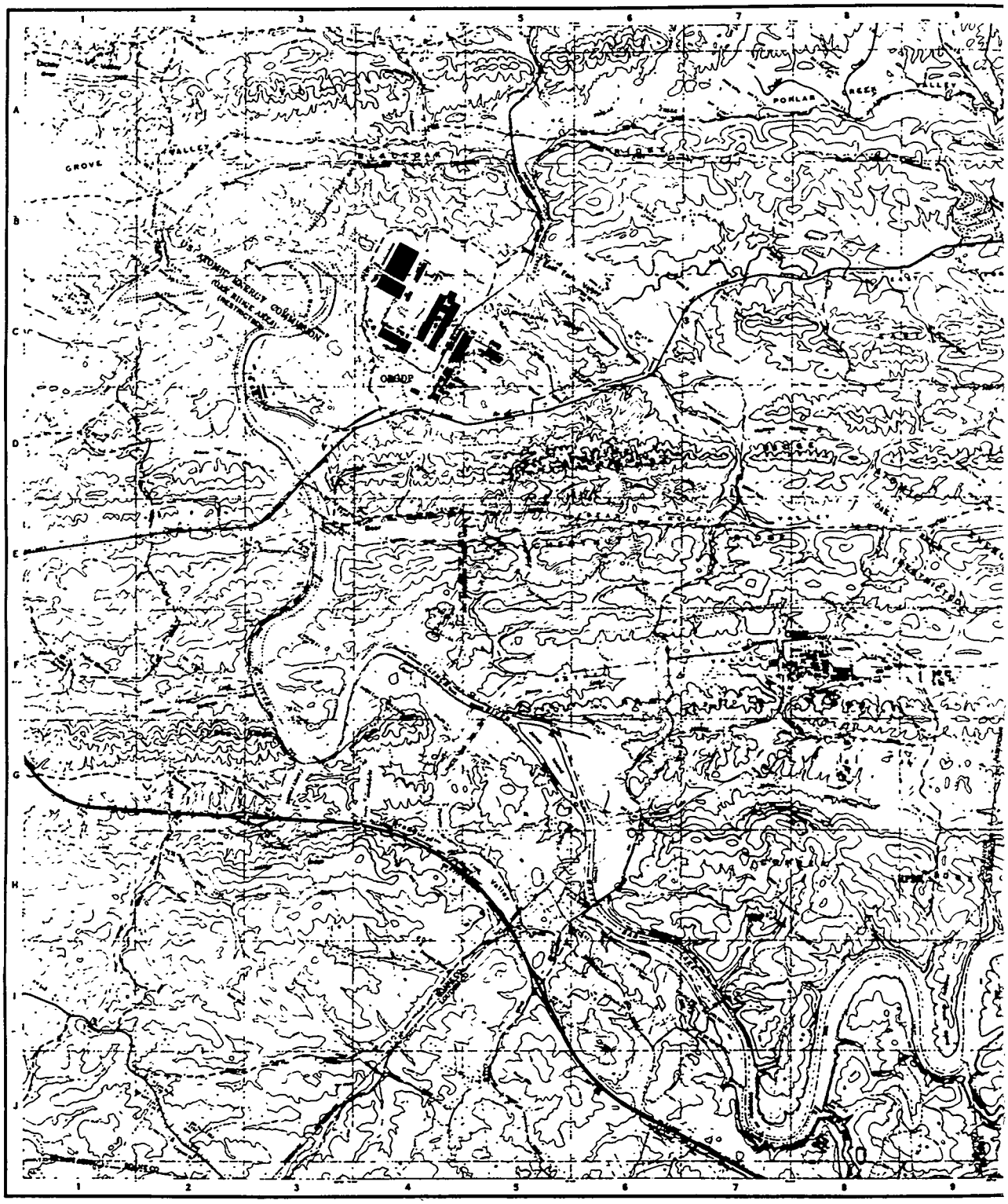
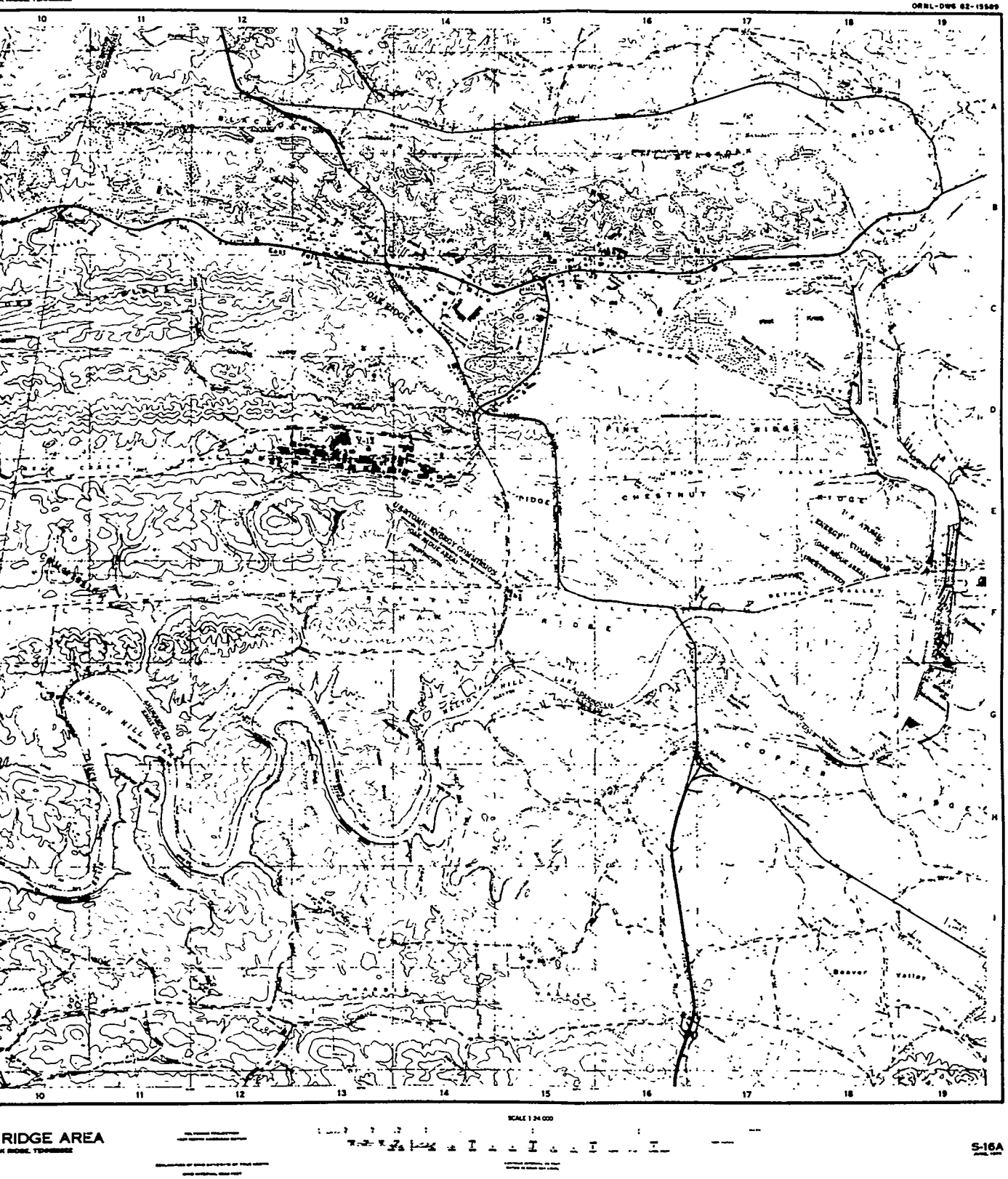


Fig. 6. Map of approximate



locations of existing facilities.

adjusting the pH to the neutral range. The basin has a capacity of 57 m^3 (15,000 gal) and is batch dumped on an annual average of three times per day with a total release of about 151 m^3 (40,000 gal) per day. Neutralization activities (i.e., pH adjustment) are exempt under current RCRA hazardous waste regulations.

6.2.2 Hazardous chemical waste storage facility

All hazardous chemical wastes generated at ORNL and its facilities at Y-12 are transported to a centralized storage facility (7507) for temporary or retrievable storage (Figs. 6 and 7). Wastes are segregated into their respective DOT hazard classes before being packed for offsite shipment. Operating and inspection records for this facility are maintained as required by RCRA hazardous waste management regulations.

6.3 Radioactive Wastes Storage Areas

6.3.1 Solid waste storage area No. 5 (SWSA 5)

This area, which opened in 1959, consists of two sections on the hillside east of White Oak Creek and south of Haw Ridge. Initially, the same burial procedures were used at this site as had been used at the preceding sites; that is, alpha-contaminated waste was placed in the lower part of the area and capped with concrete, and the beta-gamma-contaminated waste was simply covered with weathered shale. This segregation procedure was improved when the TRU came on line. Waste from TRU was packaged and placed in concrete casks. The casks were placed below grade and capped with concrete. After 1970, TRU waste was stored retrievably rather than buried. The upper section of SWSA 5 is reserved for storing this type of waste (Figs. 6 and 8).

6.3.2 Solid waste storage area No. 6 (SWSA 6)

This area, which is located immediately northwest of White Oak Lake, is about 275,187 m^2 (68 acres) and was opened in 1969 (Figs. 6 and 9). Initially, trenches were excavated as long as possible but are now limited to about 15 m (50 ft). This procedure was initiated to control

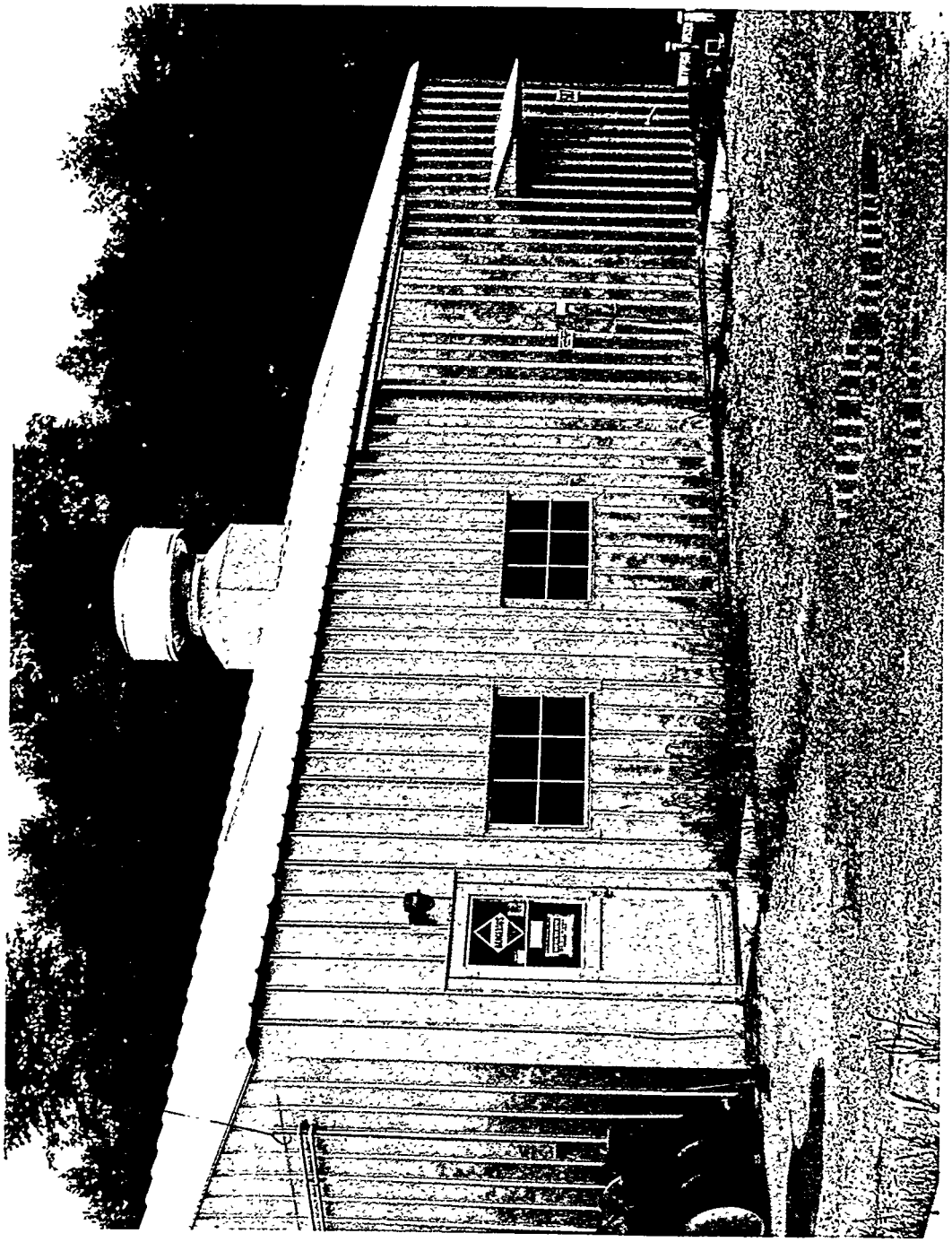


Fig. 7. Hazardous Chemical Waste Storage Facility — 7507.

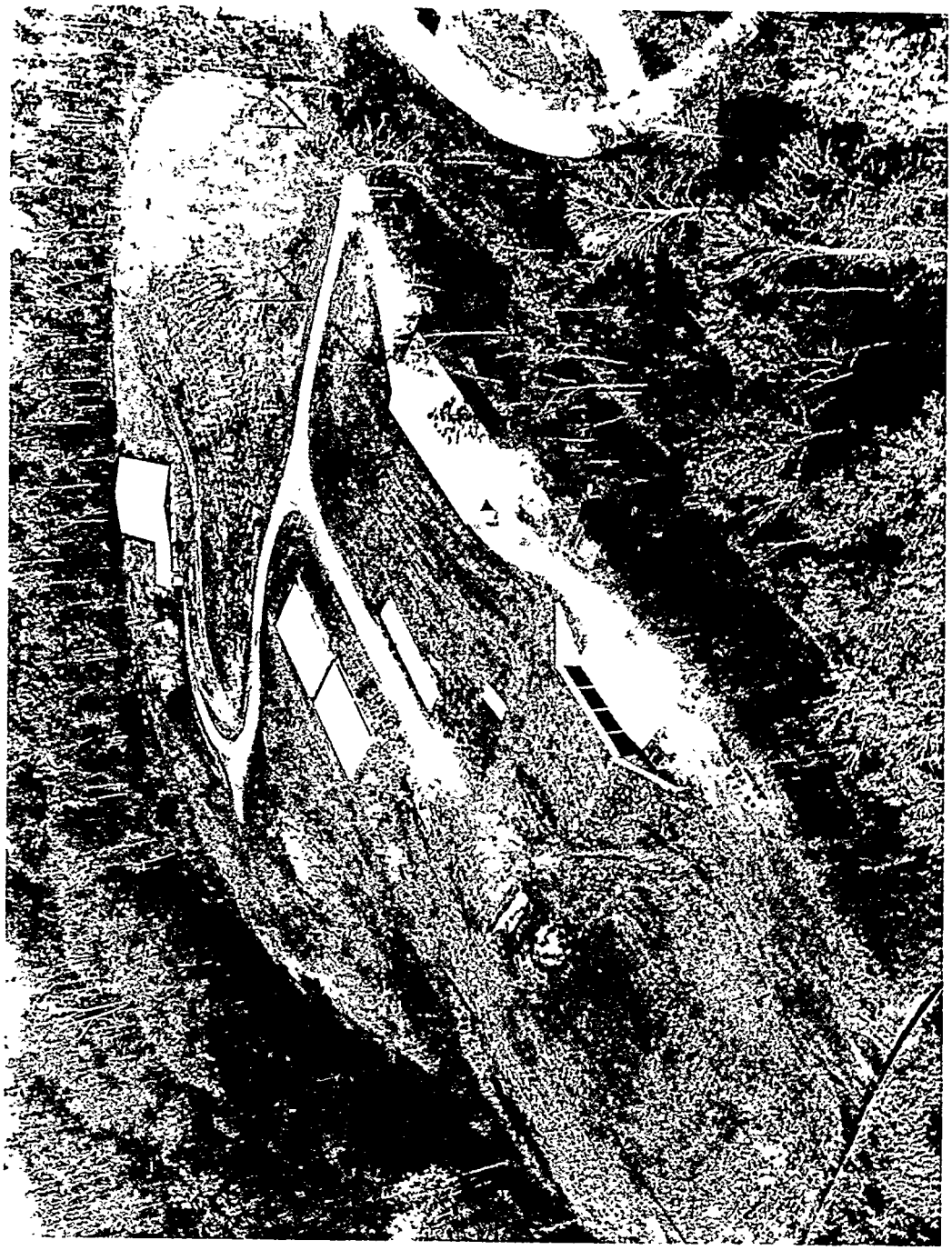


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Fig. 8. TRU waste retrievable storage in SWSA 5.

Fig. 9. Solid Waste Storage Area (SWSA 6).

the precipitation that reaches the trenches during excavation. Asbestos-contaminated wastes are currently buried at this site.

6.4 Radioactive Waste Treatment/Disposal

6.4.1 Hydrofracture facilities

Since 1965, ORNL has disposed of its concentrated intermediate-level radioactive waste via hydrofracture. The original hydrofracture operation was located at SWSA 5 and operated until 1979. The new hydrofracture facility will begin operation in FY 1982 (Figs. 6 and 10). About 4,047 m^2 (1 acre) of land in Melton Valley is being used for the new facility.

6.4.2 Process waste ponds

Eight ponds have been used for treatment of process waste at ORNL. Four of these ponds are located in Bethel Valley: (1) the 190 Pond System, (2) the 3524 Equalization Basin, and the 3513 Research Settling Basin. The other four, which are in Melton Valley, serve the HFIR and the TRU (two for the HFIR Process Waste Basin and two for the TRU Process Waste Basin System). Their combined area is less than 4,047 m^2 (1 acre) (Fig. 6).

