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**Waste Management Regulatory Compliance Issues Related to D&D Activities
at Oak Ridge National Laboratory (ORNL)**

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I. Introduction

The waste management activities at ORNL related to the decontamination and decommissioning (D&D) of radioactively contaminated buildings are divided into four categories: operational facilities, inactive or surplus facilities, future facilities planning, and D&D activities.¹ This paper only discusses regulatory issues related to inactive or surplus facilities. Additionally, rather than attempting to address all resulting waste streams and related regulations, this paper highlights only a few of the ORNL waste streams that present key regulatory issues.

Because ORNL has been in operation since the 1940s, quite a few surplus facilities currently exist. The strategy for the management of these facilities is twofold: (1) to maintain and monitor these buildings to ensure that radioactivity is contained such that ORNL personnel, the general public, and the environment are protected from any potential hazards and (2) to plan for the D&D of these structures.¹ The Remedial Action Section of the Waste Management and Remedial Action Division (WMRAD) implements the ORNL D&D Program. The goals of the Program are to decontaminate certain buildings planned for reuse to the degree necessary to meet health and safety requirements and to decommission all other buildings based on environmental compliance requirements as well as requirements established in DOE-approved project plans.¹

II. Waste Streams

Several waste streams will be produced during the D&D of ORNL facilities, the variety and complexity of which pose many challenging waste management regulatory compliance issues. The types and quantities of ORNL waste streams generated as a result of D&D activities depend upon the level or degree to which facilities are decontaminated and decommissioned.

First, D&D activities will result in the generation of solid waste. Section 1004(27) of RCRA defines "solid waste" as any garbage, refuse, sludge, from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows industrial discharges, which are point sources subject to permits under Sect. 402 of the Federal Water Pollution Control Act, as amended (86 Stat. 880), or source, special nuclear, or byproduct material as defined by the AEA. Also, EPA at 40 CFR § 261.2 has defined solid waste as any discarded material that is not excluded by 40 CFR § 261.4(a) or that is not excluded by variance granted pursuant to 40 CFR §§ 260.30 and 260.31. Heterogeneous solid waste debris is an example of solid waste generated from D&D activities.

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Secondly, radioactive wastes will be generated by the D&D of ORNL facilities. The radioactive waste streams produced are primarily transuranic (TRU) waste and low-level waste (LLW). ORNL does not generate high-level waste (HLW) but does store a small quantity of other highly radioactive material as special case (SC) waste such as irradiated and spent nuclear fuel.¹

TRU waste is defined in DOE Order 5820.2A as radioactive waste that, without regard to source or form at the end of the institution control period, is contaminated with alpha-emitting TRU radionuclides that have the following: an atomic number > 92; half-lives > 20 years; and an assay concentration > 100 nCi/g. Wastes contaminated with ²⁵²Cf, ²⁴⁴Cm, and ²³³U in concentrations > 100 nCi/g are also handled as TRU waste at ORNL, although these have not been formally declared as TRU waste by the U.S. Department of Energy Oak Ridge Operations Office (DOE-ORO). Heads of field offices can also determine that other alpha-contaminated waste, peculiar to a specific site, must be managed as TRU waste.¹

LLW includes any radioactive waste not classified as HLW, TRU, spent nuclear fuel, or byproduct material. LLW is generated by uranium enrichment processes, reactor operations, isotope production, medical diagnostic procedures, and research and development projects. LLW is typically contaminated with small amounts of radioactivity dispersed in large amounts of material. Spent ion exchange media is an example of ORNL LLW generated during D&D activities.

SC waste is waste that does not meet the criteria of the other LLW types, nor does it fall into the category of TRU waste. As a result, SC waste does not fit into typical waste management strategies and requires special management and disposal strategies.¹ The following five categories of SC waste have been identified for management at ORNL: (1) Performance Assessment limiting (PAL); (2) greater than NRC Class C (GTCC); (3) uncertified or uncharacterized; (4) high-level incidental waste; and (5) DOE loan/lease material.¹ In July 1993, a draft DOE integrated Spent Nuclear Fuel Program Plan was issued for comments.¹ ORNL recommended that all SC waste be included in the Spent Nuclear Fuel Program.¹ SC waste that will be generated during the D&D of ORNL facilities includes irradiated and spent nuclear fuel.

