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Preliminary Analysis of Environmental Regulations Related to Remedial Action Activities at the Oak Ridge National Laboratory

L. D. Voorhees
R. E. Saylor

ENVIRONMENTAL SCIENCES DIVISION
PUBLICATION NO. 2695

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ORNL/TM-9996

ENVIRONMENTAL SCIENCES DIVISION

PRELIMINARY ANALYSIS OF ENVIRONMENTAL REGULATIONS RELATED TO REMEDIAL ACTION ACTIVITIES AT THE OAK RIDGE NATIONAL LABORATORY

L. D. Voorhees
R. E. Saylor*

Environmental Sciences Division
Publication No. 2695

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*Energy Division

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NUCLEAR AND CHEMICAL WASTE PROGRAM
(Activity No. KG 02 00000; KG02570)

Prepared for the
Assistant Secretary for Energy Research

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ABSTRACT

VOORHEES, L. D. and R. E. SAYLOR*. 1986. Preliminary analysis of environmental regulations related to remedial action activities at the Oak Ridge National Laboratory. ORNL/TM-9996. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 116 pp.

Past research and development activities at Oak Ridge National Laboratory (ORNL) have resulted in the presence of several areas where low-level radioactive and/or hazardous waste have been disposed of or that have been contaminated through accidental spills or planned releases of radionuclides. Although these areas have been monitored and controlled to ensure that on-site and off-site releases of contaminants are within applicable Department of Energy (DOE) guidelines, ORNL established the Environmental Restoration and Facilities Upgrade (ERFU) Program to address formally the immediate and long-range needs of meeting all applicable federal and state regulations regarding waste disposal. The environmental laws, regulations, and DOE Orders governing the cleanup activities are numerous and complex. Hence, a synthesis of the principal regulations related to the ERFU Program is presented to facilitate efficient planning for characterization and cleanup of contaminated sites. Because of regulatory decisions made after this report was finalized, several statements presented herein may no longer apply to the ERFU Program. Nevertheless, the report is issued as originally written so that ORNL's early planning efforts to comply with environmental laws

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*Energy Division.

and legislation are formally documented. Several general principles to consider when developing a plan for environmental compliance -- which would be of use to others who must comply with legislation related to the cleanup of sites contaminated with radionuclides and hazardous chemicals -- are also discussed.

1. INTRODUCTION

Past research and development activities at Oak Ridge National Laboratory (ORNL) have resulted in the presence of several areas where low-level radioactive and/or hazardous waste have been disposed of or that have been contaminated through accidental spills or planned releases of radionuclides. Such areas include low-level waste (LLW) ponds, pits, and trenches; solid waste storage areas (SWSAs); waste processing and transfer facilities; and the environment surrounding each of these locations. Monitoring and control of these areas continue to be a responsibility of ORNL to ensure that on-site and off-site releases of contaminants are within applicable Department of Energy (DOE) guidelines. In FY 1985, however, ORNL established the Environmental Restoration and Facilities Upgrade (ERFU) Program to address formally the immediate and long-range needs of meeting all applicable federal and state regulations regarding waste disposal. Remedial action is one component of ORNL's ERFU Program. The Remedial Action Program is divided into two activities: (1) the Surplus Facilities Management Program (SFMP), designed for managing surplus radioactive- and hazardous chemical-contaminated facilities (primarily structures) from the end of their operating lives until final facility disposition, and (2) the Site Corrective Measures Program (SCMP), designed for cleanup of the sites where radioactive substances and hazardous chemicals have been disposed of or released to the environment.

One of the primary purposes of the remedial action task is to provide corrective measures and facility decommissioning necessary to place ORNL in compliance with applicable environmental and health regulations for radioactive and hazardous chemical wastes. Hence, a review of the laws and regulations is central to achieving this goal.

1.1 PURPOSE

The purpose of this document is to provide guidance to the Remedial Action Program on what actions need to be taken to comply with state and federal environmental regulations. The information presented should not be considered to be a legal interpretation of the regulations.

1.2 SCOPE

Literally hundreds of laws relate in some way to the environment. Review of all such laws, however, would clearly be impractical, if not impossible, at this phase of the project. Even reviewing all current major environmental laws directly pertaining to decontamination of the radioactively and chemically contaminated sites at ORNL is a task that must be continued as the program develops. This review considers legislation only through September 1985. Key legislation pertaining to the remedial action activities is continually being revised, and, therefore, the user must refer to the Federal Register for updated information. Furthermore, after this report was finalized, the Environmental Protection Agency (EPA) made a decision to permit the

entire ORNL facility under the Resource Conservation and Recovery Act (RCRA). Therefore, many of the statements regarding ORNL's corrective measures related to specific legislation may no longer directly apply. Nevertheless, the report is issued as originally written so that ORNL's early planning efforts to comply with environmental laws and legislation are formally documented. In addition, the report provides a good starting point for others who must review environmental legislation related to the cleanup of sites contaminated with radionuclides and hazardous chemicals.

Our initial efforts to summarize applicable regulations focused on the following:

1. National Environmental Policy Act (NEPA);
2. Resource Conservation and Recovery Act (RCRA);
3. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA);
4. Clean Water Act (CWA);
5. Safe Drinking Water Act (SDWA);
6. DOE Order 5480.14 (CERCLA Program); and
7. DOE Order 5820.2 (Radioactive Waste Management).

A synthesis of these laws and orders will facilitate efficient planning and for characterization and cleanup of the contaminated sites.

Environmental laws, regulations, and DOE Orders governing the cleanup activities are numerous and complex, totaling several hundred pages of fine print. To familiarize the reader with the purpose and general contents of these documents, we have first presented summaries of the legislation and DOE Orders referred to in this review

(Sect. 2). Next, we have attempted to define what ORNL needs to do to comply with the regulations (Sect. 3). We have tried to accomplish this primarily through the use of flowcharts, tabular material, and lists of general requirements. The flowcharts will guide the responsible official through the regulatory maze, directing him both between and within the applicable key legislative acts, regulations, and DOE Orders. Specific requirements presented in tabular format are presented in chronological order according to effective or due dates specified by the regulations. Finally, we have presented some general principles to consider when developing a plan for environmental compliance (Sect. 4).

2. SUMMARIES OF LEGISLATION AND DOE ORDERS

The following brief narrative summaries of the regulations and DOE Orders reviewed in this document were extracted from various DOE unpublished internal documents and from the laws, regulations, and DOE Orders themselves and were edited to make them more applicable to the Remedial Action Program. Specific requirements for compliance with these regulations and Orders are discussed in Sect. 3.

2.1 NATIONAL ENVIRONMENTAL POLICY ACT OF 1969

NEPA was the first major piece of environmental legislation of what was to become the environmental decade of the 1970s. The purposes of NEPA (as stated in the Act) are "to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality [CEQ]."

NEPA contains the following provisions that make it applicable to federal agencies:

> [T]he policies, regulations and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act. . . .[A]ll agencies of the Federal Government shall . . . include in . . . major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official. . . .The policies and goals set forth in this Act are supplementary to those set forth in existing authorizations of Federal agencies.

The "detailed statement" has come to be known as the environmental impact statement (EIS).

Congress usually delegates the administration of a statute to a single federal agency, which is authorized to adopt regulations interpreting the statutory provisions. In the case of NEPA, environmental responsibilities are placed on all federal agencies. The Act, however, failed to authorize adoption of regulations that interpret the statute. Consequently, in 1970 President Nixon delegated to the CEQ the authority to adopt "guidelines" for the preparation of EISs. Because the guidelines did not have the status of formal agency regulations, President Carter modified the 1970 Executive Order in 1977, authorizing CEQ to adopt regulations rather than guidelines on impact statement preparation.

The CEQ promulgated regulations for implementing the procedural provisions of NEPA on November 29, 1978 (40 CFR 1500-1508); the regulations became effective July 30, 1979. Part 1507.3 of the regulations required each federal agency to adopt procedures to supplement the regulations. DOE published its guidelines for compliance with NEPA on March 28, 1980 (45 FR 20694), and issued DOE Order 5440.1C (procedures to implement NEPA) on April 9, 1985.

2.2 RESOURCE CONSERVATION AND RECOVERY ACT OF 1976

The legislative history of RCRA began in 1965 when Congress enacted the Solid Waste Disposal Act (P.L. 89-72). This law dealt with solid waste problems in general and gave the states the responsibilities

for developing solid waste management plans. In 1970 the Resource Recovery Act was passed to provide EPA with funding for resource recovery programs, but the act had little impact on the management and ultimate disposal of hazardous wastes. The RCRA of 1976 (P.L. 94-580) completely replaced the Solid Waste Disposal Act and incorporated the concern of the Resource Recovery Act, which is to ensure the safe and environmentally acceptable management of solid wastes. Additional funding was provided for RCRA when amended in 1978 by the Quiet Communities Act (P.L. 95-609). The Used Oil Recycling Act of 1980 (P.L. 96-463) further amended RCRA by adding some definitions and clarifying container labeling requirements. The Environmental Research, Development, and Demonstration Authorization Act of 1980 (P.L. 96-510) provided additional authorization for research and development activities under RCRA. Minor amendments, primarily related to appropriating funds, were made to RCRA in 1982 by P.L. 97-272 and P.L. 97-375 and in 1983 by P.L. 98-45. On November 8, 1984, The President signed legislation that reauthorized RCRA, altered many of its provisions, and greatly expanded its scope (P.O. 98-616). This legislation (Hazardous and Solid Waste Amendments of 1984) contains unusually detailed requirements compared with those found in most statutes and nearly doubled the length of RCRA. Congress included detailed provisions that would themselves serve as the regulations should EPA fail to promulgate implementing rules and regulations within statutory deadlines. The amendments require EPA to implement the majority of the 72 substantive provisions by the end of 1986. RCRA requires compliance by federal facilities, including those of DOE, with both the substantive and procedural RCRA regulations.

RCRA, as amended, contains nine subtitles. Subtitle C -- "Hazardous Waste Management," Subtitle D -- "State and Regional Solid Waste Plans," and Subtitle I -- "Regulation of Underground Storage Tanks," constitute the regulatory portion of the law. The remaining subtitles provide the legal and administrative structure for achieving the objectives of the law. Four separate government agencies have specific responsibilities under RCRA. EPA must issue guidelines and regulations for proper management of solid wastes, oversee and approve the development of state waste management plans, and provide financial aid to agencies and firms performing research on solid waste; the Department of Commerce is responsible for encouraging greater commercialization of proven resource recovery technologies; DOE is responsible for overseeing those activities involving research and development of new techniques for producing energy from wastes; and the Department of the Interior is responsible for overseeing mineral waste problems, including recovery of metals and minerals, and methods for stabilizing mining wastes. Those sections of RCRA and EPA regulations that have the most relevance to ORNL's remedial action activities are listed in Appendixes A and B.

2.3 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980

CERCLA (also known as Superfund) was passed in response to a growing national concern about the release of hazardous substances to the environment. The purpose of CERCLA is to provide for (1) liability,

compensation, cleanup, and emergency response for hazardous substances released into the environment and (2) the cleanup of inactive hazardous waste disposal sites.

CERCLA [Section 101(14)] defines "hazardous substances" as

> (A) any substance designated pursuant to Section 311(b)(2)(A) of the Federal Water Pollution Control Act, (B) any element, compound, mixture, solution, or substance designated pursuant to Section 102 of this Act, (C) any hazardous waste having the characteristics identified under or listed pursuant to Section 3001 of the Solid Waste Disposal Act (but not including any waste the regulation of which under the Solid Waste Disposal Act has been suspended by Act of Congress), (D) any toxic pollutant listed under Section 307(a) of the Federal Water Pollution Control Act, (E) any hazardous air pollutant listed under Section 112 of the Clean Air Act, and (F) any imminently hazardous chemical substance or mixture with respect to which the Administrator has taken action pursuant to Section 7 of the Toxic Substances Control Act.

Releases of source, by-product, and special nuclear material from a nuclear incident are excluded from CERCLA requirements if the releases are subject to financial protection requirements of the Atomic Energy Act (AEA). Releases of source, special nuclear, and by-product materials from a processing site designated by the Uranium Mill Tailings Radiation Control Act of 1978 are also excluded [see Sect. 101(22) of CERCLA].

The intent of CERCLA is to provide for response to, and cleanup of, environmental problems that are not covered adequately by the permit programs of the many other environmental laws -- Clean Air Act; CWA; SDWA; Marine Protection, Research, and Sanctuaries Act; RCRA; and elements of the AEC. In general, if a release to the environment is considered a "federally permitted release," as defined by Sect. 101(10)

of CERCLA, the release is not subject to CERCLA reporting requirements. Abandoned and inactive waste disposal sites not covered by permits are clearly subject to CERCLA reporting requirements.

Identification of releases is an important function that is the responsibility of all federal, state, and local governments and private individuals. Information on unpermitted releases of hazardous substances, spills, accidents, and abandoned waste disposal sites should be transmitted to EPA and state officials.* The information is evaluated to determine if the release or abandoned waste site is eligible for listing on the National Priorities List (NPL) and, thus, eligible for federal financial support. Listing on the NPL, which now includes about 800 sites, is the first step in considering a site for remedial action. A Hazard Ranking System† (HRS) has been developed to assist EPA in evaluating the degree of hazard associated with releases and abandoned waste sites before they are listed on the NPL. The NPL is dynamic because as HRS studies are performed, waste sites may be removed from, or added to, the list.

Currently, federal sites are not listed on the NPL because remedial actions at such sites are the responsibility of the federal agency (i.e., federal sites are not eligible for Superfund money). However, the National Contingency Plan, which defines how the release of hazardous substances will be identified, responded to, and

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*DOE Order 5480.14 provides instruction for implementing the DOE CERCLA program.

†DOE Order 5480.24 implements a Modified HRS for sites containing hazardous substances and/or radionuclides.

investigated, is currently under revision. The proposed revision (published February 12, 1985) expands the provisions for listing facilities on the NPL to include federal facilities. Although federal facilities will still be ineligible for Superfund money, their inclusion on the NPL will reinforce the need to clean up such sites.

CERCLA response to releases of purely radioactive substances is currently being debated. The National Contingency Plan presently states, "Where appropriate, discharges of radioactive materials shall be handled pursuant to the appropriate federal radiological plans" [40 CFR 300.22(q)].

2.4 CLEAN WATER ACT OF 1977

The Water Pollution Control Act was first enacted in 1948. However, the Act as we know it today is largely a result of the Federal Water Pollution Control Act (FWPCA) Amendments of 1972. These amendments represented a major revision of the Act and replaced the previous language entirely, including the Water Quality Act of 1965, the Clean Water Restoration Act of 1966, and the Water Quality Improvement Act of 1970, all of which had been amendments to the original Act.

The Federal Water Pollution Control Act (Clean Water Act) establishes a comprehensive federal/state scheme for controlling the introduction of pollutants into the nation's water. The most significant change in the law brought about by the 1972 amendments was a shift from reliance on violations of water quality standards as the

primary enforcement tool to the establishment of specific technology-based effluent limitations that are enforceable as permit conditions. Following Congressional review of the first 5 years of EPA's implementation of the Act, the 1977 amendments were issued. These amendments relaxed some of the standards established under the 1972 amendments and dealt with the regulations of toxic or "priority" pollutants. In 1978 Congress again revised the Act, focusing on the provisions applicable to accidental discharges of hazardous polluting substances.

2.5 SAFE DRINKING WATER ACT

Congress recognized potential contamination threats to groundwater with enactment of the SDWA of 1974 (P.L. 93-523). This Act instructed EPA to establish a national program to prevent underground injections that would endanger drinking water sources. More specifically, SDWA requires EPA to (1) publish minimum national requirements for effective state Underground Injection Control (UIC) programs and (2) make financial grants to states for developing and implementing UIC programs.

2.6 DOE ORDER 5480.14 — COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT PROGRAM

The purpose of DOE Order 5480.14 is to describe how DOE facilities are to comply with CERCLA. The Order describes actions to (1) identify and evaluate inactive hazardous waste disposal sites on DOE

installations and (2) implement remedial actions where necessary to improve control of hazardous substance migrations from such sites. The Order does not include removal actions covered in Sect. 103(a) and 103(b) of CERCLA, which are associated with the release or threat of release of hazardous substances into the environment. Such events are to be reported according to the instructions contained in 40 CFR 302 (Designation, Reportable Quantities, and Notification).

