ATTACHMENT A

ENVIRONMENTAL LAW REPORTER

NEWS & ANALYSIS

VOL. XXIII, NO. 12 An Environmental Law Institute Publication 10699-10759

HIGHLIGHTS DECEMBER 1993

NEWS & ANALYSIS

ARTICLES

Mixed Waste: A Way to Solve the Quandary

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Editors' Summary: Currently, mixed radioactive/hazardous waste is regulated by both the NRC and DOE under the Atomic Energy Act (AEA) and by EPA under RCRA. Despite the agencies' numerous and elaborate attempts to minimize and avoid conflicts between these two regulatory schemes, a fundamental conflict remains between the approaches that the two statutes take to regulating waste.

After reviewing the disparate mixed-waste regulatory schemes of the AEA and RCRA, the authors outline some of the key inconsistencies between hazardous and radioactive waste management and disposal requirements under the Acts, and examine the effect these conflicts have had on the existing mixed-waste system. They conclude that the dual regulation of mixed waste provides no discernible benefit to human health or the environment. In response to the apparent and unabated problems of the current system, which derive from the NRC's, DOE's, and EPA's claims to common jurisdiction, the authors suggest the implementation of a mixed-waste regulatory scheme based on the recognition of the physical properties of the materials in question. They maintain that there are primarily two types of mixed waste—waste that is predominately radioactively hazardous and waste that is predominately chemically hazardous—and that regulatory requirements should reflect these differences. Under their approach, RCRA's regulatory scheme would apply to a mixed waste that contains low levels of radioactivity and is predominately chemically hazardous, whereas the AEA's regulatory requirements would control the management of a mixed waste that contains any significant amount of radioactivity. The authors review as models for their recommended approach, the cooperative schemes that the NRC and EPA have developed under both the AEA, as amended by the Uranium Mill Tailings and Radiation Control Act, and the Nuclear Waste Policy Act, in regulating, respectively, uranium mill tailings and high-level waste at sites that will ultimately be owned in perpetuity by the DOE. The fact that the approach the authors recommend has worked for mill tailings for over a decade leads them to conclude that a similar program can also be successfully applied to the mixed-waste crisis. They also conclude, however, that until key regulators recognize and accept that the current mixed-waste crisis stems not from the unique physical properties of the waste but from their own jurisdictional attitudes, the mixed-waste regulatory system can only become more intractable and unworkable.

The current system for control and permanent disposal of mixed waste is neither functional nor rational. Fundamentally ill-conceived, the largely nonexistent mixed-waste disposal system is not based on the physical properties of the waste in question, but rather on artificial distinctions between the regulatory programs under the Atomic Energy Act (AEA)[1] and the Resource Conservation and Recovery Act (RCRA).[2] Despite RCRA §1006's mandate that RCRA yield to the AEA to prevent inconsistencies caused by clashing regulatory regimes, the U.S. Environmental Protection Agency (EPA), the

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1. 42 U.S.C. §§2011-2297.
2. 42 U.S.C. §§6901-6992k, ELR STAT. RCRA 11-78.

Department of Energy (DOE), and the Nuclear Regulatory Commission (NRC) have never realistically addressed the thoroughgoing inconsistencies between the acts, much less successfully invoked the authority of §1006. Consequently, the management and disposal of "mixed waste" has become a dilemma.

The problem stems from the failure of Congress and the regulators to acknowledge the incompatibility of the AEA and RCRA regulatory regimes. This failure has led to both the creation of increasingly complex regulatory schemes by the regulators in an effort to avoid the appearance of incompatibility, and to the spending of millions, if not billions, of dollars on new technological "fixes" for mixed-waste disposal. Yet despite the proliferation of regulations, extensions, clarifications, and guidance, the basic situation remains unchanged: Permanent disposal capacity for much of the mixed waste in the United States is virtually nonexistent, and intractable political and regulatory barriers impede its development.

The present system is ineffective. First, given the AEA's stringent regulation of low-level radioactive waste (LLRW), for wastes that are significantly radioactive, EPA's assertion of RCRA jurisdiction over the chemically hazardous component of mixed waste provides, at best, a marginal environmental benefit. At worst, it detracts from public health and the environment by unnecessarily diverting resources to deal with an artificial problem and by requiring long-term storage of some dangerously radioactive materials. Similarly, for wastes that are primarily hazardous, such as many scintillation fluids containing low levels of radioactivity, assertion of AEA jurisdiction may also be unnecessary and ill-advised.

For the large portion of the mixed-waste stream that contains significant levels of radioactivity and cannot be readily incinerated, the primary long-term hazard is radioactivity, not chemical toxicity. Potentially lethal doses of radioactivity from these wastes cannot be perceived by human senses and, whereas the toxic components of chemical mixtures can be treated, neutralized, or destroyed, only time and transmutation can eliminate radioactivity. Moreover, some radioactive materials remain hazardous for hundreds or even thousands of years.