D&D of ORNL facilities also results in the generation of mixed waste streams, examples of which are radioactive lead shielding and discarded high-efficiency particulate air (HEPA) filters. Mixed waste is defined in Section 1004 of the Solid Waste Disposal Act (SWDA), as amended by the Federal Facility Compliance Act (Act) of 1992, as follows: "waste that contains both hazardous waste and source, special nuclear, or by-product material subject to the Atomic Energy Act (AEA) of 1954 (42 U.S.C. 2001 *et seq.*)."

III. Regulatory Issues

A. Solid Waste

Solid waste resulting from D&D activities is regulated by the State of Tennessee through the Tennessee Solid Waste Disposal Act and is currently being disposed of at the Y-12 Sanitary Landfill II (SLF II). However, the SLF II is scheduled to be closed when the new Industrial Landfill V is opened early in year 1994.¹ Pursuant to the Tennessee Solid Waste Disposal Act, as amended, the State of Tennessee requires permits for solid-

waste processing and disposal facilities (TDEC Rule 1200-1-7-.02). The state regulations are similar to the federal requirements and have adopted by reference all of EPA's rules, which had become final by October 1992. The permit for SLF II requires that no liquids, industrial-special waste, or waste requiring special handling shall be accepted at the facility unless prior written approval is obtained for each individual waste.¹ As required by the Tennessee Hazardous Waste Act, no hazardous waste shall be accepted at SLF II.¹ Radioactive waste is specifically excluded from disposal.¹

B. Mixed Waste

As stated earlier, mixed wastes are those containing both a RCRA hazardous waste, as defined in 40 CFR 261, and a radioactive waste subject to the AEA. At least two mixed waste streams will be generated at ORNL due to D&D activities and will require compliance with current laws. One of these waste streams is radioactive lead, usually occurring in the form of bricks, used for radiation shielding. The second mixed waste stream consists of discarded filters, including HEPA filters. These filters will comprise a radioactive waste stream, and, in some cases where hazardous substances are used in decontamination processes, mixed waste streams will be generated. Although both these categories of mixed waste make up a relatively small percentage of the mixed waste managed at ORNL, the laws and legal agreements which affect the management of mixed waste at ORNL are complex.

On July 3, 1986, EPA clarified that only the hazardous waste component of mixed waste is subject to RCRA authority and that the radioactive waste component is subject to the AEA (51 *Fed. Reg.* 24504). When the application of both standards is conflicting or inconsistent, RCRA yields to the AEA (52 *Fed. Reg.* 15940). The State of Tennessee received RCRA authorization to regulate radioactive mixed waste in 1986 and the hazardous waste component of radioactive mixed waste in 1987. While the hazardous waste component is regulated by the State of Tennessee, the radioactive component is regulated by DOE. Mixed waste exhibiting the toxicity characteristic is regulated by the Hazardous and Solid Waste Amendments (HSWA) which prohibits, under the RCRA Land Disposal Restrictions (LDRs), the disposal of hazardous wastes that have not been pretreated to standards established by EPA. EPA is developing a guidance document on the storage of mixed waste and has solicited input from the public. Its public meeting notice appeared in 57 *Fed. Reg.* 48051 on October 25, 1992.

Radioactive lead shielding is subject to waste-specific treatment standards (57 *Fed. Reg.* 37238, August 18, 1992). 40 CFR Part 268.42, Table 3, lists technology-based standards for specific radioactive hazardous mixed waste, including the Radioactive Lead Solids Subcategory, which includes lead shielding. This treatment subcategory has been given a RCRA waste code designation of D008. The designated technology-based standard applicable to D008 waste is "macroencapsulation with surface coating materials such as polymeric organics (e.g., resins and plastics) or with a jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media." [40 CFR § 268.42(a)(2), Table 1].

