Chapter 3

Overview of Federal Regulations

CONTENTS

Table

REGULATORY FRAMEWORK FOR LLW

Regulatory Authority for LLW

The Nuclear Regulatory Commission (NRC) is responsible for licensing and regulating nuclear facilities and materials and for conducting research in support of the licensing and regulatory process. Federal statutory authority for NRC to undertake these activities is derived from the Atomic Energy Act of 1954 (AEA), as amended[1]; the Energy Reorganization Act of 1974, as amended[2]; and other Federal laws. NRC's jurisdiction covers a variety of nuclear materials and operations, including the treatment, storage, and disposal of low-level radioactive waste (LLW).

Mixed LLW contains both radioactive and hazardous constituents. For its radioactive constituents, mixed LLW falls under NRC jurisdiction because it is a subset of LLW. For its hazardous constituents, mixed LLW is also subject to Environmental Protection Agency (EPA) regulations governing hazardous waste. The principal Federal hazardous waste law is the Resource Conservation and Recovery Act (RCRA) of 1976.[3]

Administratively, NRC has jurisdiction over 17,000 commercial possessors and users of nuclear materials through a network of 5 regional offices and the Agreement State Program. Under the Agreement State Program, NRC may delegate to a State agency regulatory authority over certain nuclear operations if the State agency's program meets the technical and administrative criteria established by NRC. To date, 29 States have obtained Agreement State status, and most States that contemplate licensing a LLW site have or will acquire Agreement State status. States with Agreement State authority regulate commercial practices involving radioactive materials, including subsequent waste management practices. The exception to this authority is the regulation of operations inside nuclear power plants where NRC maintains exclusive authority for licensing and regulating operations.

NRC's regulations in 10 CFR Part 61 address disposal of commercial LLW. These regulations contain:

- performance objectives for the operation of commercial LLW disposal facilities;
- technical requirements for the siting, design, operation, closure, and post-operational activities of LLW disposal facilities;
- technical requirements for waste stability;
- criteria for waste acceptance;
- criteria for classifying LLW;
- administrative and procedural requirements for licensing disposal facilities;
- administrative requirements for closure, institutional control, and long-term care; and
- provisions for adequate financial assurance.

10 CFR Part 61

"Licensing Requirements for the Land Disposal of Radioactive Waste" were developed during the 5-year period from 1978 through 1982 and were issued in 1983 (10 CFR Part 61). As NRC stated in the summary of its draft Environmental Impact Statement for the regulation, "[c]urrent [pre-1983] NRC regulations for licensing radioactive materials do not contain sufficient technical standards or criteria for the disposal of the licensed materials as waste. " The new regulations were developed at the request of a number of affected parties, including the public, Congress, the States, industry, and other Federal agencies, which saw a need for codified regulations tailored for commercial LLW disposal sites.

In developing the new regulations, NRC had the choice of establishing two types of requirements: performance objectives or prescriptive requirements. Performance objectives would establish overall goals for the disposal of LLW and would allow flexibility in how the objectives were to be met. In contrast, prescriptive requirements would specify the details of the design and operation of a LLW

[1]68 Stat. 919, 1954.
[2]Public Law 93-438, Oct. 11, 1974.
[3]Public Law 94-580, Oct. 21, 1976.

disposal facility. Based on analyses that NRC conducted for the Environmental Impact Statement, NRC chose a combination of these two approaches—four general performance objectives supported by technical requirements that are more prescriptive in nature. The four general performance objectives for 10 CFR Part 61 are:

1. protection for occupationally exposed workers and the public during the operation of the site,
2. protection of the environment over the long-term,
3. protection for any intruder who might inadvertently make contact with the waste material, and
4. assurance that the site will maintain its stability for several hundred years.

NRC regulations in 10 CFR Part 20, promulgated in the early 1980s, already provided protection for workers and the public during operation of a disposal facility. Building on this earlier provision, 10 CFR Part 61 added the important feature, among others, of protecting an intruder who might inadvertently come in contact with LLW.

Protection of Workers During Operation

Operation of the disposal facility must comply with the worker radiation exposure regulations in 10 CFR Part 20. These regulations must be observed for all releases except those governed by 10 CFR Part 61. In addition, every reasonable effort must be made to keep exposures during operation as low as reasonably achievable (ALARA). These regulations are designed to protect workers as well as any member of the public who might be exposed to radiation during operation of the site.

Protection of the General Population From Releases of Radioactivity

Releases from the site into water, air, or soil or through plants or animals must not result in an annual dose to any member of the public of greater than 25 millirems[4] of radiation to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ. As with the operational standards for workers, site operators must take action to assure that any releases of radioactivity to the environment are ALARA.

Protection of Inadvertent Intruders

The design, operation, and closure of the facility must ensure the protection of any individual who inadvertently enters or occupies the LLW site or comes in contact with the waste when institutional control of the waste facility is no longer maintained by the site operator or State. An inadvertent intruder, unaware of the hazards of the disposed waste, might engage in activities such as farming, digging a well, or building a house on the premises. After analyzing situations like these that could result in exposure to the inadvertent intruder, NRC staff established that reasonable protection to intruders must be provided but must still allow disposal of a reasonable volume and variety of LLW. Although a specific exposure limit is not cited in NRC regulations, a working limit of 500 millirems per year to the whole body was assumed in preparing the radionuclide concentration limits and waste classifications in 10 CFR Part 61. This is the annual limit that is currently considered the upper limit for exposure to members of the public.

Assurance That the Site Will Remain Stable

All aspects of establishing and operating a site, from choosing a location to closing the site, are regulated to achieve long-term stability and eliminate the need for continued active maintenance after site closure. This objective reflects lessons learned from failures at now-closed commercial sites and Department of Energy (DOE) facilities. A stable site eliminates or reduces subsidence and water infiltration, thus preventing migration of radionuclides from the site.

Technical Requirements

To achieve the performance objectives described above, NRC developed a number of technical requirements that are more prescriptive in nature for site characterization, facility design and operation, waste form and packaging, and institutional controls.

Site ***Characterization-Choosing*** a location for a LLW site begins with eliminating regions with inappropriate characteristics. Siting requirements are based on analyses of closed disposal sites and on recommendations from the U.S. Geological Survey.

[4]For comparison, humans receive about 360 millirems (or 0.36 rem) a year from natural background radiation (4).

In particular, areas to be avoided are those that are difficult to model, are geologically active, contain exploitable natural resources, and/or have high potential for water intrusion. (See ch. 6 section on "Facility Siting—Natural Site Characteristics" for more detail.)

Facility Design and Operating Practices-NRC requirements for facility design and operation are intended primarily to minimize contact with water. All design features must direct water away from the waste and must minimize contact of water with the waste throughout the waste handling process from storage to closure. Operational and closure features emphasize maintaining the stability of the site by segregating unstable Class A LLW from stable Class B and C LLW and by filling any voids between waste packages. (See ch. 6 for a description of disposal technologies.)

Waste Form and Packaging—The waste classification system (see below) dictates the form and packaging in which LLW can be accepted for disposal, the location of waste within the disposal facility, and the concentration of radionuclides allowed at a given site. NRC's requirements strictly prohibit disposal of liquid LLW or of solid LLW containing more than 1 percent liquid. Explosive, pyrophoric, and reactive wastes are also prohibited from land disposal. (See ch. 5 section on "Waste Stabilization for more detail.)

Waste Classification—There are three classes of disposable LLW: A, B, and C. Class A waste is the least radioactive of the three types and will decay within 100 years to levels that are not considered by NRC to pose a threat to public health and safety. Class A waste is not required to be stabilized but must be segregated from Class B and C LLW in disposal sites. Class B waste is more highly radioactive and must be disposed of in a form that will remain structurally stable for 300 years. Class C waste is the most highly radioactive of the three classes. Maximum concentrations of radionuclides in Class C LLW are limited to ensure that at the end of 500 years the remaining radioactivity will not pose an unacceptable hazard to an inadvertent intruder or to public health and safety. Class C waste must be stabilized and disposed of either at least 15 feet below the top of the facility or beneath a steel reinforced concrete barrier intended to discourage intrusion for at least 500 years. (See ch. 5 section on "Waste Stabilization" for more detail,)

The waste classification system, through its waste segregation and stabilization requirements, significantly contributes to the long-term integrity of licensed LLW disposal sites.