One solution to this problem is relatively straightforward. It would address the severalfold problem of the current system by focusing on the physical properties of the materials, their relative potential hazards, and the mandate of RCRA §1006. By focusing on waste characteristics, better, more efficient regulation is more readily achievable. Categorizing waste based on its hazardous characteristics allows simple placement of control of the waste under the authority of the agency best equipped to regulate the particular material. Under this system, where mixed waste is composed primarily of chemically hazardous components, such as fluids that are readily incinerable and contain very low levels of radioactivity, the NRC and EPA should be directed to exempt such materials from most applicable AEA requirements in a fashion similar to the NRC's proposed below-regulatory-concern policy. Where the primary hazard from a mixed waste is radioactivity, the AEA, not RCRA, should assume the dominant role in the regulation of mixed waste. Accordingly, mixed waste would be subject to only one set of regulations that are designed to eliminate and minimize, respectively, both the chemical and the radioactive hazards of mixed waste. Disposal could take place at commercial LLRW disposal sites or at the DOE-owned and operated sites licensed in perpetuity by the NRC. EPA would retain both an advisory role through the Federal Radiation Advisory Counsel and an affirmative regulatory role through its authority under Reorganization Plan No. 3 to promulgate "generally applicable standards" for the protection of the public from off-site releases of radioactivity.[3] A role for public participation and oversight at the DOE's LLRW disposal sites could also be incorporated into such a system.

Ample statutory and practical precedent exists for such a system, and is discussed in this Article. Although RCRA §1006 provides a means to resolve the existing inherent regulatory conflicts, all parties involved in the mixed-waste quandary would be far more comfortable with an explicit congressional blessing. To justify any such congressional action, the case must be made through an analysis of both the origins of the mixed-waste crisis and the merits of deferring to the AEA radioactive waste management system. This Article is a preliminary attempt at such an analysis.

The Origins of Mixed Waste

The AEA: A Comprehensive System for Nuclear-Related Materials

Analysis of the present mixed-waste system and the associated quandary requires an understanding of the origins of the AEA system for defining and regulating radioactive waste. Contrary to popular opinion, the AEA, not RCRA, was the nation's first "cradle-to-grave" waste management system, predating RCRA by almost 30 years. Two important facets of the AEA regulatory scheme for radioactive materials bear on the mixed-waste issue. First, the AEA does not have the scope of a general environmental statute. It is deliberately limited to regulation of nuclear materials created by, used in, or associated with the nuclear fuel cycle and the use of radioactive material in medical or experimental activities. Second, its system for controlling hazards from radioactive materials was envisioned to be both stringent and comprehensive, despite its limited scope.[4] By enacting the AEA in 1947, and amending it in 1954, Congress surely did not contemplate that another equally complex system, namely RCRA, would be simultaneously imposed on materials falling within the AEA's scope.

☐ *The Limited Scope.* The enactment of the AEA was a reaction to the Manhattan Project weapons development program and the subsequent creation and growth of the civilian nuclear power industry. As a result, and because naturally occurring radioactive materials are ubiquitous in the environment, Congress and the Atomic Energy Commission (AEC), which subsequently split to become the NRC and the DOE, deliberately limited the scope of AEA regulation to specifically defined nuclear materials.[5]

3. Reorg. Plan No. 3 of 1973, 35 Fed. Reg. 15623 (1970), *reprinted in* 5 U.S.C. app. at 112, *and in* 84 Stat. 2086 (1970).

4. NRC, NUREG 1310, Naturally Occurring and Accelerator Produced Radioactive Materials 16, 17 (1987).

5. *Id.* at 16.

The narrow circumscription of the definitions of materials subject to the AEA demonstrate this limited scope. For example, Congress and the AEC/NRC created a definition of regulated "source material" that excludes natural uranium and thorium ores until they are removed from their place in nature and unless they equal or exceed 0.05 percent by weight of thorium or uranium.[6] Congress defined "special nuclear material" (used in nuclear weapons) by reference to "uranium enriched in the isotope 233 . . . or 235,"[7] and the NRC added that such material must be "capable of releasing substantial quantities of atomic energy."[8] Similarly, the definition of "byproduct material" is keyed to either the production and use of special nuclear material or to uranium mining or milling.[9] Finally, both Congress and the NRC defined the LLRW by reference to radioactive materials that either contain, or are themselves, materials subject to AEA regulation, but which are *not* high-level waste, transuranic waste, spent nuclear fuel, or uranium mill tailings.[10]

Through its language, the AEA attempts to be exclusive in its approach to determining the materials it regulates, as opposed to RCRA, which tends to be inclusive. This approach is also reflected in the overall regulatory philosophy of both the AEC and the NRC. Moreover, the AEA definitions, such as that for byproduct material, are inherently process-specific, whereas RCRA definitions are based on both a waste's characteristics and/or the processes from which the waste arises.