RCRA was amended on October 6, 1992, by the Federal Facility Compliance Act of 1992, to waive the immunity that United States government departments have enjoyed regarding solid and hazardous waste requirements. At the same time, however, the Act recognized that unique problems exist for the storage of certain mixed waste and has

delayed the effective date for three years from enactment in certain instances. Even though the waiver is not delayed for DOE facilities that are subject to an existing agreement, permit, administrative or judicial order addressing compliance with the LDR storage prohibition for mixed waste, the waiver will not apply to DOE as long as DOE meets certain conditions. Specifically, the waiver shall not apply to DOE for mixed waste violations of LDRs as long as DOE has submitted, has in effect, and is in compliance with, a plan pursuant to Sect. 3021(b) of SWDA, and is in compliance with an order issued pursuant to SWDA § 3021(b) requiring compliance with such plan. The Act requires annual inspections of treatment, storage, and disposal facilities (TSDFs) at federal facilities; submittal of an inventory of its wastes including descriptions of each type of mixed waste, the names of the waste stream, quantities currently stored, and estimates of quantities expected to be generated in the next five years; inventories of treatment capacities for wastes for which treatment technologies exist; and plans and schedules for development of treatment technologies for mixed wastes for which no technologies exist. ORNL has met its milestones and is in compliance with the Act. A few months before the Act became law, DOE entered into a Federal Facility Compliance Agreement (FFCA) with EPA, Region IV, effective June 12, 1992, to ensure that DOE complies with LDRs under RCRA pertaining to radioactive mixed wastes (and dioxin-containing hazardous wastes). The FFCA was necessary in order to address noncompliance problems related to the management of these wastes because DOE ORR facilities, including ORNL, did not have the treatment capacity for these wastes. At this time, ORNL and the ORR are adhering separately to both the Act and the FFCA. However, in the future the Act could become the medium for bringing ORR into compliance regarding the management of mixed waste.¹

In addition to federal laws, state laws, and legal agreements, DOE Orders are binding on DOE facilities and DOE contractors. DOE Order 5400.3 established DOE's hazardous and radioactive mixed waste policies and requirements and clarifies DOE's interpretation of the definition of "by-product material" as it relates to RCRA regulation of mixed wastes. DOE Order 5820.2A requires that each site in its Waste Management Plan address radioactive mixed waste management.

A further complicating factor for ORNL's regulatory management of waste generated from D&D activities is that DOE's Office of Environmental Restoration and Waste Management imposed a moratorium on the shipment of potentially radioactive hazardous waste, effective May 17, 1991, to off-site commercial treatment, storage and disposal facilities. Next came the "No Rad Added" Policy, on November 15, 1991, requiring a determination that RCRA-hazardous waste is not radioactive before the waste can be transported off-site to non-DOE-owned TSDFs not licensed to manage radioactive materials.

C. Radioactive Waste

D&D activities at ORNL will generate TRU, LLW and SC waste streams. The AEA, as amended, delegates authority to regulate nuclear energy to EPA, DOE, and the NRC. DOE, under this Act, has the authority to manage nuclear materials at sites that it oversees. However, in some instances DOE facilities are subject to regulatory requirements of the NRC and the EPA, including those found at 10 CFR Parts 60 and 70 and 40 CFR Part 61, 191, and 192. Many DOE requirements are based on NRC

regulations and are either identical or similar. DOE Order 5820.2A, *Radioactive Waste Management*, addresses waste management issues for various types of radioactive waste. DOE is revising the Order, expected to be completed by the end of 1994, to include hazardous and sanitary wastes. Pertinent sections of this Order will be described in the paragraphs on TRU and LLW.