Institutional Control--Institutional actions are intended to insure the long-term stability of the site and to protect the public. First, the facility must be located on land owned by the State or Federal Government. After the site is closed in accordance with State and Federal regulations, the government owning the site must maintain it and restrict access for up to 100 years. At a minimum, environmental monitoring, periodic surveillance, and minor custodial care must be provided during this period. While the government agency responsible for institutional care may wish to retain a presence for longer than 100 years, after that time the site, through its natural features and design, must be able to meet Federal performance objectives relying only on passive controls such as markers and land records.

Second, financial assurance requirements specify that the site operator supply adequate funds to carry out all activities connected with licensing and provide for appropriate closure and stabilization of the site. The site operator must also ensure that sufficient funds are available to cover maintenance costs and monitoring during the institutional control period.

Summary

NRC performance objectives for the licensing and operation of a LLW disposal site are designed to provide long-term protection of the public and the environment. To a large extent, site operators, States, and other affected parties have some flexibility in how they meet performance objectives. While 10 CFR Part 61 contains numerous technical requirements for the siting, operation, closure, and institutional care of LLW facilities, many of these requirements allow latitude in interpretation and implementation. The regulatory orientation of NRC LLW regulations is clearly aimed at meeting performance objectives rather than at dictating all the minute details of the construction and operation of the site and the treatment and form of the waste.

REGULATORY FRAMEWORK FOR MIXED LLW

Historical Perspective on Mixed LLW *Regulation*

Waste containing both radioactive and hazardous constituents has been generated since the beginning of the commercial nuclear industry. This waste has come to be known as mixed waste. When the first Federal regulations covering radioactivity were adopted, they were intended to apply to all radioactive materials. Since the amount of commercial waste containing both radioactive and hazardous components has always been small, no special provisions were made by regulators of either nuclear materials or hazardous substances to control this waste stream. Anticipating the need to integrate hazardous waste legislation with existing statutes, the U.S. Congress, in establishing the Resource Conservation and Recovery Act (RCRA) in 1976, added two Atomic Energy Act (AEA) exemptions. Section 1006(a) of RCRA states that:

> Nothing in this chapter shall be construed to apply to (or to authorize any State, interstate, or local authority to regulate) any activity or substance which is subject to the [several Federal laws listed], or the Atomic Energy Act of 1954 except to the extent that such application (or regulation) is not consistent with the requirements of such Acts.

Section 1004(27) of RCRA excludes byproduct, special nuclear, and source material regulated under AEA from the definition of solid waste.

Around 1980, State and Federal agencies began to question generators and site operators regarding mixed LLW. Correspondence between site operators and the Environmental Protection Agency (EPA), which enforces RCRA, raised the question of RCRA applicability to LLW sites and the interpretation of the exclusionary language of Section 1004(27) of RCRA. An August 17, 1983, letter to US Ecology, Inc., the site operator of the Hanford, WA, facility, from EPA Director of the Office of Solid Waste, John Skinner, stated:

> In summary, we have concluded that the wastes and disposal facilities which you discuss are not completely exempt from regulation under RCRA. Therefore, you should be submitting a permit application to the appropriate Regional Office, and your facilities should be complying with the appropriate requirements of the State in which the particular facility is located.

Although no Federal agency took formal action on mixed LLW during the mid-1980s, continuing discussions on the topic among generators, regulators, and site operators brought the issue to congressional and public attention. Since Congress was intent on providing for the management of all types of LLW, an effort was made to address the regulation of mixed LLW as part of the Low-Level Radioactive Waste Policy Amendments Act (LLRWPAA) of 1985.[5]

A number of parties questioned the practicality and feasibility of disposing of mixed LLW in facilities that had to satisfy both NRC and EPA regulations. For this reason, the Senate version of the LLRWPAA contained a section giving lead agency status to NRC in licensing mixed LLW facilities. Key committee and subcommittee chairpersons in the House of Representatives found this proposal unacceptable. They were convinced that the hazardous component of mixed LLW required regulation by EPA or a RCRA-authorized State. The two houses of Congress could not agree on a compromise, so the regulation of mixed LLW was not addressed in the LLRWPAA.

In the following session of Congress in 1986, key committees of Congress held oversight hearings on mixed LLW. The consensus that emerged from these hearings was that mixed LLW should be regulated under the dual jurisdiction of NRC and EPA. Representatives of NRC and EPA were instructed to identify and resolve any regulatory impediments to the management of commercial mixed LLW. The first set of joint guidance which NRC and EPA issued addressed the disposal of mixed waste so that States could use the Federal guidance to meet the first LLRWPAA milestone requiring submission of a siting plan by January 1, 1988. Subsequent to the guidance, States, compacts, and generators have raised additional management issues on mixed LLW that may require the attention of both agencies.

[5] Public Law 99-240, Jan. 15, 1986.

Before congressional deliberation of the mixed LLW issue, the States that licensed the three operating LLW sites had taken some action on mixed LLW regulation. The facilities at Beatty, NV, and Hanford, WA, never received permission from the State or a Federal agency to accept mixed LLW. Nonetheless, because of uncertainties regarding the interpretation of the AEA exemption to materials containing both hazardous and radioactive materials, any LLW-even that containing some hazardous constituents-was disposed of at these sites. As the issue of dual regulatory jurisdiction received more attention at the State and national level, Washington State, in April 1985, requested that US Ecology, Inc., the operator of the commercial site in Hanford, obtain a RCRA permit to continue receiving mixed LLW, The facility operator chose not to seek the permit and thus mixed LLW disposal was no longer allowed at Hanford. Similarly, as a result of EPA's clarification of RCRA's application to mixed LLW, on July 3, 1986, no mixed LLW disposal has been allowed at the Beatty, NV, facility because the site operator has not obtained the required permit.

South Carolina prohibited the disposal of scintillation vials containing both hazardous and radioactive materials in 1978. This prohibition was due largely to the increase in the volume of these materials that began arriving at the Barnwell, SC, facility after the closing of three other commercial LLW sites in the eastern half of the country in the late 1970s. While some LLW containing hazardous materials may have been disposed of at Barnwell between 1978 and 1987 due to the ambiguity of applying the AEA exemption, South Carolina, on July 6, 1987, expressly prohibited disposal of mixed LLW at the Barnwell site.

As a result of EPA's clarification of the AEA exemption and subsequent State and site operator action, licensed disposal options for mixed LLW have been eliminated. While the ability to dispose of mixed LLW was uncertain in the past and gave rise to legislative and regulatory efforts at the national level to promote additional disposal capacity, at present there are no facilities licensed to accept mixed LLW under both NRC and EPA regulations.

Overview of the Resource Conservation and Recovery Act and Hazardous and Solid Waste Amendments

In 1976, Congress passed RCRA, giving EPA broad authority to develop a comprehensive regulatory program for the management and disposal of hazardous waste, Under RCRA, EPA is responsible for identifying wastes that are subject to regulation and for regulating and permitting generators, transporters, treaters, storers, and disposers of waste covered by the regulations. It also granted EPA broad authority to promulgate regulations as necessary to protect human health and the environment from adverse impacts associated with hazardous waste management. This ''cradle-to-grave' regulatory system for hazardous waste was designed to track and regulate wrote from the point of generation to the point of disposal.

Congress amended RCRA with the passage of the Hazardous and Solid Waste Amendments Act of 1984 (HSWA)[6] which, among other things, established minimum technology requirements for land disposal facilities and surface impoundments, corrective action requirements for hazardous waste facilities seeking permits under RCRA, statutory deadlines for promulgation of land disposal restrictions and treatment standards, small-quantity generator requirements, and waste minimization requirements. The passage of HSWA shifted the focus away from land disposal of hazardous waste to a more comprehensive management system including waste reduction, recycling, and treatment. Section 1004(s) of RCRA defines hazardous waste as:

> . a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may
>
> -cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or
>
> —pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

[6]Public Law 98-616, Nov. 9,1984.