ORNL-PHOTO 8023-81

Fig. 10. Hydrofracture Facility.

7. CURRENT WASTE MANAGEMENT OPERATION AND PRACTICES

7.1 Nonhazardous Waste

The nonhazardous waste streams generated at the Laboratory are the easiest to manage of the three categories of waste. This is true for the following reasons:

1. Disposal operations of nonhazardous waste are performed on the Oak Ridge Reservation [i.e., Y-12 Sanitary Landfill and the ORNL Contractors' Landfill (Fig. 11)].
2. Several of the nonhazardous waste streams (e.g., scrap metal, old tires, and paper waste) are sold to commercial contractors and recycled.
3. Laws and regulations dealing with sanitary waste are better established than many of the more recent environmental laws dealing with hazardous wastes.

There are several nonhazardous waste management options not currently being utilized [e.g., volume reduction and reuse (recovery and incineration)] which will need to be examined as part of the total long-range waste management planning.

7.2 Hazardous Waste

As pointed out earlier, the management of hazardous wastes is more complicated and requires a substantial amount of personnel time to ensure proper handling of the waste streams included in this category. The quantities and characteristics of the waste streams play a major role in determining whether resource recovery, volume reduction of residuals via compaction, thickening/solidifying, incineration, or landfilling may be considered as practical waste management options. Current management will be discussed for each hazardous waste stream.

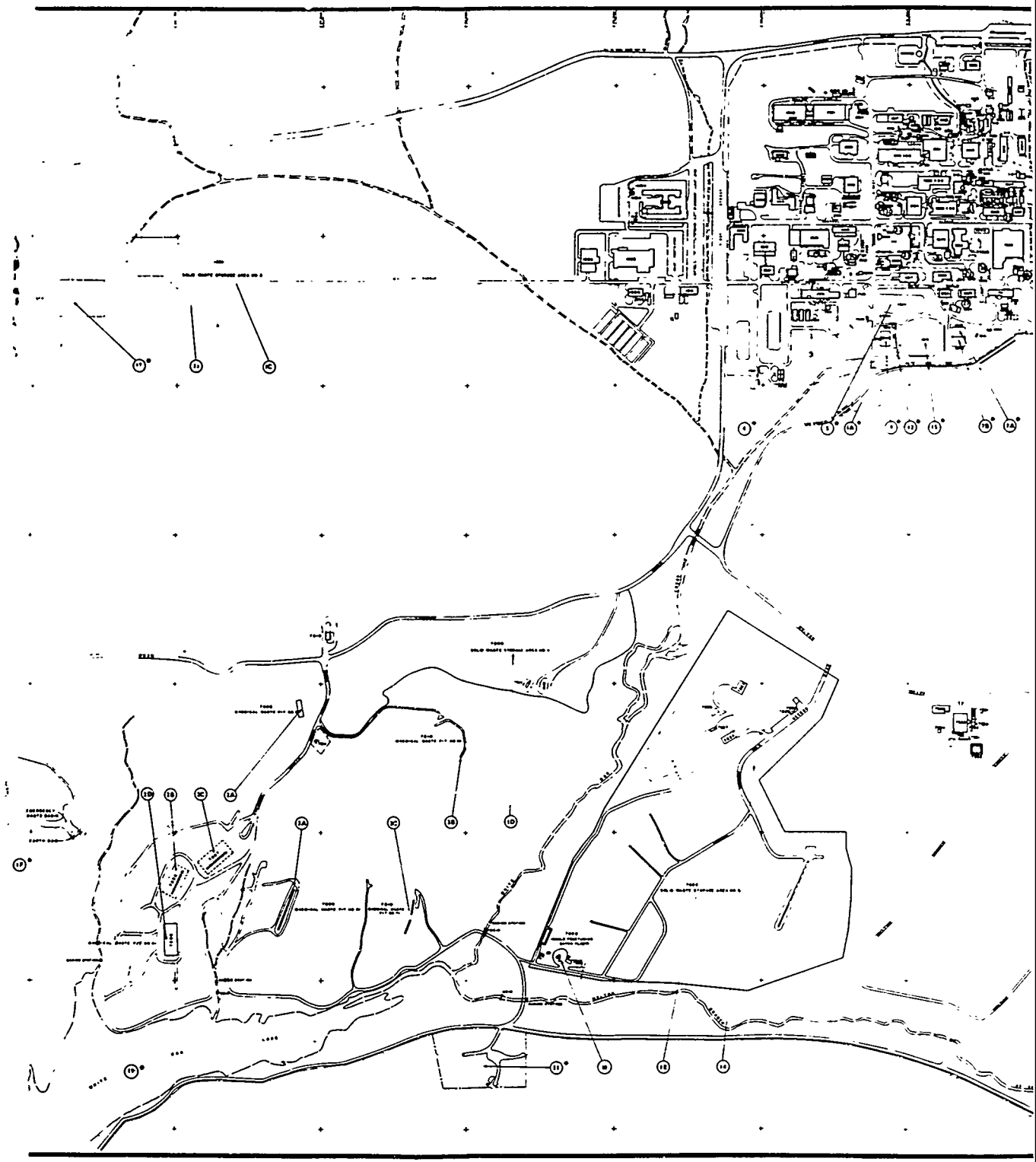
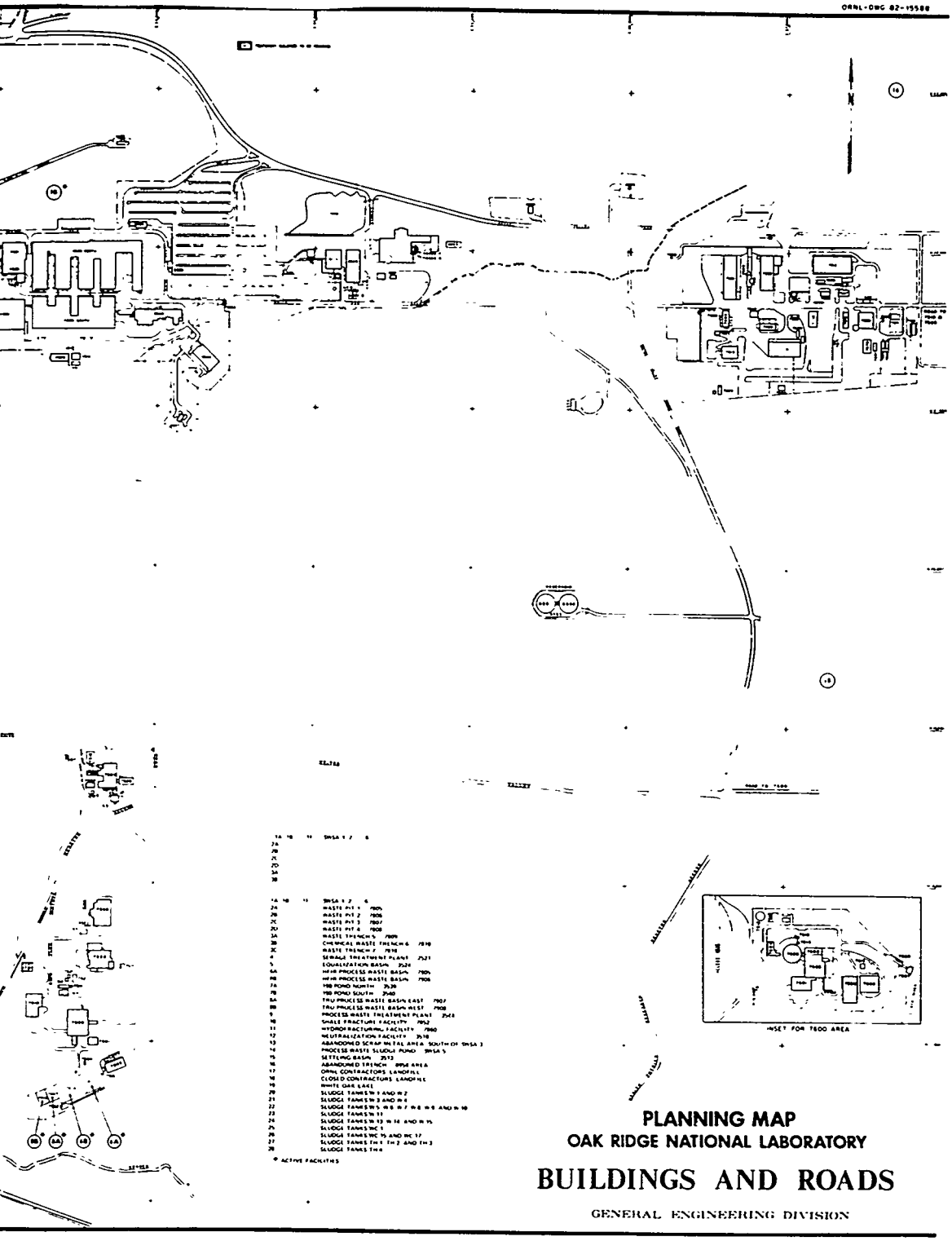


Fig. 11. Map of Oak Ridg



Operations area.

7.2.1 Asbestos material

Asbestos-containing waste is presently disposed of onsite in ORNL SWSA 6 (Fig. 12). At the present rate of usage, two trenches are filled to capacity per year. Quarterly inspections of disposal areas are made to ensure regulatory compliance with 40 CFR 61, Subpart B, Paragraph 61.25.

Plans are to continue disposal of asbestos-containing material in onsite burial grounds. However, this practice may not be permitted to continue under NRC's additions to NRC 10 CFR 61. Future asbestos waste, which is nonradioactive, may have to be disposed of in an offsite commerical facility. Procedures for the removal of asbestos-containing material during demolition and renovation operations can be found in the ORNL Environmental Protection Manual (Appendix A). As asbestos-containing material is replaced with nonasbestos materials, the disposal of this waste stream is expected to decrease and, at some point, no longer exist.

7.2.2 Compressed-gas cylinders

Gas cylinders containing a variety of toxic, ignitable, corrosive, and inert gases are used for various projects and operations at the Laboratory. Many of these cylinders are small lecture-type, nonreturnable cylinders. This, combined with the fact the contents of many of the cylinders are RCRA-regulated waste materials, creates a major disposal problem. Currently, these gas cylinders are being placed in retrievable storage. Cylinders found to be leaking can be transported to a remote area onsite and vented into the atmosphere. However, this method of disposal may only be used in emergency situations.

Alternative disposal options are being investigated to help alleviate this problem. These options include (1) a facility for the controlled explosion (cylinders with frozen valves) and gas dispersion into a collecting medium); (2) gas incinerator; and (3) disposal via commercial facilities offsite.

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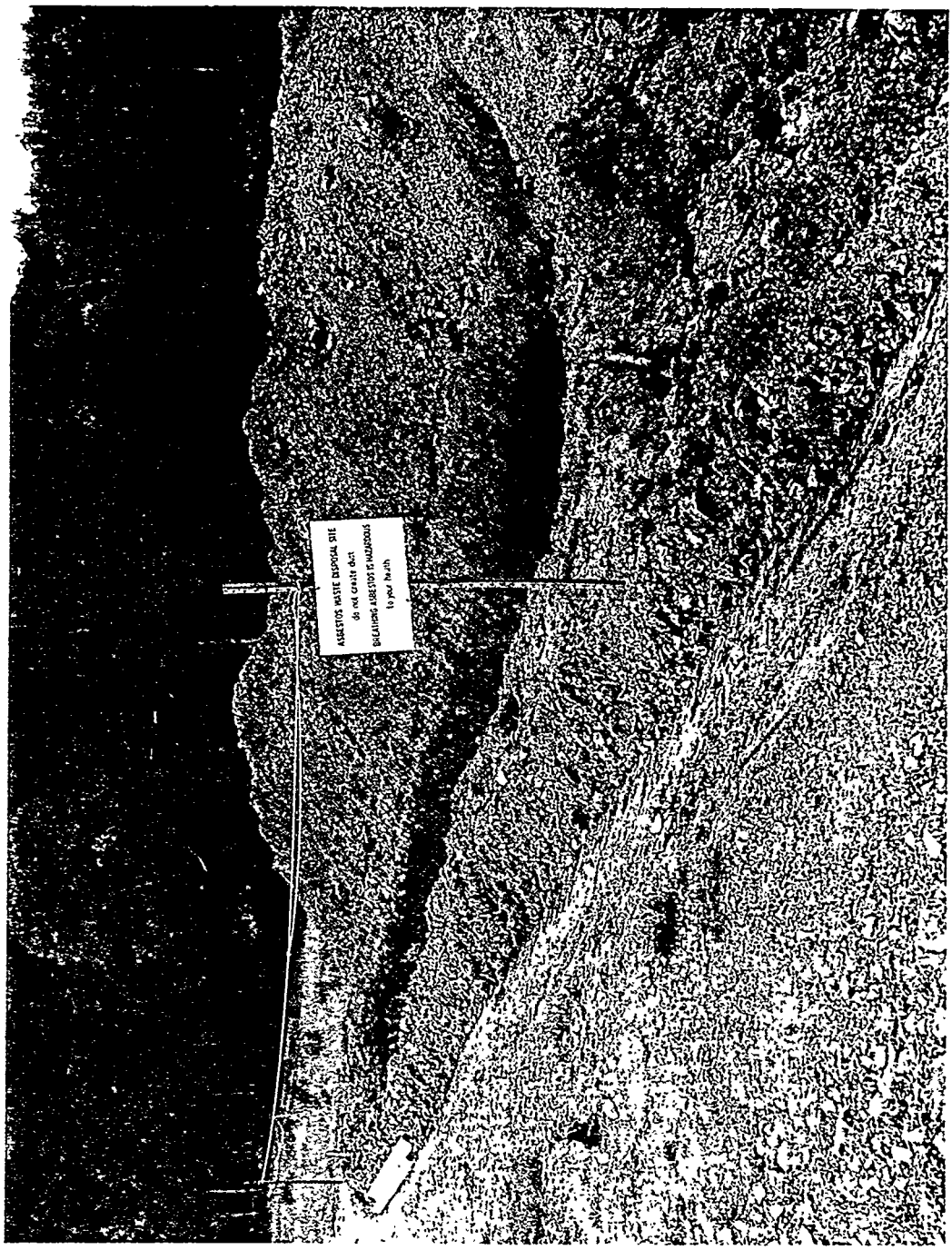

Fig. 12. Asbestos Disposal Trenches in SWSA 6.

7.2.3 Photographic wastes

Large quantities of photographic wastes generated by the Laboratory's photographic and reproduction departments are classified as hazardous wastes by RCRA, either because of their corrosiveness (pH >12.5) or because of the concentration of silver (>5.0 mg/L). Because of the significant amount of recoverable silver found in these waste solutions, they cannot be shipped offsite for disposal. Presently, this waste is stored in polyethylene-lined 0.21-m^3 (55-gal) steel drums, which require large amounts of storage space.

To help mitigate the problems associated with the storage of this waste stream, two tanks [11 and 8 m^3 (3000 and 2000 gal)] have been installed in a diked containment area. The tanks are located above ground in a diked area and are currently being used (Fig. 13).

Laboratory personnel from the Analytical Chemistry, Chemical Technology, and Chemistry divisions in cooperation with the ORNL Department of Environmental Management have developed an effective method for recovering 99.999% of the silver from the wastes to achieve an effluent discharge containing <1 ppm of silver, with acceptable values for pH and biochemical oxygen demand (BOD). Following the silver-recovery phase of the operation, the waste will be treated with commerical-grade sulfuric acid to adjust the pH before discharging the high BOD effluent to the ORNL Sewage Treatment Plant for final clarification. Recovered silver metal will be turned over to the Finance and Materials Division for resale. To this date, test runs have proven very successful and routine silver recovery from bulk quantities is expected to begin soon.

7.2.4 Organic and inorganic wastes (liquids and solids)

Waste materials that comprise these two categories are very diverse and are generated by a variety of activities at the Laboratory. Organic and inorganic waste streams can be either pure laboratory-grade chemicals or mixtures of several chemicals with other inert materials. Under RCRA, many materials found in these two groups are considered hazardous in their pure form, as hazardous constituents in other materials, or have some hazardous characteristics (i.e., ignitable, reactive, etc.).