2.7 DOE ORDER 5820.2 -- RADIOACTIVE WASTE MANAGEMENT

The purpose of DOE Order 5820.2 is to ensure that all DOE operations involving the management of radioactive waste, waste by-products, and surplus facilities pursuant to the AEA of 1954 as amended (P.L. 83-703) are conducted to protect adequately the public health and safety in accordance with radiation protection standards specified in DOE Orders. Such Orders include

1. DOE 5480.1A (Environmental Protection, Safety, and Health Protection Program for DOE Operations), which establishes an overall framework of program requirements for safety and environmental and health protection, including criteria for radiation exposure and radioactive effluent releases for operating facilities and sites;
2. DOE 5480.2 (Hazardous and Radioactive Mixed Waste Management), which provides interim guidance for managing mixed waste (radioactive waste containing nonradioactive hazardous constituents);

3. DOE 5484.2 (Unusual Occurrence Reporting System), which establishes the Department's policy and provides instructions for a system of reporting, analyzing, and disseminating information on programmatically significant events;
4. DOE 4320.1A (Site Development and Facility Utilization Planning), which establishes policies and procedures and assigns responsibilities and authorities for site development and planning of facility utilization;
5. DOE 5632.2 (Physical Protection of Special Nuclear Materials), which establishes minimum physical protection standards for special nuclear materials; and
6. DOE/NE-0017-1 (Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics), which, with annual updates, summarizes data in the Integrated Data Base program on all domestic spent fuel and radioactive waste.

Specific requirements and guidance for managing radioactive wastes, presented as separate management plans based on the type of waste that is handled, are discussed in Sect. 3.5.

3. COMPLIANCE WITH REGULATIONS

3.1 COMPLIANCE WITH NEPA

On January 1, 1970, the President signed NEPA into law. Over the past 15 years, NEPA has become the basic policy-setting federal law relating to protection of the environment and has provided the initiatives for passage of other federal and state environmentally related statutes. The principal provision of NEPA is to determine if a major federal action has significant environmental effects. A simplified flowchart of the NEPA process for a DOE action is given in Fig. 1. NEPA documentation for such actions can take several forms [e.g., Action Description Memorandum (ADM), Environmental Assessment (EA), and EIS], depending on anticipated environmental effects of the proposed action. How ORNL remedial action activities will comply with NEPA is the subject of a strategy paper to be completed during the first quarter of FY 1986.

The NEPA strategy paper will evaluate the applicability of NEPA to ORNL remedial actions under RCRA and CERCLA and will propose a preliminary strategy for complying with NEPA. This paper will identify the types of NEPA documentation that may be required for particular kinds of remedial actions and will address the possibility of using RCRA/CERCLA documentation (e.g., permit applications) for satisfying NEPA requirements. This strategy paper will serve as the first step in developing a proposal for complying with NEPA.

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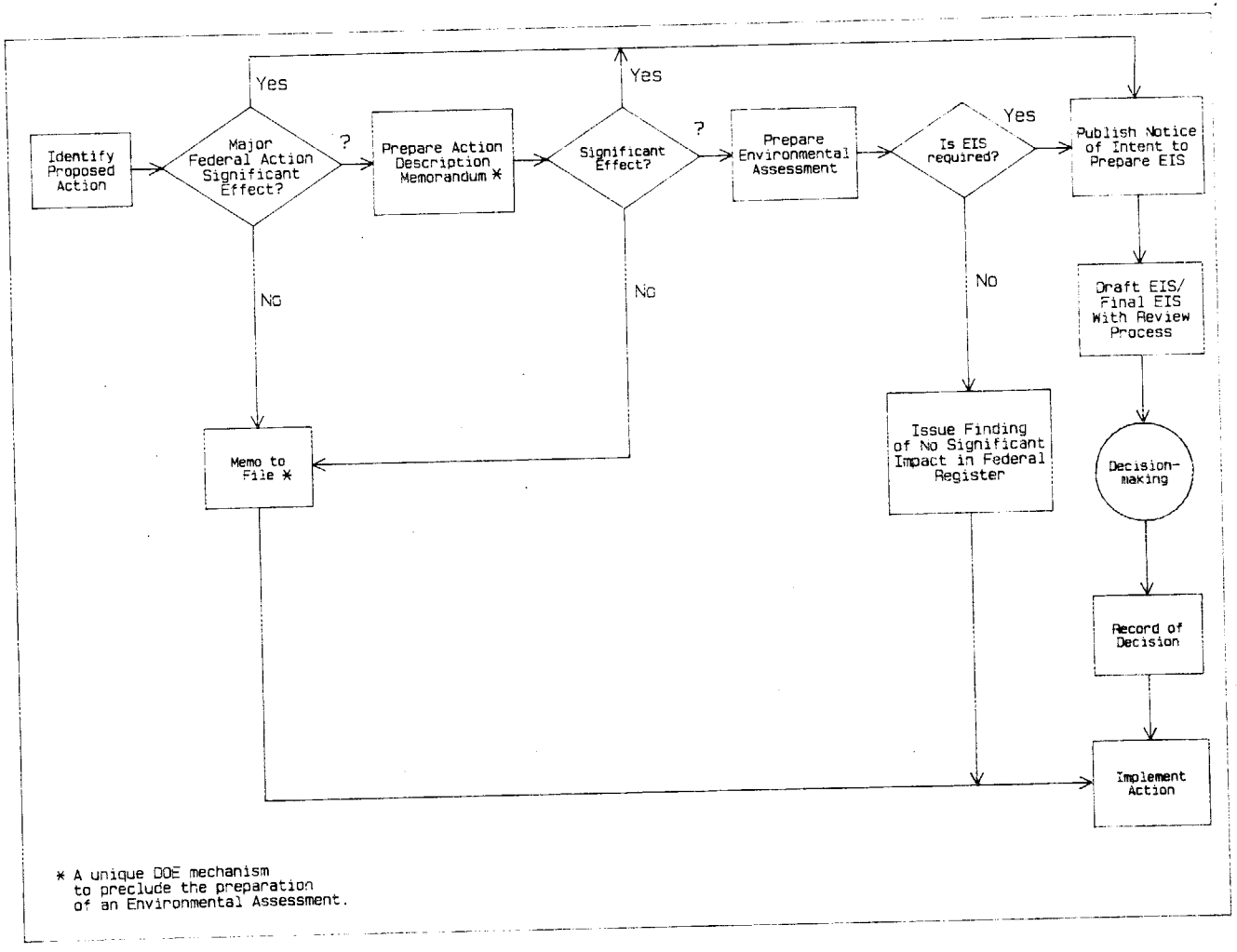

Fig. 1. Simplified flowchart for implementation of NEPA.

3.2 COMPLIANCE WITH RCRA

3.2.1 General Requirements

The regulatory program implementing Subtitle C of RCRA is complex, as evidenced by the large number of regulations published by EPA. The generation and accumulation, transportation, storage, treatment, and disposal of hazardous wastes are to be managed by a system of recordkeeping, reporting, and permitting. The regulatory program is applicable to DOE facilities that generate, transport, store, treat, or dispose of hazardous waste. Exemptions are possible where implementation of RCRA at a facility would be inconsistent with AEA.

RCRA requires a permit for the "treatment," "storage," or "disposal" (TSD) of any hazardous waste as identified or listed in 40 CFR 261. Owners and operators of waste management units must have permits (1) during the active life (including the closure period) of the unit; (2) for any unit which closes after January 26, 1983, during any post-closure period; and (3) during any compliance period [270.1(c)]. Figure 2 depicts a simplified flowchart for complying with RCRA.

Part 270 of the regulations specifies the information an applicant must submit to EPA when applying for a permit. The permit is in two parts. Part A permit applications for ORNL RCRA sites under SCMP have been submitted and accepted by EPA. Part A simply defines the processes to be used at each site, the design capability, and the hazardous waste to be handled. Details on the contents required in Part A applications are given in 270.13. Acceptance of Part A gives

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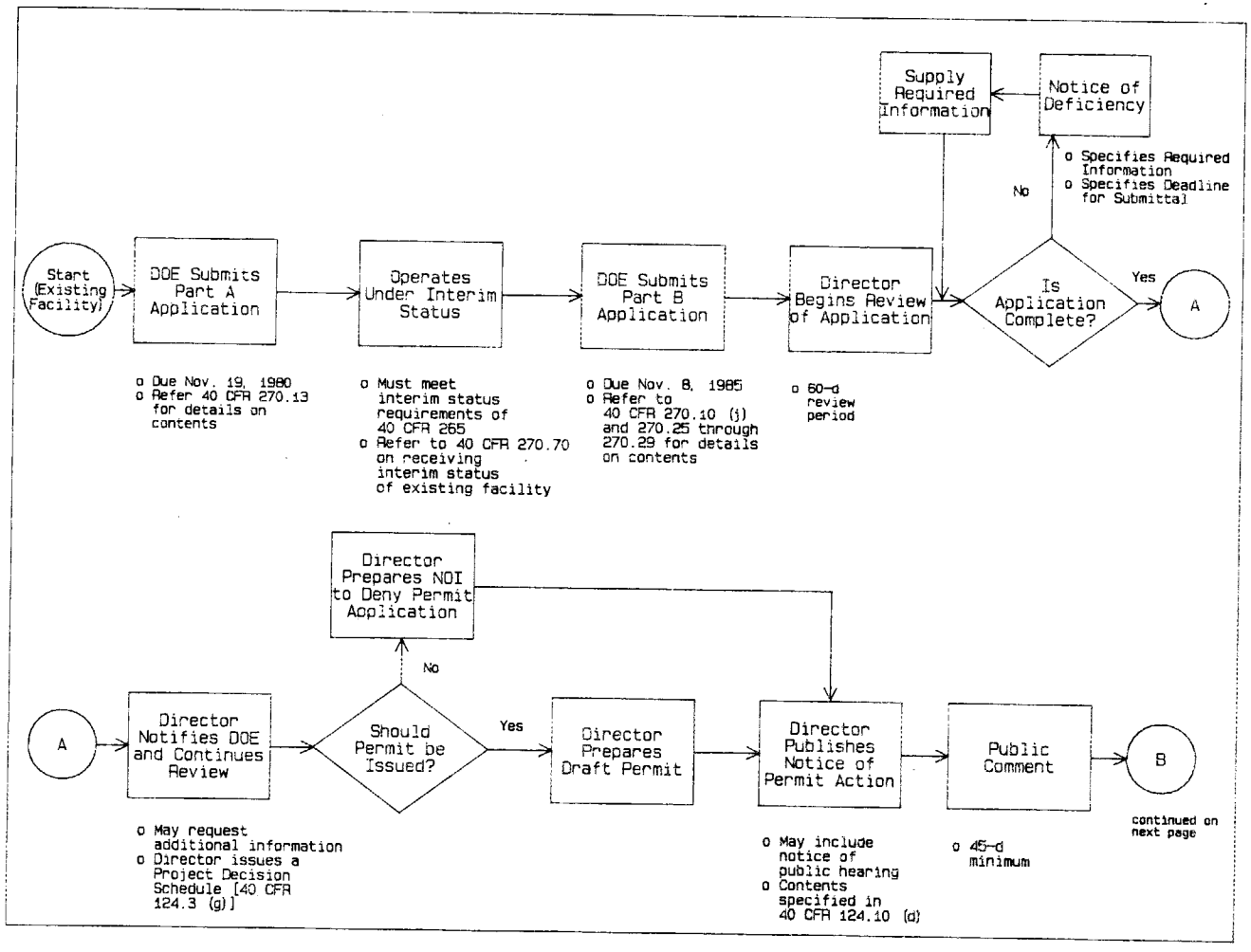

Fig. 2. Simplified RCRA permitting flowchart for an existing facility.

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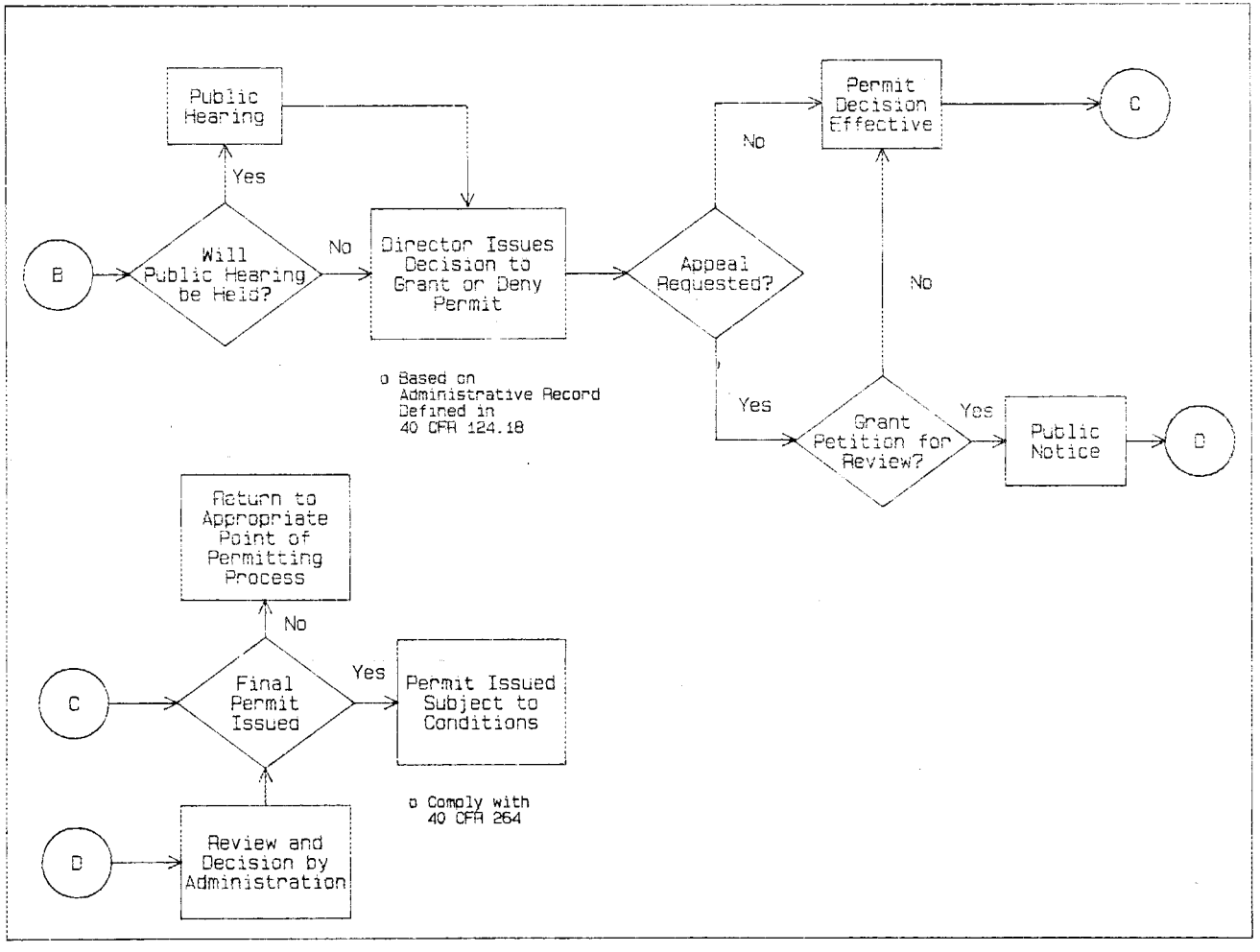

these sites "interim status" and allows ORNL to temporarily continue operations associated with such sites, pending final administrative action on facility permit applications. Interim status sites are required to comply with regulations defined in Part 265. Changes can be made in plant processes (e.g., capacity, design, and wastes handled) during interim status as long as they are reported in accordance with 270.72.

Interim status for a particular site terminates unless Part B of the permit application is submitted by November 8, 1985 (270.73). All ORNL sites requiring RCRA permits are scheduled to have the Part B permit applications submitted by November 1, 1985. Part B permit applications contain information intended to establish that the facility can meet certain technical standards. Details on the required contents of these applications are defined in 270.10(j), 270.14, and 270.17.

The EPA Regional Director and/or State agency reviews an application for completeness. If EPA decides to issue a permit, a draft permit is prepared and then subjected to public notice, public comment, and, in some cases, public hearings. After the comment period, EPA issues a final decision on a permit, as well as a response to all significant comments. Facilities receiving a final permit must comply with 40 CFR 264. RCRA permits are effective for a fixed term not to exceed 10 years.