To implement this definition, RCRA required the EPA Administrator to develop and promulgate criteria for identifying characteristics of hazardous waste and for listing wastes to be regulated as hazardous under RCRA. Section 3001(a) of the statute directs EPA to consider the toxicity, persistence, biodegradability, and the potential for bioaccumulation of waste material in developing these criteria, as well as other factors such as flammability, corrosiveness, and other hazardous characteristics.

Under RCRA, hazardous waste is considered a subset of solid waste, which is defined by Section 1004(27) as:

> . . . any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations and from community activities, but does not include solid or dissolved materials in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under Section 402 of the Federal Water Pollution Control Act, as amended, or source, special nuclear or byproduct material as defined by the Atomic Energy Act of 1954, as amended.

Before a substance can be considered a hazardous waste, it must first be determined to be a solid waste according to the above definition. After determining if a substance is a solid waste and is not a useful product or is being recycled, EPA regulations establish two methods for determining if a material is a hazardous waste and thereby regulated under RCRA. First, EPA lists wastes from specific and nonspecific sources as hazardous waste based on the presence of certain constituents, such as identified carcinogens or mutagens, in the wastes at levels that endanger human health. These are known as 'listed' wastes.

Secondly, EPA may determine that a waste material is hazardous because it exhibits one or more hazardous characteristics. EPA considers a waste material to be hazardous if it is ignitable, corrosive, reactive, or toxic. Such a waste is known as a ''characteristic' waste. RCRA also considers mixtures of listed hazardous waste or characteristic hazardous waste, which still exhibit hazardous characteristics, as hazardous waste, as well as residue resulting from the treatment of a listed waste.

EPA lists over 400 wastes from various sources as hazardous in 40 CFR Part 261 Subpart D. The criteria for determining if the waste exhibits one or more of the hazardous characteristics mentioned above are included in Subpart C of 40 CFR Part 261. It is the responsibility of the waste generator to determine if the waste material is hazardous based on the conditions outlined above.

Applicability of RCRA to Mixed LLW

After Congress expressed its preference for an administrative solution to the debate on joint regulation of mixed LLW by EPA and NRC, both agencies began working on guidance to assist potential generators and States in developing strategies for managing mixed LLW and establishing mixed LLW disposal capacity. In a July 3, 1986, Federal Register notice[7], EPA required a State to obtain authorization to regulate the hazardous component of mixed LLW under RCRA and formally clarified the applicability y of RCRA to waste containing both hazardous and radioactive constituents. This clarification was necessary because of confusion between the interpretation of Section 1004(27) of RCRA, which excludes ''source, special nuclear, and byproduct material as defined by the Atomic Energy Act of 1954, as amended. .,' and the definition of ''solid waste' to be covered by the RCRA requirements.

In a subsequent notice of clarification issued in the Federal Register. on September 23, 1988[8], on the application of RCRA to hazardous waste treatment. storage, and disposal facilities (TSDFs) for mixed LLW, EPA stated that RCRA applies to any waste containing both RCRA hazardous constituents and AEA radioactive constituents. This interpretation assumes that if a waste is a mixture of both hazardous and radioactive constituents, only the individual radioactive constituents are exempt from RCRA—not the entire mixture of hazardous and radioactive materials. As a result of these notices, mixed LLW is now formally subject to dual regulation under both RCRA and AEA.

7 51 Federal Register 24504, July 3, 1986.

8 53 Federal Register 37045, Sept. 23, 1988.

State Implementation of RCRA

Under RCRA, EPA may delegate to a State agency the authority to implement hazardous waste regulations if the State agency's program is equivalent to the Federal RCRA program. A State program must have the necessary statutory authority and expertise to implement RCRA under State regulations. An authorized State program may adopt requirements that are more stringent and comprehensive than Federal requirements as long as they are not inconsistent with the Federal program. Requirements for a State applying for authorization are listed in 40 CFR Part 271. Although there are some differences, this provision for authorizing a State to assume the regulatory role for hazardous waste is similar in concept to the NRC Agreement State program for regulating radioactive waste.

Before HSWA was passed, a State received RCRA authorization in phases based on the various components of the RCRA regulatory program. A State with full RCRA authorization was considered to have base RCRA program authorization. Following HSWA's passage, EPA assumed responsibility for enforcing the new regulations until the authorized State agency could incorporate them into its regulatory program.

Since HSWA required EPA to promulgate many new regulations, EPA divided the Federal rules required under HSWA authority and pre-HSWA authority into groups+ ailed clusters—based on schedules for when they are to be issued. A State is to incorporate regulatory changes by a cluster deadline and to apply for authorization within a specified timeframe after a cluster of rules is promulgated by EPA. A State with base authorization that fails to adopt the necessary statutory authorities and equivalent regulations in a timely fashion runs the risk of having EPA withdraw the entire RCRA program authorization.

State Authorization for Mixed Waste

Under EPA's approach, the authority to regulate the hazardous component of mixed waste is included in the non-HSWA Cluster III. The July 3. 1986. Federal Register notice required a State with base program authorization to revise its program if necessary and apply for authorization to regulate the hazardous component of mixed waste. The notice allowed a State 1 year from the date of publication to make necessary regulatory changes and to demonstrate that its hazardous waste program applies to all hazardous waste, even if mixed with radioactive waste. A State requiring statutory amendments to regulate the hazardous component of mixed waste is given 2 years from the date of the notice to incorporate necessary changes. A State initially applying for base authorization after July 3, 1987, is required to include authority to regulate mixed waste in its application.

The cluster established deadlines, which extended previous deadlines, requiring States with base programs to demonstrate mixed waste regulatory authority by 1 year-by July 1988, or by July 1989 it a statutory change is required. Furthermore, a 2-month grace period can be granted. The EPA Regional Administrator may also grant States with base authorization a 6-month extension beyond the July 1989 deadline to apply for mixed waste authorization. If necessary, the Regional Administrator may place States on a maximum 1 -year schedule of compliance to apply for mixed waste authorization. Given that only nine States have mixed waste authorization as of October 1989, it is likely that most States are or will be placed on the compliance schedule.

Currently, 45 States are authorized for the base RCRA program. Of these States, only Tennessee, South Carolina, Washington, Kentucky, Colorado, Georgia, Utah, Minnesota, and Ohio have received authorization for mixed waste. These nine States are responsible for regulating the generation, treatment, storage, and disposal of mixed waste within their borders. In the remaining 36 States which have base authorization but are not currently authorized to regulate mixed waste, mixed waste is not subject to regulation as a hazardous waste under RCRA and is regulated as a hazardous waste only if the State has adopted specific mixed waste statutes and regulations or is regulating the material under some other State statute or regulation. In the six unauthorized States and territories, EPA administers the RCRA program, including regulation of mixed waste.

Clarification of Interim Status Requirements for Mixed LLW Treatment, Storage, or Disposal Facilities

Under RCRA regulations, hazardous waste TSDFs in existence prior to November 19, 1980--or in existence prior to the effective date of statutory or regulatory changes that bring the facility under RCRA regulation—are eligible for interim status. Interim status allows a TSDF to operate without a final permit under regulations found in 40 CFR Part 265 until EPA or an authorized State makes a formal decision to issue or deny the final TSDF permit. To be eligible for interim status, the owner or operator of a TSDF that meets the ''in existence' requirements mentioned above must comply with the notification requirements of Section 3010 of RCRA and must submit a RCRA Part A permit application pursuant to 40 CFR Part 270.70. Without interim status, hazardous waste activities at existing facilities must cease until a final permit is issued, which in some cases might take several years.

On September 23, 1988, EPA issued a Federal Register notice to clarify interim status qualification requirements for TSDFs handling mixed waste. In this notice, EPA determined that TSDFs handling mixed waste in an unauthorized State had to be in existence or under construction as of July 3, 1986, to be eligible for interim status. This "in existence" date differs from the November 19, 1980, date for TSDFs handling only hazardous waste, as it corresponds to the EPA's first official pronouncement that RCRA requirements are applicable to mixed waste.