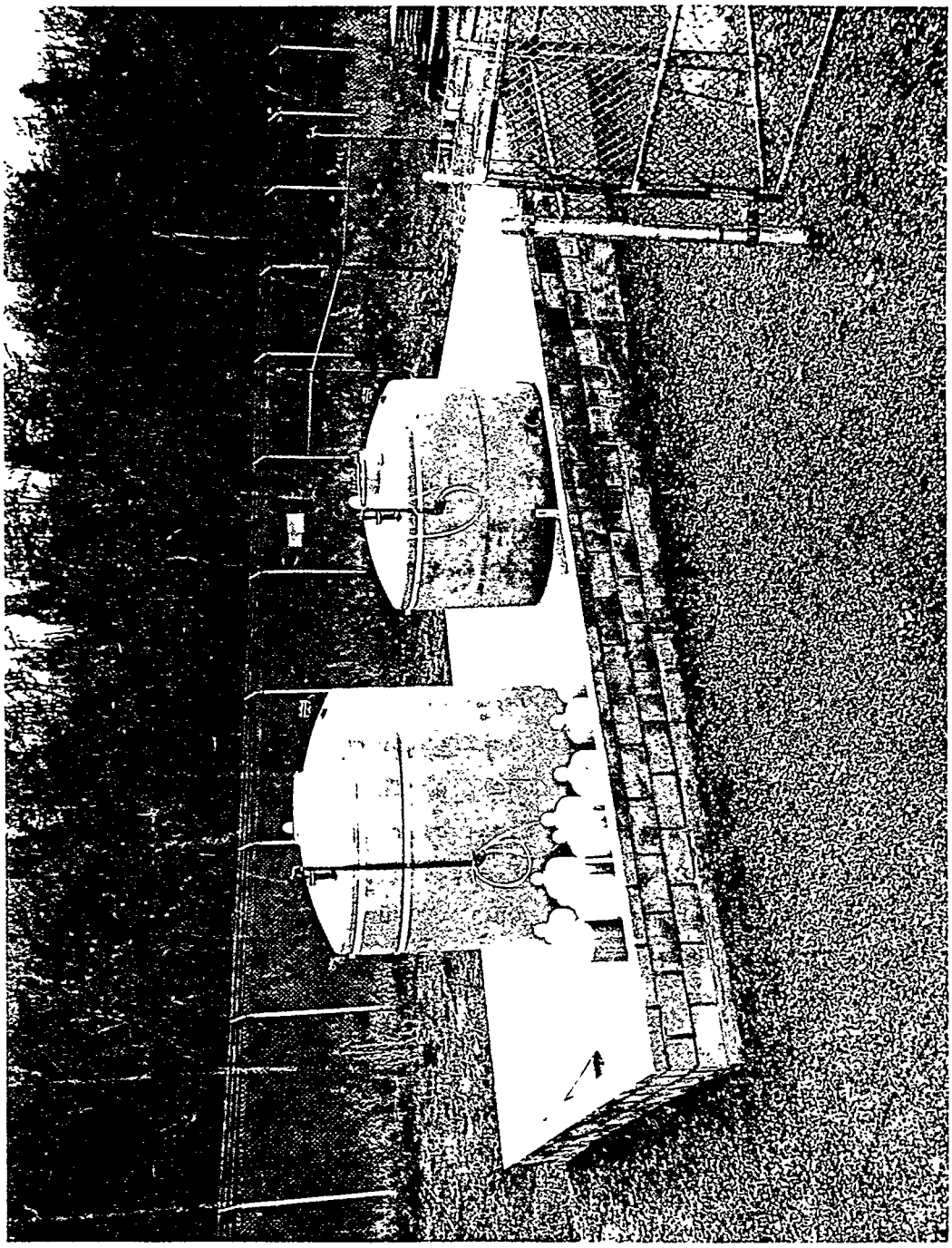

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Fig. 13. Photographic Waste Storage Area — 7075.

Present management of these two waste streams is limited to one option. The wastes are classified into the appropriate DOT hazard class and placed in temporary storage. Since no chemical landfill (EPA-approved) exists onsite, these wastes are transported offsite for disposal. At present, ORNL has a contract with Chemical Waste Management, Inc., for the transportation and disposal of all hazardous wastes. This arrangement has worked well up to this point, but because of ever-increasing disposal costs levied by offsite commercial facilities, the time is rapidly approaching when this method of waste management will no longer be cost effective.

A major step in the future management of these waste streams will be to reduce the volume of chemical waste requiring disposal. Reuse and recovery mechanisms, detoxification of sludges and plating wastes, and incineration of burnable residues can substantially reduce the amounts of waste that will require landfilling.

7.2.5 Solvent waste

Spent organic solvents from small-scale cleaning and degreasing operations, mixtures of several solvents, and pure laboratory-grade chemicals (acetone, perchloroethylene, cyclohexane, etc.) are common types of waste included in this group. Many of these wastes are considered hazardous because of their ignitable or toxic nature and must be handled accordingly.

The solvent waste stream is a very good candidate for distillation and recovery operations. Nonrecoverable solvent wastes could be incinerated. These wastes have a high heat value and could lead to heat-recovery options or direct fuel utilization. Either option could help reduce the amount of waste destined for an offsite chemical landfill. Recent EPA regulations have prohibited the disposal of bulk ignitable wastes in chemical landfills. However, the majority of ORNL's ignitable wastes are shipped out in small lab-pack quantities (5 gal or less), which are permissible for landfill disposal.

7.2.6 Low-level carcinogenic waste

This waste stream represents a substantial amount of the total hazardous chemical wastes generated annually (32%). The major sources of generation are the synthetic-fuel research programs at the Laboratory and toxicological studies ongoing at ORNL's Biology Division. These wastes, both solids and liquids, contain trace amounts of polycyclic aromatic hydrocarbons (PAHs) (benzopyrene, benzanthracene, etc.) which are known or suspected carcinogens.

Incineration should be considered an ideal means of disposition for this waste. It has been estimated that as much as 89% of the total could be disposed of via this method with the remainder being sent to a chemical landfill.

7.2.7 Acids/bases

A wide variety of acids and bases are used at the Laboratory. Inorganic acids (e.g., hydrochloric, nitric, and sulfuric) are used for routine operations such as metal etching and descaling/demineralizing operations. Occasionally, mixtures of dilute acids will need to be discarded. Most of the acid waste is presently disposed of via the onsite Neutralization Facility, which is part of the Process Waste Treatment System at the Laboratory. Noncontaminated acid wastes are used in the pH adjustment (pH 6–9) of treated waste before its ultimate discharge into White Oak Creek. Alkaline (basic) wastes and chromic and hydrofluoric acids are shipped offsite for disposal.

7.2.8 Reactive wastes

Although these wastes represent less than 0.1% of the total hazardous wastes, they are very important from a safety and disposal standpoint. Many of these materials become unstable with time (isopropyl ether, picric acids, etc.) while others spontaneously ignite on exposure to the atmosphere (alkali metals). An effective management system should track these types of materials from their time of entry onsite, to the individual laboratory where they are used, to disposal. Items with

expired shelf lives must be discarded immediately to minimize personnel risk. At present, most of the reactive chemical wastes are shipped offsite for disposal.

7.2.9 Experimental animals/cage-cleaning wastes

The ORNL Biology Division generates significant quantities of cage-cleaning wastes as part of its research programs. These wastes include cage linings and animal carcasses which potentially contain small quantities of hazardous chemicals. Currently, the linings are being disposed of at the Y-12 Sanitary Landfill and the carcasses at ORNL's SWSA 6. However, EPA has announced its intent to regulate infectious waste under RCRA in the near future. When and if this occurs, cage-cleaning wastes can no longer be disposed of in this manner.

7.2.10 Waste oils

Three categories of waste oils are generated at the Laboratory. These categories are based on the detectable concentrations of PCBs found in the numerous types of oils used.

The noncontaminated oils (<5 ppm of PCBs) are the largest group. These oils are currently analyzed for PCB content and possible organic solvent contamination before being dumped into a 15.9-m^3 (4200-gal) underground storage tank (Fig. 14). Procedures for the management of noncontaminated and contaminated waste oils are contained in the ORNL Environmental Protection Manual (Appendixes B and C). The oil is then sold to an offsite commercial oil-recycling facility.

The PCB-contaminated oil category is further broken down into oils containing >5 ppm but <500 ppm of PCBs and oils with >500 ppm PCBs. Most of these oils are being used as dielectric fluid for electrical equipment (e.g., transformers and capacitors) or in heat exchange systems. Low concentrations of PCBs (>5 ppm) are constantly being detected in waste oils from various sources. Oils with >500 ppm of PCBs are mainly found in PCB transformers and are potential waste streams. However, in a recent survey at the Laboratory, machine shop equipment was also discovered to contain PCB-contaminated fluids, some containing >500 ppm.

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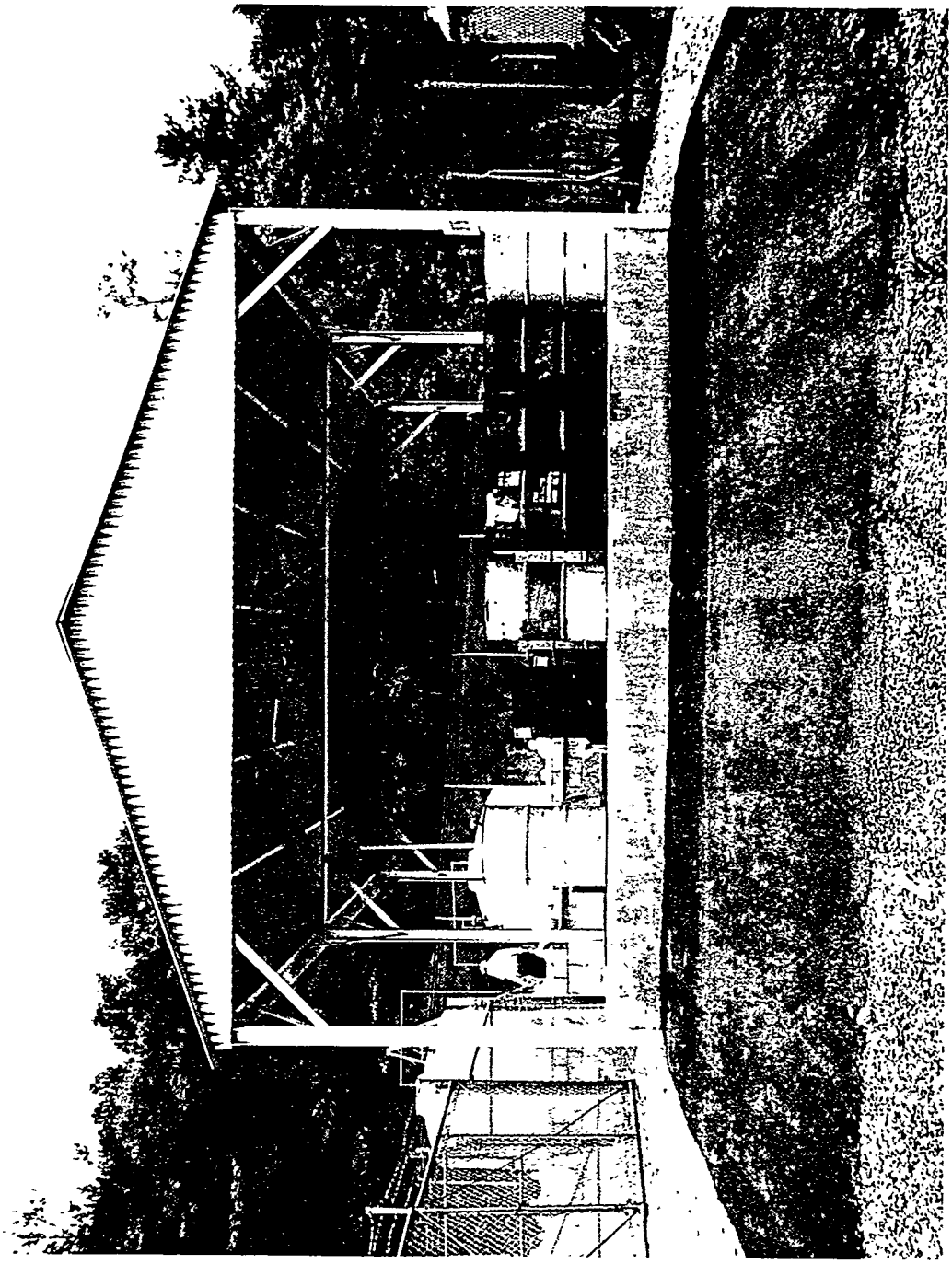

Fig. 14. Noncontaminated Waste Oil Storage Area — 7075.

The PCB-contaminated (>5 ppm) wastes are currently shipped offsite for disposal. Commercial costs for PCB-incineration are quite high and almost certain to increase. At present, there are several incinerators in the United States which have been given approval to operate by EPA. There is also an ocean-going incinerator ship owned and operated by Chemical Waste Management, Inc., which accepts PCB wastes for incineration.

In addition to thermal destruction of PCBs, Sunohio has developed a chemical destruction method known as PCBX. The PCBs in the oil are converted into a salt and inert solids by the process. The PCBX process is portable and can go to the site of the oil, flush the oil out of the system, clean it of PCBs and other contaminants, and return it to the system for reuse.[5]

An incineration facility to dispose of radioactively contaminated polychlorinated biphenyls (PCBs) and other combustible wastes from the DOE Oak Ridge Operations facilities, has been proposed. The final Environmental Impact Statement for the facility was issued in June 1982.[6] This incineration facility could help alleviate the dependence of ORNL on offsite commercial treatment/disposal operations.

7.3 Radioactive Wastes

The radioactive wastes are by far the largest category of waste materials generated at the Laboratory. As stated earlier, this waste is treated, stored, or buried onsite.

7.3.1 Solid waste

Solid radioactive waste is generated by a variety of sources throughout the Laboratory. Depending on the type of radionuclide involved, it is either disposed of in ORNL burial grounds or placed in retrievable storage (Fig. 6).

7.3.2 TRU waste

The transuranic wastes are all placed in onsite retrievable storage areas (Fig. 8).

7.3.3 Liquid waste

Liquid radioactive waste also originates from Laboratory processes. The level of radioactivity in the waste determines its route of treatment and disposal. Low-level wastes go through the process waste system and are ultimately discharged into White Oak Creek. The intermediate-level waste goes through the Intermediate Waste System and ultimately ends up at the Hydrofracture Facility (see Fig. 6).

7.3.3.1 190 Pond System

The 190 Pond System (Fig. 6) consists of two ponds, each having a capacity of 568 m^3 (150,000 gal). The system is batch dumped on an average of once per day. Before dumping, the pond is sampled, and if the radioactivity is above a predetermined level, the water is diverted to the Process Waste Treatment Plant before being discharged into White Oak Creek. If the radioactivity is below the activity level, the pond is dumped directly into White Oak Creek. The approximate flow of water into the 190 Pond System is 454 to 568 m^3 (120,000 to 150,000 gal) per day. The water consists mainly of process water from the Building 4500 area.

7.3,3.2 Equalization Basin 3524

The wastewater treated at the Process Waste Treatment Plant is primarily discharged from laboratory areas where radioactivity may be handled. The sources of radioactivity in the process waste are mainly from evaporator distillate and runoff in contaminated areas. The waste [545 m^3 (144,000 gal) per day] flows intermittently into a 3785 m^3 (10^6 gal) equalization basin; the water in the basin acts as a surge volume to equalize the flow to the Process Waste Treatment Plant (Building 3544, Fig. 6).

The treatment process consists of three operations: filtration where water from the equalization basin is filtered; ion exchange, where the water is passed over resin columns; and pH adjustment before discharge into White Oak Creek.

7.3.3.3 3513 Research Settling Basin

This settling basin is currently inactive as far as routine use is concerned. Its primary function is in serving as a research area for the Environmental Sciences Division in field research and experimentation (Fig. 6).

7.3.3.4 HFIR process waste basin

Most of the nonradioactive wastewater from the HFIR facility is from the secondary system of the cooling tower (Fig. 6). This water flows directly into Melton Branch at the rate of about 757 m^3 (200,000 gal) per day. The pH and conductivity of this water are measured daily. A biocide is added to control microorganisms: sodium phosphate, to control corrosion, and sulfuric acid, to control pH.

Wastewater from sources such as floor drains, demineralizer regeneration operations, filter cleaning activities, and other processes goes into holding basins. Water that is slightly radioactive or suspected of being radioactive is first sent to the 1893-m^3 (500,000-gal) retention ponds and checked for radioactivity before being discharged into Melton Branch. If the alpha or beta activity in the water exceeds 1 count min^{-1} mL^{-1}, a gamma spectrum is taken. Any radioactivity detected is usually that of short-lived activities, which are held for decay to acceptable levels before release into Melton Branch. If the pH is out of the range of 6.5 to 9.0, the water is treated before dumping. The pond is dumped when it reaches one-third capacity. With a flow of 6.3×10^{-4} m^3/s (10 gal/min) into the basin, an annual average of two dumps per month is typical. If excess activity is found, the water is pumped to the process waste system.

7.3.3.5 Transuranium process plant waste basin system

Process Plant Waste System liquid wastes that are susceptible to slight contamination are collected continuously in two 200-m^3 (50,000-gal) earth retention basins (Fig. 6). The basins are periodically sampled and, depending on analytical results, are released into Melton Branch or

pumped into the main ORNL waste facilities in Bethel Valley for treatment and disposal. One basin collects waste while the second is being sampled and emptied.

The following wastes are collected and monitored for beta-gamma radioactivity: process wastes from the laboratory area, decontamination glove-box room, chemical makeup area, transfer area, limited access area (high bay area), operations control room, recirculating cooling water system, process condensate receiver; floor drains in the change rooms, process areas, and air locks; and sink drains in janitors' closets. Radioactivity above a predetermined value activates an alarm on the radiation panelboard in the operations control room.

If significant radioactivity is detected, the flow of the process liquid waste is automatically diverted into the 2000-m^3 (500,000-gal) HFIR surge basin; otherwise, it is discharged into one of the 200-m^3 (50,000-gal) TRU basins.

7.3.4 Oils

Waste radioactive oils currently are stored in an underground tank in SWSA 5. This oil will be injected underground along with other contaminated liquid waste during a hydrofracture injection. The current storage tank has been filled to capacity and waste oils are being stored in 0.21-m^3 (55-gal) drums. To help alleviate this storage problem, a FY81 General Plant Project has been proposed for the installation of one additional tank. To this date, no "hot" injections have been performed at the new Hydrofracture Facility. However, once these injections have begun, additional storage space for the waste oils will become available.

7.3.5 Co-contaminated waste

The major problem area with the radioactive waste category is co-contaminated wastes, that is, low-level radioactive wastes that also contain or consist of RCRA-defined hazardous wastes. These wastes, ~2722 kg (3 tons) annually, are generated by a variety of sources. Scintillation fluid containing radioactive tracers such as ^{14}C and ^{3}H and carcinogenic materials labeled with these same tracers are two prime

examples of this waste stream. Because of current regulations, these wastes cannot be buried, since many are in a liquid state, and cannot be shipped offsite to a radioactive disposal site because of current DOE regulations. With these two options being closed, plus the fact that no onsite treatment or disposal method presently exists, these wastes are now being placed in retrievable storage (Fig. 7).

8. CONCLUSIONS

In a facility such as ORNL where the waste streams are highly diverse, no one waste treatment/disposal method will be the best or most cost-effective. Each waste stream must be examined separately to determine the appropriate plan of waste management. This report has examined each waste stream from the standpoint of characterization and quantification, present management operations and practices, and existing facilities available for storage, treatment, and disposal. Only after priorities have been thoroughly examined can an overall waste management program be formulated to meet present and future requirements.