The following general administrative and facility requirements are similar under both interim status and final status standards:

1. waste analysis -- detailed chemical and physical analyses, waste analysis plan, and specific requirements for each facility type;

2. security -- artificial or natural barrier with controlled entry or 24-h surveillance and warning signs;
3. inspection -- inspection plan and log and remedy of any deterioration, malfunction, or imminent hazard;
4. personnel training -- classroom or on-the-job training, annual review of training, and records of personnel training;
5. preparedness and prevention -- alarm system and emergency coordinator;
6. contingency plan, emergency procedures, and emergency coordinator;
7. manifest system procedures;
8. operating records of activities required by the regulation, such as manifest information, waste analysis records, testing and analytical data, and demonstration reports for variances;
9. reporting requirements, such as annual reports and unmanifested waste reports;
10. special requirements for ignitable, reactive, and incompatible wastes;
11. groundwater monitoring; and
12. closure and post-closure plans -- estimate of costs and description of how facility will be closed, notice of facility closure, and post-closure monitoring and maintenance.

In addition, if remedial actions result in the establishment of any new facilities, they must also comply with the following siting requirements:

1. New facilities should not be located within 62 m (200 ft) of a fault that has displaced in Holocene time.

2. New facilities located in the 100-year floodplain must be designed, constructed, and operated to prevent obstruction of the floodplain and washout by a 100-year flood.

Construction of new facilities cannot begin until Part A and B permit applications have been approved and the final permit has been issued.

In addition to the general requirements of RCRA and the specific conditions of its permitting process, the regulations specifically list federal laws that may apply to the issuance of an RCRA permit (270.3). Of these laws, the following apply to the issuance of permits for ORNL RCRA sites:

1. The National Historic Preservation Act of 1966. Section 106 of the Act and implementing regulations (36 CFR Part 800) require EPA, before issuing a license, to adopt measures when feasible to mitigate potential adverse effects of the licensed activity on properties listed or eligible for listing in the National Register of Historic Places. The Act's requirements are to be implemented in cooperation with State Historic Preservation Officers and upon notice to, and, when appropriate, in consultation with, the Advisory Council on Historic Preservation.
2. The Endangered Species Act. Section 7 of the Act and implementing regulations (50 CFR Part 402) require EPA to ensure, in consultation with the Secretary of the Interior or Commerce, that any action authorized by EPA is not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat.

3. The Fish and Wildlife Coordination Act. This Act requires that EPA consult with the appropriate state agency exercising jurisdiction over wildlife resources to conserve those resources before issuing a permit proposing or authorizing the impoundment (with certain exemptions), diversion, or other control or modification of any body of water.

3.2.2 Groundwater Monitoring Requirements

With respect to ORNL's remedial action activities, the heart of RCRA deals with groundwater monitoring. RCRA defines specific groundwater monitoring requirements for those facilities operating under interim status (Part 265), for those applying for a permit (Part 270), and for those facilities operating under a final permit (Part 264).

During the transition period from interim status to final permitting, land disposal facilities are bound by both the interim status regulations and the permit application regulations. Once a permit has been issued, facilities are bound by standards specified in Part 264. EPA designed the interim status (Part 265), permit application (Part 270), and permitting regulations (Part 264) to be followed in sequence. A facility would move from one phase of monitoring to the next (and from interim to permitted status) by building upon the information generated during the previous year.

To appreciate fully the requirements related to groundwater monitoring, one not only must become familiar with the specifics of the individual parts of the regulations, but also must understand the

interrelationships that exist among the various sections. Therefore, detailed summaries of the groundwater monitoring requirements are presented in the following three sections.

3.2.2.1 Interim Status Groundwater Monitoring: 40 CFR 265, Subpart F

Facilities operating under interim status must establish a two-stage groundwater monitoring program designed to detect and characterize the migration of any wastes that escape from a facility. The focus of both stages of the program (detection and assessment) is on evaluating the nature and extent of leakage, not on removal or treatment of contamination should it occur.

Detection monitoring

The objective of detection monitoring, the first stage of interim monitoring, is to determine which land disposal facilities have leaked hazardous waste into an underlying aquifer in quantities sufficient to cause a significant change in groundwater quality. The regulations establish a minimum of three downgradient wells and one upgradient well, although the preamble language clearly indicates that four wells would be adequate only in the simplest hydrogeologic environment. Ultimately, the number, depth, and location of wells must be selected so that the network meets the regulatory performance standard of immediately detecting any migration of statistically significant amounts of hazardous waste or hazardous waste constituents into the uppermost aquifer [265.91(a)].

To determine if leakage has occurred, monitoring data collected from downgradient wells must be compared with background (upgradient)

water-quality data established over an initial period of 1 year, samples taken quarterly. The comparison is based on three sets of parameters designed to characterize water unaffected by the facility and to predict possible leakage of hazardous waste. The three sets of parameters are (1) EPA primary drinking water standards (Part 265, Appendix III), (2) those establishing groundwater quality (chloride, iron, manganese, phenols, sodium, and sulfate), and (3) those used as gross indicators of groundwater contamination (pH, specific conductance, total organic carbon, and total organic halogen)[265.92(b)]. During the first year, background concentrations of the first set of parameters (EPA primary drinking water standards) for each groundwater monitoring well must be reported to EPA within 15 d after completing each quarterly analysis [265.94(a)(2)(i)].

At the end of the first year, the background for each contamination indicator is established by averaging the quarterly measurements obtained for that parameter from the upgradient wells [265.92(c)(2)]. These upgradient mean values are important because they not only establish the initial background concentrations to which all subsequent downgradient concentrations will be compared, but they also will be compared with subsequent upgradient concentrations. A change in upgradient water quality could be due to unforeseen contamination from upgradient sources, a mounding of contaminated groundwater beneath the facility, or a change in hydraulic gradient such that the original upgradient wells are now downgradient relative to the facility.

The second set of parameters must be analyzed at least annually, and the third set at least semiannually [265.92(d)(1-2)]. Elevation of the groundwater surface must be determined each time a sample is taken [265.92(e)]. Each time a facility samples for a contamination indicator, the values obtained from both the upgradient and downgradient wells must be compared with the mean values obtained for that parameter during the first year of background sampling (e.g., from the upgradient wells)[265.93(b)]. Results of the monitoring program must be investigated as appropriate and submitted to EPA no later than March 1 of each year [265.94(a)(2)(ii)].

If the groundwater monitoring program indicates that a site may be leaking, a second set of samples is taken to confirm the significant difference. A "detection" must be reported to EPA within 7 d of the date of such confirmation [265.93(d)(1)]. Confirmation of a leak requires the facility to move into assessment monitoring, the next phase of interim status monitoring.

Assessment monitoring

Once a significant change in water quality has been detected, a groundwater quality assessment plan must be submitted to EPA within 15 d for determining whether hazardous wastes or their constituents have entered the groundwater and, if so, their concentration, rate, and extent of migration [265.93(d)(2-4)]. Because detection monitoring parameters are nonspecific, a statistically significant change in one parameter may not necessarily represent migration of hazardous waste constituents into groundwater. Therefore, the first step in assessment

monitoring is to determine whether hazardous waste constituents have indeed leaked into the groundwater.

In most cases, the detection monitoring network installed at the site can be used for assessment monitoring. This assumes, of course, that the network and sampling and analysis techniques have been reviewed and deemed capable of detecting low-part-per-billion levels of hazardous wastes or their constituents (261.20-33 and associated appendixes). The groundwater quality assessment plan must be implemented as soon as technically feasible. If sampling reveals no contamination, the original detection protocol or a revised protocol (designed to avoid future false detections) can be reinstated. However, if the presence of hazardous wastes is confirmed, then the assessment plan must continue to characterize the rate and extent of migration.

Assessment monitoring to characterize the rate and extent of migration will generally require installation of additional well clusters located to define the vertical and horizontal extent of the plume. Unlike detection monitoring where wells would be placed more or less evenly along the downgradient border of the waste management area, additional wells for assessment monitoring would be placed in those areas necessary to track the migration of a localized discharge. In addition to direct sampling for hazardous waste constituents, indirect techniques, such as electrical resistivity or ground-penetrating radar, may be used to help define the boundaries of the plume.

Within 15 d after the first determination, a written report containing an assessment of the groundwater quality must be submitted

to EPA [265.93(d)(5)]. Following this initial analysis, assessment monitoring must continue quarterly until the facility closes or is permitted [265.93(d)(7)]. In addition, EPA's Groundwater Compliance Order Guidance (draft, March 21, 1985) states that detection monitoring must continue for any wells unaffected by the initial leak. Although this requirement could not be found in the regulations, it seems to be a reasonable extension of an assessment monitoring plan. The regulations do, however, require annual evaluation of the groundwater surface elevation to determine if the requirements for locating the monitoring wells continue to be satisfied [265.93(f)].

No direct regulatory consequences result from finding contaminated groundwater. The purpose of assessment monitoring is strictly to acquire information to support future decisions regarding the need for corrective action. Strategies for cleaning up unacceptable contamination must be developed through the permit process.

3.2.2.2 Groundwater Monitoring Regulations for Permitted Facilities: 40 CFR 264, Subpart F

Regulations for Part 264 groundwater monitoring are contained in a three-stage program designed to detect, evaluate, and correct groundwater contamination arising from leaks or discharges from hazardous waste management facilities. The three-stage program consists of (1) detection monitoring, (2) compliance monitoring, and (3) corrective action. Although these regulations are applicable to applicants who are seeking permits for new facilities, they also generally apply to interim status facilities that have not detected groundwater contamination (through Part 265 interim status detection monitoring).

Detection monitoring

Part 264 detection monitoring requires routine monitoring for a select set of indicator parameters specified in the permit rather than the four indicator parameters (pH, specific conductance, total organic carbon, and total organic halogen) specified in Part 265 regulations. The actual monitoring requirements of Part 264 (e.g., number of wells and frequency of sampling) are similar to those already imposed under interim status regulations. If sampling indicates that the groundwater has become contaminated, the following requirements apply [264.98(h)].

1. Notify EPA in writing within 7 d, indicating which parameters are statistically different from background.
2. Sample groundwater wells for all constituents listed in Part 261, Appendix VIII (with the exception of those substances that are unstable in groundwater or for which there exists no EPA-approved test method).
3. Establish background values for each Appendix VIII constituent that has been found at the compliance point.
4. Within 90 d, submit to EPA an application for a permit modification to establish a compliance monitoring program.
5. Within 180 d, submit to EPA an engineering feasibility plan for corrective action that outlines an approach for cleaning up the groundwater if necessary.

The applicant is then required to move into compliance monitoring, the next stage of Part 264 groundwater monitoring program.

Compliance monitoring

The goal of compliance monitoring is to ensure that leakage of hazardous constituents (Part 261, Appendix VIII) into the groundwater does not exceed acceptable levels. EPA and the applicant, through the permit, specify what level of each constituent will be considered environmentally acceptable and then establish a program of routine monitoring to ensure that acceptable levels are not exceeded (264.99). If the concentration limits are exceeded, the applicant must institute a corrective action program designed to bring the concentration levels back within acceptable limits.

The framework for compliance monitoring is the groundwater protection standard that is written into the permit [264.99(a)]. The standard consists of four elements. The first element is a listing of all Appendix VIII hazardous constituents present in the groundwater that could reasonably have been derived from the facility. The burden of demonstrating that a particular Appendix VIII constituent could not reasonably be derived from a facility lies with the applicant [264.99(j)]. Facilities entering compliance monitoring from Part 264 detection will have identified Appendix VIII constituents present in the groundwater as part of their detection monitoring responsibilities [264.98(h)(2)]. Facilities entering compliance monitoring from Part 265 assessment monitoring, however, may have to perform additional sampling because assessment monitoring requires determination of only Appendix VII (Part 261) substances rather than the full complement of constituents listed in Appendix VIII. [Note: permit application

regulations (Part 270, discussed below) require facilities to characterize plumes with respect to all Appendix VIII constituents (270.14(c)(4).]

The second element of the groundwater protection standard is the specification in the permit of a concentration limit for each hazardous constituent. Concentration limits must be set at either

1. the maximum concentration limit for drinking water established by the National Interim Primary Drinking Water Regulations (where applicable),
2. the background level of the constituent in groundwater, or
3. an alternate concentration limit (ACL) if the applicant can demonstrate that a higher concentration will not pose a substantial present or potential hazard to human health or the environment (264.94).

The third and fourth groundwater protection standards are the establishment of the point of compliance and the compliance period. The point of compliance (the point where monitoring must occur), located at the downgradient limit of the waste management area, is the vertical surface that extends down into the uppermost aquifer underlying the regulated sites (264.95). The compliance period (time over which the standard applies) is equal to the active life of the facility plus the closure period (264.96).

Monitoring during the compliance period must be conducted at least quarterly [264.99(d)]. In addition, the groundwater flow rate and direction in the uppermost aquifer must be determined annually [264.99(e)], and all monitoring wells must be sampled annually for all

Appendix VIII constituents to detect any additional substances that may have entered the groundwater [264.99(f)]. Any change in groundwater direction of flow or the detection of additional Appendix VIII constituents requires a modification of the permit, as specified in 264.99.

If the groundwater protection standard is exceeded at any compliance point well during compliance monitoring, then the applicant must notify EPA of this finding in writing within 7 d [264.99(i)]. In addition, the applicant must submit to EPA an application for a permit modification to establish a corrective action program within 180 d, or within 90 d if an engineering feasibility study has been previously submitted under 264.98(h)(5).

Corrective action program

If compliance monitoring reveals that a facility is violating its groundwater protection standard, the applicant must implement a corrective action program. The goal of corrective action is to bring the facility back into compliance with permit conditions. To achieve this goal, the applicant must remove the hazardous waste constituents or treat them in place within both the waste disposal site [264.100(b)] and groundwater between the compliance point and downgradient facility property boundary [264.100(e)]. The permit will specify the specific measures to be taken. Corrective action must begin within a reasonable time period after the groundwater protection standard is exceeded; EPA will specify that time period in the facility permit [264.100(c)].

The applicant must also establish and implement a groundwater monitoring program to demonstrate the effectiveness of the corrective

action [264.100(d)]. This program will be essentially the same as the compliance monitoring program, although EPA's Groundwater Compliance Order Guide (draft, March 21, 1985) indicates that the number of wells and the frequency of monitoring at or near the compliance point where the plume appears to be concentrated may have to be increased. Also, it is likely that additional monitoring wells will have to be installed near the downgradient edge of the plume.

Corrective actions need to continue until compliance with the groundwater protection standard is achieved [264.100(f)]. Written reports on the effectiveness of the corrective action program must be submitted to EPA semiannually [264.100(g)]. Once contamination has been reduced to meet the protection standard, the applicant may discontinue corrective actions and corrective action monitoring and return to the monitoring schedule established for compliance monitoring. If compliance is not achieved before the end of the compliance period specified in the permit, corrective action must continue until monitoring shows that the groundwater standard has not been violated for three consecutive years [264.100(f)].

3.2.2.3 Groundwater Information Requirements for Permit (Part B) Application

The information requirements related to groundwater monitoring associated with 40 CFR 270 (Permit Programs) can be organized into two basic groups. The first group, outlined in 270.14(c), establishes the nature of the facilities' impact on the groundwater, as well as the subsurface hydrogeologic characteristics of the site and extent of the waste management area. The second group includes the information

necessary to establish one of the three Part 264 groundwater monitoring and response programs (detection monitoring, compliance monitoring, and/or corrective action).

Requirements of 270.14(c)

Section 270.14(c) includes the following four basic requirements:

1. present data collected during the interim status monitoring (where applicable);
2. identify the uppermost aquifer and hydraulically interconnected aquifers beneath the facility property;
3. delineate the waste management area, the property boundary, and the proposed point of compliance; and
4. describe any plume of contamination that has entered the groundwater by
    a. delineating the extent of the plume, and
    b. identifying the concentration of each Part 261 Appendix VIII constituent throughout the plume or identifying the maximum concentrations of each Appendix VIII constituent in the plume.

Requirements for appropriate part 264 compliance

EPA envisioned the interim status period as a time to develop the information necessary to support permitting. ORNL, however, only recently began to establish a groundwater monitoring program as required by 265.91. Had such information been available at the time of Part B permit applications, it would have been used to decide whether the facility permit should include a detection monitoring program, a

compliance monitoring program, or a program for corrective action. Facilities with inadequate Part 265 monitoring systems at the time of Part B permit application (e.g., ORNL RCRA sites) are not allowed to delay undertaking the more comprehensive assessment and sampling activities mandated by 270.14(c)(4) by first going back to implement the less demanding monitoring protocol established in Part 265.

3.2.3 Closure and Post-closure Requirements

All facilities managing hazardous waste must provide for closure of their sites; those that dispose of hazardous waste must also provide for post-closure care. All ORNL RCRA regulated sites are operating under interim status. Therefore, ORNL must comply with the requirements of 265.111-265.115 and 265.117-265.120 for closure and post-closure care of their sites. A facility must be closed in a manner that

1. minimizes the need for further maintenance and
2. controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste constituents, leachate, contaminated rainfall, or waste decomposition products to the ground or surface waters or to the atmosphere.