Owners and operators of TSDFs handling mixed waste that were in existence or under construction by July 3, 1986, and are located in a State which *did not* have base program authorization as of September 23, 1988, were required to submit Part A permit application to the appropriate EPA Regional Office by March 23, 1989.

Owners and operators of TSDFs handling only mixed waste in a State that *did* have base authorization by July 3, 1986, are not subject to RCRA regulation until the State program receives authorization to regulate mixed waste. The latest "in existence' date in a State for determining interim status eligibility is the effective date of the State's mixed waste authorization. However, once authorized, a State may select an earlier "in existence" date on which to base interim status qualifications. For example, a State might choose to select an earlier date to prevent facilities from obtaining interim status because these facilities were not in existence as of the earlier date. As a result, facilities in this situation would have to cease operations until a final permit was obtained and would not be allowed to operate under less stringent interim status requirements. However, as a practical matter, the nine States that have already received mixed waste authorization have not chosen earlier in existence' dates.

In a State with base authorization, TSDFs handling mixed LLW that have already obtained interim status under RCRA because they handle other RCRA hazardous waste, will be required to submit a revised Part A permit application reflecting their mixed LLW activities within 6 months of the State's receipt of mixed waste authorization.

The owners and operators of the three existing commercial LLW disposal facilities have decided not to apply for RCRA permits to dispose of mixed LLW or for interim status under RCRA. As a result, these facilities are no longer allowed to receive mixed LLW, and mixed LLW generators are presently without available disposal capacity. If these three facilities were to apply for RCRA disposal permits, they would be subject to the HSWA corrective action requirements, which stipulate that the facility owner/operator must address any previous releases of hazardous constituents before a final RCRA permit can be issued.

NRC and EPA Guidance on Mixed LLW

To clarify how dual regulation of mixed LLW is to be implemented, the two agencies jointly developed three guidance documents that address the identification and definition of commercial mixed LLW (8), siting guidelines for mixed LLW disposal facilities (9), and a conceptual design for mixed LLW disposal facilities (10).

The first joint guidance document, issued on January 8, 1987, defines mixed LLW as:

> **waste** that satisfies the definition of low-level waste in the LLW Policy Amendments Act of 1985 and contains hazardous waste that either (1) is listed

as a hazardous waste in Subpart D of 40 CFR Part 261 or (2) causes the low-level waste to exhibit any of the hazardous waste characteristics identified in Subpart C of 40 CFR Part 261. (8)

It was determined that the RCRA exclusion of source, byproduct material, and special nuclear material from the definition of solid waste only applies to the actual radionuclides in the waste. If the radionuclides cannot be separated from the waste, waste containing both radioactive and hazardous constituents falls under dual jurisdiction and must be managed in accordance with the requirements of both RCRA and AEA as implemented by EPA and NRC respectively. This guidance also includes a methodology for generators of commercial LLW to identify mixed LLW.

The second joint guidance document, issued on March 13, 1987, contains combined NRC and EPA siting guidelines for mixed LLW disposal facilities. The guidance states that both NRC and EPA do not consider the absence of EPA's final location standards for hazardous waste facilities (which are currently under development) to be a justification for States and compacts not to proceed with the development of LLW disposal sites, including mixed LLW disposal units in accordance with the LLRWPAA (9). The joint guidance includes a preview of EPA's location standards, combined with NRC's site suitability requirements in 10 CFR Part 61.50. EPA has promulgated **minimum** location standards for hazardous waste TSDFs and has established interim final criteria for identifying areas of vulnerable hydrogeology (6), but EPA has not developed **final** location standards that specify siting criteria for new hazardous waste TSDFs. EPA's schedule for adopting these additional location standards is lagging behind the timeframe needed for States to meet the LLRWPAA. Because of this delay, the agencies combined their existing requirements and guidance and developed 11 siting guidelines for mixed LLW disposal facilities (9) (see ch. 6). The guidance encourages States and compacts planning to develop mixed LLW disposal units in conjunction with LLW sites to stay abreast of EPA's plans for promulgating the location standards required by HSWA.

The third joint guidance was issued on August 3, 1987, and includes a conceptual design for mixed LLW disposal facilities developed by NRC and EPA (10). The agencies consider the conceptual design depicted in the guidance for a mixed LLW disposal unit to be capable of meeting both EPA minimum technology requirements for liners and leachate collection systems and NRC's requirements for minimizing contact of waste with water. The design is also to assure long-term stability and avoidance of long-term active maintenance, which is required by both agencies. The guidance discusses the need to evaluate mixed LLW disposal technologies on a site-specific basis and the potential for site developers to obtain a variance to EPA's minimum technology requirements.[9] According to the guidance, variations to the conceptual design submitted by license applicants will be reviewed by NRC and EPA on a case-by-case basis to evaluate their acceptability and conformance with Federal regulations. This guidance also discusses facility closure requirements.

EPA and NRC have also discussed the need to develop joint guidance on mixed LLW storage, sampling and testing, inspection and enforcement procedures, and dual licensing and permitting procedures. No final guidance in these areas has been issued by the agencies as of November 1989. In a report for the LLW Forum[10], prepared by Afton Associates, officials from States planning to build mixed LLW disposal facilities voiced the need for guidance in these and other areas to increase the efficiency and feasibility of dual regulation (1). The Forum also saw joint guidance needed on treatment standards for particular mixed LLW, pre-approval of conceptual facility designs, post-closure failure scenarios, monitoring, and remediation.

Dual Regulation of Mixed LLW

There are four potential scenarios for State and Federal regulation of mixed waste under dual jurisdiction:

[9]To obtain a variance, the Site operator must demonstrate that an alternative design and operating practices together with the characteristics of the site location are equally effective in preventing the migration of any hazardous constituent into groundwater or surface water.

[10]The LLW Forum is an association of State and compact officials that was established to facilitate implementation of the Low-Level Radioactive Waste Policy Amendments Act of 1985.

1. regulation by a State radiation protection agency and a State hazardous waste program in an Agreement State that is also an authorized RCRA State,
2. regulation by a State radiation protection agency and by EPA in an Agreement State that is not authorized for RCRA,
3. regulation by NRC and a State hazardous waste program in a non-Agreement State that is an authorized RCRA State, or
4. regulation by NRC and EPA in a non-Agreement State that is not authorized for RCRA.

Generally, NRC and EPA regulations differ in their levels of specificity under their governing statutes. As discussed above, NRC's regulations for LLW disposal are primarily based on performance objectives, allowing the site developer considerable flexibility in meeting them. Conversely, EPA's regulations for managing hazardous waste are prescriptive in many significant areas, such as minimum technology requirements for land disposal, manifest requirements for waste transportation and waste sampling, and verification procedures. Because many of these requirements are also mandated by statute, EPA has little flexibility in developing regulations for their implementation and must incorporate statutory requirements and prohibitions as required by law. Although RCRA does offer some relief from these prescriptive requirements through variances, the statutory standards for demonstrating variances found in Section 3004(d) of RCRA are very stringent.

The provision in RCRA Section 1006(a) for exempting a substance for which RCRA requirements are inconsistent with AEA requirements has been much discussed between EPA, NRC, and States planning to develop mixed LLW disposal facilities. No guidance, however, has been offered by either agency on how to implement this provision. As of November 1989, neither NRC nor EPA has publicly identified any potential inconsistencies under dual regulation that might preclude compliance with either agency's requirements.

Of particular concern to the States planning to build mixed LLW disposal units are the additional procedural and administrative requirements for permitting a mixed LLW facility under RCRA as well as under AEA. To meet the milestones and deadlines prescribed by the LLRWPAA, most States are hoping to integrate RCRA permitting procedures for the mixed LLW disposal unit with the licensing process for their LLW disposal facility. It is unclear whether or not NRC and EPA will issue guidance or rulemaking on dual licensing and permitting because they will only serve as the licensing and permitting authorities for those few States that have not obtained delegated regulatory authority. If such guidance or rulings are not issued, Agreement State programs and RCRA authorized State hazardous waste programs will have little direction in integrating facility approval procedures.