1. LLW

Spent ion exchange media is a LLW stream generated by ORNL D&D activities. Although this is currently not a significant waste stream, it will become significant in the future. Even though the capability for liquid low-level treatment systems once existed for D&D structures at ORNL, this is no longer the case. A self-contained, self-filtering system will probably be necessary to manage this waste stream. EPA plans to establish standards for the management and disposal of LLW under the authority of the AEA, as amended, to be codified at 40 CFR 193.² Second, EPA intends to regulate the disposal of certain accelerator-produced radioactive wastes, to be codified at 40 CFR 764.³ The proposed standards are expected in late 1994, and the final rules are scheduled for December 1995.⁴ DOE Order 5820.2A specifies that the management of LLW must ensure that external exposure to the waste and concentrations of radioactive material that may be released into surface water and soil does not exceed 25 mrem/year to any member of the public. Releases to the atmosphere shall not exceed 10 mrem/year. Chapter III, 3., establishes performance objectives for proper management of DOE LLW that was not disposed of prior to September 26, 1988. Included are requirements for ensuring that inadvertent intruders to the facility after the loss of active institutional control (100 years) not be exposed to effective dose equivalents (EDEs) exceeding 100 mrem/year for continuous exposure or 500 mrem for a single acute exposure. Groundwater resources must be protected in accordance with federal, state, and local requirements.

2. TRU waste

EPA at 40 CFR 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Waste," has established environmental protection standards for the management, storage, and disposal of spent nuclear fuel, HLW, and TRU wastes at all facilities operated by DOE. Management and storage must be conducted in such a manner as to provide reasonable assurance that the combined annual dose equivalent, to any member of the general public shall not exceed 25 mrems to the whole body and 75 mrems to any critical organ (40 CFR § 191.03). On December 20, 1993, EPA published a final rule pertaining to the disposal of spent nuclear fuel and HLW and TRU radioactive waste. This final rule requires that disposal systems be designed to provide a reasonable expectation that, for 10,000 years after disposal, undisturbed performance of the disposal system shall not cause the annual committed effective dose, received through all potential pathways from the disposal system, to any member of the public in the accessible environment, to exceed 15 mrems (58 *Fed. Reg.* 66414, Dec. 20, 1993). This final rule is codified at 40 CFR § 191.15.

DOE Order 5820.2A, Chap. II, addresses the management of TRU waste from its generation to burial. The stated policy is to manage these wastes in a manner

protective of the public and workers, protective of the environment, and in compliance with regulations and radiation protection standards. DOE policy requires that TRU waste be certified in compliance with the WIPP-Waste Acceptance Criteria, placed in interim storage if required, and sent to the WIPP if and when that facility becomes operational.

3. SC waste

As stated above, SC waste does not meet the criteria of the other LLW types nor is it categorized as TRU waste. Examples of SC waste that will be generated during D&D activities include irradiated and spent nuclear fuel. Spent nuclear fuel is defined in 40 CFR § 191.02 as "fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing." 40 CFR § 191.03(b) requires that the management and storage of all spent nuclear fuel at facilities operated by DOE and not regulated by the NRC or Agreement States must be carried out in such a manner that members of the public are not exposed to a combined annual dose equivalent from discharges and direct radiation to exceed 25 mrem to the whole body and 75 mrem to any critical organ. EPA has published a final rule, codified at 40 CFR § 191.15, that requires disposal systems be designed to provide a reasonable expectation that, for 10,000 years after disposal, undisturbed performance of the disposal system shall not cause the annual committed effective dose, received through all potential pathways from the disposal system, to any member of the public in the accessible environment, to exceed 15 mrem (58 *Fed. Reg.* 66414, Dec. 20, 1993).

IV. Conclusion

Waste management challenges at ORNL are not unique within the DOE system. The greatest issues involve the planning and construction of needed facilities to accept waste generated from the D&D Program. Regulatory requirements limiting storage and disposal options continue to challenge DOE facilities, and ORNL is no exception. If *de minimis* radiation contamination levels were established, many wastes could go through a limited release and be recycled into finished products for use on federal facilities.⁵ As more and more DOE facilities across the United States are being D&Ded, federal and state regulators must increasingly work toward tailoring laws that are technically feasible and provide practical problem solving in managing the waste from inactive D&D structures from a bygone era.

Endnotes:

1. 1994 ORNL Waste Management Plan, prepared by the ORNL WMRAD Staff, ORNL/TM-11433/R3, December 1993.
2. 57 *Fed. Reg.* 52016, November 11, 1992.
3. 57 *Fed. Reg.* 52061, November 11, 1992.
4. L.M. Houlberg, G.T. Hawkins, and M.S. Salk, *Environmental Regulatory Update Table*, November/December 1993, ORNL/M-2648/R5, MMES, ORNL, 1993.