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Appendix A

ORNL ENVIRONMENTAL PROTECTION PROCEDURE FOR ASBESTOS, EPM 1.0

OAK RIDGE NATIONAL LABORATORY

ENVIRONMENTAL PROTECTION PROCEDURE

UNION CARBIDE

NUMBER	EPM-1.0
DATE	August 1, 1981
SUPERSEDES	Feb. 23, 1979
PAGE	1 of 10

SUBJECT: ASBESTOS

1.0 POLICY

It is the policy of the Laboratory to install, remove, and dispose of asbestos-containing materials in a manner which is safe for personnel and nonpolluting to the environment.

2.0 DEFINITIONS

2.1 Asbestos is a term used for commercially-mined and milled, naturally-occurring, crystalline fibers of the serpentine and amphibole family of minerals. Types of asbestos include chrysotile and the amphiboles (amosite, anthophyllite, crocidolite, tremolite, and actinolite).

2.2 Asbestos material means asbestos or any material containing asbestos. Examples of asbestos that may be observed in ORNL Facilities are pipe insulation, building insulation, furnace insulation, gloves or column fire proofing materials among others.

2.3 Radioactive contaminated asbestos means asbestos material that has been exposed to radioactive contaminants or fission products such as thorium, uranium, or radioactive contaminated oil among others.

2.4 Demolition means the wrecking or taking out of any load supporting structural member and any related removing or stripping of friable asbestos materials.

2.5 Friable asbestos material means any material that contains > 1 percent asbestos by weight that can be crumbled, pulverized or reduced to powder when dried by hand pressure.

2.6 Renovation means the removing or stripping of friable asbestos materials used on any pipe, duct, boiler, tank, reactor, turbine, furnace or structural member. Operations in which load supporting structural members are wrecked or taken out fall under the definition of demolition.

2.7 Removing means the same as renovation (See 2.6).

2.8 Stripping means the same as renovation (See 2.6).

2.9 Asbestos containing waste material means any waste which contains asbestos or asbestos material.

2.10 Structural member means any load supporting member such as beams and load supporting walls or any non load supporting member such as ceilings and non load supporting walls.

2.11 Closed vehicle means a vehicle such as a closed trailer, van or dump truck with a secure tarpaulin.

2.12 Visible emissions mean any emissions which are visually detectable without the aid of instruments and which contain particulate asbestos material.

2.13 Clean-up means the pickup of loose asbestos that has crumbled due to age deterioration (i.e. loose asbestos on attic floor) and not associated with a demolition or renovation project.

3.0 PERTINENT REGULATIONS

Federal regulations that apply to this procedure are contained in
(1) Title 40, Code of Federal Regulations, Part 61, Subpart B, National Emission Standards for Asbestos and;
(2) Title 29, Code of Federal Regulations Part 1910, Subpart Z, Section 1910.1001 OSHA Standards for Asbestos.

Regulations are available from the ORNL Department of Environmental Management (DEM) Building 4500-south, Room G-260, telephone 4-6670.

4.0 RESPONSIBILITIES

4.1 Supervisor or Project Manager or Project Engr.

4.1.1 Submits completed Form UCN-13385 (Figure 1) and Form UCN-13386 (Figure 2) to the DEM if the project involves demolition or renovation.

Note: If the project is simply a cleanup, only Form UCN-13386 is required. (See 6.1.1 and 6.1.2 for scheduling requirements)

4.1.2 Ensures that no work is started on any part of the project in which material containing asbestos is involved until approval has been received from the DEM.

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Figure 1

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

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

UCN 13365
(3 2 79)

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Figure 2

REQUEST FOR THE DISPOSAL OF ASBESTOS OR MATERIAL CONTAINING ASBESTOS

REQUESTER COMPLETES

DATE | REQUESTER | ORIGIN OF WASTE (BLDG.)

REQUESTER'S SIGNATURE | PHONE NO. | ROOM NO. | BLDG. NO.

ACCOUNT NO. | TOTAL VOLUME (CU. FT.) | 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 DR 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

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4.1.3 Ensures the protection of employees from exposure to asbestos fibers as set forth in the Industrial Hygiene Department procedure. (IH-1.10 at ORNL and Biology Division at Y-12 and HS-70-057 at Y-12 except Biology Division).

4.1.4 Ensures that the material is packaged according to the instructions in 6.0 Disposal Procedures.

4.1.5 Notifies the landfill operator after approval has been granted, (ORNL 4-7044; Y-12 4-0466) that material containing asbestos is being shipped to the landfill.

4.1.6 Ensures that the material is transported to the landfill in a closed vehicle (see Definitions 2.11).

4.1.7 Notifies the appropriate Industrial Hygiene Department by telephone [(X-10 Site, 4-6165); (ORNL Facilities at Y-12 at 4-1590)] before any work involving asbestos material is started.

4.2 Landfill (Burial Ground) Operator

4.2.1 Checks the documentation of the shipper.

4.2.2 Checks for proper packaging.

4.2.3 Prepares and signs the second part of Form UCN-13386 and sends it to the DEM (G-260, 4500S).

4.2.4 Ensures that an adequate liner is placed in the trench.

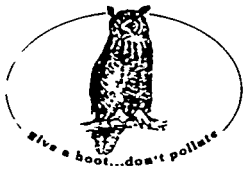
4.2.5 Ensures that proper signs are placed at the disposal site.

4.2.6 Covers the disposal material promptly (by end of work day).

4.3 Department of Environmental Management (DEM)

4.3.1 Numbers and signs Forms UCN-13385 (Fig. 1) and 13386 (Fig. 2) if project involves demolition or renovation. Numbers and signs Form UCN-13386 if the project is merely a cleanup operation.

4.3.2 Notifies the Environmental Protection Branch of DOE-ORO.



4.3.3 Reviews and updates procedures as needed.

4.3.4 Sends a copy of Form UCN-13385 to the Industrial Hygiene Department. (ORNL Facilities at Y-12 send copy to Y-12 Industrial Hygiene Department.)

4.3.5 Notifies the project manager or supervisor of demolition or construction approval.

4.3.6 Inspects the disposal site quarterly.

4.3.7 Prepares the third part of Form UCN-13386.

4.3.8 Keeps records on the total inventory of asbestos that has been disposed of during the calander year.

4.3.9 Submits quarterly report to DOE-ORO.

4.3.10 Retains record copy of Form UCN-13385 and UCN-13386.

4.3.11 Coordinates and documents DOE, EPA and/or state inspections.

4.4 Industrial Hygiene Department (IHD)

Assists in the protection of employees from exposure to asbestos fibers. (See Procedure (IH-1.0 or H&S 70-057 for ORNL facilities at Y-12.) [ORNL (4-6165) and Y-12 (4-1590)]

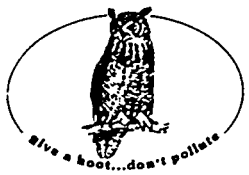
5.0 HEALTH PROTECTION PROCEDURES

Procedures for employee health protection that have been prepared by the ORNL Industrial Hygiene Department (IH-1.0) and by the Y-12 Industrial Hygiene Department H&S 70-057) shall be strictly adhered to.

The following criteria are given as general guidelines:

5.1 Personnel performing work in asbestos areas must use suitable respiratory protection.

5.2 The asbestos area must be posted with warning signs and segregated from personnel other than those performing work with asbestos to avoid asbestos exposure.



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5.3 Prior to performing the work, personnel must be informed of the requirements for handling asbestos and the hazards from asbestos exposure.

5.4 To the extent practicable, all operations are to be conducted in a wetted condition. Use of surfactants to improve wetting should be considered.

5.5 Protective clothing must be worn by personnel performing work in the segregated area.

5.5.1 Protective clothing with visible asbestos fibers must be removed when leaving the segregated area.

5.5.2 Washable protective clothing must be placed in water-soluble bags, sealed, and suitably labeled at the end of the workday for transport to the laundry.

5.5.3 Disposable protective clothing must be placed in plastic bags, sealed, and suitably labeled at the end of the workday for transport to the designated disposal area.

5.6 In the segregated area, any dry, loose asbestos material must be removed by vacuuming; and wetted materials on the floors or surfaces must be cleaned up. All waste materials must be suitably bagged and labeled.

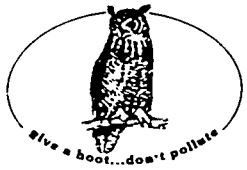
5.7 All material removed must be wetted, double-bagged in plastic, sealed, suitably labeled, and disposed of in accordance with Item 6.0, Disposal Procedures.

5.8 Materials (i.e., pipes, ducts, structural members, etc.) that are covered with asbestos must not be dropped or thrown to the ground but must be carefully lowered to ground level.

5.9 Smoking, eating, or drinking will not be permitted in the segregated work area.

5.10 Personnel working with asbestos should shower at least at the end of the workday.

5.11 Any questions or proposed deviations from these criteria shall be addressed to the appropriate IHD.



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6.0 DISPOSAL PROCEDURES

6.1 Written notices must be given to the DEM before any work may be performed which involves demolition or renovation of friable asbestos material anywhere at ORNL (X-10 Site and ORNL facilities at the Y-12 Site, See 6.1.1 and 6.1.2 below).

6.1.1 Written notification (Form UCN-13385) must be given to the DEM at least 10 days prior to beginning work on any project when more than 80 m (260 ft) or more than 15 m^2 (160 ft^2) of asbestos material is to be removed.

6.1.2 Written notification (Form UCN-13385) must be given to the DEM at least 3 days prior to beginning work on any project when less than 80 m (260 ft) or less than 15 m^2 (160 ft^2) of asbestos material is to be removed.

6.2 Once DEM notification has been made, projects must not be started until approval has been received from the DEM.

6.3 Notification will be made to the Environmental Protection Branch of DOE-ORO by the ORNL DEM.

6.4 Upon approval, written notification will be given by the DEM to the project manager or supervisor responsible for the project.

6.5 The initiator of emergency jobs involving asbestos work must notify the DEM and IHD as soon as practicable prior to the start of the job.

6.6 The initiator of emergency jobs involving asbestos work must on off-shifts notify the installation Shift Superintendent's Office, who shall in turn notify the DEM and IHD the following day.

6.7 During the removal operation, a fine, low-pressure water spray must be used to wet down the material. The material should be saturated with water before being placed in a plastic bag.

6.8 On removal, the material should not be allowed to fall but should be placed immediately in 8-mil polyethlene plastic bags which are double-sealed at the bottom. These bags can be purchased through ORNL Stores; the catalogue number is 15-005-0865 for 15- by 9-in. bags, 15-005-0915 for 30- by 20-in. bags, and 15-005-1025 for 64- by 64-in. bags.

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6.9 The first plastic bag should then be placed in a second bag and sealed and labeled with the following warning (Form UCN-10781):

CAUTION
CONTAINS ASBESTOS FIBERS -
AVOID CREATING DUST - BREATHING
ASBESTOS DUST MAY CAUSE SERIOUS
BODY HARM

* Note Labels are available from ORNL & Y-12 Stores and G-260 4500S

6.10 Transportation of asbestos must be in closed vehicles (See Definitions 2.4).

6.11 The shipper must complete the top part of the asbestos disposal form, UCN-13386.

6.12 The landfill operator should not dispose of any asbestos waste until the following requirements are met:

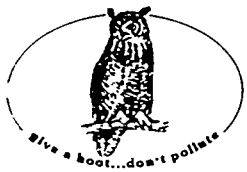
6.12.1 The shipper shows documentation that the waste came from an approved project.

6.12.2 The material is packaged and transported according to the procedure in this section.

6.13 The landfill operator should complete and sign the lower part of disposal form UCN-13386 and mail to the DEM.

6.14 All landfill sites to be used for asbestos wastes should be selected so as to prevent horizontal and vertical migration of contaminants to ground or surface waters. This selection of sites will be made by the DEM with the assistance of the Environmental Sciences Division. In cases where geologic conditions may not reasonably ensure this, an impervious liner approved by DEM should be used to ensure long-term protection to the environment. Final site approval will be given by DEM.

6.15 Warning signs must be placed along the perimeter of the disposal site. The landfill will be restricted to asbestos-containing materials only. The warning signs should be 20- by 14-in., upright-format signs as specified in 29 CFR 1910.145(d)(4). The signs are to display the following legend with letter sizes and styles of a visibility at least equal to those specified in this paragraph.



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(LEGEND)
ASBESTOS WASTE DISPOSAL SITE
DO NOT CREATE DUST
BREATHING ASBESTOS IS HAZARDOUS
TO YOUR HEALTH

Note: First line - 1-in. Sans Serif, Gothic or Block type
Second line - 3/4-in. Sans Serif, Gothic or Block type
Third and fourth lines - 14 point Gothic type spacing between lines should be at least equal to the height of the upper two lines.

6.16 At the end of each disposal operation, the asbestos-containing waste material is to be covered promptly (end of work-day) with at least 6 in. of consolidated earth or other suitable material capable of forming a seal to prevent subsequent dispersal of dust. No asbestos waste is to be left uncovered at the end of the working day.

6.17 Site will be inspected at least once a quarter by DEM staff.

6.18 Inspection report will be written by Staff and record copies kept in DEM files.

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Appendix B

ORNL ENVIRONMENTAL PROTECTION PROCEDURE
FOR OILS (NON-PCB), EPM 2.0

OAK RIDGE NATIONAL LABORATORY

ENVIRONMENTAL PROTECTION PROCEDURE

UNION CARBIDE

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SUBJECT: OILS (NON-PCB)

1.0 POLICY

It is the policy of the Laboratory to require that all oily substances be handled and disposed of in a manner that protects the environment and personnel from harm.

2.0 SCOPE

This procedure comprises general guidelines for handling, storing, using, transporting and disposing of liquid materials such as oils, coolants, cutting fluids and oils, and special mop solutions which have a flash point greater than 100°F (37.8°C). Liquid saturated solids (i.e., oily rags, oily blotter paper and mops) are included within the scope of this procedure.

3.0 PERTINENT REGULATIONS AND GUIDELINES

3.1 Federal regulations that apply to this procedure are contained in Title 40, Code of Federal Regulations as required by DOE. The Water Pollution Control Act Regulations and the ORNL Spill Prevention, Control, and Countermeasure Plan are available for review from the Department of Environmental Management, Building 4500-south, Room G-260, Telephone 4-6670. Federal regulations are also available at the Central Research Library-Reference Desk.

3.2 National Fire Protection Association Flammable and Combustible Liquids Code (NFPA 30-1981) especially Chapter 4.

4.0 DEFINITIONS

4.1 Coolants: A fluid other than water used to remove heat.

4.2 Cutting Fluids: Any fluid applied to a cutting tool to assist in cutting, cooling, or lubricating operations.

4.3 Cutting Oils: A cutting fluid composed either entirely of oil or of oil and additives which are usually oil soluble.

APPROVED BY: C. C. Hopkins

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SUBJECT:
OILS (NON-PCB)

4.0 DEFINITIONS (cont'd)

4.4 Oils: Any substance of the numerous mineral, vegetable, synthetic substances, and animal and vegetable fats that are generally slippery, combustible, unctuous, viscous, liquid, or liquefiable at room temperatures; soluble in various organic solvents, but not in water; and used in a great variety of products especially lubricants and fuels. This includes petroleum and all petroleum derivatives, such as machine oils and lubricants.

4.5 Cleanness: Oil containing an insignificant amount of hazardous material.

4.6 Oil-Containing Liquids: Liquid contaminated with or containing oil.

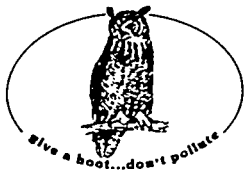
4.7 Oily Materials: Oils, coolants, cutting fluids, oil-containing liquids and solids, and special mop solutions.

4.8 Oil-Containing Solids: Solids contaminated with or containing oil.

4.9 Special Mop Solutions: Mop water that is collected during the mopping of floors that have oils or oily substances on them.

4.10 Flash Point means the temperature at which a liquid gives off vapor in sufficient concentration to form an ignitible mixture with air near the surface of the liquid with the liquid contained in the vessel.

Generally, the flashpoint of a substance is a few degrees below the fire point since at the flashpoint temperature the vapors are not being generated fast enough to sustain combustion.



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D. DEFINITIONS (CONT'D)

4.11 Combustible liquid means a liquid having a flash point at or above 100°F (37.8°C)

Combustible liquids are subdivided as follows:

Class II liquids include those having flash points at or above 100°F (37.8°C) and below 140°F (60°C)

Class III A liquids include those having flash points above 140°F (60°C) and below 200°F (93.4°C)

Class III B liquids include those having flash points at or above 200°F (93.4°C)

4.12 Flammable liquid means a liquid having a flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 pounds per square inch (absolute) at 100°F (37.8°C)

Note: The Resource Conservation & Recovery Act uses the term ignitable and defines the term as any liquid having a flash point below 140°F (37.8°C).

5.0 RESPONSIBILITIES

5.1 Division Director

Ensures necessary indoctrination of division personnel for compliance with procedures for handling, storing, and disposing of oil-containing liquid and solid waste.

5.2 Generating Group

5.2.1 Ensures minimum generation of oil-containing waste where feasible by reduction of fluid used, elimination of duplicate fluids, usage of biodegradable products, filtration and recycle of fluids, and reduction of unnecessary changeout of fluids.

SUBJECT: OILS (NON-PCB)

5.2.2 Initiates programs to reduce and segregate the volume of oily liquids and solids that are generated.

5.2.3 Provides proper containers (preferably 55-gal drums) as required for segregated collection and storage of waste oil material that is awaiting pickup or transfer for disposal. Round bottom drums should not be used. Contacts the Finance and Materials Division Salvage and Reclamation representative (telephone 4-5520) for drums.