Implications of RCRA Requirements on Mixed LLW Management and Disposal

As of November 1989, NRC and EPA were planning to regulate mixed LLW under their existing hazardous waste and LLW regulations and were not planning to develop regulations specifically for mixed LLW. The two agencies examined the two sets of existing regulations and found that they are consistent with one another-no instances were identified where compliance with one set of regulations would result in noncompliance with the other. However, both agencies recognize the potential for conflicts or inconsistencies to arise when implementing the regulations in site-specific cases.

As mentioned earlier, RCRA Section 1006(a) provides for AEA to take precedence in cases where the application of RCRA regulations are inconsistent with AEA requirements. Neither agency, however, has adopted procedures or regulations for making inconsistency determinations under Section 1006(a). Instead, the agencies plan to review on a case-by-case basis any potential inconsistencies found by generators or site developers. In its September 23, 1988, Federal Register notice, EPA encouraged the regulated community to bring forward actual examples of inconsistencies. If warranted, these examples would be addressed in future rulemakings or guidance.

Since the agencies are not currently planning to develop separate regulations for mixed LLW, the full requirements of the existing regulations will apply. Under RCRA regulations, the generator is responsible for determining if the waste being

generated contains a listed hazardous waste or if the waste exhibits any of the four hazardous characteristics of ignitability, corrosivity, reactivity, or toxicity. Generators of mixed LLW containing hazardous constituents are required to notify EPA or the State agency authorized for mixed waste and obtain a generator identification number, Large-quantity generators (those that generate greater than 1,000 kilograms (2,200 pounds) per month) that are planning to store mixed LLW for more than 90 days must apply for a hazardous waste storage permit from EPA or the authorized State agency. Small-quantity generators (those that generate 100 to 1,000 kilograms (220 to 2,200 pounds) per month) may store hazardous waste for up to 180 days without a permit and may store up to 6,000 kilograms (13,200 pounds) for 270 days if the waste must be shipped over 200 miles for management or disposal.

Storing short-lived radioactive waste until the radioactivity decays to below regulatory concern (BRC) levels[11] has been a common LLW management practice. Mixed LLW generators may incur additional costs and regulatory burdens to obtain a RCRA storage permit if they plan to store this waste for the decay of its radioactive materials. Impacts of storage prohibitions related to the Land Disposal Restrictions mandated by HSWA (see the next two sections) may also affect a facility's ability to store mixed LLW.

Generators shipping hazardous waste offsite for storage, treatment, or disposal must complete EPA's Uniform Hazardous Waste Manifest and use a transporter who has an EPA identification number. The waste must be shipped to a permitted or interim status TSDF in accordance with the applicable Department of Transportation (DOT) regulations governing hazardous materials. Mixed LLW generators will have to complete the Uniform Hazardous Waste Manifest, as well as the manifest required by the LLW facility operator. Mixed LLW shipments will also be required to meet DOT regulations for shipment of radioactive materials. In its September 23, 1988, Federal Register notice, EPA determined that NRC's and EPA's packaging and waste transportation regulations are complemental} and consistent with DOT regulations. The Federal agencies do not anticipate States or generators encountering any problems with conflicts among Federal regulations. However, in cases where RCRA-authorized States and NRC Agreement States are licensing mixed LLW facilities, the State regulations will apply and conflicts may result where these regulations are more stringent.

After receipt of the hazardous waste at a permitted or interim status TSDF, the waste is managed in accordance with EPA regulations and facility permit conditions. It is the responsibility of the TSDF owner/operator to sample and verify the contents of the waste package. The owner/operator must also determine that the waste has been properly treated prior to land disposal. This determination may be based on information supplied by the generator or on the analysis conducted at TSDF.

The sampling of mixed wrote containers has been a focus of concern. RCRA requires that samples be taken large enough (100 grams) to be representative, but a large enough sample could result in increased worker exposure to radiation and a violation of ALARA principles. Currently, LLW disposal facilities do not open LLW containers prior to disposal unless external radiation-monitoring indicates the need to further inspect the waste package. EPA and NRC are working on resolving this issue but no final joint guidance has been established as of October 1989.[12]

Currently, many TSDFs that accept hazardous waste have self-imposed prohibitions on accepting radioactive waste. even in de *minimis*[13] quantities. Others cannot accept radioactive waste for treatment, storage, or disposal because they do not have the necessary license from NRC or the appropriate Agreement State agency for managing mixed LLW. At present, there are no commercial TSDFs that have the necessary AEA license and RCRA permit to accept offsite mixed LLW.

[11] These levels are set by NRC so that BRC wrote poses no undue risk to public health and safety and the environment.

[12] EPA and NRC have drafted a document entitled "Characlen/ahon Guidance" that addresses the sampling procedure.

[13] *De minimis* waste is different from BRC waste in that d, *minimus* waste implies a trivial radiation hazard when disposed of and no regard for cost or technology. BRC waste, in contrast, implies costs will be evaluated against benefits and current technology. This distinction was made by Timothy Johnson in his talk "Below Regulatory Concern Wastes—Identification and Implications for Mixed Waste Management," *Proceedings of U S Environmental Protection Agency Mixed Waste Workshop,* Denver, Colorado, July 19-20, 1988, pp. 43-46.

Some mixed LLW generators have developed onsite treatment facilities for mixed LLW, including incinerators operating with AEA licenses and interim status RCRA permits. However, due to the complexities and stringent requirements of obtaining a final RCRA Part B permit, these facilities may opt not to pursue final permits. The development of onsite facilities as an option for treating mixed waste is not considered economically feasible for the majority of generators that produce small quantities of mixed LLW. The Department of Energy has developed treatment capacity for defense mixed waste, "including incinerators-with RCRA permits. These facilities, however, are not regulated by NRC nor available to commercial generators.

Impact of the HSWA Land Disposal Restrictions

As mentioned earlier, the three existing commercial LLW disposal facilities are not authorized to accept mixed LLW. The Land Disposal Restrictions (LDRs) mandated by HSWA in 1984 will also profoundly affect the future management and disposal of mixed LLW. EPA is promulgating the LDRs as regulations over a 31/z-year period from November 1986 to May 1990. Once a LDR is effective for a particular hazardous waste, any mixed LLW containing that hazardous component must be treated to an adequate level, as determined by EPA, prior to land disposal in a mixed LLW disposal facility.

As part of HSWA, Congress mandated a schedule for EPA to evaluate all hazardous wastes to determine if continued land disposal of these wastes is sufficiently protective of public health and the environment. If EPA does not meet the statutory deadlines for making specific determinations for certain wastes, these wastes will be prohibited from land disposal. Section 3004(m) of RCRA requires EPA, when issuing its regulations prohibiting the land disposal of particular hazardous wastes, to also promulgate regulations specifying levels or methods of treatment that would substantially diminish the toxicity or reduce the likelihood of migration of the hazardous constituent from the wastes. The goal of these regulations is to minimize short-term and long-term threats to human health and the environment.

Once the treatment standard is met, the statute allows the waste or the residues of waste to be disposed of in a permitted land disposal facility. The legislation allows the EPA Administrator to delay the effective date of the treatment standards and land disposal prohibitions if treatment capacity is not currently available. The Administrator is also responsible for evaluating and granting site-specific petitions requesting land disposal facilities to accept banned waste, based on the finding that there will be no migration of hazardous constituents from the land disposal unit for as long as the waste remains hazardous.

To implement these provisions, EPA has issued or is planning to issue regulations based on the schedule that Congress prescribed in HSWA. (See table 3-l—Schedule for Land Disposal Prohibitions.)

In November 1986, EPA issued LDRs and treatment standards for spent solvents and dioxin-containing waste. On July 8, 1987, the agency issued LDRs and treatment standards for the California List wastes. (See table 3-1 for a list of these wastes.) In August 1988, the agency issued LDRs and treatment standards for the first third of EPA's listed hazardous wastes. The second third of LDRs and treatment standards for EPA's listed hazardous wastes was issued on June 23, 1989. The final third is expected in May 1990.