A written closure plan, required for each facility by May 19, 1981 [265.112(a)], must include at least

1. a description of how and when the facility will be partially closed, if applicable, and finally closed;
2. an estimate of the maximum inventory of wastes in storage and in treatment at any time during the life of the facility;

3. a description of the steps needed to decontaminate facility equipment during closure; and
4. an estimate of the expected year of closure and a schedule for final closure.

The plan and all revisions must be kept at the facility until closure is completed and certified in accordance with 265.115. The plan must be submitted to EPA at least 180 d before the date closure is expected to begin [265.112(c)]. Changes may be made in closure design, etc., as long as the plan is amended within 60 d of the changes [265.112(b)].

EPA will provide the public, through a newspaper notice, the opportunity to submit written comments on the plan for a period of 30 d [265.112(d)]. If warranted, a public hearing may be held, given a 30-d notice before it occurs. EPA will approve, modify, or disapprove the plan within 90 d of its receipt [265.112(d)]. If required, the plan must be modified within 30 d; this plan will be approved or modified by EPA within 60 d.

Closure of a site must begin within 30 d after the date on which the final volume of wastes is expected to be received [265.112(c)(2)]. All hazardous wastes must be removed, treated, or disposed of on-site within 90 d after receiving the final volume of such wastes or 90 d after approval of the closure plan, if that is later [265.113(a)] (exceptions are possible). Closure activities must be completed within 180 d after receiving the final volume of wastes or 180 d after approval of the closure plan, if that is later [265.113(b)] (exceptions are possible). Post-closure care must continue according to an

EPA-approved plan for 30 years after the date of completing closure (265.117).

A written post-closure plan, required for each facility by May 19, 1981 [265.118(a)], must include at least

1. a description of the planned groundwater monitoring activities and frequencies at which they will be performed to comply with Subpart F during the post-closure period;
2. a description of the planned maintenance activities and frequencies at which they will be performed; and
3. the name, address, and phone number of the person or office to contact about the disposal facility during the post-closure care period.

Changes in the plan during the active life of the facility are handled in the same manner and schedule as described for the closure plan [265.118(b)]. A change in the post-closure plan during the post-closure period is possible and is regulated by 265.118(e). Schedules for submission of the plan to EPA and subsequent reviews by EPA and the public are the same as those described for the closure plan [265.118(c-d)].

Within 90 d after closure is completed, a notice (including several specific items) must be submitted to EPA and the local land authority (265.119). A notation must be recorded on the deed of the property, or other instruments that are normally examined during the title search, that will notify any potential purchaser of the property that the land has been used to manage hazardous waste and that its use is restricted under 265.117(c).

Once the ORNL facilities have been fully permitted, they are regulated by Part 264 of the regulations. Closure and Post-closure Plans required by Subpart G of Part 264, however, will have already been developed.

3.2.4 Regulation of Hazardous Waste Storage Tanks

Hazardous waste storage tanks are regulated under both RCRA Subtitles C and I. Subtitle C specifies the requirements that must be met for the storage of Subtitle C hazardous wastes within tanks located aboveground, inground, or underground. Subtitle I, as instituted by the RCRA 1984 Amendments, regulates underground storage tanks that contain regulated substances. The term "regulated substances" refers to any petroleum or petroleum products or any hazardous substances as defined in Sect. 101(14) of CERCLA, except those regulated as a hazardous waste under Subtitle C of RCRA.

The June 26, 1985, Federal Register (50 FR 26444-26504) published EPA's proposed standards for hazardous waste storage and treatment tank systems. The proposed regulation deals mainly with implementing Subtitle C; some parts, however, address Subtitle I. The proposed regulations address EPA's promulgation of standards requiring any new underground tank system to utilize an "approved leak detection system" and EPA's permitting standards for hazardous waste underground storage tanks that cannot be entered for inspection.

The proposed rules indicate that EPA will not use the latitude available within RCRA to differentiate between requirements for different types of storage tanks. Instead, it is expected that the

same or similar requirements would be applied to all storage tanks under either Subtitle C or Subtitle I and to all types of contents, whether petroleum products or hazardous wastes.

The following is a summary of EPA's June 26, 1985, proposed regulations for hazardous waste storage and treatment tank systems. Comments from the public on the proposed amendments to the regulations were due to EPA by August 26, 1985. Depending upon the extent of the comments received, the regulations are expected to be published in final form by June 1986.

EPA has proposed regulatory measures for storage tanks by (1) developing permitting standards under Part 264 for underground tanks that cannot be entered for inspection, (2) developing corrosion protection requirements for metal tank systems that are susceptible to corrosion, and (3) selecting a secondary containment approach. These revisions also fulfill mandates of the 1984 amendments that new underground tanks be equipped with leak detection systems [RCRA, Section 3004(o)(4)] and that EPA issue permitting standards for underground tanks that cannot be entered for inspection [RCRA, Section 3004(w)]. In addition, EPA has proposed revisions to certain unworkable and ineffective existing standards.

The major elements of the proposal include the following: under proposed revisions to the Part 264 permitting standards, the structural integrity of all tank systems for which permits are sought would be assessed by a qualified registered professional engineer and submitted to EPA. Included in this assessment for metal tank systems would be a determination by a corrosion expert of the type and degree of corrosion

protection needed to ensure the integrity of the system for its intended life. This requirement would replace the existing minimum shell thickness requirements of 264.191.

Proposed Part 264 requirements would also establish installation standards for new tank systems and require that a qualified registered professional engineer or a qualified inspector trained in the installation of tank systems prepare a written statement to be kept on file at the facility attesting to the proper installation of the system. Supervision and certification by a corrosion expert of the installation of cathodic protection systems would also be required.

Proposed Part 264 regulations would require that all new tank systems have secondary containment and that existing tank systems either have full secondary containment or implement a groundwater monitoring program. Facilities with existing tanks that elect to implement groundwater monitoring rather than retrofit full secondary containment would be required to construct partial secondary containment for any aboveground portions of their systems. In addition, existing underground tank systems that do not have secondary containment would be required to test the integrity of their systems every 6 months. Tank systems that have secondary containment would have to maintain a leak detection system that detects leaks within 24 h of liquid entry into the containment system.

Part 264 inspection requirements would be revised to ensure that structures or devices required under the new regulations, such as corrosion protection devices and leak detection systems, are periodically inspected. In addition, these revisions would require

owners and operators to establish a schedule for assessing the integrity of aboveground and inground tanks. Part 264 would also be amended to establish procedures for responding to leaks once they are detected.

Proposed revision to the Part 265 interim status standards would require that the structural integrity of all tank systems that have interim status be assessed within 6 months of the effective date of these proposed regulations. The assessment would consist of internally inspecting aboveground and inground tanks that can be entered for inspection and by leak testing underground tanks.

Proposed Part 265 regulations would also provide a secondary containment option similar to that proposed for existing permitted tanks under Part 264. The regulations would require that tank systems either have full secondary containment or that a groundwater monitoring program be implemented. Tank systems that do not have secondary containment would have to have partial secondary containment for any aboveground portions of the tank system without secondary containment and would have to be leak tested every 6 months.

Inspection requirements for interim status tanks would also be revised to ensure that structures or devices required under the new regulations are inspected. Part 265 would be amended to establish procedures for responding to leaks and for repairing or replacing unfit tanks.

Finally, the proposal would require that all tanks subject to the 90-d accumulator provisions of 40 CFR 262.34 have full secondary containment.

EPA's experience and studies since early 1981 have led the Agency to believe that some releases from primary-tank systems are inevitable over time; all releases cannot be prevented by tank design and operating requirements. Such factors as the accelerated corrosion of metal tanks in contact with the soil; breaks and leaks in ancillary equipment and piping; breakdowns in, and spills from, overflow equipment; and operators' errors have caused the Agency to conclude that full secondary containment is the most effective means of preventing releases from tank systems. Thus, the Agency proposes to require, whenever feasible, full secondary containment for hazardous waste tank systems (i.e., tanks and ancillary equipment). For new tank systems, EPA has determined that full secondary containment is always the least costly means of containing releases. The proposal, therefore, would require all new tank systems to have secondary containment.

The Agency has determined, however, that full secondary containment may not be the most practical means of containing releases from existing tank systems. Thus, the Agency is proposing an alternative to full secondary containment for existing tanks systems. This alternative would require secondary containment of any portion of a tank system that is aboveground (i.e., partial secondary containment), plus a groundwater monitoring program. In addition, underground tank systems would be required to be leak tested every 6 months. The alternative to full secondary containment will be termed simply the "groundwater monitoring alternative."

This alternative containment option would apply only to existing tank systems that are operating under either interim status or are already permitted. Because of the need for interaction between the facility owner or operator and EPA whenever groundwater monitoring is implemented, such an option would not be viable for 90-d accumulation tank systems. Thus, these facilities must either be provided with full secondary containment within 1 year of the effective date of these regulations or apply for a RCRA Part 264 permit. Table 1 provides a summary of the containment strategy being proposed.

EPA believes that the groundwater monitoring alternative would provide essentially equivalent protection to full secondary containment. This protection is further ensured by the requirement that the owner or operator take immediate response measures should a release occur.

In addition, EPA is proposing to expand both the closure standards for tank systems without full secondary containment to require removal of contaminated soil at closure and post-closure care if all hazardous waste residues and contaminated soil are not removable at closure.

Finally, although the requirement for secondary containment constitutes perhaps the major difference between the existing standards and today's proposed regulatory strategy, there are also other notable changes. One such change is the increased emphasis on the proper design, installation, and operation of ancillary equipment (e.g., pipes and pumps).

Subtitle I of RCRA establishes a comprehensive scheme for the regulation of underground storage tanks containing "regulated

Table 1. Summary of proposed containment requirements for Subtitle C hazardous waste storage and treatment tank systems

Type of tank system	Containment requirements
All permittable hazardous waste storage/treatment tank systems	
New	Full secondary containment
Existing (aboveground and inground)	Within 1 year of effective date, provide either full secondary containment or partial secondary containment and groundwater monitoring
Existing (underground)	Within 1 year of effective date, provide either full secondary containment or groundwater monitoring and leak testing every 6 months
90-d accumulation tank systems	
New	Full secondary containment
Existing	Full secondary containment within 1 year of effective date or apply for a Part 264 permit

substances." Some of its provisions require EPA to promulgate requirements (see Sect. 3.6, Table 7); others go into effect without action on the part of EPA (see Sect. 3.6, Tables 3 and 4). Major provisions of Subtitle I include the following:

1. A notification provision requiring that all owners of currently used tanks and nonoperational tanks taken out of service after January 1, 1974, notify designated state and local agencies of the existence of their tanks (Sect. 9002).
2. A requirement that EPA promulgate regulations governing petroleum tanks by February 8, 1987; regulations governing new tanks containing hazardous substances by August 8, 1987; and regulations governing existing tanks containing hazardous substances by August 8, 1988 (Sect. 9003).
3. A prohibition against the installation of new tanks that do not satisfy statutory requirements [Sect. 9003(g)].
4. A provision for the approval of state underground storage tank programs that are no less stringent than federal regulations promulgated under Sect. 9003 (Sect. 9004).
5. A provision providing EPA authority to inspect facilities, conduct monitoring and testing at facilities, or require tank owners to conduct monitoring and testing and to provide information pertaining to their tanks to EPA (Sect. 9005).
6. A provision providing EPA authority to enforce the requirements of Subtitle I through the use of administrative orders, injunctions, or civil penalties (Sect. 9006).

7. A provision making tanks within the control of federal government subject to Subtitle I requirements (Sect. 9007).
8. A requirement that EPA conduct the following studies: (a) a study concerning petroleum tanks by November 8, 1985; (b) a study concerning tanks containing hazardous substances by November 8, 1987; and (c) a study concerning exempted farm and heating oil tanks by November 8, 1987 (Sect. 9009).

The only regulations to date promulgated by EPA to implement Subtitle I of RCRA are Parts 280.1 (definitions and exemptions) and 280.2 (interim prohibition) (50 FR 28702). The interim prohibition, which became effective May 7, 1985, states that no underground storage tanks for the purpose of storing regulated substances may be installed unless the tank (whether of single- or double-wall construction)

1. will prevent releases caused by corrosion or structural failure for the operational life of the tank (a tank without corrosion protection may be installed in soil whose resistivity is 12,000 ohms/cm or more);
2. is cathodically protected against corrosion, constructed of noncorrosive material, steel clad with a noncorrosive material, or designed in a manner to prevent the release or threatened release of any stored substance; and
3. has material used in construction or lining that is compatible with the substance to be stored.

Additional regulations dealing with other aspects of underground storage tanks addressed by Subtitle I are forthcoming.

3.2.5 State vs Federal Authority for Implementing RCRA

The State of Tennessee received final authorization from EPA to implement Phase I of the RCRA program on July 16, 1981. Phase I refers primarily to the general regulations promulgated by EPA on May 19, 1980, covering 40 CFR 260-263 and 265. Tennessee was granted interim authorization on February 5, 1985, to implement the "base program" (i.e., all of RCRA, excluding the amendments of November 8, 1984). "Interim authorization" refers to temporary authorization that is granted if the state program is "substantially equivalent" to the federal program [Sect. 3006(c)]. Any future regulations issued by EPA to implement the requirements and prohibitions of the 1984 Amendments will automatically be applicable to authorized and nonauthorized states alike. Thus, a state's authorization status may change in response to further implementation of the 1984 Amendments. Until the State of Tennessee has been approved to fully implement all provisions of the Act, the permitting process for ORNL RCRA sites will involve both the State of Tennessee Department of Health and Environment and EPA Region IV.

3.3 COMPLIANCE WITH CERCLA AND DOE ORDER 5480.14

A flowchart representing DOE's implementation of CERCLA for ORNL's remedial action sites is shown in Fig. 3. Sites that contain both hazardous and radioactive wastes must be considered under either RCRA or CERCLA. If future site characterization and chemical use inventories establish that a site does not contain a hazardous

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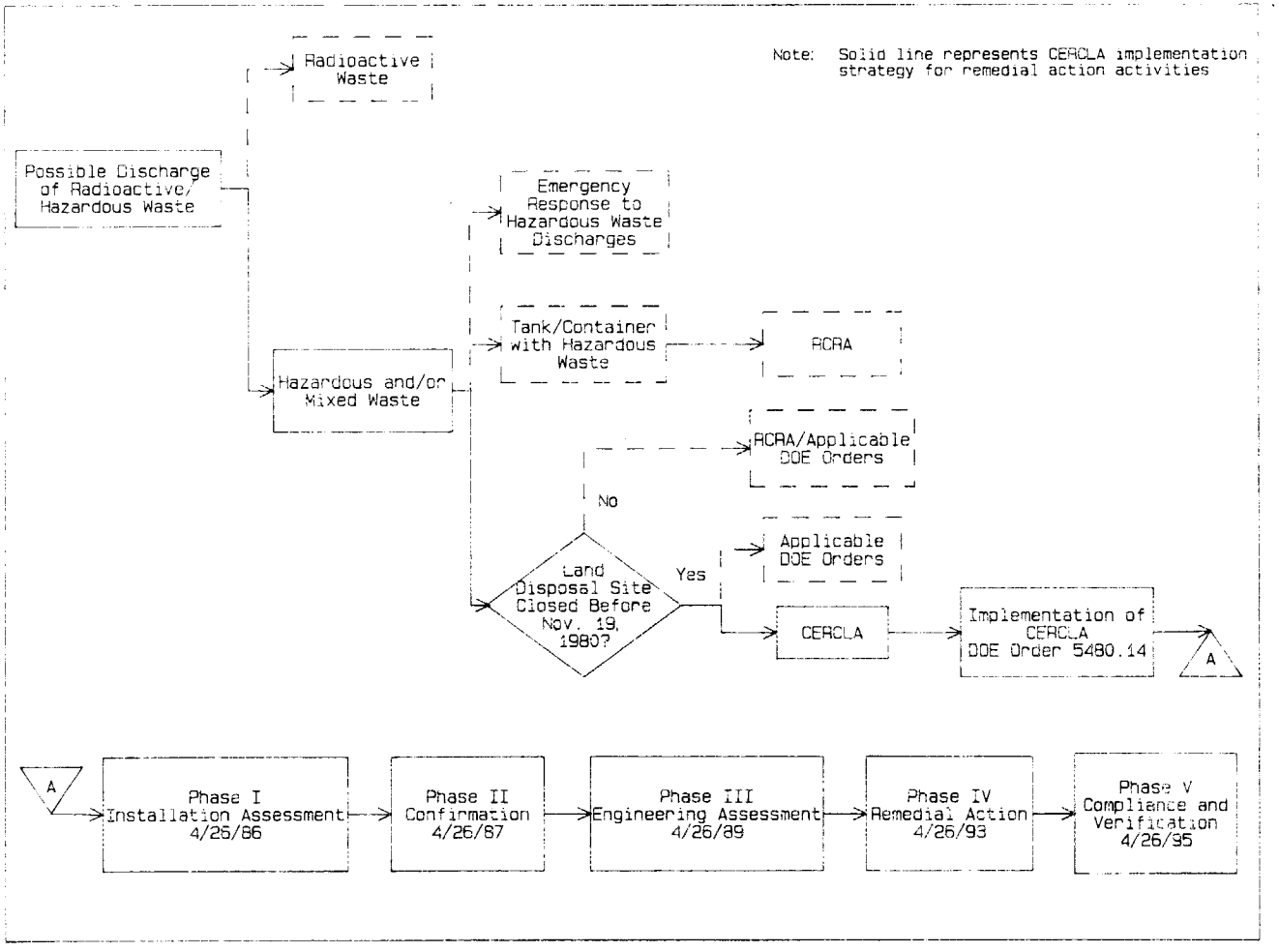

Fig. 3. Flowchart representing DOE's implementation of CERLA for remedial action sites.

substance, then RCRA and CERCLA would apply only with respect to nonhazardous wastes. Radioactively contaminated sites excluded by RCRA [40 CFR 261.46(a)(4)] are presently administered under the Atomic Energy Act of 1954 (P.L. 83-703), the Energy Reorganization Act of 1974 (P.L. 93-438), and applicable DOE Orders.