Table 1(1)

Maximum Allowable Size of Containers and Portable Tanks

	Flammable Liquids			Combustible Liquids	
Container Type	Class IA	Class IB	Class IC	Class II	Class III
Glass	1 pt	1 qt	1 gal	1 gal	5 gal
Metal (other than DOT drums) or approved plastic	1 gal	5 gal	5 gal	5 gal	5 gal
Safety Cans	2 gal	5 gal	5 gal	5 gal	5 gal
Metal Drum (DOT Spec.)	60 gal	60 gal	60 gal	60 gal	60 gal
Approved Portable Tanks	660 gal	660 gal	660 gal	660 gal	660 gal
Polyethylene DOT Spec. 34, or as authorized by DOT Exemption	1 gal	5 gal	5 gal	60 gal	60 gal

SI Units: 1 pt = 0.473 L; 1 qt = 0.95 L; 1 gal = 3.785 L.
(1) From NFPA 30 - Chapter 4

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E. RESPONSIBILITIES (CONT'D.)

5.2.4 Stores liquid waste containers in a manner suitable to preclude volume increases that result from precipitation or unauthorized disposals. Also, leaves two to three inches at the top of drums to allow for expansion.

5.2.5 Obtains written approval from the Fire Department (telephone 4-6277) before storing oil drums or containers.

5.2.6 Samples potentially radioactive-contaminated oil and has analyzed for gross alpha and beta activity and scanned for gamma emitters by the Analytical Chemistry Division. If oil contains radioactivity, the form Request For Storage Or Disposal Of Radioactive Solid Waste Or Special Materials (UCN-2822) (See page 6) should be completed and sent to the Department of Environmental Management (DEM). Be sure to include the analysis and scan data on the form. Once the form has been approved by DEM, the oil should be sent to the ORNL burial grounds for storage.

5.2.7 Requests a representative of Health Physics Department to complete an H.P. Material Transfer Clearance Tag (UCN-14) for each drum of oil-containing waste to preserve identity.

5.2.8 Obtains identification and specifications for oily material waste or provides chemical analysis (e.g. PCB analysis) and technical data as requested for identification of material and for determination of an acceptable disposal method.

5.2.9 Attaches the form Waste Oil/Oily Sludge (UCN-13459) (ORNL Stores 10-966-7297; see page 7 for a sample form) to each drum of oil-containing waste to preserve identify.

5.2.10 Completes Part I of the form Request For Disposal Of Oil (NON-PCB) Material (UCN-13553) (See page 8) and sends the form with the drum to be disposed.

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REQUEST FOR STORAGE OR DISPOSAL OF RADIOACTIVE SOLID WASTE OR SPECIAL MATERIALS

REQUESTER: EXECUTES THIS SECTION BEFORE ARRANGING MATERIAL TRANSFER

DATE	ORIGIN OF WASTE BLDG (IF ORNL)	REQUESTER'S SIGNATURE	BADGE NUMBER	PHONE NO	OFFICE AND BLDG NO	ACCT NO

TOTAL VOLUME CU FT	COMBUSTIBLE VOL CU FT	WEIGHT (LBS)	ACCOUNTABILITY NM NUMBER	TOTAL CURIES IN WASTE (BEST ESTIMATE)

WASTE CLASSIFICATION (CHECK ONE)

1 ☐ TRU OR ^{233}U (> 10 μ Ci / Kg)
☐ TPU OR ^{233}U (≤ 10 μ Ci / Kg or less)
2 ☐ URANIUM/THORIUM
3 ☐ FISSION PRODUCT
4 ☐ INDUCED ACTIVITY
5 ☐ TRITIUM
6 ☐ BETA-GAMMA TRU OR ^{233}U (> 10 μ Ci / Kg)
☐ BETA-GAMMA TRU OR ^{233}U (≤ 10 μ Ci / Kg or less)
7 ☐ ALPHA
8 ☐ OTHER _____

TYPE OF WASTE (CHECK ONE)

1 ☐ BIOLOGICAL (BI)
2 ☐ CONTAMINATED EQUIPMENT (CE)
3 ☐ DECONTAMINATION DEBRIS (DD)
4 ☐ DRY SOLIDS (DS)
5 ☐ SOLIDIFIED SLUDGE (SS)
6 ☐ NOT CLASSIFIED (NC)

CONTAINER(S) IDENTIFICATION (INDICATE NUMBER OF EACH)

1 ☐ 55 GAL SS DRUM
2 ☐ 30 GAL SS DRUM
3 ☐ 4½ WALL CONCRETE CASK
4 ☐ 6 IN WALL CONCRETE CASK
5 ☐ 12 IN WALL CONCRETE CASK
6 ☐ 55 GAL BI DRUM
7 ☐ 30 GAL BI DRUM
8 ☐ WOOD OR ☒ METAL BOX
9 ☐ OTHER
10 ☐ GI CAN
11 ☐ PLASTIC
12 ☐ DUMPSTER
13 ☐ NONE
14 ☐ SHIELDED CARRIER

CARRIER DATA
WALL THICKNESS _____ IN. SHIELDING MATERIAL _____ CAVITY DIMENSIONS _____ X _____ X _____ X HIGH

PRINCIPAL ISOTOPE'S BEST ESTIMATE
1 QUANTITY _____ ☐ GRAM(S) ☐ CURIE(S) IDENTITY _____
2 QUANTITY _____ ☐ GRAM(S) ☐ CURIE(S) IDENTITY _____
3 QUANTITY _____ ☐ GRAM(S) ☐ CURIE(S) IDENTITY _____
4 QUANTITY _____ ☐ GRAM(S) ☐ CURIE(S) IDENTITY _____

REQUESTER'S COMMENTS FOR THOSE HANDLING WASTE IN FIELD

HEALTH PHYSICIST: EXECUTES THIS SECTION BEFORE MATERIAL TRANSFER

RAD AT ON DATA
BETA-GAMMA FOR PACKAGE _____ mrem/hr @ _____ IN OR FOR SHIELDED CARRIER _____ mrem/hr @ _____ IN
SURFACE CONT _____ dpm (β-γ), _____ dpm (α) NEUTRON READING _____ mrem/hr
HP SURVEYOR'S COMMENTS FOR THOSE HANDLING WASTE IN FIELD

	HP'S SIGNATURE	PHONE NO

STORAGE AREA FOREMAN: COMPLETES AND SENDS COPY TO ORIGINATOR AFTER HANDLING WASTE

ACTION TAKEN CHECK ONE
WASTE WAS ☐ STORED ☐ BURIED ☐ COMPACTED ☐ OTHER _____ LOCATION SWSA NO _____ DATE _____

FACILITY ☐ BLDG NO ☐ WELL ☐ RAVINE WASTE DESCRIPTION _____ FACILITY NUMBER _____ SWSA ATN _____
Check One ☐ TRENCH ☐ ON GROUND ☐ OTHER

LOCATION WITHIN FACILITY
FED _____ FLT _____ COMP NO _____ LAYER _____ FILE _____ RANK _____

FISSILE WASTE DATA
WELL FULL ☐ YES ☐ NO CRITICALITY COMMITTEE APPROVAL FOR _____ GRAMS BALE NO _____

COMMENTS FROM AREA FOREMAN REGARDING WASTE AND OR OPERATION

FOREMAN'S SIGNATURE _____

DISTRIBUTION WHITE STORAGE AREA FOREMAN RETAINS
BLUE COMPLETED AND RETURNED TO ORIGINATOR
CANARY RETAINED BY ORIGINATOR

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WASTE OIL/OILY SLUDGE

TYPE _____
(INDICATE OIL CODE, SOLVENT TYPE, ETC.)

FROM BUILDING NO. _____

SHIPPED BY _____
(EMPLOYEE NO.)

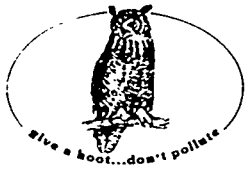
CONTAMINATED WITH:

☐ WATER

☐ OTHERS _____
(MATERIAL)

DATE FILLED _____

(Color Key: X-10 green; Y-12 blue; K-25 red)



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SUBJECT OILS (NON-PCB)

REQUEST FOR THE DISPOSAL OF OIL (NON-PCB) MATERIAL

REQUESTER COMPLETES

DATE	REQUESTER		ORIGIN OF WASTE (BUILDING)	
REQUESTER'S SIGNATURE		PHONE NO.	ROOM NO.	BUILDING NO.
ACCOUNT NO.	TOTAL VOLUME (GAL.)		TYPE OF OIL	

SALVAGE AND RECLAMATION FOREMAN COMPLETES AND SENDS TO THE OFFICE OF ENVIRONMENTAL COORDINATOR

☐ SOLD ☐ Y-12 ☐ STORED ☐ OTHER

LOCATION

DATE

WAS OIL DRUMMED ACCORDING TO PROCEDURE? ☐ YES ☐ NO

IF NO, WAS MATERIAL SENT BACK? ☐ YES ☐ NO

WAS DRUM (S) LABELED ACCORDING TO PROCEDURE? ☐ YES ☐ NO

COMMENTS FROM SRF FOREMAN REGARDING OIL OPERATION

	FOREMAN'S SIGNATURE	DATE

OFFICE OF ENVIRONMENTAL COORDINATOR COMPLETES

WAS OIL RADIOACTIVE? ☐ YES ☐ NO

RESULTS OF ANALYSIS

WAS THIS GROUP INSPECTED? ☐ YES ☐ NO

COMMENTS FROM OFFICE OF ENVIRONMENTAL COORDINATOR

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SUBJECT: OILS (NON-PCB)

5.3 Finance and Materials Division (F&M) or Y-12 Waste Coordinator

5.3.1 Assists the Generating Group in disposal of liquid and solid oil waste.

5.3.2 Verifies proper identification and labeling of containers used to store and transport oil-containing waste within the Laboratory or Plant.

5.3.3 Follows disposal guidelines given in this procedure or as approved by the DEM.

5.3.4 Coordinates and establishes procedures for the operation of storage, transfer, and disposal facilities operated by the division to comply with methods approved by the DEM.

5.3.5 Maintains current documentation on oil-bearing liquid and solid waste pickup, storage, and disposal.

5.3.6 Completes Part II of Form UCN-13553 and mails to the DEM.

5.3.7 Ensures that Laboratory stores has a stock of oil clean-up materials.

5.3.8 Notifies DEM when final disposal of each lot of oil has been completed and identifies the UCN-13553 forms covering disposal of these lots.

5.4 Department of Environmental Management (DEM)

5.4.1 Reviews engineering design for new handling and disposal facilities for compliance with environmental regulations.

5.4.2 Approves storage and collection facilities, disposal methods, and disposal sites to be used for oil-containing wastes.

SUBJECT. OILS (NON-PCB)

E. RESPONSIBILITES (CONT'D)

5.4.3 Monitors around oil-waste disposal facilities to ensure compliance with regulations and to minimize the risk of insult or injury to the environment.

5.4.4 Specifies approved disposal methods and sites for each oil-bearing liquid or solid waste.

5.4.5 Provides written certification of cleanness for each lot of waste oil to be offered for public sale.

5.4.6 Completes part three of Form UCN-13553.

5.5 Plant and Equipment Division (P&E) or Y-12 Waste Coordinator

5.5.1 Provides labor and equipment for transport and disposal in accordance with established procedures.

5.5.2 Ensures that the following equipment is available during the draining or filling of transformers: bung-type 55 gal. (ORNL Stores #02-089-6350) drum for liquid-waste material open-top 55 gal. (ORNL Stores #02-089-6400) drum for solid-waste material, rags and absorbent. Any pump that is used must be in good condition (non-leaking) and only a hydraulic hose may be used for any oil pumping operation.

5.6 Engineering Division

5.6.1 Designs waste oil storage and disposal facilities as required to meet Laboratory needs and current UCC-ND guidelines. (See Chapter 4 of NFPA 30 - Flammable and Combustible Liquids Code)

5.6.2 Ensures that construction groups are informed of procedures for handling, storing, and disposing of oil-containing waste.

5.7 Analytical Chemistry Division

Provides analysis on samples submitted and collects sample residue for approved disposal.

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E. RESPONSIBILITIES (CONT'D)

5.8 Industrial Hygiene Department

Provides guidance and any necessary monitoring for personnel protection in regard to safe handling and disposal of oil.

5.9 Health Physics Department

Provides health physics services in the transfer and appropriate tagging oil-containing drums.

5.10 Fire Department (ORNL Fire Dept. at X-10 site; Y-12 Fire Dept. for ORNL at Y-12)

Reviews and approves the location method and design for storage and disposal of oil-bearing waste.

5.11 Industrial Safety Department (ORNL IHD at X-10 site and Biology Division at Y-12; Y-12 IHD for all ORNL Facility at Y-12 except Biology)

Reviews and approves the method and design for storage and disposal of oil-bearing waste.

6.0 PROCEDURE

6.1 If there is any likelihood that the oil, coolant, etc., may be contaminated with radioactivity, the substance shall be checked by the area health physicist.

6.2 If containers that are not green taggable by the Health Physics Department, samples of the material should be taken by the generating group and analyzed for gross alpha and beta activity and scanned for gamma emitters by the Analytical Chemistry Division. If the specific activity is within limits, a green tag may then be issued by health physics.

6.3 The receiving stations for analytical chemistry work are as follows:

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PROCEDURE (CONT'D.)

6.3.1 For samples that do not require measurements of radioactivity:

General Analysis Laboratory,
Building 4500S, Room S-154
Telephone 4-4893

6.3.2 For samples that require measurements of radioactivity:

Low-Level Radiochemical Analysis Laboratory,
Building 4500S, Room F-64,
Telephone 4-4910

6.4 If oil contains radioactivity then Form UCN-2822 should be completed and sent to the DEM. Once Form UCN-2822 has been approved, the oil will be shipped to the ORNL burial grounds for storage.

6.5 If the material does not contain radioactivity, then it should be separated by the different liquids: oils (e.g., crankcase oils, machine oils, etc.), gasoline, kerosene, animal and vegetable oils, coolants, and special mop solutions. Liquids shall be sealed in leak-proof, non-returnable 55 gal. drums (bung top only). Solids can be in containers with open tops with sealed lids.

6.6 If containers are not available, the F&M Division Salvage and Reclamation representative should be notified (telephone 4-5520).

6.7 Each drum must have a completed label, Form UCN-13459 (ORNL Stores #10-996-7297) and tag, Form UCN-14.

6.8 Each generating group will be responsible for completing Form UCN-13459 with the following information:

SUBJECT: OILS (NON-PCB)

PROCEDURE (CONT'D.)

a. Type of oil (see Table 2, for different classifications.)

b. Building or area where waste oil was generated.

c. Name of person who shipped the oil or is responsible for area in which the oil was generated.

d. Non-oil additives.

e. Completion date of form.

Table 2. Lubricants and cutting coolants

Series description	Use
A - Premium grade petroleum oil, straight, uninhibited	A/C and refrigeration compressors, electrical insulation, quencing oil in heat treating, high temperature baths and mechanical vacuum pumps.
B - Premium grade turbine oil, inhibited (3A-3U)	Journal and Roller Element bearings, turbines, hydraulic systems, gears (except hypoid) under nonshock and light to medium load conditions.
C - Premium grade petroleum oil, inhibited, strong extreme pressure	Industrial gears subject to severe shock loading, worn and hypoid gears, open gears, power transmission chains, wire rope subject to heavy-duty service, automotive and truck gears, vertical and horizontal slideways, apron gears, guides and rails of machine tools in heavy-duty precision service.

SUBJECT: OILS (NON-PCB)

PROCEDURE (CONT'D.)

Table 2. (continued). Lubricants and cutting coolants

Series description	Use
D - Petroleum, inhibited, mild EP	Steam cylinders, industrial gears under moderate shock loading, wire rope, spindle oil high speed journal and roller element bearings, turbines, hydraulic systems, small electric motors, office machines, dial indicating and recording instruments.
E - Petroleum, inhibited, high detergent dispersant crackcase oil	Automotive, truck, tractors, and heavy equipment, engines, and diesel engines with or without spark ignition and automatic transmission fluid.
F - Cutting coolants, water type, water soluable preformed chemical emulsion, petroleum base, emulsible water base chemical-type machine fluid.	General purpose grinding and machining of ferrous and nonferrous metals and heavy duty application.
G - Cutting coolants, non-water type, non-emulsible cutting coolant	General purpose metal machining use with carbide tipped and high speed cutting tools for coring, drilling, grinding, milling, turning, including screw machining, small high speed diamond point drilling in carbon steels and in forming of nonferrous metals such as aluminum and magnesium. Fine finish high accuracy grinding of hardened steels, heavy-duty machining of high alloy and stainless steel, including iron base heat resistant and super alloys. Fire resistant and EP.

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PROCEDURE (CONT'D.)

Table 2. (continued). Lubricants and cutting coolants

Series description	Use
H - Synthesized fluids, covers an application requiring fire-resistance properties.	Hydraulic systems, vane-type pumps, elevators, electrical transformers.
I - Speciality Items, Miscellaneous	Penetrating oil for frozen nuts, bolts, and leather conditioner.
J- Speciality Items, Electrical	Hydraulic applications under extreme temperature variations, hydraulics dashpot, circuit breakers, electrical potting and lubricating applications.
K - Solid lubricants, dry powder Molybdenum disulfide	Slides, cams, locks, hinges, instruments, anti-seize compound, splines.
L - Solid libricants, concentrates, Molybdenum disulfide	Slides, points, ways, guides, tapping, bearings, galling, seizing, cams, splines, tapers, wedges.
M - Solid lubricants, bonded coating, Molybdenum-disulfide graphite powder	Louver bearings, joints, slides, cams, valve stems, chains, small gears.
N - Solid lubricants, greases	Shaft bearings, gears, slides, dies, cams, splines, punches.
O - Solid lubricants, dispersions. These lubricants cover a dispersion of graphite in petroleum oil for lubrications and penetrating applications.	Small gears, screws, bearings, valve stems, bolts, nuts, splines, joints.

SUBJECT: OILS (NON-PCB)

PROCEDURE (CONT'D.)