In establishing treatment standards, EPA identifies wastes with similar physical and chemical characteristics and categorizes them into waste treatability groups. EPA then evaluates technologies to treat these wastes to determine the best demonstrated available technology (BDAT) for each waste treatability group. EPA only considers treatment technologies that have been demonstrated by full-scale operation. Once identified, a technology must meet three criteria; it must:

- be commercially available,
- present less risk to human health and the environment than land disposal of the untreated waste, and
- provide substantial treatment.

Each of these criteria is explained in detail in a November 7, 1986, Federal Register notice.[14] Treatment technologies prohibited under Section 3004(n) of RCRA because of air emissions are excluded as available technologies for purposes of establishing treatment standards.

If EPA concludes that a demonstrated technology does not meet the above criteria and therefore is not available, the treatment standard is based on the next best technology determined to be available. The resulting treatment standards, which are determined to be available, may be expressed as concentration limits based on the performance of the BDAT or as technology-based standards in the regulations. EPA has generally indicated a preference for concentration-based standards. However, if analytic methods for determining concentrations are not readily available, EPA prescribes technology-based standards. To allow the generator considerable flexibility in meeting a concentration-based standard, EPA does not require that the waste be treated using a specific technology.

Possible Variances and Extensions to the Effective Date for Treatment Standards

National Capacity Variance-Due to the lack of available treatment capacity for spent solvents and dioxin-containing waste, EPA granted a 2-year national postponement of the effective date for applying the LDRs and treatment standards, allowing waste containing these materials to be land disposed until the effective date. This reprieve has since passed for these wastes, and the regulations became effective on November 7, 1988.

A similar determination was made for some of the California List wastes. The effective date for LDRs and treatment standards for halogenated organic compounds (HOCs) in total concentrations of greater than or equal to 1,000 milligrams per liter (0.033 ounces per quart) was delayed until July 8, 1989, due to the lack of incineration capacity. In EPA's August 17, 1988, rulemaking, which promulgated LDRs and treatment standards for the first third of the 'listed' hazardous waste, EPA issued treatment standards applicable to certain California List HOC waste to allow burning in industrial boilers and furnaces.

Table 3-l-Schedule for Land Disposal Prohibitions

Nov. 8, 1986:
Dioxin-containing wastes (F020, F021, F022, F023, F026, F027, F028)
Spent solvents (F001, F002, F003, F004, F005)
July **8, 1987:**
California List wastes (liquid hazardous wastes containing: free cyanides, polychlorinated biphenyls (PCBs), and certain metals at or above specified concentration levels, and those liquid hazardous wastes having a pH of less than or equal to 2.0. Also, both liquid and nonliquid hazardous wastes containing halogenated organic compounds at or above specified concentration levels)
Aug. 8, 1988:
At least one-third of all listed hazardous wastes
Wastes disposed of in injection wells
Nov. 8, 1988:
Contaminated soil and debris from the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) of 1980a Section 104 or 106 response actions and RCRA correction actions
June 8, 1989:
At least two-thirds of all listed hazardous wastes
May 8, 1990:
All remaining listed hazardous wastes
All characteristic hazardous wastes
Within 6 months of listing or identification (these wastes **are not subject to the automatic land disposal prohibition):**
Newly listed wastes

aPublic Law 96-510.

SOURCE: U.S. Environmental Protection Agency, *Land Disposal Restrictions* Summary, *Volume 1, Solvents and* Dioxins, EPA/530-SW-87-019A, May 1987,

Treatment standards have not been established for California List corrosive wastes, metals, or free cyanides. Generators must, therefore, treat these wastes to levels below the statutory prohibition levels found in RCRA Section 3004(d)(2) or render them nonliquid prior to land disposal. With respect to other California List wastes, the effective date of July 8, 1987, still holds.

The LDRs and treatment standards in effect for dioxins, spent solvents, and the California List wastes are in effect for the hazardous constituent in mixed LLW. However, in issuing the LDRs and treatment standards for the first third of EPA's listed hazardous wastes, EPA decided to postpone the issuance of the first two-thirds of the LDRs and standards for mixed LLWs until it issues the final third in May 1990.

[14] Federal Register 40572, Nov. 7, 1986.

EPA could decide to grant a national capacity variance for the scheduled listed wastes as well. A maximum 2-year national capacity variance would extend the effective date of these treatment standards to May 1992. However, most of the hazardous constituents known in commercial mixed LLW whose generation cannot be avoided fall into the group of dioxins, solvents, and certain California List wastes, for which treatment standards are in effect now. Nonetheless, if any hazardous constituents in mixed LLW are detected for which treatment standards would not be established until the last third treatment standards are established, a 2-year national capacity variance could extend the effective date of these standards to May 1992.

Case-by-Case Extensions—For the commercial mixed LLWs for which treatment standards are currently effective, generators must either treat the wastes to meet the applicable treatment standards of 40 CFR Part 268.40-43 prior to land disposal or request a case-by-case extension of up to 2 years of the effective date of the treatment standard. To obtain an extension, generators must apply to the EPA Assistant Administrant for a l-year extension, renewable only once for an additional year. To be considered for an extension, the petitioner must demonstrate that he/she has made a good faith effort to locate an appropriate available treatment facility and that he/she has entered into a binding contract to construct or otherwise provide for alternative treatment or recovery capacity that meets the treatment standard for the entire waste volume. The petitioner must also demonstrate that, due to circumstances beyond his/her control, such alternative capacity cannot reasonably be made available by the applicable effective date.

If an extension to the effective date is granted, the generator may dispose of the restricted waste without treatment. The land disposal unit must either meet RCRA's minimum technology requirements for land disposal facilities or be determined by the Administrator to be equally protective of human health and the environment until the extension expires. To meet the underlying standard for protecting human health and the environment, in cases where LDRs apply but no treatment standard has been established, EPA will require that the generator have the capability to manage the waste for which the extension is requested,

Variances to the Treatment Standard-Under 40 CFR Part **268.44,** generators may also apply for a variance from the applicable treatment standard if the particular waste in question is considerably different from the waste used by EPA in setting the treatment standard and if the waste cannot be treated to meet the applicable standard. Although no such variances have been requested for mixed LLW, it is evident that the presence of high levels of radioactivity in certain mixed LLWs could preclude the use of certain hazardous waste treatment technologies necessary to meet applicable standards. For example, such a variance will likely be needed for organic solvents containing high concentrations of carbon-14 and tritium, which if incinerated would escape through an off-gas system.

To obtain a variance, the generator must not only demonstrate that the waste is significantly different, but also that the waste cannot be treated to meet the standard, whether it be a concentration-based or technology-based standard. The generator must also provide an alternative treatment method for the waste, which EPA will evaluate to establish a new treatment standard for the waste if the variance is granted. During consideration of variances to a treatment standard, generators requesting the variance must comply with all applicable restrictions on land disposal. Each application for a variance must include information found in 40 CFR Part 260.20(b)(1-4).

No-Migration Petition-In 40 CFR Part 268.6 of the RCRA regulations, generators of waste restricted from land disposal have the opportunity to petition EPA, through their TSDF permit application, for a no-migration variance. The petitioners must demonstrate that no migration of hazardous constituents from a site-specific land disposal unit will occur for as long as the waste remains hazardous. If the EPA Administrator approves the petition, the waste for which the variance was requested may be disposed of at the specific land disposal facility without treatment. EPA has stated that it ''believes there will be very few instances when no-migration demonstrations can be successfully made' (7). EPA identifies likely circumstances where no-migration variances might be used, which include the disposal of relatively immobile hazardous constituents in arid land disposal units with no groundwater recharge and the disposal of small amounts of hazardous

waste in stable geologic formations. All variances and extensions must be granted by EPA through rulemaking procedures published in the Federal Register as tentative and final decisions.

Delisting-Generators may also petition the agency to delist the hazardous waste in question to allow disposal in a conventional landfill at any point in the process.