The Remedial Action Program has been established to perform remedial action on contaminated sites and facilities and not to respond to emergency releases of either hazardous or radioactive substances. Figure 3 shows that if a site were no longer used for disposal of hazardous materials after November 19, 1980, it is regulated by CERCLA. The implementation of CERCLA at a DOE facility is currently* governed by DOE Order 5480.14.

DOE Order 5480.14 establishes a five-phase compliance program for all DOE CERCLA sites. A brief description of each phase of the Order and its suggested completion date are given in Table 2. Lack of money or time does not relieve DOE from the obligation of responding to each phase of DOE Order 5480.14. Phases I, II, III, and V require report preparation. Although the DOE Order does not specifically require a report for Phase IV (implementing the remedial action plan), the conduct of such activities would be expected to be part of the annually updated Waste Management Plans required by DOE Order 5820.2. To indicate the type of information required by DOE Order 5480.14, suggested outlines for Phases I, II, and III reports are reproduced in Appendix C.

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*Future legislative action by Congress could alter DOE response to CERCLA.

Table 2. Outline and description of DOE Order 5480.14 implementation of CERCLA

Phase I - Installation Assessment, to evaluate site history and records, and to locate and identify those inactive hazardous waste disposal sites that may pose a risk to health, safety, and the environment as a result of migration of hazardous substances; includes performing modified hazard ranking of each site. Suggested completion date is April 26, 1986.

Phase II - Confirmation, to quantify, by preliminary and comprehensive environmental survey, the presence or absence of hazardous substances that may pose a risk to health, safety, and the environment. Suggested completion date is April 26, 1987.

Phase III - Engineering Assessment, to develop, evaluate, and recommend a plan for controlling the migration of hazardous substances identified in Phase II or for effecting remedial actions at the installation. Suggested completion date is April 26, 1989.

Phase IV - Remedial Actions, to implement the recommended site-specific remedial measures identified in Phase III. This includes the engineering, design, and actual construction of barriers to restrain migration of identified hazardous substances and/or decontamination operations. Suggested completion date is April 26, 1993.

Phase V - Compliance and Verification, to review monitoring data, perform any monitoring required to determine that remedial action and decontamination have been effective, establish any continuing monitoring requirements, and prepare remedial action documentation. Suggested completion date is April 26, 1995.

The major activity of Phase I is the evaluation of risk posed to health, safety, and the environment as a result of migration of hazardous substances. This activity will require a large information gathering task, as well as the performance of a modified hazard ranking of each DOE CERCLA site.

Phase II requires installation of monitoring wells and collection, analysis, and evaluation of data. The report must include an interpretation of site-specific data and make recommendations for needed corrective actions.

Phase III of the Order emphasizes evaluation of the remedial action alternatives. The preferred alternative for controlling the migration of hazardous substances identified in Phase II, along with needed resource requirements and a proposed schedule for implementing the remedial actions, should be described.

Phases I and II require near-term immediate action by ORNL because of the short lead time for each activity. An understanding of Phase IV through Phase V requirements can be gained from reviewing Table 2. Note that DOE Order 5480.14 requires that all DOE CERCLA sites have remedial action performed before April 26, 1993.

As opposed to RCRA, the CERCLA federal statute and regulations do not establish methodology for monitoring CERCLA sites. It seems logical to follow well-placement guidelines established in RCRA regulations and compliance guidance documents. Actual chemical analyses performed could vary because of the different substances covered by the two laws.

The interface between the CERCLA/DOE Order 5480.14 and the requirements of the State of Tennessee has not been completely analyzed at this time. DOE Order 5480.14 does not address State requirements regarding CERCLA sites. The State of Tennessee does, however, have its own "Superfund" under the Tennessee Division of Solid Waste Management, indicating the necessity to review further the state's role in implementing CERCLA/DOE Order 5480.14.

3.4 COMPLIANCE WITH CWA AND SDWA

The objectives of CWA include prohibition of toxic discharges, protection of fish and wildlife, and availability of federal funds for public waste treatment works. The sections of the act most relevant to ORNL's remedial action activities include

1. permits under the National Pollutant Discharge Elimination System (NPDES) (Sect. 402),
2. technology-based effluent limitations (Sect. 301),
3. water quality-based effluent limitations (Sect. 302),
4. new source performance standards (Sect. 306),
5. regulation of toxics (Sect. 307),
6. federal facilities pollution control (provisions for presidential exemption) (Sect.313), and
7. permits for the discharge of dredged or fill materials into navigable waters (Sect. 404).

The primary objective of the SDWA is to ensure that underground injection techniques will not endanger drinking water sources. The EPA

has issued regulations to establish requirements for UIC programs. They establish minimum standards for state programs, list states in need of a program, grant monies, review state programs, and establish needed programs where states have not acted.

A flowchart of pollution sources and applicable regulations implementing CWA and SDWA, pertinent to ORNL's Remedial Action Program, is given in Fig. 4. A discussion of this diagram follows.

All DOE facilities that discharge wastewaters to a surface water body must ensure compliance with CWA by obtaining an NPDES permit (Sect. 402), that specifies the discharge standards and monitoring requirements that the facility must achieve for each point source or outfall.

Section 404 of the Act enables the Corps of Engineers to issue permits* for the discharge of dredge or fill material into waters of the United States at specific sites. The Corps specifies a site by applying guidelines promulgated by EPA (40 CFR 230). Under Subsect. 404(c) of the Act, EPA can prohibit (or limit use of) a proposed disposal site or withdraw an already designated site, pursuant to regulations codified at 40 CFR 231. This may occur if EPA foresees unacceptable impacts on municipal water supplies, fishery areas, or wildlife and recreational areas. However, such a determination must be made after consultation with the Corps and the permit applicant. Such an EPA "veto" has rarely been used.

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*Department of Energy (DOE). 1982. Guidance Manual for Department of Energy Compliance with Corps of Engineers Permits on Dredging and Filling Activities. U. S. DOE, Office of Environmental Protection, Safety, and Emergency Preparedness.

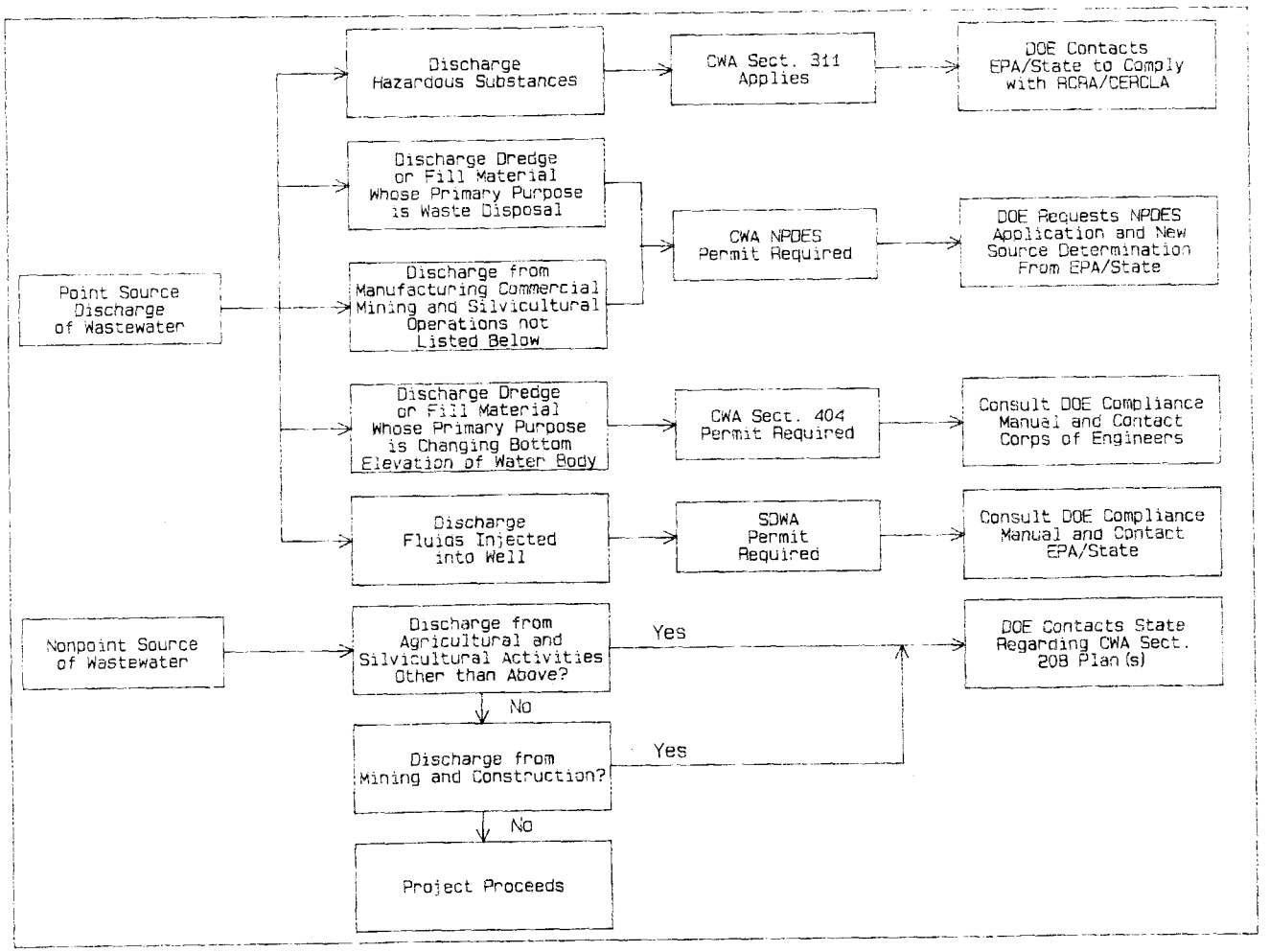

Fig. 4. Flowchart of pollution sources and applicable regulations under the CWA and SDWA that apply to remedial action activities.

Various dredge and fill activities may be excluded from CWA Sect. 404 permitting requirements unless the action (1) alters the use of navigable waters or (2) impairs the flow of those waters. DOE actions that may be excluded from permitting requirements include maintenance or emergency construction on damaged dams, transportation structures, and related structures; drainage ditch maintenance; placement of temporary sediment basins at construction sites (if fill is not discharged to navigable water); and temporary road construction for moving equipment. Placement of rip-rap and construction of new dams do fall under the purview of Sect. 404 permits.

On November 17, 1980, CEQ released guidance for federal agencies seeking to apply for a permit exemption for construction projects specifically authorized by Congress (memorandum to Heads of Agencies from Gus Speth, CEQ Chairman). Exemptions can be granted, provided that the EIS, pursuant to NEPA, contains sufficient information on the proposed discharges and that the proposed action is consistent with EPA's 404(b)(1) guidelines for the discharge of dredged or fill materials. Federal projects not specifically authorized by Congress are not candidates for exemption and are subject to regulation under nationwide, general, or individual permit requirements.

For those states that choose to issue dredge and fill permits themselves, much of the remainder of Sect. 404 deals with the role of the Corps and EPA in state-administered programs. The State of Tennessee has not elected to institute this program.

Sections of the SDWA most relevant to ORNL waste management activities deal with the permitting process for the UIC Program* and the classification of injection wells. Each class of well has a different monitoring, reporting, construction, regulatory, and review requirement, as defined by 40 CFR Part 146.

Provisions applicable to accidental discharges of hazardous polluting substances were revised in 1978. These provisions, along with CERCLA, provide for cleanup of accidental releases of toxic materials. Currently, response to an accidental spill is not a responsibility of SCMP.

The discharge of waste water from a nonpoint source (i.e., construction) is covered in Sect. 208 of CWA. This section empowers Tennessee's Division of Water Quality Control to regulate nonpoint source discharges. The State is responsible for ensuring that construction activity does not degrade the State's water quality.

3.5 COMPLIANCE WITH DOE ORDER 5820.2

DOE Order 5820.2 deals with policies and guidelines by which DOE manages its radioactive waste, waste by-products, and radioactively contaminated surplus facilities. The Order defines responsibilities for various offices of DOE. Heads of Field Organizations such as ORNL are responsible for ensuring that day-to-day radioactive waste

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*Department of Energy (DOE). 1982. Draft Guidance Manual for Department of Energy, Compliance with Underground Injection Control Program. U.S. DOE, Office of Environmental Protection, Safety, and Emergency Preparedness.

management operations and surplus facility programs at their sites are conducted in compliance with the requirements of this Order. Specific responsibilities include the following.

1. Documenting detailed radioactive waste management practices and procedures that apply to all operations at their respective sites. These documents shall include appropriate references to safety, health, environmental, economic, and other analyses. They shall also include procedures for performing impact analyses and obtaining exemptions from their respective site-specific requirements for storage/ disposal of radioactive waste that are consistent with applicable law.
2. According to an established format, preparing annual updates of Waste Management Plans for all operations under their cognizance. These plans shall be submitted at the end of each fiscal year and distributed to the Director of Defense Waste and Byproducts Management; the Assistant Secretary for Policy, Safety, and Environment; and other appropriate Headquarters Program Offices for review and comment.
3. Ensuring fiscal responsibility for waste transportation and establishing fees, as necessary, for storage and disposal of DOE waste at their sites.
4. Maintaining environmental, safety, health, and quality assurance programs for all radioactive waste management programs under their cognizance.
5. Managing surplus facilities for which they are responsible, according to the requirements of this Order.

6. Reporting any unusual occurrences (including potential excessive radiation exposures) associated with DOE waste management operations at their sites per the requirements of DOE Order 5484.2.

Approval authority for certification programs, standard containers, transportation, waste acceptance criteria, and all other aspects related to transuranic (TRU) waste emplacement at the Waste Isolation Pilot Plant (WIPP) have been delegated to the Manager of Albuquerque Operations Office.

A detailed schedule for preparing annual updates of the Waste Management Plan is given below. To indicate the type of information required in the report, a suggested outline is reproduced in Appendix D. The dynamic nature of the ERFU Program over the next several years will have a profound influence on the contents of these documents. Therefore, the ERFU Program, and, hence, Remedial Action Program, could be expected to provide input to the Waste Management Plan by July 15 of each year.

Schedule for annual update of Waste Management Plan

Date	Item
July 15	Letter from DOE-Oak Ridge Operations to each site requesting an updated Waste Management Plan; the letter will specify the format to be used and identify items to be given special attention
September 1	Draft updated Waste Management Plan to DOE-ORO
September 15	Comments to sites from DOE-ORO
September 25	Final Waste Management Plan to DOE-ORO
September 30	DOE-ORO submits updated Waste Management Plan to DOE Headquarters

Specific requirements and guidance for managing radioactive wastes are presented in DOE Order 5820.2. With the exception of establishing disposal site closure/post-closure plans for LLW, such guidance pertains principally to operational activities and only indirectly to remedial actions at ORNL. Thus, a brief summary of the guidelines for day-to-day management of TRU and LLWs is presented in Appendix E. Guidance for developing disposal site closure/post-closure plans is reproduced below.