5. "Cutting the Costs of Waste Disposal, an interview with Clyde Frank," Initiatives in Environmental Technology Investment, December 1993.

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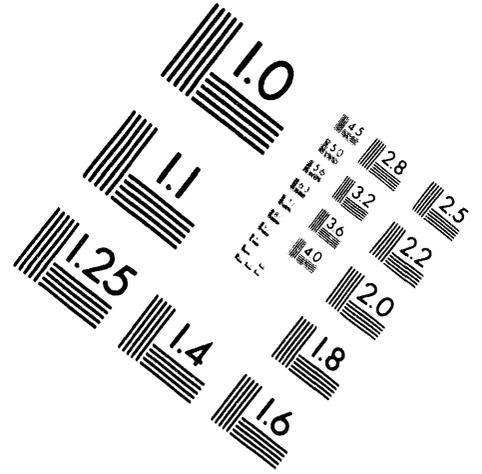
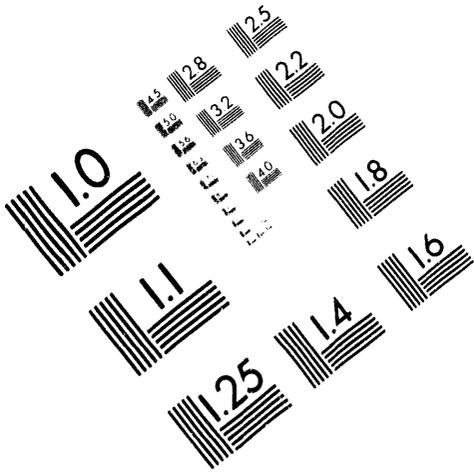