Table 2. (continued). Lubricants and cutting coolants

Series description	Use
P - Vacuum Fluids, synthetic silicone and hydracarbon fluids.	Diffusion pumps, ultra-high vacuum systems, optical equipment, fractionating pumps.
Q - Vacuum greases	Stopcock vacuum applications, bell jars, valves, joints.
R - Greases and automotive miscellaneous	Chassis, wheel bearings, water pumps, cams, brake fluid.
S - Radiation items, greases and oils	Radiation applications.
T - Greases, general multi-purpose	Roller element bearings, chassis, water resistance gears, universal joints, cams, high temperatures, sealed-for-life bearings and subtemperatures.
U - Greases, general multi-purpose full EP	Roller element bearings, and packings, universal joints, cams slides, journal bearings, water pumps.
V - Greases, valves	Valves subjected to acids, alkalines, alcohol, chlorine, gasoline, steam, natural gas and hot caustics.
W - Greases, synthesized	Roller element bearings, high speed, high temperature, low temperature, precision bearings.
Z - Lubricants, spare parts	Air conditioning system filters.

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PROCEDURE (CONT'D.)

6.9 Each generation group should fill the drum as completely as possible before requesting disposal; however, two or three inches should be left at the top for expansion.

6.10 Both bungs in the closed-top drums will be tightened by wrench rather than by hand.

6.11 Where large quantities of waste oils are generated, drums should be palletized (4 drums per pallet). Palletized drums of waste oil will be picked up by P&E Division riggers (telephone 4-4218) and transported to the Salvage and Reclamation Facility.

6.12 Single or unpalletized drums will be picked up by members of the P&E Division (telephone 4-4228) and delivered to the Salvage and Reclamation Facility. A two-wheel drum dolly should be used in the handling of single drums.

6.13 Large quantities can be picked up with tanker trucks and transported to the Salvage and Reclamation Facility.

6.14 If less than 55 gal must be disposed of, the Salvage and Reclamation Facility (telephone 4-5520) should be called for instruction. (See Table 1)

6.15 Drums awaiting disposal or ones being used for storage of oil should be stored so that no water will enter the drum.

6.16 No containers other than closed-top 55-gal drums, tanker trucks, or approved containers for liquid waste will be accepted at the Salvage and Reclamation Facility. Drums with sealed lids are permitted for solid oily waste.

6.17 Before the drums or tanker of waste oil are unloaded and/or accepted at the Salvage and Reclamation Facility, a F&M Division representative will inspect the drums or truck to ascertain if the generator has complied with the procedures. If any drums show signs of leakage or have bungs missing or are not labeled, they will be returned to the point where they were picked up.

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SUBJECT: OILS (NON-PCB)

PROCEDURE (CONT'D.)

6.18 When the drums are accepted by the Salvage and Reclamation Facility, a F&M Division employee will transfer the oil from the drums into an underground tank.

6.19 Arrangements for all disposals will be made through the Salvage and Reclamation Facility foreman (4-5520) or Hazardous Materials Coordinator (4-6674).

6.20 Disposal procedures for oily material that have been approved by the DEM are:

6.20.1 Oily cloth and paper will be incinerated at the K-25 site.

6.20.2 Oily absorbent booms will be burned at the ORNL steam plant.

6.20.3 Other oily solids will be land farmed at the K-25 site.

6.20.4 Animal and vegetable fats, coolants, and special mop solutions will be disposed of at the Y-12 site.

6.20.5 Nonradioactive and non-PCB contaminated (<5 ppm) liquid oils will be disposed of by means of on-site public sale. The successful bidder will be responsible for pumping the waste oil from ORNL's tanks.

6.20.6 Radioactive oils will be stored at the ORNL burial grounds (telephone 4-7111).

6.21 The DEM will approve the final disposal of waste oil and will provide written certification of cleanness for each lot of waste oil offered for public sale.

6.22 Any questions that should arise on the disposition of used oils should be directed to the Salvage and Reclamation Facility (telephone 4-5520).

6.23 No oil shall be disposed of by emptying the liquid into a drain or storm sewer. Oil reaching a waterway represents a reportable spill and must be reported promptly to the DEM. If an oil sheen is noticed on any creek at ORNL, the DEM (telephone 4-6670) must be notified immediately. A procedure for reporting a spill is given in this manual.

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Appendix C

ORNL ENVIRONMENTAL PROTECTION PROCEDURE
FOR PCBs, EPM 4.0

OAK RIDGE NATIONAL LABORATORY

ENVIRONMENTAL PROTECTION PROCEDURE

UNION CARBIDE

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SUBJECT: POLYCHLORINATED BIPHENYLS (PCB)

1.0 POLICY

It is the policy of the Laboratory to handle and store polychlorinated biphenls (PCB) in a manner that will comply with DOE, Environmental Protection Agency (EPA) and other federal regulations.

2.0 SCOPE

This procedure contains guidelines for labeling, handling, storing, transporting, and disposing of PCB.

3.0 DEFINITIONS

3.1 Polychlorinated biphenyls (PCB) are organic chemicals with a formula of $ClC_6H_4C_6H_4Cl$. PCB chemical substances are limited to the biphenyl molecule that has been chlorinated to varying degrees.

3.2 Askarel-Fluids containing PCB are known generically (See Appendix 4.0) as "askarel". Askarel is the generic term for synthetic, nonflammable, insulating and cooling liquids. Table 1 lists the PCB terminology of EPA.

Table I Environmental Protection Agency
PCB Regulation Terminology

Term	Definition	Examples
PCB	Any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees; any combination of substances that contains such a substance	
PCB article	Any manufactured article, other than a PCB container, that contains PCB and whose surface(s) has been in direct contact with PCB	Capacitor, transformers, or other PCB-cooled motors and pumps

APPROVED BY: C. C. Hopkins

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SUBJECT: POLYCHLORINATED BIPHENYLS (PCB)

Table I Environmental Protection Agency
PCB Regulation Terminology (continued)

Term	Definition	Examples
PCB-article container	Any device used to contain (hold) PCB articles or PCB equipment and whose surface(s) has not been in direct contact with PCB	Packages, cans, bottles, bags, barrels, drums, tanks, or other devices
PCB container	Any device that contains (holds) PCB or PCB articles and whose surface(s) has been in direct contact with PCB	Packages, cans, bottles, bags, barrels, drums, tanks, or other devices
PCB equipment	Any manufactured item, other than a PCB container or a PCB-article container, that contains (holds) a PCB article or other PCB equipment	Microwave ovens, electronic equipment, and flouresscent light ballasts and fixtures
PCB item	Any PCB article, PCB-article container, PCB container, or PCB equipment that deliberately or unintentionally contains or has as a part of it any PCB at a concentration of 50 ppm or greater	

Source: Federal Register, Vol. 44, No. 106, Thursday, May 31, 1979.

3.0 DEFINITIONS (Continued)

3.3 A PCB spill is a discharge of sufficient magnitude to give reason to suspect that it has produced, at any point in the surrounding soil, gravel, sludge, fill, rubble, or other land-based substances, a PCB contamination level exceeding 50 ppm.

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SUBJECT: POLYCHLORINATED BIPHENYLS (PCB)

4.0 PERTINENT REGULATIONS AND CODES

4.1 Title 40, Code of Federal Regulations, Part 761 (40 CFR 761) "Polychlorinated Biphenyls" (PCB) [Viewing copies are available at the Department of Environmental Management (DEM), Building 4500-south, Room G-260, and the Central Research Library (CRL)].

4.2 Toxic Substances Control Act (TSCA), Public Law 94-469 (Viewing copies are available at the DEM and CRL).

4.3 Title 49, Code of Federal Regulations, Part 173.346 (49 CFR 173.346), Department of Transportation requirements for transporting PCB material (Viewing copies are available at the DEM and CRL).

4.4 NFPA Flammable and Combustible Liquids Code (NFPA 30-1981)

5.0 RESPONSIBILITIES

5.1 Division Director

Ensures the necessary indoctrination of division personnel for compliance with procedures for labeling, handling, storing, transporting, and disposing of PCB.

5.2 Finance and Materials Division (F&M)

Assists the Department of Environmental Management in the preparation of any required shipping documents for the transportation and disposal of PCB's and/or PCB contaminated materials.

5.3 Engineering Division

Designs dikes and storage facilities as required to meet Laboratory needs and federal regulations.

5.4 Analytical Chemistry Division (AC)

Provides PCB analysis on submitted samples. Samples should be submitted to the General Analysis Laboratory, Building 4500-south, Room S-154.

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SUBJECT: POLYCHLORINATED BIPHENYLS (PCB)

5.0 RESPONSIBILITIES (continued)

5.5 Industrial Hygiene Department (IHD) at X-10 site and IHD at Y-12 for ORNL Facilities at Y-12

Provides guidance and any necessary monitoring to ensure personnel protection during the handling of PCB.

5.6 Plant and Equipment Division (P&E) at X-10 site and Y-12 Waste Disposal Coordinator for ORNL at Y-12

5.6.1 Ensures that all labeling, servicing, draining, decontaminating, and transporting of PCB material is performed as stated in 6.0 of this procedure.

5.6.2 Provides equipment and services to other Laboratory personnel involved in the handling of PCB material.

5.6.3 Dikes all PCB transformers on the power grid as required.

5.6.4 Transports waste material to the proper storage sites.

5.6.5 Ensures that DEM/guidelines set forth under the PCB Interim Measures Program are complied with for all PCB transformers and/or PCB contaminated transformers (>50 ppm).

5.7 Department of Environmental Management (DEM)

5.7.1 Reviews and keeps current with federal laws that will affect PCB handling.

5.7.2 Provides appropriate labels for PCB users.

5.7.3 Inspects PCB transformers for proper diking and containment.

5.7.4 Approves storage facilities for appropriate engineering design.

5.7.5 Keeps appropriate PCB records at ORNL.

5.7.6 Reviews transportation procedures for PCB material.

5.7.7 Approves final disposal techniques for PCB.

SUBJECT POLYCHLORINATED BIPHENYLS (PCB)

6.0 PROCEDURES

6.1 Labeling

6.1.1 PCB and PCB contaminated material must be properly labeled; all storage containers, including not-in-service transformers, must be labeled. Each transport vehicle loaded with more than 45 kg (~99 lb) of PCB in the liquid phase or with one or more PCB transformers must be properly labeled. Further, all in-use PCB transformers, all large PCB capacitors, and all equipment containing small amounts of PCB must be labeled. The following label should be used.

CAUTION

CONTAINS

PCBs

(Polychlorinated Biphenyls)

A toxic environmental contaminant requiring special handling and disposal in accordance with U.S. Environmental Protection Agency Regulations 40 CFR 761—For Disposal Information contact the nearest U.S. E.P.A. Office.

In case of accident or spill, call toll free the U.S. Coast Guard National Response Center: 800:424-8802

Also Contact Tel. No. 574-6669, 8:00 AM - 4:30 PM
574-6606, During Off Hours

PC 6 LABELMASTER CHICAGO, IL 60660

Large PCB label
(M_L)

SUBJECT: POLYCHLORINATED BIPHENYLS (PCB)

6.0 PROCEDURES (continued)

6.1.2 When PCB equipment is too small to accommodate the large PCB label, the following label should be used:

Small PCB Label
(M_S)

6.1.3 Each large, low-voltage capacitor, each small capacitor, and each fluorescent light ballast manufactured between July 1, 1978, and July 1, 1998, that does not contain PCB must be labeled with the following label:

Small No PCB Label

6.1.4 The requirements for labeling PCB-related items are given in Table II.

SUBJECT: POLYCHLORINATED BIPHENYLS (PCB)

Table II Labeling

The following items shall be marked with the large PCB label (M_L); (see p. 5 of 12) when possible. If the PCB article or equipment is too small to accommodate the large label, the small PCB label (M_S) (see p. 6 of 12) should be used.

1. PCB containers.

2. PCB transformers - labeled at time of manufacture, at time of distribution in commerce if not already labeled, and at time of removal from use if not already marked.

3. PCB large, high-voltage capacitors [containing 1.36 kg (3 lb) or more of fluid and operating at 2000 V ac or above] - labeled at time of manufacture, at time of distribution in commerce if not already labeled, and at time of removal from use if not already marked.

4. Equipment containing a PCB transformer or a PCB large, high-voltage capacitor - labeled at time of manufacture, at time of distribution in commerce if not already labeled, and at time of removal from use if not already marked.

5. PCB large, low-voltage capacitors [containing 1.36 kg (3 lb) or more of fluid and operating below 2000 V ac] - labeled at time of manufacture, at time of distribution in commerce if not already labeled, and at time of removal from use if not already marked.

6. Electric motors using PCB coolants.

7. Hydraulic systems using PCB hydraulic fluid.

8. Heat-transfer systems using PCB.

9. PCB-article containers containing articles or equipment that must be marked under provisions (1) through (8) above.

10. Each storage area used to store PCB and/or PCB items.

11. Each transport vehicle shall be marked on each end and each side if it is loaded with PCB containers that contain more than 45 kg (99 lb) of PCB in the liquid phase or loaded with one or more PCB transformers.

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SUBJECT: POLYCHLORINATED BIPHENYLS (PCB)

6.0 PROCEDURES (continued)

6.2 Servicing Transformers

6.2.1 PCB transformers can be serviced until July 1, 1984, provided the dielectric fluid contains less than 500 ppm PCB.

6.2.2 Any servicing of PCB transformers that requires the removal of the transformer coil from the transformer casing is prohibited.

6.3 Decontaminating PCB Containers

6.3.1 The internal surfaces of the container are flushed three times with a solvent containing less than 0.005% PCB chemical substance in which the solubility of PCB is 5% or more by weight.

6.3.2 Each rinse will use a volume of the normal diluent equal to approximately 10% of the PCB container's capacity.

6.3.3 The solvent may be reused for decontamination until it contains 0.005% PCB chemical substance (Verified by Analytical Chemstry Division).

6.3.4 The solvent and materials used in the decontamination procedures must then be disposed of in accordance with Item 6.9 of this procedure. Contact the DEM (4-6670) for specific instructions, if needed.

6.3.5 Notify the IHD for any health considerations and DEM for any environmental considerations.

6.4 Corrective Action in Minor Leakage

6.4.1 Transfer leaking containers and articles, and their contents, to properly marked, nonleaking containers.

6.4.2 Use sorbents (stores item number 01-247-0420) or other adequate means to clean any spilled or leaked material immediately.

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SUBJECT: POLYCHLORINATED BIPHENYLS (PCB)

6.0 PROCEDURES (continued)

6.4.3 Dispose of (or store for future disposal) residue as DEM indicated in 6.9 of this procedure. Contact the DEM (4-6670) for specific instructions, if needed.

6.4.4 Notify the IHD for any health considerations and DEM for any environmental considerations.

6.5 Corrective Action for PCB Spills

6.5.1 Notify the owner of the equipment (shown on the PCB marker label), IHD, and the DEM.

6.5.2 Transfer leaking containers and articles, and their contents, to properly marked, nonleaking containers.

6.5.3 Use sorbents (or other adequate means) to clean any spilled or leaked material immediately.

6.5.4 Dispose of (or store) residue as indicated in Items 6.9 and 6.6 of this procedure.

6.5.5 Conduct tests, using EPA-approved sampling techniques and laboratory methods, to determine if PCB concentration in soil, gravel, sludge, fill, rubble, or other land-based substances exceeds 50 ppm.

6.5.6 Decontaminate liquids containing more than 50 ppm of PCB to less than 50 ppm by the methods stated in Item 6.3 of this procedure.

6.5.7 Dilution is not an acceptable decontamination procedure.

6.6 Storage Requirements

6.6.1 As a general rule combustable oil is the usual major constituent in liquid mixtures containing PCB. The NFPA Flammable Liquids Code (NFPA-30) shall be consulted for storage quantities and construction requirements for storage facilities.

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SUBJECT POLYCHLORINATED BIPHENYLS (PCB)

6.0 PROCEDURES (continued)

6.6.2 Provide roof and walls to prevent rainfall from reaching PCB.

6.6.3 Use floor space surrounded by a minimum 15-cm (6-in.) curbing which provides a containment capacity of at least two times the volume of the largest PCB container or 25% of the total volume of PCB stored, whichever is greater.

(Note: Curb height may have to be increased to accommodate sprinkler system operation.)

6.6.4 Use flooring constructed of an impervious material and without drains to prevent escape of the PCB.

6.6.5 Do not locate facilities below the 100-year flood elevation.

6.6.6 Mark the facilities as PCB storage.

6.6.7 Inspect all containers at least once each 30 days.

6.7 Storage Records

6.7.1 Storage records are kept at ORNL by the DEM.

6.7.2 Records are required for each facility or area containing 45 kg (~99 lb) or more of PCB or having one or more PCB transformers. The weight of the PCB may be calculated from known volume.

6.7.3 A document, based on records, must be prepared annually and filed prior to July 1 detailing the manner in which PCB was handled at the facility during the previous calendar year.

6.7.4 Records must be maintained for at least five years after the facility no longer contains PCB in the prescribed quantities.

SUBJECT: POLYCHLORINATED BIPHENYLS (PCB)

6.0 PROCEDURES (continued)

6.7.5 The annual document shall include the dates when PCB was removed from service, placed into storage for disposal, and placed into transport for disposal. The quantities of such PCB shall be indicated by the following breakdown:

6.7.5.1 Total mass in kilograms of PCB in containers, including the identification of container contents (e.g., liquids), and capacitors.

6.7.5.2 Total number of PCB transformers and mass in kilograms of PCB in service and/or in storage.

6.7.5.3 Total number of PCB large, low- and high-voltage capacitors in service and/or in storage.

6.7.6 Further information required for records includes:

6.7.6.1 Name of person responsible for, and location of, PCB storage areas.

6.7.6.2 Name of person and facility placing PCB in storage.

6.8 Regulations for Transporting Containers of PCB

6.8.1 DOE requires that Liquid-PCB material storage containers meet Department of Transportation (DOT) specifications as outlined in 49 CFR 178.80, 178.82, 178.102, or 178.116.

6.8.2 Nonliquid-PCB storage containers must meet DOT Specs. 5, 5B, or 17C contained in 49 CFR 178.80, 178.82, or 178.115 respectively.

6.8.3 Accurate records of PCB storage operations must be maintained, including sufficient detail to locate any individual container according to the date it was stored.