Disposal Site Closure/Post-closure

Field Organizations shall develop a site-specific comprehensive closure plan before initiation of operations at new, or closure of existing, LLW disposal sites. The plan shall be reviewed and, if necessary, amended before initiation of closure activities to ensure that the objective of DOE Order 5820.2 can be met. LLW disposal sites closed before implementation of this Order shall be periodically monitored to assess both radioactive and nonradioactive hazards; program offices, in consultation with the Director of Defense Wastes and Byproducts Management and the Assistant Secretary for Policy Safety and Environment, shall reevaluate the safety of such sites to determine the need for corrective measures, as necessary. Guidance is provided below for use by Field Organizations in developing their site-specific plans. The plans should address, as appropriate, the following:

1. stabilization of the disposal site for post-closure care, including filling and capping of disposal excavations, as specified in design requirements, and removal of unneeded equipment and facilities;

2. residual radioactivity levels for surface soils that comply with requirements for site threshold quantities;
3. a security system to prevent unauthorized entry or removal of equipment or material during closure and a passive security system for the post-closure period;
4. maintenance of emergency response plans, facilities, and equipment until closure is complete;
5. permanent identification markers for locating disposal excavations and monitoring wells when closure is complete;
6. periodic surveillance and maintenance programs until closure is complete and modification of those programs, as necessary, to measure performance and assess the need for corrective measures following closure; and
7. corrective measures to be applied to existing disposal sites if conditions occur that could jeopardize attainment of the objective of this Order.

3.6 SCHEDULE FOR COMPLIANCE WITH ENVIRONMENTAL REGULATIONS

The primary purpose of the Remedial Action Program is to provide corrective measures necessary to place ORNL in compliance with applicable environmental regulations. The key to developing a compliance schedule for conducting remedial action activities is to identify those requirements of the regulations that must be met at a particular time. Although the laws and regulations are many and complex, relatively few deadline dates that establish a critical path for compliance are actually presented in the regulations. Such dates,

however, are of paramount importance and have been compiled in Table 3. The requirements are listed in chronological order according to due dates specified by the regulations. Note that RCRA and DOE Order 5480.14 (DOE's implementation of CERCLA) are the principal regulations requiring actions by a specified date.

Many requirements of the Acts and regulations do not have specific "deadline dates." For example, owners and operators of treatment, storage, and disposal facilities are required to clean up off-site contamination [RCRA, Sect. 3004(v)]. A requirement such as this has an "effective date" corresponding to the day on which the Act or its amendment was passed or the day on which the regulation was promulgated. Such general requirements of RCRA and their effective dates are listed in Table 4.

The sites and facilities currently considered under the Remedial Action Program are listed in Tables 5 and 6. Many of the sites are regulated either by CERCLA or RCRA. The major criteria for determining which of these two laws governs a particular site is its operational status. If the site stopped receiving wastes before November 19, 1980, it is regulated by CERCLA; a site that was closed or will close after November 19, 1980, is regulated by RCRA. It is expected that the number of remedial action sites to be addressed will increase as the program continues.

Requirements of other regulations summarized in this review (NEPA, CWA, SDWA, and DOE Order 5820.2) have been discussed earlier. Of these, only the DOE Order 5820.2 (Radioactive Management) refers to a deadline date; Heads of Field Organizations must prepare Annual Waste

Table 3. Schedule for compliance with environmental regulations applicable to ORNL's Remedial Action Program

Deadline date	Reference	Requirement
Sep. 30, 1984	DOE Order 5820.2 (Radioactive Waste Management)	Heads of Field Organizations prepare annually updated waste management plans, including status of compliance with the requirements of this Order
Nov. 8, 1984	RCRA 9002(a)	Owner who brings a USI[a] into service after the initial reporting period must notify authorities within 30 d
May 8, 1985	40 CFR 264.221(c) 40 CFR 265.221(a) (RCRA)	Requires installation of two or more liners, leachate collection systems, and groundwater monitoring for new landfills, surface impoundments, replacements, and lateral extensions thereof (exemptions are possible). Units fully operational and receiving waste by November 8, 1984, are exempt from the minimum technology requirements until November 8, 1988
May 8, 1985	RCRA 7010(a)	Ban on hazardous waste injection within 1/4 mile of underground source of potable water
May 8, 1985	40 CFR 280.2 (RCRA)	New USIs[a] must meet new corrosion protection and material compatibility standards
Aug. 8, 1985	40 CFR 270.10 (RCRA)	Exposure assessments due for Part B applications filed before August 8, 1985. Part B applications filed after this date must include exposure assessments (see EPA's Permit Applicants' Guidance Manual for Exposure Information Requirements under RCRA Sect. 3019, July 3, 1985)
Nov. 8, 1985	40 CFR 270.10 40 CFR 270.73 (RCRA)	Interim status for land disposal facilities expires unless Part B applications are filed
Nov. 8, 1985	RCRA 3005(e)	Interim land disposal facilities must certify that they comply with groundwater monitoring requirements
Nov. 8, 1985	40 CFR 260.22 (RCRA)	New delisting requirements are in effect
Nov. 8, 1985	RCRA 3007(c)	EPA or states begin annual inspection of federal facilities

Table 3. (continued)

Deadline date	Reference	Requirement
Nov. 8, 1985	40 CFR 265.91(a) (RCRA)	Detection Monitoring: establish a minimum of three down-gradient wells and one upgradient well. The number, depth, and location of wells must be selected so that the network meets the regulatory standard of immediately detecting any migration of statistically significant amounts of hazardous waste or hazardous waste constituents into the uppermost aquifer
Nov. 8, 1985	40 CFR 270.14(c)(4) (RCRA)	Describe any plume of contamination that has entered the groundwater and define its extent and identify the concentration of each Appendix VIII constituent throughout the plume or identify the maximum concentrations of each Appendix VIII constituent in the plume
Nov. 8, 1985	40 CFR 265.92 (RCRA)	Obtain and analyze samples quarterly for 1 year from the groundwater monitoring system according to an established plan (defined in Part B permit application). Guidance is defined in EPA-530/SW-611, August 1977, and EPA-600/4-79-020, March 1979
Jan. 31, 1986	RCRA 3016(a)	Federal agencies must report inventories of all TSD[b] facilities, active and inactive. Inventory reports are due biennially hereafter
Mar. 1, 1986	40 CFR 265.75 (RCRA)	A biennial report, including data on the quantity of waste and the manner of its disposal, must be submitted by March 1 of each even-numbered year for the preceding calendar year
Apr. 26, 1986	DOE Order 5480.14 (CERCLA)	CERCLA Phase I report on Installation Assessment: evaluate site history and records to locate and identify those inactive hazardous waste disposal sites that may pose a risk to health, safety, and environment as a result of migration of hazardous substances
May 8, 1986	RCRA 9002(a)	Notify state of all USTs[a] taken out of service after January 1, 1974: include age, date taken out of service, size, type, location, and type and quantity of substance left in the tank
May 8, 1986	RCRA 9002(a)	States must be notified of active USTs,[a] specifying age, size, type, location, and uses of such tank

Table 3. (continued)

Deadline date	Reference	Requirement
Nov. 8, 1986	RCRA 3005(j)(5)	Owners/operators of interim status surface impoundments must apply for applicable exemption from minimum technological requirements or forfeit eligibility for exemption
Mar. 1, 1987	40 CFR 265.94 (RCRA)	Submit results of the evaluations of groundwater surface elevations and a description of the response to that evaluation, where applicable. Results of the groundwater assessment program must be submitted annually, including, but not limited to, the calculated (or measured) rate of migration of hazardous waste or hazardous waste constituents in the groundwater during the reporting period
Apr. 26, 1987	DOE Order 5480.14 (CERCLA)	CERCLA Phase II report on Confirmation: quantify, by preliminary and comprehensive environmental survey, the presence or absence of hazardous substances that may pose a risk to health, safety, and the environment
Nov. 8, 1988	RCRA 3005(j)	Surface impoundments in existence on November 8, 1984, must comply with minimum technology requirements (double liners, leachate collection system, leak detection, and groundwater monitoring systems)
Nov. 8, 1988	RCRA 3004(d)(3)	Contaminated soil and debris from CERCLA cleanup are subject to RCRA regulations as hazardous waste
Nov. 8, 1988	RCRA 3005(C)(2)(c)	Part B applications are due for all interim facilities (other than land disposal facilities and incinerators that have earlier deadlines)
Apr. 26, 1989	DOE Order 5480.14 (CERCLA)	CERCLA Phase III report on Engineering Assessment: develop, evaluate, and recommend a plan for controlling the migration of hazardous substances identified in Phase II or for effecting remedial actions at the installation
Nov. 8, 1992	RCRA 3005(c)	Interim status expires for all facilities (other than land disposal facilities and incinerators) unless Part B applications were submitted by November 1988

Table 3. (continued)

Deadline date	Reference	Requirement
Apr. 26, 1993	DOE Order 5480.14 (CERCLA)	CERCLA Phase IV on Remedial Actions to be completed: implement the recommended site-specific remedial measures identified in Phase III. This includes the engineering, design, and actual construction of barriers to restrain migration of identified hazardous substances and/or decontamination operations
Apr. 26, 1995	DOE Order 5480.14 (CERCLA)	CERCLA Phase V report on Compliance and Verification: review monitoring data, perform any monitoring required to determine that remedial action and decontamination have been effective, establish any continuing monitoring requirements, and prepare remedial action documentation

[a]UST = underground storage tank.
[b]TSD = treatment, storage, and disposal.

Table 4. General requirements of RCRA applicable to ORNL's Remedial Action Program

Effective date	Reference	Requirement
Nov. 8, 1984	RCRA 3004(b)	Prohibition on disposal of hazardous wastes in certain geologic formations[a]
Nov. 8, 1984	RCRA 3005(a)	Permits are required for the construction of any new TSD[b] facility
Nov. 8, 1984	RCRA 3004(u)	Permits issued after November 8, 1984, must include compliance schedule for cleanup of continuing releases
Nov. 8, 1984	RCRA 3004(v)	Owner/operators of TSD[b] facilities obligated to clean up off-site contamination
Nov. 8, 1984	RCRA 3008(d-e)	Employees are liable for knowingly violating permits or supplying false information on permits, manifests, or records
Nov. 8, 1984	RCRA 7002(a)	Citizen suits are allowed in cases of imminent hazard to human health and environment
Nov. 8, 1984	40 CFR 270.60 (RCRA)	Permits by rule for underground injection wells under UIC Program are modified to include new corrective action, financial assurance, and compliance schedule requirements under 264.101
Nov. 8, 1984	RCRA 3008(a)(2)	EPA authorized to issue a corrective action order when it determines that a hazardous waste release has occurred from an interim status facility. Such an order may include suspension or revocation of facility's permit. Failure to comply is subject to a fine of $25,000/d of noncompliance for each violation
Nov. 8, 1984	40 CFR 264.222 40 CFR 264.252 40 CFR 264.253 40 CFR 264.302 (RCRA)	No waivers from groundwater monitoring requirements for waste piles, landfills, surface impoundments, and land treatment units. Existing waivers are removed

Table 4. (continued)

Effective date	Reference	Requirement
Nov. 8, 1984	40 CFR 264.90(b) (RCRA)	New variance introduced for engineered structures provided that such structures (1) do not receive or contain liquid waste; (2) are designed and operated to exclude precipitation and runoff; (3) have multiple leak-detection systems operated and maintained throughout the life of the unit, including closure and post-closure; and (4) prevent the migration of hazardous constituents. Both inner and outer layers of containment are required
Nov. 8, 1984	40 CFR 270.34(b)(2) (RCRA)	EPA may add terms to permit conditions beyond those specified in the regulations to protect human health and environment
Nov. 8, 1984	RCRA 3005(c)(2)	RCRA permits are effective for a fixed term not to exceed 10 years. Permits are reviewed 5 years after issuance and may be modified for compliance to currently applicable standards
Nov. 8, 1984	RCRA 9005(a)	EPA and states are granted authority to inspect, monitor, and test UST[c] facilities or to require owner to do so
Nov. 8, 1984	RCRA 9007	Federal facilities are subject to federal, state, and local UST[c] requirements unless specifically exempted by the President
Nov. 8, 1984	RCRA 9006(d)	EPA is given enforcement authority through use of corrective orders, injunctions, or civil penalties up to $10,000/d per tank
May 8, 1985	40 CFR 264.314(b) 40 CFR 265.314(b) (RCRA)	Prohibition on disposal of bulk or noncontainerized liquid hazardous waste in landfills
Sep. 1, 1985	RCRA 3002(b)	Generators must certify that they are minimizing the quantity and toxicity of their hazardous waste
Sep. 1, 1985	RCRA 3002(h)	All RCRA permits will require annual reporting on efforts to minimize waste

Table 4. (continued)

Effective date	Reference	Requirement
Nov. 8, 1986	RCRA 3004(e)	Prohibition on land disposal (except underground injection) of wastes containing dioxins or certain solvents[a]
July 8, 1987	RCRA 3004(d)	Prohibition on land disposal (except underground injection) of "California List" wastes[a]
Aug. 8, 1988	RCRA 3004(f)	Prohibition on underground injection of "California List" wastes, dioxins, and certain solvents[a]
Aug. 8, 1988	RCRA 3004(g)(6)(B)	Prohibition on land disposal of one-third of listed hazardous wastes (to be determined by EPA), except at facilities meeting specified standards[a]
June 8, 1989	RCRA 3004(g)(4)(B)	Prohibition on land disposal of remaining two-thirds of listed hazardous wastes (to be determined by EPA), except at facilities meeting specified standards[a]
May 8, 1990	RCRA 3004(g)(6)(C)	Prohibition on land disposal of all listed and identified hazardous wastes[a]

[a]Takes effect unless EPA determines that this method of disposal is protective of human health and the environment.

[b]TSD = treatment, storage, and disposal.

[c]UST = underground storage tank.

Table 5. Compendium of ORNL remedial action sites: Site Corrective Measures Program

Description	Site No.
Equalization Basin	3524
190 Process Waste Pond	3539
190 Process Waste Pond	3540
Sewage Lagoon, East Basin	
HFIR Waste Basin	7905
HFIR Waste Basin	7906
TRU Waste Basin	7907
TRU Waste Basin	7908
Process Waste Sludge Basin, SWSA-5	7847 (7835)
Abandoned Filled-in Waste Basin	3512
Waste Holding Basin	3513
SWSA-1	2624
SWSA-2	4003
SWSA-3	1001
SWSA-4	7800
SWSA-5	7802
SWSA-6	7822
Waste Pit 1	7805
Waste Pit 2	7806
Waste Pit 3	7807
Waste Pit 4	7808
Waste Trench 5	7809
Waste Trench 6	7810
Waste Trench 7	7818
White Oak Creek	0853
White Oak Lake	7846
Spill Sites[a]	

[a]Includes contaminated research areas, LLW line leaks, etc. See The ORNL Site Corrective Measure Program Long-Range Plan (ORNL/NFW-84/86) for listing of known sites. Updated list is the subject of a separate study.

Table 6. Compendium of ORNL remedial action sites: Surplus Facilities Management Program

Description	Location
ORNL at X-10	
Radiochemical Processing/Development	Bldg. 3019
High-Level Radiation Analytical Lab.	Bldg. 3019-B
Cobalt-60 Storage Garden	Bldg. 3029
High-Level Alpha Handling Facility	Bldg. 3508
FPDL Filter Pit	Bldg. 3517
FPDL LLW Transfer Line	Bldg. 3517
High-Level Radiochemical Laboratory	Bldg. 4501
High-Radiation-Level Chemical Development Laboratory	Bldg. 4507
Transuranium Research Laboratory	Bldg. 5506
Isotopes Ductwork/3110 Filterhouse	Isotopes Area
LLW Collection Tank W-1A	N. Tank Farm
Storage Pad	SW of Bldg. 3503
Tower Shielding Facility	Bldg. 7702
Decontamination Facility	Bldg. 7819
Oil Storage Tank	New Hydrofracture Fac.
Fission Product Development Lab	Bldg. 3517
Metal Recovery Facility	Bldg. 3505
ORNL Graphite Reactor	Bldg. 3001
Waste Holding Basin	Site 3513
Gunite Storage Tanks W5-W10	Site 3507
Waste Storage Tanks	
Waste Tank WC-1	SW of Bldg. 3037
Waste Tanks WC-15, WC-17	SE of Bldg. 3587
Waste Tanks WI-W4, W13-W15	Site 3023
Waste Tank W11	S of Bldg. 3536
Waste Tanks TH1-TH3	S of Bldg. 3503
Waste Tank TH4	SW of Bldg. 3500
Old Hydrofracture Facility	Site 7852
Storage Garden 3033	N of Bldg. 3033
Waste Evaporator Facility	Bldg. 3506
Fission Product Pilot Plant	Bldg. 3515
Shielded Transfer Tanks (5)	SWSA-4
Molten Salt Reactor Experiment	Bldg. 7503
Low-Intensity Test Reactor	Bldg. 3005
Homogeneous Reactor Experiment	Bldg. 7500

Table 6. (continued)

Description	Location
ORR Experimental Facilities	
Reactor Experiments	Bldg. 3042
ORR Heat Exchanger	Bldg. 3087
ORNL at Y-12	
ORNL 86-in. Cyclotron	Bldg. 9201-2
MSRE Fuel Handling Facility	Bldg. 9201-3
Storage Tank	Bldg. 9201-3
Coolant Salt Technology Facility	Bldg. 9201-3
Attic	Bldg. 9204-1
Floor Drain System	Bldg. 9204-1
Concrete Laboratory	Bldg. 9204-1
East End Basement	Bldg. 9204-1
Laboratory and Animal Facilities	Bldg. 9207
Decontamination Facility	Bldg. 9419-1

Management Plans by September 30 of each year (Table 3). Remedial action sites that contain radioactive wastes can be expected to be included in such Plans.