Summary of LDRs and Treatment Standards

The LDRs and treatment standards for spent solvents, dioxin-containing waste, and some California List hazardous wastes are applicable to those mixed LLWs containing these substances as of the effective dates. Surveys of mixed LLW generators indicate that these standards may cover a large portion of total mixed LLWs requiring treatment. With this information in hand. generators of these wastes can begin immediately to meet these standards.

For other hazardous constituents found in mixed LLW, treatment standards will not be established until May 1990. EPA decided to defer establishing treatment standards for listed hazardous wastes until standards for the final third of the scheduled listed wastes are established. This decision was based on the agency's determination that while these hazardous wastes exist in large volumes, only a relatively small volume of mixed LLW containing these constituents is currently being generated. As a result of the deferral, generators of mixed LLW containing hazardous constituents other than dioxins, solvents, or some California List wastes will be allowed to continue storing their waste, despite the storage prohibitions discussed below, until at least May 1990.

Storage Prohibitions Affecting Mixed LLW

As part of the LDRs in HSWA, Congress adopted legislation prohibiting the storage of hazardous constituents restricted from land disposal ''. . . unless such storage is solely for the purpose of accumulation of such quantities of hazardous waste as are necessary to facilitate proper recovery, treatment, or disposal. ' This prohibition is found in RCRA Section 3004(j) and in 40 CFR Part 268.50. The regulations allow transporters to store manifested shipments of restricted waste for up to 10 days. For TSDFs storing mixed LLW for "the purpose of accumulation. . .," the burden of proof is on EPA or a RCRA-authorized State agency during the first year to demonstrate that the purpose of accumulation does not meet the requirement. Storage of restricted waste beyond 1 year shifts the burden of proof to the TSDF owner/operator to demonstrate that the storage is solely for the purposes outlined in the statute. Since no treatment or disposal facility exists for mixed LLW, it is unlikely that generators would be granted a storage permit. The storage prohibition does not apply to wastes for which extensions or variances have been granted or to wastes that meet applicable treatment standards.

The storage prohibition is a major problem for mixed LLW generators currently storing or planning to store their mixed LLW due to the lack of available treatment and disposal capacity. This prohibition may also make it more difficult for States and compacts planning to submit Governors' certifications to comply with the 1990 milestone of the LLRWPAA of 1985. The sited States, DOE, and NRC have issued guidance and criteria for the 1990 milestone which requires States not in sited compact to document their plans for the post-1992 management of all LLW, including mixed LLW, as part of their Governors' certifications. Many States are contemplating requiring generators to store LLW onsite for an extended period until new LLW and mixed LLW disposal units are licensed and permitted. Most of these new facilities will not be in place until well after 1992.

Storage prohibitions for the majority of untreatable mixed LLWs—those containing dioxin, solvent, or certain California List constituents—are in effect as of November 1988. While case-by-case extensions for treatment could be granted for 1 year and renewed for an additional year, these extensions are unlikely because the generator has to have a binding contract in place for alternative treatment capacity before the extension is granted. A contract will be difficult to arrange given that no commercial facility is operational for treating mixed LLW aside from onsite incinerators and one offsite incinerator that accepts only BRC scintillation fluids.

EPA's ability to allow continued storage of mixed LLW containing restricted hazardous constituents in

the absence of treatment and disposal facilities may be limited since the prohibition is a statutory requirement. It may, however, be possible for rulemaking to allow mixed LLW containing restricted constituents to be stored until adequate treatment and disposal facilities are available. Under the current schedule of EPA and NRC issuing guidance on mixed LLW, it is unlikely that such rulemaking will be available before the January 1, 1990, milestone deadline for submission of Governors' certifications. As a result, States may have difficulty complying with the 1990 milestone.

States could go so far as to require generators of mixed LLW containing land disposal restricted constituents to cease their operations. This could potentially cripple utilities, radiopharmaceutical manufacturers, and research and medical institutions.

Generators are currently trying to change their practices so that they do not produce mixed LLW, and, for mixed LLW generation that cannot be avoided, generators are using all available in-house treatment techniques to alter their waste so that it is either solely radioactive or solely hazardous. Nonetheless, some mixed LLW generation cannot be avoided short of shutting down the facilities producing the waste. Generators, in turn, are storing their waste which is illegal if it is a land disposal restricted waste falling into the category of dioxin, solvent, or a California List waste. Generators are pressuring EPA for relief from the storage prohibition. Mixed LLW generators could also begin pressuring the private sector to develop mixed waste treatment facilities. States could also take it upon themselves to develop these facilities, but the result could be that substantial resources and staff would be diverted from their primary responsibility of developing disposal facilities, as required by Federal law.

Regulatory Issues Affecting the Development of Mixed LLW Disposal Capacity

Of primary concern to States and compacts are the additional technical and procedural requirements of dual permitting and licensing of mixed LLW facilities under both RCRA and AEA. Although States with Agreement State status and RCRA programs authorized for mixed waste will actually permit and license these facilities in lieu of EPA and NRC, the two agencies will still be able to exert considerable influence over the process through the development of rulemaking or guidance, imposition of minimum Federal technical and procedural requirements, and issuance of variances.

Although some State officials believe that dual permitting and licensing are workable, these officials also note the additional expense and time required to meet both sets of requirements. One State has estimated that characterizing sites to meet RCRA requirements as well as NRC requirements may increase site characterization costs by $2 million to $4 million per site and could delay the entire facility siting process by up to a year, jeopardizing the State's ability to meet milestones prescribed by Federal law (2). State officials also worry about the dynamic nature of RCRA regulations—the moving target syndrome. They are concerned that the regulations will disrupt the facility development process if additional regulations are promulgated for site selection criteria and disposal facility design in the midst of the process (1).

Regarding disposal facility design requirements, EPA and NRC have promulgated performance objectives and technical requirements which differ in approach. NRC has issued general technical requirements and performance objectives in 10 CFR Part 61, while EPA has prescribed specific engineering features in 40 CFR Part 264. Most significantly, EPA requires that all land disposal units install two or more liners and a leachate collection system above and between the liners to protect human health and the environment. Conversely, NRC calls for the development of free-draining disposal units to avoid the "bathtub effect." NRC's approach depends on trench caps and natural site characteristics to minimize infiltration of water and migration of radionuclides into the environment. (See ch. 6 for a more details on these differences).

While the joint guidance issued by the agencies shows that EPA's minimum technology requirements, which are also statutory requirements, are not likely to preclude compliance with NRC's requirements, the guidance does not address operational concerns resulting from these requirements. One of these concerns is increased worker exposure due to the potential radiological hazard posed by leachate collection and waste verification procedures required by RCRA. States are also interested in how to

obtain variances from RCRA minimum technology requirements by demonstrating that their alternative designs provide equivalent protection for human health and the environment. States have requested guidance in both areas (l). Beyond the minimum technology requirements which have given rise to these concerns, other EPA and NRC technical requirements for land disposal units appear to be complementary.

To assist them in licensing mixed LLW facilities, States have requested additional guidance for integrating the administrative licensing procedures of both regulations and have requested that the agencies develop consultative review and preapprove.1 procedures for State conceptual designs for mixed LLW disposal units. Recognizing the tight timetable States are on to develop these disposal facilities, NRC officials informed their Advisory Committee on Nuclear Waste that they plan to assist the States in determining ways to streamline the licensing of mixed LLW disposal units (11). Nonetheless, this effort should be jointly conducted with EPA to ensure that both agencies' regulations are met.

Future Considerations for the Management and Disposal of Mixed LLW

Despite the small volumes of mixed LLW currently generated or projected to be generated, the management and disposal of these materials has been of great concern both to generators who must manage the waste in compliance with two sets of regulations and to State and compact officials who must develop disposal facilities in accordance with both RCRA and AEA requirements. While **NRC** regulations for treatment of LLW are not as prescriptive as EPA's, EPA regulations will eventually require that all LLW containing hazardous constituents be treated to meet the applicable standard. With no treatment capacity and no assurance of future treatment capacity, generators may not be able to manage these wastes in accordance with EPA's treatment standards. Furthermore, States may not be able to do so after 1992 unless regulations are modified to allow storage while encouraging the development of treatment and disposal capacity. In addition, the radiological impacts on the environment, the public, and workers from mixed LLW treatment will need to be evaluated by the regulatory community.