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SUBJECT POLYCHLORINATED BIPHENYLS (PCB)

6.0 PROCEDURES (continued)

6.9 Disposal

6.9.1 Throughout the handling of PCB, it is illegal to deposit any oily material down a drain or storm sewer. PCB reaching a waterway must be reported promptly to the DEM (4-6670).

6.9.2 Liquid materials suspected of containing PCB material should be placed in a 10-ml glass bottle and taken to the AC Division (Building 4500-south, Room S-154) for analysis.

6.9.3 Forms entitled Askarel Inventory (UCN-11736), Identification Tag (UCN-2114), and Request For Disposal Of Waste Materials And Equipment (UCN-12463) must be filled out by the requester.

6.9.4 Current regulations require that all liquids having more than 500 ppm of PCB must be incinerated in an EPA-approved facility.

6.9.5 Nonliquid PCB and liquids with 50 to 500 ppm of PCB can also be incinerated or disposed of in an EPA-approved landfill. Further, incineration of PCB is permitted in utility and industrial boilers of specific types under specified conditions.

6.9.6 Large high-voltage or low-voltage capacitors may be disposed of in an EPA-approved landfill until January 1, 1980; after that date, they must be disposed of in high-temperature incinerators.

6.9.7 Incineration and landfill requirements are stated in EPA specifications 40 CFR 761.40 and 40 CFR 761.41 respectively.

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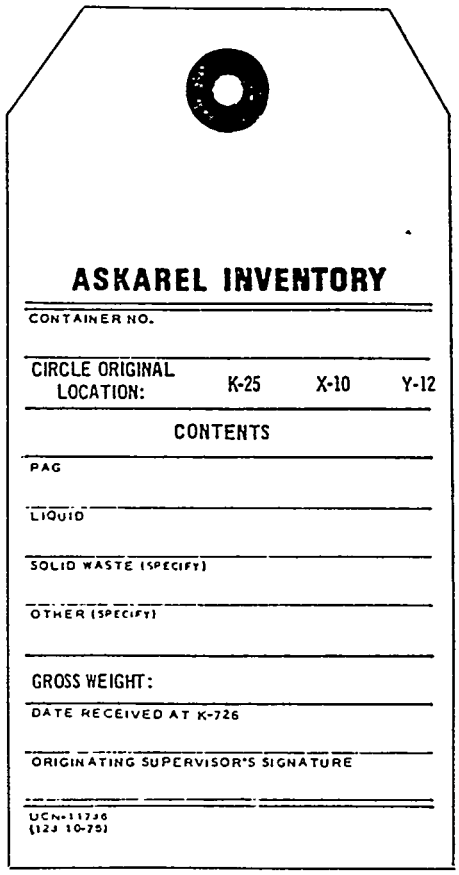

ASKAREL INVENTORY

CONTAINER NO.

CIRCLE ORIGINAL LOCATION: K-25 X-10 Y-12

CONTENTS

PAG

LIQUID

SOLID WASTE (SPECIFY)

OTHER (SPECIFY)

GROSS WEIGHT:

DATE RECEIVED AT K-726

ORIGINATING SUPERVISOR'S SIGNATURE

UCN-11736
(12) 10-75)

Form UCN-11736
Used for askarel (PCB fluid) inventory.

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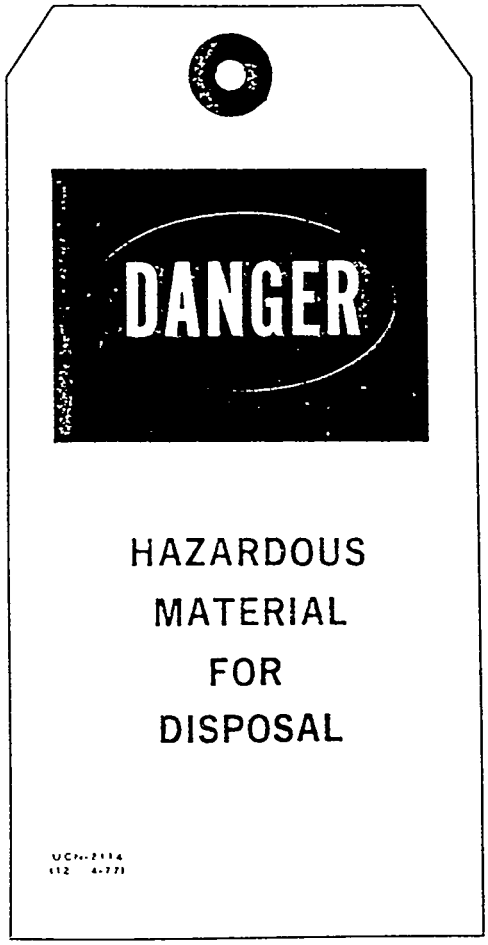
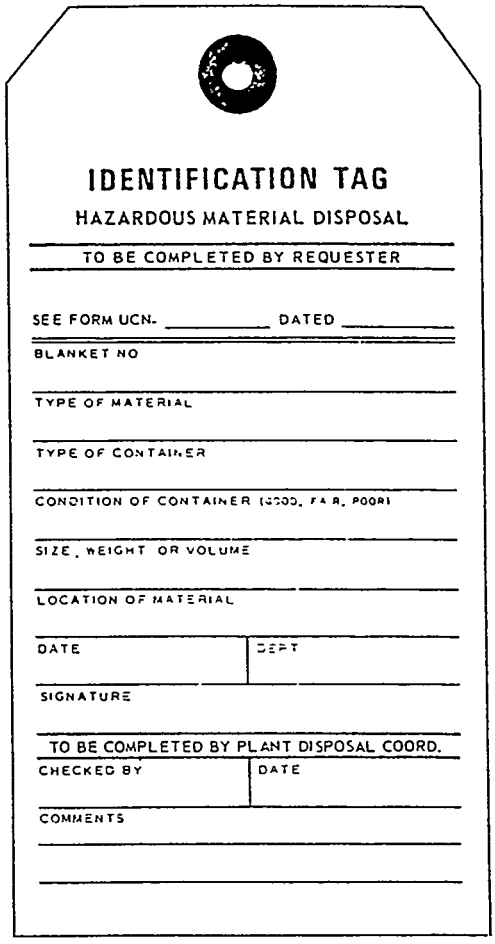
(front) (back)





Form UCN-2114
Used for hazardous material disposal.

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SUBJECT: POLYCHLORINATED BIPHENYLS (PCB)

REQUEST FOR DISPOSAL OF WASTE MATERIALS AND EQUIPMENT

No. 12176

Material to be disposed (*One material per sheet — Must be identified by Requisitioner*)

CHECK APPROPRIATE BLOCKS

☐ Classified ☐ Unclassified

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

HAZARDOUS

NO	YES	UNKNOWN

☐ Radioactive ☐ Nonradioactive

Nuclides	Curies

Hazards in Handling and Disposal:

Suggested Method and Location of Disposal:

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-1147-A Neutralizing Pit
- ☐ K-1407-B Holding Pond
- ☐ K-1407-C Retention Basin
- ☐ K-1303 Cylinder Yard
- ☐ 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 Std. No.
- ☐ Other

Plant Waste Disposal Co-ordinator (*Signature*)	Disposal Completed by (*Signature*)
Date	Date / Department

Distribution after Disposal

White Copy - Plant Disposal Coordinator

Blue Copy - Security Department Headquarters

Green Copy - Requisitioner

Yellow Copy - Retained by the Disposer

UCN-12463
11 5-781

NUMBER: EPM-4.0

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Appendix D

ORNL ENVIRONMENTAL PROTECTION PROCEDURE
FOR ORNL CONTRACTORS' LANDFILL, EPM 14.0

OAK RIDGE NATIONAL LABORATORY

ENVIRONMENTAL PROTECTION PROCEDURE

UNION CARBIDE

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SUBJECT: CONTRACTOR'S LANDFILL

1.0 POLICY

It is the policy of the Laboratory to ensure the proper utilization of on-site solid waste disposal areas in an environmentally safe manner.

2.0 SCOPE

This procedure comprises the general guidelines to be followed for disposal of waste at the subject facility and includes specific requirements for types of wastes permitted for disposal, methods of operation and other pertinent information.

3.0 PERTINENT LAWS AND PROCEDURES

3.1 State and Federal

3.1.1 Tennessee Solid Waste Regulations

3.1.2 Resource Conservation and Recovery Act (RCRA) of 1976 and implementing regulations.

3.1.3 Toxic Substances Control Act (TSCA) and implementing regulations.

3.1.4 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and implementing regulations.

3.2 Nuclear Division Standard Practice Procedure

3.2.1 UCC-ND Standard Practice Procedure D-5-15, "Waste Management and Environmental Pollution Control."

3.2.2 UCC-ND Standard Practice Procedure D-2-18, "Control of Hazardous Materials."

4.0 DEFINITIONS

4.1 Refuse - Putrescible and nonputrescible solid wastes except body wastes, including, but not limited to garbage, animal carcasses, rubbish, incinerator residue, street cleanings, and industrial waste.

4.2 Rubbish - Nonputrescible solid wastes, consisting of both combustible and noncombustible wastes, such as, but not necessarily limited to, paper, cardboard, tin cans, yard clippings, wood, glass, bedding, crockery, plastics, rubber by products, or litter of any kind.

4.3 Solid Waste - Garbage, refuse, and other discarded solid materials, including solid waste materials resulting from industrial, commercial, and agricultural operations, and from community activities, but does not include solids or dissolved material in domestic sewage or other significant pollutants in water resources, such as silt, dissolved or suspended solids in industrial waste water effluents, dissolved materials in irrigation return flows or other common water pollutants.

4.4 Garbage - All kitchen and table waste, and every accumulation of animal or vegetable waste that attends or results from the preparation, dealing with or handling of food stuffs.

4.5 Hazardous Waste - A solid waste, or a combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

4.6 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.

4.7 Contractors' Landfill - An area designated by the Department of Energy and Oak Ridge National Laboratory Management to serve as a disposal site for construction-related wastes and other wastes as determined by the Department of Environmental Management, generated at the Laboratory. See Figure 1 for location.

5.0 PERMISSIBLE WASTES FOR DISPOSAL

5.1 Fly ash waste generated by the burning of fossil fuels at ORNL Steam Plant.

5.2 Waste and/or debris generated by the demolition and/or renovation of existing structures or by the construction of new facilities at the Laboratory. Examples: scrap lumber, concrete, plaster, soil, masonry, electrical wiring, piping (not covered by asbestos insulation), packing materials, light bulbs, and other construction spoils.

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SUBJECT. CONTRACTOR'S LANDFILL

5.3 Other waste materials as approved by the Department of Environmental Management.

NOTE: All permissible wastes, from areas where radioactive contamination is a possibility, must be checked for radioactive contamination by Health Physics personnel and found to be at acceptable "green tag" limits prior to transport to the facility (see Health Physics Manual Procedure 2.5).. Also, light fixtures and light ballasts found to contain oil should not be disposed of in the contractors' landfill.

6.0 WASTES NOT PERMITTED FOR DISPOSAL IN THE CONTRACTORS' LANDFILL

Wastes which will not be permitted for disposal will include:

Garbage,
Refuse,
Rubbish (unless the result of construction operation),
Waste chemicals (hazardous or nonhazardous),
Empty chemical containers (glass, metal or fiber),
Empty pesticide containers,
Paints, lacquers, thinners or their empty containers,
Paper products (except from construction operations, i.e., packaging materials),
Wastes containing large amounts of free liquids.

7.0 OPERATING PROCEDURE

7.1 The entrance to the Contractor's Landfill will be locked 24 hours a day. A two lock system will be employed so that responsible Divisions, e.g., Plant and Equipment, Construction Engineering, have an individual lock. The Department of Environmental Management of the IS&AHP Division will have keys to both locks. An appropriate number of keys for each lock will be issued to individuals of the above named divisions who have need for access to the area. Authorized individuals entering this facility must unlock the entrance gate upon entry and resecure the gate upon exit.

7.2 Individuals transporting permissible wastes to this facility should unload waste material at the edge of the open pit to allow access to the entire area. P&E personnel should be notified of wastes which may pose a windblown waste problem so that some type of cover can be provided before end of workday.

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SUBJECT: CONTRACTOR'S LANDFILL

7.3 A dumpster will be placed inside the locked area of this facility for disposal of empty containers. Individuals using the landfill should place paint cans, chemical containers, and pesticide containers which are empty and have been thoroughly rinsed into the dumpster. These items should not be placed in the open landfill area.

8.0 RESPONSIBILITIES

8.1 Plant and Equipment Division (P&E)

8.1.1 Ensures that personnel are aware of the types of wastes which are permitted for disposal at the landfill.

8.1.2 Issues keys to appropriate personnel who have need for access to the area.

8.1.3 Ensures that personnel authorized to use facility understand and adhere to the operating procedure (7.0).

8.1.4 Ensures that some type of cover is provided by the end of each workday to prevent windblown waste problem.

8.1.5 Notifies DEM of any questionable material which may be destined for disposal at the landfill to determine if it should be taken there.

8.2 Engineering Division

8.2.1 Ensures that contractor personnel are aware of the types of wastes which are permitted for disposal at the landfill.

8.2.2 Issues keys to contractors who have need for access to the area.

8.2.3 Ensures that personnel authorized to use facility understand and adhere to the operating procedure (7.0)

8.2.4 Notifies DEM of any questionable material which may be destined for disposal at the landfill to determine if it should be taken there.

8.3 Other Individuals Utilizing Landfill

8.3.1 Individuals who have been issued keys to enter facility must ensure that security barrier is locked upon exit.

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SUBJECT: CONTRACTOR'S LANDFILL

8.3.2 Notifies the DEM of any irregularities noted at the landfill.

8.3.3 Adhere to established operating procedure (7.0).

8.4 Department of Environmental Management (DEM)

8.4.1 Inspects landfill area on a monthly basis to ensure compliance with guidelines specified in this procedure (see Appendix I).

8.4.2 Makes determinations on the disposal of questionable waste materials.

8.4.3 Inspects empty container dumpster to ensure that containers are empty and have been rinsed before transporting to an approved facility for disposal.

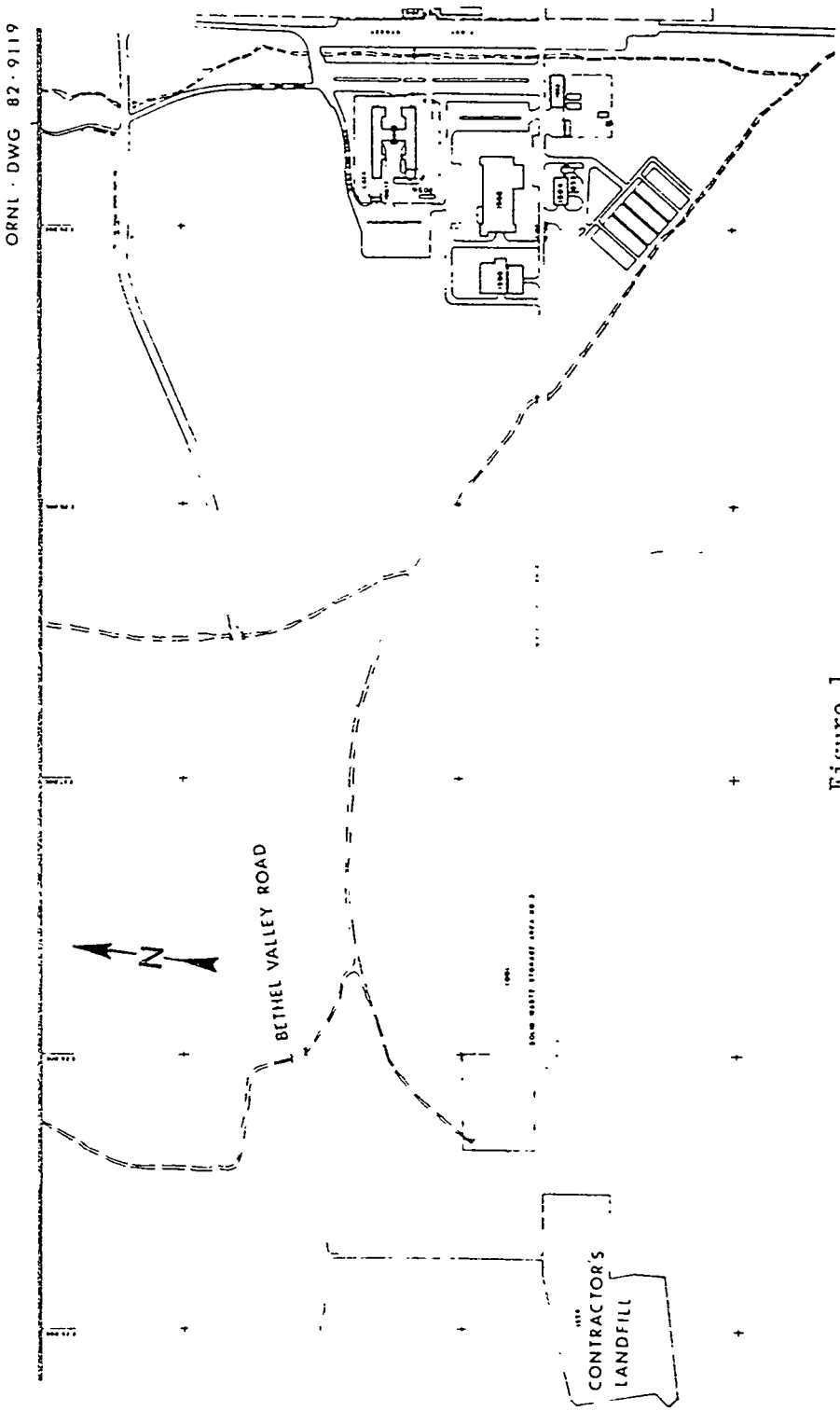

Figure 1

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SUBJECT: CONTRACTOR'S LANDFILL

APPENDIX I

Inspection Guidelines for ORNL's Contractor Landfill

I. Check Entrance Gate

Was gate locked or unlocked?
If unlocked, were authorized personnel in the facility?