Although many of the regulatory requirements do not have deadline dates, they can become part of the critical path for compliance. For example, surface impoundments in existence on November 8, 1984, must stop receiving wastes by November 8, 1988, unless they comply with minimum technology requirements [RCRA, Sect. 3005(j)]. Furthermore, they must be closed within 180 d after receiving the final volume of wastes [40 CFR 265.113(b)]. Although NEPA does not refer to specific deadline dates, it does require some form of documentation before implementing a proposed action (Sect. 3.1). If an EA or EIS is needed for closing one of the surface impoundments, considerable lead time could be required to complete the appropriate assessment before the RCRA deadline for closing the site. Similar examples can be cited with respect to the permitting processes of the CWA and SDWA (see Sect. 4) and with other sections of RCRA, such as reporting groundwater monitoring results (see Sects. 3.2.2.1-3.2.2.2).

As stated in the introduction of this document, the regulations governing management of hazardous wastes are constantly changing. Passage of the 1984 Amendments to the Solid Waste Disposal Act (1984 Hazardous and Solid Waste Amendments) requires EPA to implement more than 70 provisions of the amendments. The statutory deadlines for EPA studies, reports, and rulemaking that relate to ORNL remedial action activities are presented in Table 7.

Table 7. Schedule for EPA studies, reports, and rulemaking for 1984 hazardous and solid waste amendments

Statutory deadline	Reference	Description
ASAP	3004(v)	Amend regulations requiring groundwater corrective action for TSD[a] facilities to require action beyond facility boundary
Mar. 1, 1985	3004(w)	Promulgate final permitting standards for underground HW[b] tanks that cannot be entered for inspection
May 8, 1985	3007(e)(2)	Report on potential for private inspection program for TSDs[a]
Nov. 8, 1985	3001(e)(1)	List wastes containing halogenated dioxins and halogenated dibenzofurans
Nov. 8, 1985	3014(b)	Propose whether to list or identify used automobile and truck crankcase oil as hazardous waste
Nov. 8, 1985	9002(b)(2)	Prescribe form of notice to state/local agencies about underground storage tanks
Nov. 8, 1985	9009(a)	Complete study of underground petroleum storage tanks
Feb. 8, 1986	3004(c)(2)	Promulgate regulations to minimize disposal of containers of liquid HW[b] in landfills and to minimize presence of free liquids in containers of HW[b]
Feb. 8, 1986	3001(e)(2)	Determine whether to list certain specified wastes, including solvents, chlorinated aromatics, and coal slurry pipeline effluent, as hazardous

Table 7. (continued)

Statutory deadline	Reference	Description
Feb. 8, 1986	3004(b)	Promulgate regulations requiring producers and users of fuels derived from or containing HW or used oil to maintain certain records
May 8, 1986	3004(o)(7)	Publish guidance criteria for siting of TSD[a] facilities and for identifying areas of vulnerable hydrogeology
Oct. 1, 1986	8002(r)	Report on feasibility of establishing standards for reduction of quantity and toxicity of HW
Nov. 8, 1986	3004(q)(1) 3003(c)	Promulgate regulations establishing standards applicable to producers and users of fuels derived from or containing HW or used oil
Nov. 8, 1986	3001(h)	Promulgate regulations identifying additional characteristics of HW, including measures or indicators of toxicity
Nov. 8, 1986	3014(b)	Determine whether to list used automotive, truck crankcase, and other used oil as hazardous waste
Nov. 8, 1986	3014(c)(2)	Promulgate standards for generation and transportation of recycled used oil
Nov. 8, 1986	3004(g)	Submit a schedule to Congress for reviewing all listed wastes and the eligibility for land disposal of all listed wastes
Nov. 8, 1986	3004(o)(5)(A)	Revise permit regulations to require all new land disposal facilities to meet minimum technological requirements (double liner, leachate collection, and groundwater monitoring systems)

Table 7. (continued)

Statutory deadline	Reference	Description
Mar. 8, 1987	3001(g)	Revise EP toxicity characteristics as a predictor of leaching potential of wastes
May 8, 1987	3004(o)(4)(A)	Promulgate standards for leak detection systems for all new land disposal and underground storage tanks (TSD[a] facilities)
May 8 1987	9003(f)(1)	Regulations for release detection, prevention, and correction at underground storage tanks containing petroleum must become effective
May 8, 1987	3004(n)	Promulgate regulations for monitoring and control of air emissions at TSD[a] facilities, including open tanks, surface impoundments, and landfills
July 8 1987	3004(d)(1-2)	Prohibition on land disposal of specified liquids
Nov. 8, 1987	9003(f)(2)	New underground storage tank performance standards must become effective
Nov. 8, 1987	9009(b)	Complete study of all underground storage tanks
Aug. 8, 1988	3004(g)(4)(A)	Review one-third of listed hazardous wastes to determine whether land disposal should be banned and promulgate land disposal regulations
Nov. 8, 1988	9003(f)(3)	Regulations for release detection, prevention, and correction at underground storage tanks (other than those containing petroleum) must become effective

Table 7. (continued)

Statutory deadline	Reference	Description
Nov. 8, 1988	3005(c)(2)(A)(i)	Review all land disposal permit applications submitted before enactment
June 8, 1989	3004(g)(4)(B)	Review remaining two-thirds of listed hazardous wastes to determine whether land disposal should be banned and promulgate land disposal regulations
May 8, 1990	3004(g)(4)(c)	Promulgate regulations prohibiting land disposal of all listed and identified hazardous wastes, unless a particular method of land disposal is found to be protective of human health and the environment

[a]TSD = treatment, storage, and disposal.
[b]HW = hazardous waste.

3.7 GUIDANCE DOCUMENTS

EPA has issued several guidance documents to assist owners/operators in complying with regulations promulgated by EPA. While some of these are general in nature, others refer specifically to the provisions of the 1984 RCRA amendments. Documents that should be consulted in planning and conducting the ORNL remedial action activities include

1. Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities, EPA-530/SW-611, August 1977.
2. Handbook for Sampling and Sample Preservation of Water and Wastewater, EPA-600-4-82-029, September 1982.
3. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, 2nd ed., July 1982.
4. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1979.
5. Permit Applicants' Guidance Manual for Hazardous Waste Land Treatment, Storage, and Disposal Facilities, EPA-530/SW-84-004, May 1984.
6. Ground Water Compliance Order Guidance, EPA Draft Report, March 21, 1985.
7. Ground Water Technical Enforcement Guidance Document, EPA Draft Report, March 21, 1985.
8. Permit Applicants' Guidance Manual for Exposure Information Requirements Under RCRA Section 3019. EPA Final Report, July 3, 1985.

The EPA guidance documents are written not only to guide the owner/operator but also to assist EPA inspection and enforcement officials in deciding if a facility is in compliance with the law and implementing regulations. Hence, although the guidance documents are not regulations per se, they provide further elaboration on EPA's interpretation of the law. For example, regarding the manual for exposure information requirements, EPA's Director of the Office of Solid Waste writes:

> Applicants who provide all of the information and the discussion described in the Manual will generally be considered to have met the Section 3019 information submittal requirements. Depending on the nature of the information submitted, however, EPA may use other authorities (e.g., Sections 3004(u), 3008(h), 3013, and 7003) to obtain more definitive information on releases and exposures.*

DOE, through its Office of Environmental Compliance, has developed an Environmental Compliance Guide (DOE/EV-0132, February 1981) to assist DOE personnel in formulating environmental compliance plans for DOE actions. Although the document is somewhat out of date with respect to some legislation, it is currently being updated. The Guide, which provides information on achieving compliance with NEPA and various other environmental statutes (Table 8), is divided into three parts.

Part I of the document provides guidance for developing environmental compliance plans. Basically, the compliance plan is formulated by determining the applicability and requirements of various

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*July 5, 1985, memo from John Skinner, Director of EPA Office of Solid Waste to Directors of Regional Hazardous Waste Management Divisions.

Table 8. Federal environmental statutes outlined in Environmental Compliance Guide (DOE/EV-1032)

National Environmental Policy Act of 1969
Clean Air Act of 1963, as amended
Clean Water Act of 1977
Corps of Engineers Permits
Floodplain/Wetlands Regulations 10 CFR 1022
Coastal Zone Management Act of 1972, as amended
Endangered Species Act of 1973, as amended
Fish and Wildlife Coordination Act of 1934, as amended
Wild and Scenic Rivers Act of 1968, as amended
National and Historic Preservation Act of 1966, as amended
Federal Nonnuclear Research and Development Act of 1974
Resource Conservation and Recovery Act of 1976
Safe Drinking Water Act of 1974

environmental statutes and regulations (through reference to Parts II and III of the Guide) and then factoring these requirements into the development schedule for the proposed plan.

Part II of the Guide is devoted to NEPA with detailed flowcharts depicting the compliance procedures required by CEQ regulations and DOE NEPA Guidelines. The flowcharts provide a step-by-step guide for compliance with NEPA and indicate DOE internal responsibilities based on DOE Order 5440.1C. This Order generally provides for program office document preparation, assistance, and oversight by the Assistant Secretary for Environment.

Part III of the Guide contains a series of flowcharts for other federal environmental requirements that may apply to DOE projects. A series of questions is posed in Part III (reproduced in Table 9) to assist the user in determining which regulations are applicable to the proposed action. Once the applicable environmental regulations have been tentatively identified, the flowcharts can be used as guidance for complying with the various regulations. The flowcharts show both DOE and outside agency activities (e.g., submission of applications, consultation requirements, public hearings, and issuance of permits). Although each flowchart is based on existing or proposed responsible agency regulations, actual implementation procedures used in various regional offices may vary somewhat from that depicted. The flowcharts also contain simplified milestone charts demonstrating how compliance with NEPA and particular requirements should be phased and how environmental review should be integrated with the project development process to minimize delays in satisfying environmental requirements. In addition, internal DOE responsibilities are depicted on the flowcharts.

Table 9. Preliminary screening for determining applicability of federal environmental regulations

Question	If yes, examine need for following permit, consultation, or review	Flowchart[a]
Does the project involve emissions of pollutants to the air?	PSD Permit, NSPS Permit possible	III-1
Does the action involve the discharge of pollutants into a U.S. waterway or the ocean?	NPDES permit	III-2
Will the project require the discharge of dredged or fill materials into U.S. waters?	Corps of Engineers Permit and State Water Quality Certification	III-3
Does the project require structures (piers, power lines, etc.) or work such as dredging in navigable U.S. waters?	Corps of Engineers Permit	III-3
Is the action located within a floodplain or in a wetland area?	Floodplains/Wetlands Review	III-4
Might the action impact a coastal zone area?	State Coastal Zone Management Consultations	III-5
Are there any threatened or endangered species or their critical habitats located in the area of the proposed action?	Endangered Species Consultation	III-6
Will the project modify or impact a waterway?	Fish and Wildlife Review	III-7

Table 9. (continued)

Question	If yes, examine need for following permit, consultation, or review	Flowchart[a]
Will the action affect a wild and scenic river area or areas designated as potential additions to the Wild and Scenic Rivers System?	Review by Secretary of DOI or USDA	III-8
Are there historic sites in the project area?	Consultation with State HPO and ACHP	III-9
Might the project have an effect on a water resource?	Water Resources Council Review	III-10
Does the project require treatment, storage, or disposal of hazardous materials?	RCRA Permit	III-11
Does the project involve the injection of a substance into the ground?	UIC Permit	III-12

[a]Flowcharts are contained in DOE Environmental Compliance Guide Part III (DOE/EV-1032, February 1981).

4. PRINCIPLES OF ENVIRONMENTAL COMPLIANCE PLANNING

Environmental compliance plans for ORNL's remedial action activities need to be developed early as an integral part of the total planning effort. DOE's Office of Environmental Compliance has discussed a number of general planning principles for developing an efficient compliance strategy (DOE/EV-0132, February 1981). Although DOE's discussion centers around NEPA documentation, it is not clear yet what role NEPA will play in the ORNL remedial action task. This topic is being addressed in a NEPA strategy document prepared as a separate task for the Remedial Action Program. Many of the principles presented in DOE's Environmental Compliance Guide, however, are still applicable and are discussed below.

For a given action, a number of environmental requirements may be applicable, resulting in complex trade-offs of time, program risk, financial and environmental costs, quality of environmental review, and other considerations. Failure to comply properly with applicable environmental laws and regulations invites lawsuits, project delays, loss of resources, and environmental degradation. The following general principles are involved in developing an efficient environmental compliance strategy that does not sacrifice the quality of review of major issues.

1. Integrate the requirements of NEPA and other environmental review procedures with the appropriate phase of project development. The development of environmental analyses, whether as part of an (EIS) or part of a permit application, depends on the availability of an

appropriate level of engineering detail. Therefore, the timing of such analyses is primarily dictated by the project development schedule, that is, progression from conceptual to preliminary to detailed design. EIS and consultative reviews can generally be initiated and performed in coordination with the preliminary design phase of a project. Consultative reviews are defined as those requirements that do not involve the granting or denial of a permit by a regulatory agency and include, for example, those conducted under the National Historic Preservation Act and the Endangered Species Act. Permit applications, on the other hand, generally require a greater level of detailed design information. Therefore, permitting reviews are generally performed later, in coordination with the detailed design phase. Examples of permit type requirements include Prevention of Significant Deterioration (PSD) permits issued under the Clean Air Act and permits issued under the Corps of Engineers by the authority of Sect. 404 of the CWA.

2. An EIS serves as a vehicle for presentation and critical review of the environmental issues associated with the project. Compliance with the NEPA process identifies major issues, allows public participation, and requires consideration of alternatives and mitigating measures. Publication of the final EIS allows a project to proceed and provides a certain degree of assurance of eventual project implementation. Initiation of substantial detailed design work and completion of permit applications for the proposed action before completion of the EIS process incurs a

program risk in terms of (a) prejudicing the NEPA review, potentially resulting in litigation, and (b) prematurely committing financial and other resources to the project.

3. Generally, construction cannot commence before successful completion of environmental reviews for permitting. The most significant of these are the EPA permits issued under the Clean Air Act, the RCRA, and the Corps of Engineers Sect. 404 permits. Consultative reviews, although begun earlier, may become constraining in certain circumstances where sensitive issues arise (e.g., impact on an endangered species).
4. In light of the opportunities for coordinating environmental reviews with engineering schedules as discussed above, any schedule that limits overall environmental review time should be carefully scrutinized because it may not actually accelerate completion of the project. On the other hand, initiatives to consolidate or coordinate similar environmental reviews within a specific engineering phase (e.g., detailed design) may be quite useful and productive.

These general planning principles suggest a strategy for "Phased Compliance," which is characterized by

1. coordination of the EIS and consultative environmental reviews with the preliminary design phase,
2. completion of the EIS process before initiating full detailed design,
3. submission of permit applications following publication of the EIS and Record of Decision, and

4. submission of permit applications and coordination of permitting reviews with the detailed design phase.

Some detailed design before the completion of the EIS process may be possible and even desirable in certain situations. For example, it may be reasonable to begin that portion of detailed design work directly applicable to permit application preparation following the close of the comment period on the draft EIS and review of comments received. This approach, however, may incur risk of litigation and should be analyzed on a case-by-case basis.

In many instances, the permitting authority will not begin review of permit applications until a draft EIS, as a minimum, has been circulated. As a result, the permitting process is no longer controlled by the availability of detailed design information, but, instead, by the availability of the draft EIS. The Corps of Engineers, for example, by practice requires federal agencies to submit a draft EIS with a Sect. 404 permit application under the Clean Water Act. Other permitting agencies may be reluctant (particularly on controversial projects) to seriously review an application until the draft EIS is available. In addition, submittal of permit applications on a proposed action before a draft EIS is available may incur risks for the program in terms of premature commitment of resources and subject the project to criticism of prejudicing the NEPA review. In such circumstances, the EIS and other environmental review processes become critical path items. Any delays in these processes will further delay the proposed project.