RCRA regulations are continual y evolving which adds to the uncertainty of managing mixed LLW. The small volume of mixed LLW currently being generated, could significantly increase if EPA characterizes waste oil as a hazardous waste.

Another issue that may directly impact mixed LLW management is the development and implementation of a Federal BRC standard and regulations that could theoretically allow mixed LLW with very low levels of radioactivity to be disposed of as a hazardous waste. Currently, NRC has established regulations in 10 CFR Part 20.306 (the Biomedical Rule) for allowing very low concentrations of certain radionuclides in scintillation fluids and animal carcasses to be disposed of without regard to radioactivity. Furthermore, NRC has issued a policy for designating certain waste streams as BRC.[15] NRC staff is also in the process of developing a broad generic policy for exempting certain practices involving radioactive materials from regulatory control. As proposed in the December 12, 1988, Federal Register[16], this generic policy would establish a 10-millirem-per-year individual whole body dose as the limit for BRC determinations. However, EPA plans to propose as part of its LLW standard (40 CFR Part 193) a BRC limit of 4-millirem-per-year effective body dose, the consideration of collective doses, extensive recordkeeping and waste characterization requirements, and the potential for recycling the waste. If EPA's BRC standard is promulgated, NRC's regulations for BRC will have to be modified to conform with the EPA standard. The resolution of this inconsistency between the two agencies' BRC limits may take years. Even once a BRC standard and regulations are in effect, operators of hazardous waste landfills may refuse to accept the BRC mixed LLW. Furthermore, operators of municipal landfills may refuse to accept BRC nonmixed LLW. It is, therefore, unclear what actual impact BRC will have on waste volumes.

In addition, as of October 1989 the Capacity Assurance Requirement imposed by the Superfund

---

[15] 51 Fe&al Register 30839, Aug. 29,1986.

[16] 51 Federal Register 49886, Dec. 12, 1988.

Amendments Reauthorization Act of 1986[17] directs States to demonstrate that they have the capacity to manage hazardous waste generated within their borders for 20 years. This demonstration is necessary for a State to maintain its eligibility for Federal Superfund money. According to criteria released by EPA, States are also required to address mixed LLW in their capacity assurance submissions to EPA. With no current treatment and disposal facilities, it is unclear how this problem will be solved.

While States have expressed their commitment to providing disposal of mixed LLW, they are not currently able to address storage and treatment uncertainties faced by generators. Unless States and compacts decide to develop mixed LLW treatment facilities (for which they are not directly responsible under Federal or State law), the private sector will have to provide these facilities in a timely fashion to avoid a potential disruption of services provided by mixed LLW generators. Generators are currently studying methods to minimize the amount of mixed LLW generated and treatment options to render the waste nonhazardous, but it seems unlikely that all mixed LLW can be eliminated.

The potential volume reduction of mixed LLW requiring treatment and disposal is a double-edged sword—it may reduce volumes but it may discourage the private development of needed commercial mixed LLW treatment facilities by eliminating economies of scale. To know the types of mixed LLW generated and their volumes nationwide, it may be necessary to conduct a comprehensive survey. A survey could help States in their planning and could provide marketing information to the private sector on treatment facility needs,

In summary, while the requirement that generators and disposal facilities operate under dual regulation may be workable, it presents many challenges and uncertainties. The workability of dual regulation would be enhanced if flexible and practical approaches were taken to ensure that human health and the environment are protected. For example, the EPA could decide to allow generators/operators to store a particular waste for which no treatment capacity and/or no disposal capacity is available. In other words, storage would be allowed if it is not being used in lieu of disposal. This provision would give mixed LLW generators an intermediate option until treatment capacity and disposal capacity are developed and available. EPA could establish this provision to allow intermediate storage when it issues its rule for treatment standards, which will be included in the final third of hazardous wastes (due to be released in May 1990). To ensure that generators do not abuse this provision, EPA could keep authority to rescind the provision if good faith effort is not being made to develop treatment and disposal capacity. An advantage of this approach is that by generators applying for a storage permit, EPA would have a record as to what types and volumes of mixed LLW are being generated. EPA could use the data to better ensure that wastes are not being illegally disposed. The waste treatment industry also could use the data as a marketing tool to develop necessary waste treatment facilities.

NRC and EPA rulemaking and the issuance of additional guidance for mixed LLW would eliminate a number of issues that are impeding the protection of human health and the environment:

- *regulations that are currently unattainable."*
  - -certain treatment standards (particularly for certain problem mixed LLWs (e.g., solvents containing carbon-14 and tritium),
  - —storage prohibitions;
- regulatory conflicts *and inconsistencies..*
  - —waste sampling and testing,
  - —facility inspection and enforcement,
  - —timing conflict between EPA location standards and LLW disposal siting efforts,
  - —timing conflict between States being granted mixed waste authorization and States' schedules to develop LLW disposal facilities;
- regulatory *overlap and duplication..*
  - —procedures for determining inconsistencies between AEA and RCRA,
  - —BRC limits for specific wastes,
  - —facility design variance procedures,
  - —waste package manifest requirements,
  - —licensing and permitting procedures,
  - —recordkeeping,
  - —financial assurance requirements,
  - —facility monitoring requirements,

[17] Public Law 99-499, Oct. 17, 1986.

-emergency preparedness and prevention requirements,
—post-closure failure scenarios,
—remediation.

The EPA and NRC will have to work closely together in these areas to ensure that States and compacts can meet LLRWPAA milestones and that disposal capacity for both LLW and mixed LLW is made available.

CHAPTER 3 REFERENCES

1. Afton Associates, ' 'Assessment of Mixed Waste Management Issues and Federal Guidance, contractor report prepared for the LLW Forum, September 1988.
2. Afton Associates, ''LLW Forum Meeting Report, " based on quarterly meeting held in Sante Fe, NM, Apr. 12-13, 1989.
3. Johnson, Timothy, "Below Regulatory Concern Wastes—Identification and Implications for Mixed Waste Management, ' in the *Proceedings of U.S. Environmental Protection Agency Mixed Waste Workshop,* Denver, Colorado, July 19-20, 1988, pp. 43-46.
4. National Council on Radiation Protection and Measurements, *Ionizing Radiation Exposures of the Population of the United States,* NCRP report 93, Bethesda, MD, 1987.
5. U.S. Environmental Protection Agency, letter from John Skinner, Director, EPA Office of Solid Waste, to S.V. Wright, Jr., Vice President Operations, US Ecology, Inc., Aug. 17, 1983.
6. U.S. Environmental Protection Agency, ' 'Criteria for Identifying Areas of Vulnerable Hydrogeology Under RCRA: Statutory Interpretive Guidance, ' Interim Final, Office of Solid Waste, July 1986.
7. U.S. Environmental Protection Agency, *Land Disposal Restrictions Summary, Volume I, Solvents and Dioxins (EPA/530-sw-87-019A),* May 1987.
8. U.S. Nuclear Regulatory Commission—U. S. Environmental Protection Agency, *Guidance on the Definition and identification of Commercial Mired Low-Level Radioactive and Hazardous Waste and Answers to Anticipated Questions,* Jan. 8,1987.
9. U.S. Nuclear Regulatory Commission—U. S. Environmental Protection Agency, *Combined NRC-EPA Siting Guidelines for Disposal of Mixed Low-Level Radioactive and Hazardous Waste, Mar.* 13,1987.
10. U.S. Nuclear Regulatory Commission—U.S. Environmental Protection Agency, *Joint NRC-EPA Guidance on a Conceptual Design Approach for Commercial Mixed Low-Level Radioactive and Hazardous Waste Disposal Facilities,* Aug. 3, 1987.
11 U.S. Nuclear Regulatory Commission, presentation by Daniel Martin, NRC, to the Advisory Committee on Nuclear Waste, Apr. 27, 1989,