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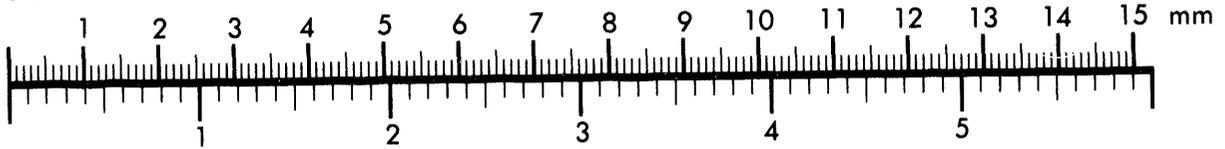
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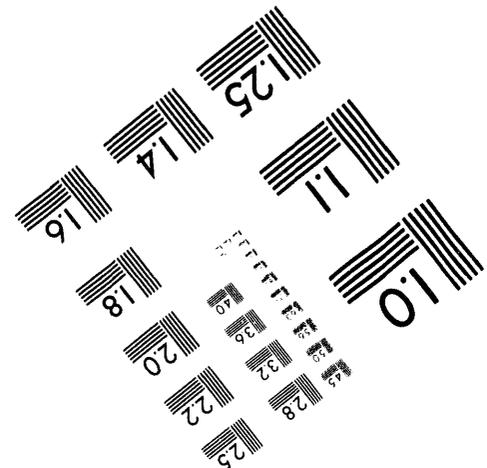
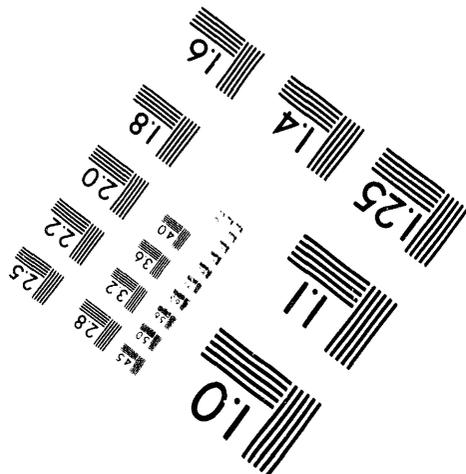
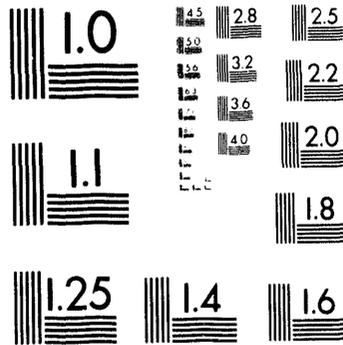
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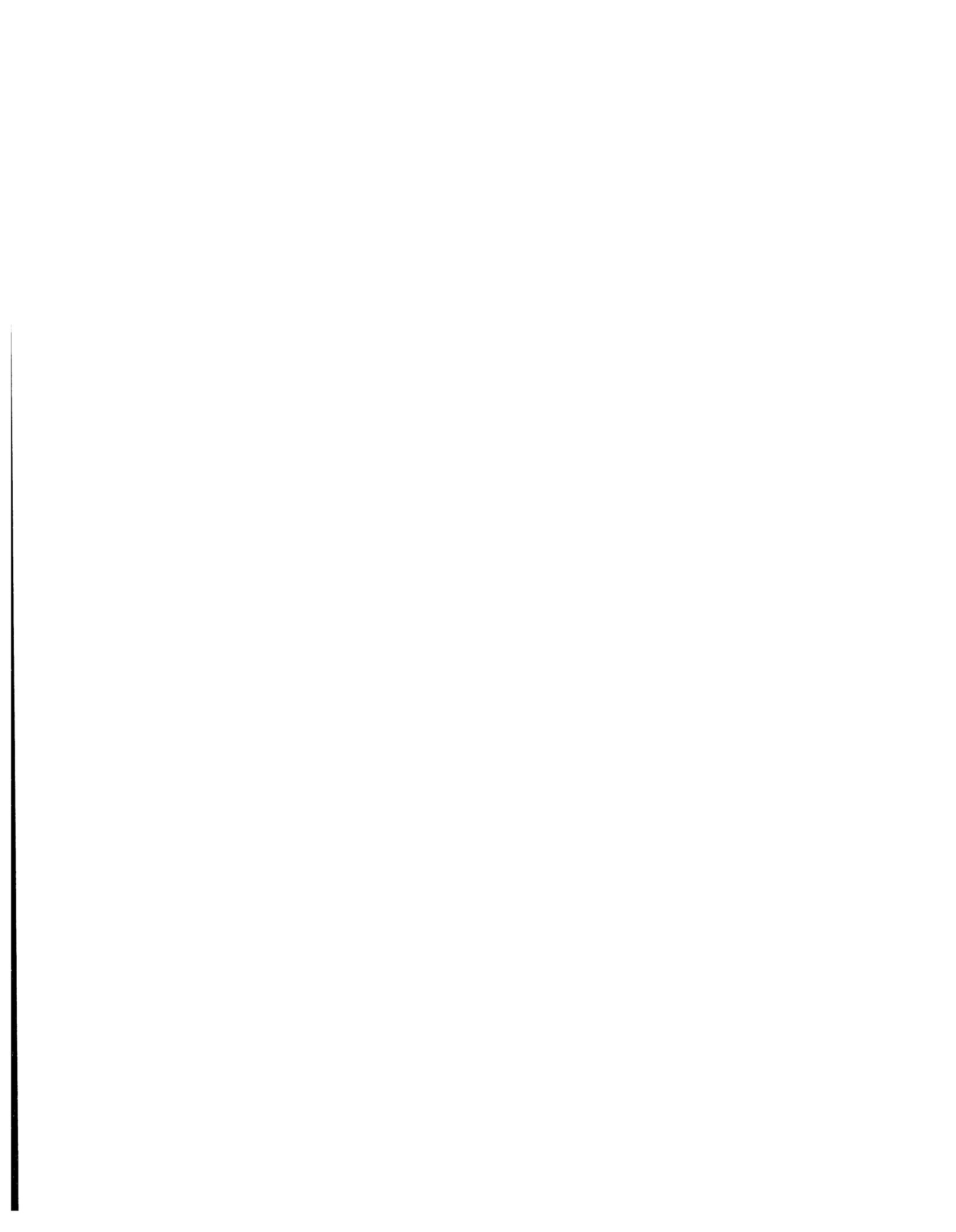
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