Appendix A

SECTIONS OF RCRA RELEVANT TO ORNL's REMEDIAL ACTION ACTIVITIES

Description	Subtitle	Section
Definitions important to solid waste management	A	1004
Exclusion of source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended	A	1004(27) and 1006(a)
Authority of EPA to conduct criminal investigations	B	2002
Office of Ombudsman	B	2008
Identification and listing of HW	C	3001
Exclusion of fly ash, bottom ash, slag, and flue gas emission control wastes generated by coal and fossil fuel combustion	C	3001(b)(3)
Standards applicable to generators of HW	C	3002
Standards applicable to transporters of HW	C	3003
Standards applicable to owners and operators of HW treatment, storage, and disposal facilities	C	3004
Requirements for permit applications for facilities that treat, store, and dispose of HW	C	3005
Inspections	C	3007
Federal enforcement	C	3008
Requirement to notify EPA of generation, transportation, treatment, storage, and disposal of HW	C	3010
Monitoring, analysis, and testing for HW	C	3013
Expansion during interim status	C	3015

Description	Subtitle	Section
Inventory of federal agency HW facilities	C	3016
Exposure information and health assessments	C	3019
Prohibition of open dumping	D	4005(a)
Requirement for federal agencies to comply with federal, state, and local laws	F	6001
Right of citizens to bring suit against violators of any permit, standard, regulation	G	7002
Applicability of federal, state, and local laws on solid and HWs to federal agencies	F	All
Rights of citizens to sue government agencies on their own behalf	G	7002
Right of EPA to bring suit against those shown to be handling solid or HW in a way that presents an imminent hazard to health or the environment	G	7003
Interim control of HW injection	G	7010
Definitions and exemptions relevant to regulation of underground storage tanks	I	9001
Requirement to notify designated state or local agencies of details regarding existing underground storage tanks	I	9002
Detection, prevention, and correction requirements for owners and operators of underground storage tanks	I	9003
Requirements concerning inspections, monitoring, testing, and furnishing of information regarding underground storage tanks	I	9005

Appendix B

BRIEF SUMMARY AND INDEX OF REGULATIONS IMPLEMENTING RCRA

An index to the major regulations implementing Subtitle C of RCRA is given in Table B.1. A brief summary of the contents of the regulations follows.

Part 260--Hazardous Waste Management System: General

This part includes definitions and general provisions applicable to all of RCRA Subtitle C. This part also includes flowcharts to assist in the interpretation of definitions and the regulatory provisions.

Part 261--Identification and Listing of Hazardous Waste

This part defines solid and hazardous wastes, allows for exclusions of certain wastes, and provides special considerations for small quantity generators and hazardous wastes that are used, reused, recycled, or reclaimed. The characteristics of hazardous waste (ignitability, corrosivity, reactivity, and toxicity) are defined. Finally, lists of wastes that are hazardous are presented.

Part 262--Standards Applicable to Generators of Hazardous Waste

This part establishes the responsibilities of hazardous waste generators, primarily, obtaining an ID number, preparing a manifest, ensuring proper packaging and labeling, and recordkeeping and reporting.

Part 263--Standards Applicable to Transporters of Hazardous Waste

This part establishes the responsibilities of hazardous waste transporters, primarily, obtaining an ID number, complying with the manifest, recordkeeping, and cleaning up and reporting spills or accidents.

Part 264--Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

This part establishes the requirements and technical standards that owners and operators of hazardous waste TSD facilities must meet. In addition to general requirements of obtaining ID numbers, conducting waste analyses, preparing contingency plans and emergency procedures, complying with manifests, recordkeeping and reporting, and establishing

groundwater monitoring systems, the standards specify technical requirements for categories of facilities, including

1. containers,
2. tanks,
3. surface impoundments,
4. waste piles,
5. land treatment,
6. landfills, and
7. incinerators.

Part 265--Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

This section establishes the requirements and technical standards that owners and operators of existing hazardous waste treatment, storage, and disposal facilities must meet to continue operating until a final permit can be written for their facility. Existing hazardous waste TSD facilities are those in operation or under construction by November 19, 1980. In addition to general requirements of obtaining ID numbers, conducting waste analyses and inspections, preparing contingency plans and emergency procedures, complying with manifests, and recordkeeping and reporting, the standards specify technical requirements for the following categories of facilities:

1. containers;
2. tanks;
3. surface impoundments;
4. waste piles;
5. land treatment;
6. landfills;
7. incinerators;
8. thermal treatment;
9. chemical, physical, and biological treatment; and
10. underground injection.

Groundwater monitoring, financial requirements, and closure and post-closure requirements are included.

Part 266--Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities

This part sets forth the applicability of standards established in this part and in other RCRA regulations to the (1) use of recyclable materials in a manner that constitutes disposal, (2) burning of hazardous wastes for energy recovery, (3) use of recyclable materials for recovery of precious metals, and (4) the reclamation of spent lead-acid batteries.

Part 267--Interim Standards for Owners and Operators of New Hazardous Waste Land Disposal Facilities

This part establishes temporary standards for owners and operators of new land disposal facilities for which standards are not yet promulgated under 40 CFR 264. Currently, regulations for underground injection facilities have not yet been promulgated within 40 CFR 264.

Part 270--EPA-Administered Permit Programs: The Hazardous Waste Permit Program

This part establishes the requirements of the EPA hazardous waste permit program. Requirements such as application requirements, standard permit conditions, and monitoring and reporting requirements are included.

Part 280--Underground Storage Tanks

This part prohibits the installation of any new underground storage tank for regulated substances unless the tank is protected against corrosion and structural failure and is compatible with the substance to be stored.

Part 124--Procedures for Decisionmaking

This part explains the procedures for obtaining permits from EPA. Specific procedures applicable to RCRA permits are contained in Subpart B. These regulations cover activities such as submitting an application, preparation of draft permits, public comment and hearings, issuance or denial of permits, and appeals processes.

Table B.1. Index to RCRA Subtitle C Regulations Related to ORNL's Remedial Action Activities

Subject	40 CFR Part
Definitions	260.10, Subpart B, and 270.2
Solid waste	260, App. I, and 261.2
Hazardous waste	260, App. I, and 261.3
Petition to exclude waste	260.22
Overview of Subtitle C regulations, including flowcharts to determine applicable regulations	260, App. I
Exclusions of specific wastes	261.4
Exclusion of source, special nuclear, or byproduct material as defined by Atomic Energy Act of 1954, as amended	261.4(a)(4)
Exclusion of mining overburden; flyash waste, bottom ash waste, slag waste, and flue gas emission control waste generated by coal or fossil fuel combustion; drilling fluids, produced waters, and wastes associated with development or production of crude oil, natural gas, or geothermal energy; waste from extraction, beneficiation, and processing of ores and minerals (including coal), including phosphate rock and overburden from the mining of uranium ore	261.4(b)(3,4,5, and 7)
Characteristics of hazardous waste	261.20, Subpart C
Ignitability	261.21
Corrosivity	261.22
Reactivity	261.23
EP toxicity	261.24

Table B.1. (continued)

Subject	40 CFR Part
Lists of hazardous wastes	261.30-261.33, Subpart D
Representative sampling methods	261, App. I
EP toxicity test procedures	261, App. II
Chemical analysis test methods	261, App. III
Generator standards	262
Hazardous waste determination by generator	262.11
Pretransport requirements--packing, labeling, marking, and accumulation (90 d)	262.30-262.34, Subpart C
Recordkeeping and reporting requirements of the generator	262.40-262,43, Subpart D
The manifest	262, 263, 264, and 265
Responsibilities of generator	262.20
Responsibilities of transporter	263.20
Responsibilities of owners and operators of TSD facilities	264.70, Subpart E 265.70, Subpart E
Transporter standards	263
Standards for owners and operators of hazardous waste TSD facilities	264
General facility standards	264.10-264.18, Subpart B

Table B.1. (continued)

Subject	40 CFR Part
Location standards	264.18
Manifest system	264.70-264.77, Subpart E
Groundwater protection	264.90-264.100, Subpart F
Corrective action	264.101
Closure and post-closure requirements	264.110-264.120, Subpart G
Use and management of containers	264.170-264.178, Subpart I
Tanks	264.190-264.199, Subpart J
Surface impoundments	264.220-264.230, Subpart K, and 267.30-267.35, Subpart D
Waste piles	264.250-264.258, Subpart L
Land treatment	264.270-264.282, Subpart M
Landfills	264.300-264.316, Subpart N
Underground injection	267.60-267.64, Subpart G

Table B.1. (continued)

Subject	40 CFR Part
Interim status standards for owners and operators of hazardous waste TSD facilities[a]	265
General facility standards	265.10-265.18, Subpart B
Manifest system	265.70-265.77, Subpart E
Groundwater monitoring	265.90-265.94, Subpart F
Use and management of containers	265.170-265.177, Subpart I
Tanks	265.190-265.199, Subpart J
Surface impoundments	265.220-265.230, Subpart K
Waste piles	265.250-265.258, Subpart L
Land treatment	265.270-265.282, Subpart M
Landfills	265.300-265.316, Subpart N
Chemical, physical, and biological treatment	265.400-265.406, Subpart Q
Underground injection	265.430, Subpart R
Permit program regulations	270

Table B.1. (continued)

Subject	40 CFR Part
Permit application contents and requirements	270.10-270.21
Compliance schedules	270.33
Interim status requirements	270.70-270.73
Underground storage tank regulation	280
Interim prohibitions	280.2
General decisionmaking procedures	124.1-124.21, Subpart A
Decisionmaking procedures specific to RCRA	124, Subpart B (reserved)
Evidentiary hearing procedures for EPA-terminated RCRA permits	124.71-124.91, Subpart E
Panel hearing procedures	124.111-124.128, Subpart F
Guide to decisionmaking	124. App. A

[a]Generally applies to existing facilities; an existing facility is one built before the effective date of the regulations (November 18, 1980). Some existing facilities will be required eventually to meet standards of 40 CFR 264.

Appendix C

DOE ORDER 5480.14 REPORT OUTLINE FOR PHASES I, II, AND III

DOE Order 5480.14 Phase I

INSTALLATION ASSESSMENT REPORT OUTLINE

1. Executive Summary
2. Introduction
    a. Background
    b. Authority
    c. Purpose
    d. Scope
    e. Methodology, including decision tree
3. Installation Descriptions
    a. Location, size, boundaries, and so forth
    b. Organization and mission summary
4. Environmental Summary
    a. Meteorology
    b. Geology and soils
    c. Hydrology and hydrogeology
    d. Air and water quality
    e. Environmentally sensitive conditions
    f. Biological pathways
5. Findings
    a. Past waste activity review
        (1) Wastes generated by activity
        (2) Description of waste management methods

b. Disposal site(s) identification, location, evaluation, and hazard assessment

6. Conclusions (by site)

7. Recommendations (by site)

8. Appendixes (typical)

a. Professional qualifications of installation assessment team

b. Outside agency contact list

c. Installation history, organization, and mission

d. Supplemental environmental setting information

e. Supplemental information on facilities and processes

f. Photographs

g. References

h. Hazard ranking system calculations

i. Glossary

DOE Order 5480.14 Phase II

SITE CHARACTERIZATION REPORT OUTLINE

1. Executive Summary
2. Sampling and Analytical Measurement Plan
   a. Rationale
   b. Methods and techniques
   c. Quality assurance
3. Summary of Data and Findings
   a. Sources and quantities of contamination
   b. Extent and pathways for migration
4. Interpretation and Analysis
   a. Existing conditions
   b. Future implications
   c. Hazard assessment
5. Recommendations
   a. Need for corrective action
   b. Priorities
   c. Constraints
6. Appendixes
   a. Sampling locations
   b. Sample analysis data
   c. Pathways calculations
   d. Calculations of impacts on receptors

DOE Order 5480.14 Phase III

ENGINEERING ASSESSMENT OUTLINE

1. Executive Summary
2. Criteria
3. Evaluation of Remedial Action Alternatives
4. Recommended Remedial Action (Project Proposal)
5. Resource Requirements
6. Proposed schedule

Appendix D

SUGGESTED OUTLINE FOR A WASTE MANAGEMENT PLAN

A. Program Administration

1. Site
2. Office Responsible
3. Contractors
4. Lead Responsibility for Site Plans
5. Source of Funds for Waste Management
6. Status of Compliance with DOE 5820 Requirements

B. Description of Waste Generating Processes

1. Waste Process Flowcharts
2. Radiological and Chemical Characteristics of Waste

C. Description of Waste Management Facilities

1. Identification and Location of Facilities
2. Description of Waste Treatment Facilities
3. Description of Waste Storage and Disposal Sites
4. Description of Surplus Facilities
5. Description of Effluent Control Systems
6. Site Administration Limits on Effluents

D. Radioactive Waste Disposed of or Stored

1. High-Level Waste from Chemical Processing Operations
2. TRU Waste
   a. Certified
   b. Uncertified

3. Low-Level Waste

4. Waste Contaminated with Naturally Occurring Radionuclides

5. Other Radioactive Materials

E. Schedules and Major Milestones for Waste Management Activities

1. High-Level Waste

2. TRU Waste

3. Low-Level Waste

4. Other Waste (liquids and gases)

F. Quality Assurance Implementation Plans (per DOE 5700.6A)

G. Environmental Monitoring Programs (Radioactive and Nonradioactive)

H. Radioactive Waste Documentation Systems

1. High-Level Waste

2. TRU Waste

3. Low-Level Waste

4. Waste Containing Only Naturally Occurring Radioactivity

5. Other Waste

Appendix E

SUMMARY OF DOE ORDER 5820.2 GUIDANCE FOR DAY-TO-DAY MANAGEMENT OF TRANSURANIC (TRU) AND LOW-LEVEL WASTES AT ORNL

Management of TRU Waste

1. TRU waste shall be certified as practical and stored in preparation for disposal at the Waste Isolation Pilot Plant.

2. A program for certifying TRU wastes shall be prepared, documented, and implemented. TRU wastes stored before issuance of this Order (Feb. 6, 1984) shall be certified before disposal. Administrative controls shall be directed toward reducing or completely eliminating the generation of TRU waste that cannot be certified in a practical manner.

3. Certified waste shall be shipped to disposal as soon as practical. Certified waste that cannot be disposed of immediately shall be stored in a manner that is unlikely to alter its certification determination.

4. TRU waste that is classified for security reasons must be treated to remove or destroy the characteristic(s) requiring classification before disposal at an unclassified site.

5. TRU waste that cannot be certified by practical techniques shall be stored or disposed of by greater confinement at the expense of the generating program.

6. TRU waste that has been buried in shallow land burial sites or emplaced on soil columns before issuance of this Order shall be periodically monitored in place to assess both radioactive and nonradioactive hazards. The safety of such waste must be periodically reevaluated to determine the need for corrective measures, as necessary.

7. Heads of Field Organizations shall ensure that disposal under this Order provides adequate protection for the public and the environment from potential hazards of nonradioactive constituents as required by DOE 5480.2 and may impose additional requirements deemed necessary to achieve such protection.

8. Technical and administrative controls shall be directed toward reducing the gross volume of TRU waste generated and the amount of radioactivity in such waste.

9. TRU waste shall be placed in approved waste containers that meet transportation and disposal site acceptance criteria, as appropriate, before shipment off-site for storage or disposal.

10. A documentation system shall be developed and implemented that identifies TRU waste storage and disposal sites, waste quantities, and waste characteristics and provides data as necessary to the Integrated Data Base program (DOE/NE-0017-1). The data collected by this system shall be included in the annual Waste Management Plans (required by this Order) and site development plans required by DOE 4320.1A.

Management of Low-Level Waste

1. LLW shall be disposed of, where practical, by shallow land burial or greater confinement disposal. Site-specific requirements for waste acceptance and disposal, site selection, site design, site operation, and site closure/post-closure shall be developed and implemented by Field Organizations according to the guidance set forth in this Order.

2. Waste acceptance criteria shall be developed, addressing several specific properties.

3. Siting criteria shall be developed, addressing several specific points (e.g., size, hydrogeologic characteristics, and potential impacts).

4. Disposal design criteria shall be developed before selection of new disposal sites. Design criteria should address several characteristics identified in the Order.

5. Operating procedures for new and existing LLW disposal sites shall be developed and implemented. Specific requirements of the operating procedures are defined in the Order.

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