II. Inspect Waste Materials in Area

Was any waste found in the area which is listed as nonpermissible waste in EPM-14.0?

If yes, describe in detail.

Has the waste been sufficiently covered with earth to prevent windblown pollution problem?

Was any waste found which might present a possible rodent problem?

III. Inspect Any Vehicles Seen Dumping at Time of Inspection

IV. Additional Comments

Date of Inspection _____

Signature of Inspector _____

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Appendix E

ORNL DISPOSAL PROCEDURES FOR OLD, UNWANTED CHEMICALS (NONRADIOACTIVE), EMP 8.0

OAK RIDGE NATIONAL LABORATORY

ENVIRONMENTAL PROTECTION PROCEDURE

UNION CARBIDE

NUMBER	EPM-8.0
DATE	August 1, 1981
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SUBJECT: DISPOSAL PROCEDURES FOR OLD, UNWANTED CHEMICALS (NON-RADIOACTIVE)

1.0 POLICY

It is the policy of the Laboratory, UCC-ND and DOE to require that all old, unwanted chemicals be handled and disposed of in a manner that protects the environment and personnel from harm.

2.0 SCOPE

This procedure comprises the general guidelines to be followed for the disposal of old, unwanted chemicals and includes specific requirements for notification, identification, labeling, and packaging. Reference to "chemicals" in this procedure applies only to old, unwanted chemicals.

3.0 PERTINENT REGULATIONS AND PROCEDURES

3.1 The Resource Conservation and Recovery Act (RCRA) of 1976 (Public Law 94-580). The major regulatory program concerning hazardous waste management is contained in Subtitle C of RCRA.

3.2 Pertinent ORNL Procedures applicable to this procedure are:

3.2.1 Safety Manual

Procedure 1.4 - Chemical Laboratory Safe Practices
Procedure 2.0 - Guide for Handling or Storing Flammable Materials in Enclosures.

3.2.2 All Procedures of Hazardous Materials Management and Control Manual

3.2.3 Industrial Hygiene Manual

Procedure 1.4 Control of Toxic Chemical
Procedure 1.5 Beryllium and Its Compounds
Procedure 1.6 Lead and Lead Compounds
Procedure 1.7 Handling Chemical Carcinogen in Research Laboratory Activities

SUBJECT DISPOSAL PROCEDURES FOR OLD, UNWANTED CHEMICALS (NON-RADIOACTIVE)

PERTINENT REGULATIONS AND PROCEDURES (cont'd.)

Procedure 1.8 Polynuclear Aromatic Hydrocarbon
Procedure 2.1 Toxic Metals and Their Compounds
Procedure 2.3 Incompatible Chemicals
Procedure 2.4 Threshold Limit Valves for Chemical Substances and Physical Stresses in the Workroom Environment with Amended Charges for 1979
Materials Safety Data Sheets-

The Basic for Control of Toxic Chemicals
ORNL/TM-6981/V1, V2, V3
E. E. Ketcher and W. E. Porter

4.0 DEFINITIONS

4.1 Hazardous Chemicals: Any unused and unwanted nonradioactive chemical classified as hazardous by RCRA, State of Tennessee, and the Department of Transportation (DOT). Figure 1 indicates selected RCRA parameters for classifying hazardous wastes. A standardized method of hazard classification may be found in Appendix.

Fig. 1 Selected RCRA Parameters for Classifying Hazardous Wastes

Parameter	Example Materials or Compounds
Ignitability	Alcohols, ethyl ether
Corrosivity	Acids and bases
Reactivity	Cyanide or sulfide exposed to acidic or basic conditions
Toxicity	Boron oxide, Th salts
Mutagenicity	Benzo(a)pyrene
Teratogenicity	Benzo(a)pyrene, ethyl sulfide, thalidomide
Carcinogenicity	Chloroform, diarsenic trioxide, benzo(a)pyrene, vinylidene chloride
Bioaccumulative	Mercury, lead

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SUBJECT: DISPOSAL PROCEDURES FOR OLD, UNWANTED CHEMICALS (NON-RADIOACTIVE)

4.2 OTHER SPECIAL HAZARDS

4.2.1 Reacts-With-Water Hazard (See Fig. 2)

4.2.1.1 Scope of Category

The reacts-with-water hazard category deals with the tendency of a material to react more or less violently if it comes in contact with water (including moist air). The danger could come through the formation of potentially explosive or flammable gases, or it might come through spontaneous ignition or explosion of the material.

NOTE

Reacts-with-water hazard evaluations is to be based on nonfire situations since the primary concern is employee safety from the effects of a water-induced reaction under normal working conditions. The reacts-with-water hazard must be considered separately from the other normal hazard categories and other special hazards.

Fig. 2

SELECTED MATERIALS WHICH REACT VIOLENTLY WITH WATER

Acrylonitrile (Monomer)
Calcium Carbide
Calcium Metal
Chlorosulfonic Acid
Lithium Hydride
Lithium Metal
Magnesium Metal (Powder or Shavings)
Sodium Metal
Sodium-Potassium Alloys (NaK)

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DEFINITIONS (cont'd)

4.2.2 Oxidizer Hazard (See Fig. 3)

Scope of Category

The oxidizer hazard category deals with the tendency of a material to react readily with other compounds. Most oxidizing materials will decompose readily to yield oxygen, especially when heated. When mixed with or contaminated by combustible materials, oxidizers may cause violent reactions. Such mixtures are very sensitive, even under ordinary circumstances, to heat, friction, and impact. Other materials which react similarly to oxygen are also classed as oxidizers.

NOTE

Oxidizers may, in and of themselves, be fairly harmless. They present a grave potential for violent reaction, however, if allowed to mix with combustible materials.

Oxidizer hazard evaluations shall be based on nonfire situations since the primary concern is employee safety from the effects of oxidizers under normal working conditions.

Fig. 3

SELECTED GROUPS OF MATERIALS WHICH ARE OXIDIZERS

Bromates	Chlorine	Nitrates	Permanganates
Bromine	Fluorine	Nitrate Acid	Peroxides
Chlorates		Perchlorates	

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SUBJECT: DISPOSAL PROCEDURES FOR OLD, UNWANTED CHEMICALS (NON-RADIOACTIVE)

DEFINITIONS (Cont'd)

4.2.3 Peroxidizable Hazard

4.2.3.1 Scope of Category

Peroxides are formed when a peroxidizable material reacts with molecular oxygen, which is available in the air. Thus, once such a material has been exposed to the air, it will begin to form peroxides; the rate at which peroxides are formed depends on the characteristics of the peroxidizable material and exposure to heat or light. As the peroxides form, they tend to accumulate under normal storage conditions. When sufficient accumulation has occurred, they can explode when subjected to a thermal or mechanical shock.

NOTE

Once peroxides have accumulated in a material, its reactivity (stability) level changes from that of the pure material to a level 4. Category (See Industrial Hygiene Manual)

4.2.3.2 The materials are divided into two groups based on normal shelf-life (shelf-life begins upon receipt in stores) of the material when it is properly handled and stored as follows:

Group 1 Peroxidizable Materials - Safe for 3 Months

Group 2 Peroxidizable Materials - Safe for 12 Months

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DISPOSAL PROCEDURES FOR OLD, UNWANTED CHEMICALS (NON-RADIOACTIVE)

DEFINITIONS (cont'd)

4.2.3.3 Ensure that each container of peroxidizable material has a special label, Form UCN-12731, affixed and that the date received is noted on it. Enter the date opened and the number of months to test/discard the material.

PEROXIDIZABLE MATERIAL

DATE RECEIVED
DATE OPENED
DISCARD TO TEST ___ MONTHS
AFTER OPENING
UCN-12731 (2-9-77)

4.2.3.4 A review of peroxidizable hazard potential can be obtained from DEM.

4.2.3.5 Figure 4 lists some of the materials which are commonly used in the Laboratory that can form peroxides during storage. The materials are divided into two groups based on the normal safe-life of the material when it is properly handled and stored.

4.2.3.6 Safe Handling of Peroxidizable Materials

4.2.3.6.1 Store under approved conditions. Review of storage conditions for approval can be obtained from DEM.

4.2.3.6.2 Ensure that every person who will work with peroxidizable solvents and reagents can recognize them and know how to work with them safely.

SUBJECT: DISPOSAL PROCEDURES FOR OLD, UNWANTED CHEMICALS (NON-RADIOACTIVE)

Fig. 4

SELECTED MATERIALS WHICH ARE PEROXIDIZABLE

Group 1 Peroxidizables (Safe for 3 Months)	Group 2 Peroxidizables (Safe for 12 Months)	
Isopropyl Ether	Ethyl Ether	Cyclohexene
Divinyl Acetylene	Tetrahydrofuran	Methylcyclopentane
Vinylidene Chloride	Dioxane	Styrene
Potassium Metal	Acetal	Butadiene
Sodium Amide	Methyl i-butyl Ketone	Tetrafluoroethylene
Sodium-Potassium Alloy (NaK)	Ethylene Glycol Dimethyl Ether	Chlorotrifluoroethylene
	Vinyl Ethers	Vinyl Acetylene
	Dicyclopentadiene	Vinyl Acetate
	Diacetylene	Vinyl Chloride
	Cumane	Vinyl Pyridine
	Tetrahydronaphthalene	Chloroprene
	Methyl Acetylene	

4.2.3.6.3 Inventory peroxidizable materials to ensure shelf-life (test/discard), as follows:

Group 1 Peroxidizable Materials - Inventory Every 3 Months
Group 2 Peroxidizable Materials - Inventory Every 12 Months

5.0 NOTIFICATION (Request for Disposal)

5.1 The generator of waste completes Form UCN-13698 (Figure 5). It is important to describe accurately the quantity and condition of the material and the size and condition of the container.

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SUBJECT: DISPOSAL PROCEDURES FOR OLD, UNWANTED CHEMICALS (NON-RADIOACTIVE)

Figure 5

REQUEST FOR DISPOSAL OF NONRADIOACTIVE WASTE MATERIALS

No. 2373

	MATERIAL TO BE DISPOSED	NO. OF ITEMS	QUANTITY	TYPE AND CONDITION OF CONTAINER	HAZARDS IN HANDLING AND DISPOSAL (FILL IN AS COMPLETELY AS POSSIBLE)
1					
2.					
3					
4					
5					

LOCATION OF MATERIAL (BLDG.) ROOM OR AREA DATE

SIGNATURE OF REQUISITIONER BUILDING DEPT CHARGE NO ROOM NO PHONE NO

INFORMATION BELOW THIS LINE TO BE FILLED IN BY OFFICE OF ENVIRONMENTAL COORDINATION

INSTRUCTIONS FOR HANDLING AND DISPOSAL	DESIGNATE APPROPRIATE AREA FOR ABOVE MATERIALS BY NO	DISPOSAL AREA

AUTHORIZATION FOR DISPOSAL (SIGNATURE) OFFICE OF ENVIRONMENTAL COORDINATION DATE

PERSON HANDLING DISPOSAL (SIGNATURE) DATE (PERSON COMPLETING DISPOSAL (SIGNATURE) DATE

UCN-13888 (3 11-79)

NUMBER:	EPM-8.0

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SUBJECT: DISPOSAL PROCEDURES FOR OLD, UNWANTED CHEMICALS (NON-RADIOACTIVE)

DEFINITIONS (cont'd)

5.2 This form should then be signed by the generator and sent to the Department of Environmental Management (DEM), Building 4500S, Room G-260. The last copy of the form should be retained by the generator for his files.

6.0 PROCEDURE FOR DISPOSAL

6.1 The requisitioner (generator) completes Form UCN-13698, (See Figure 5) available outside Room G-260, Building 4500S, or from the division EPO.

6.2 This form shall be signed by the requisitioner or the EPO and sent to the Department of Environmental Management (DEM), Building 4500S, Room G-260.

6.3 The requisitioner can expedite the removal and disposal of extremely hazardous chemicals by having the EPO request priority handling.

6.4 After Form UCN-13698 is received by the DEM and the appropriate action for disposal has been decided, the requisitioner will be provided packaging materials and assistance in packing by the DEM. The DEM also will provide instructions on grouping of chemicals for packaging (e.g., acids, oxidizers in separate containers, etc.)

6.5 The individual chemicals shall be clearly labeled and placed in the packing containers with enough vermiculite to prevent breakage. Unlabeled items will not be accepted for disposal.

6.6 A legible list of the chemicals and the quantities of each must be affixed to the outside of the container and covered with some type of transparent seal to protect it from the weather. All containers must be "green-tagged" by the Health Physics Department. Radioactive-contaminated chemicals will not be accepted.

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SUBJECT DISPOSAL PROCEDURES FOR OLD, UNWANTED CHEMICALS (NON-RADIOACTIVE)

6.7 If the generator identifies an age-unstable chemical, a shock-sensitive chemical, or otherwise potentially explosive material, (See 4.2 above) he shall contact the DEM and the EPO immediately. The generator shall ensure that the material is not moved or touched by anyone and will put signs around the material indicating its nature. The DEM will handle all packaging and moving of material of this nature and will arrange a convenient time with the requisitioner for the initial inspection and subsequent removal.

7.0 SPECIAL SITUATIONS

7.1 Large Volumes

Volume reduction is recommended wherever possible. This will result in significant disposal-cost reductions for the generating division, particularly with respect to carcinogenic materials and compounds of high hazard and/or toxicity. If volume reduction is not feasible, proper packaging can also help offset the cost.

Wherever possible, collect the wastes in DOE Spec. drums [113.6-liter (30-gal) - catalog No. 02089-63-35 or 189.3-liter (50-gal) -catalog No. 02-089-6350 open top] which are available through Stores.

7.2 Corrosive Wastes

These should be collected in polyethylene carboys, which are available through Stores in various sizes.

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APPENDIX
for
EPM-8.0

The following tables are a summary of the methodology used for hazard classification determinations of chemicals. A detailed description of these methods may be found in ORNL/TM-6981/V1 entitled Materials Safety Data Sheets, The Basis for Control of Toxic Chemicals and NFPA 704M entitled Identification of the Fire Hazards of Materials. A similar explanation may be found in the ORNL Hazardous Materials Management and Control Manual.

Table A - Health

HAZARD CODE	COMMONLY USED TERM	TLV ppm	TLV mg/m^3	LD50/LC50 LD50 Single Oral Dose Rats mg/kg	LD50/LC50 LC50 Inhalation 4-hr. Vapor Exposure Rats PPM	LD50/LC50 LD50-Skin Rabbits mg/kg
4	Extremely Toxic	≤ 10	≤ .25	≤ 1	≤ 10	≤ 5
3	Highly Toxic	11 to 250	.26 to 2.5	1.1 to 50	11 to 100	5.1 to 43
2	Moderately Toxic	251 to 500	2.51 to 5.0	50.1 to 500	101 to 1,000	44 to 350
1	Slightly Toxic or Practically Non-Toxic	501 to 1,000	5.1 to 10	501 to 15,000	1,001 to 100,000	350 to 22,600
0	Relatively Harmless	>1000	> 10	>15,000	>100,000	>22,600

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Table B - Stability

HAZARD CODE	EXPLANATION
4	Materials which in themselves are readily capable of detonation or of explosive decomposition or explosive reaction at normal temperatures and pressures. This degree should include materials which are sensitive to mechanical or localized thermal shock at normal temperatures and pressures.
3	Materials which in themselves are capable of detonation or of explosive decomposition or explosive reaction but which require a strong initiating source or which must be heated under confinement before initiation. This degree should include materials which are sensitive to thermal or mechanical shock at elevated temperatures and pressures or which react explosively with water without requiring heat or confinement.
2	Materials which in themselves are normally unstable and readily undergo violent chemical change but do not detonate. This degree should include materials which can undergo chemical change with rapid release of energy at normal temperatures and pressures or which can undergo violent chemical change at elevated temperatures and pressures. It should also include those materials which may react violently with water or which may form potentially explosive mixtures with water.
1	Materials which in themselves are normally stable, but which can become unstable at elevated temperatures and pressures or which may react with water with some release of energy but not violently.
0	Materials which in themselves are normally stable, even under fire exposure conditions, and which are reactive with water.

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Table C - Fire

HAZARD CODE	EXPLANATION
4	Materials which will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or which are readily dispersed in air, and which will burn readily. This degree should include: a. Gases. b. Cryogenic materials. c. Any liquid or gaseous material which is a liquid while under pressure and having a flash point below 73°F (22.8°C) and having a boiling point below 100°F (37.8°C). (Class IA flammable liquids.) d. Materials which on account of their physical form or environmental conditions can form explosive mixtures with air and which are readily dispersed in air, such as dust of combustible solids and mists of flammable or combustible liquid droplets.
3	Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions. This degree should include: a. Liquids having a flash point below 73°F (22.8°C) and having a boiling point at or above 100°F (37.8°C) and those liquids having a flash point at or above 73°F (22.8°C) or below 100°F (37.8°C). (Class IB and Class IC flammable liquids).

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Table C - Fire (cont'd)

HAZARD CODE	EXPLANATION
	b. Solid materials in the form of coarse dusts which may burn rapidly but which generally do not form explosive atmospheres with air. c. Solid materials in a fibrous or shredded form which may burn rapidly and create flash fire hazards, such as cotton, sisal and hemp. d. Materials which burn with extreme rapidity, usually by reason of self-contained oxygen (e.g., dry nitrocellulose and many organic peroxides). e. Materials which ignite spontaneously when exposed to air.
2	Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating may release vapor in sufficient quantities to produce hazardous atmosoheres with air. This degree should include: a. Liquids having a flash point above 100°F but not exceeding 200°F; b. Solids and semisolids which readily give off flammable vapors.

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Table C - Fire (cont'd)

HAZARD CODE	EXPLANATION
1	Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur. This degree should include: a. Materials which will burn in air when exposed to a temperature of 1500°F for a period of 5 minutes or less. b. Liquids, solids, and semisolids having a flash point above 200°F. c. Most ordinary combustible materials.
0	Materials that will not burn. This degree should include any material which will not burn in air when exposed to a temperature of 1500°F for a period of five minutes.

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