☐ *The Comprehensive Nature of AEA Coverage.* Nevertheless, because the AEA represents perhaps the first attempt by the U.S. government to respond to an environmental and public health hazard, it goes to great lengths to ensure complete control over materials falling within its scope. Indeed, in the early days of the AEA and the AEC, the entire nuclear industry was created, owned, and monopolized by the federal government.[11] The government owned all source material and, even today, requires a license for its mere possession. Congress also made clear that, like no industry before it, the nuclear power industry would be comprehensively regulated from its inception on a cradle-to-grave basis. Moreover, the AEA preempted state regulation of radioactive hazards for materials subject to the AEA.[12] This comprehensive and preemptive authority was implemented through regulations that required the tracking, accounting, and regulated disposal of all the materials throughout the United States that are subject to the AEA. As originally conceived, that system was intended to address permanently the hazards from radioactive waste.

6. *See* 42 U.S.C. §2014; 10 C.F.R. §20.3(a)(15).

7. 42 U.S.C. §2014; 10 C.F.R. §20.3(16).

8. 10 C.F.R. §20.3(a)(16). Congress also defined the term "spent nuclear fuel" by reference to the nuclear reactor cycle and defined the term "high-level radioactive waste" by reference to "reprocessed spent nuclear fuel." *See* Train v. Colorado Pub. Interest Research Group, 426 U.S. 1, 6 ELR 20549 (1976).

9. 42 U.S.C. §2014(e); 10 C.F.R. §20.3(3).

10. 42 U.S.C. §2021b(a); 10 C.F.R. §61.2.

11. NRC, NUREG 1310, *supra* note 4, at 17.

12. *See, e.g.*, Northern States Power Co. v. Minnesota, 447 F.2d 1143, 1 ELR 20218 (8th Cir. 1971), *aff'd*, 405 U.S. 1035, 1 ELR 20451 (1972); Pacific Gas & Elec. Co. v. State Energy Resources Conservation & Dev. Comm'n, 461 U.S. 190, 191, 13 ELR 20519, 20520 (1983).

RCRA: Mixed Waste Comes Into Being

In 1976, because of the limited, though pervasive scope of the AEA's regulatory scheme, Congress purposely excluded from the definition of solid waste under RCRA those materials falling under the purview of the AEA.[13] RCRA §1004(27) excludes AEA controlled materials, including source, special nuclear, and byproduct material, from the definition of a solid waste.[14] This exclusion is also present in RCRA implementing regulations, issued by EPA at 40 C.F.R. §261.

Furthermore, Congress made clear that in cases of inconsistency, RCRA would "yield" to other preexisting programs, such as the AEA. According to RCRA §1006: "Nothing in this Act [RCRA] shall be construed to apply to any activity or substance which is subject . . . to the Atomic Energy Act of 1954, except to the extent that such application is not inconsistent with the requirements of such Act."[15] This language has two equally important effects. First, it contemplates, to the degree practical, a system of dual regulation for materials falling under both RCRA and other statutes. To that extent, it can be viewed as important, although indirect, support for the concept of mixed waste and a complementary AEA/RCRA waste management system. Second, however, it makes clear that such a system must be complementary, rather than inconsistent, and that in cases of inconsistency, RCRA yields.

RCRA §1006, however, has never been used successfully for the proposition that RCRA must yield. In 1984, the DOE invoked §1006 for the proposition that *all* of its activities falling under the purview of the AEA and relating to the nation's national security interests were exempt from regulation under RCRA whether involving RCRA materials or not.[16] The DOE lost the argument, the court ruling that RCRA applies to the DOE's facilities, absent a specific finding of incompatibility.[17] The court concluded that "the most reasonable reconciliation of the RCRA and the AEA is that AEA facilities are subject to the RCRA except as to those wastes which are expressly regulated by the AEA: nuclear and radioactive materials."[18]

In the wake of this decision, congressional attention turned to the issue of mixed waste. Although the 1984 amendments to RCRA retained the status quo, the recognition of the importance of the mixed-waste question by two key members of Congress, Senators John Chafee and

13. Congress also took similar measures under other major environmental statutes. For instance, under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. §§9601-9675, ELR STAT. CERCLA 7-61, any releases of source, special nuclear, or byproduct material in accordance with a permit issued under the AEA are exempt from CERCLA. *See id.* §9601(10)(k), ELR STAT. CERCLA 7. Similarly, releases of source, special nuclear, and byproduct material are also exempt from the definition of a pollutant under the Federal Water Pollution Control Act, 33 U.S.C. §1362(6), ELR STAT. FWPCA 99.

14. 42 U.S.C. §6903(27), ELR STAT. RCRA 13.

15. 42 U.S.C. §6905, ELR STAT. RCRA 14.

16. Legal Envtl. Assistance Found. v. Hodel, 586 F. Supp. 1163, 14 ELR 20425 (E.D. Tenn. 1984) (*LEAF*).

17. The DOE has been criticized for taking this position. In retrospect, had the DOE limited its exemption claim solely to the AEA's regulated materials rather than the entirety of the AEA's facilities, the DOE might have prevailed, thereby largely avoiding the mixed-waste issue.

18. *LEAF*, 586 F. Supp. at 1167, 14 ELR at 20426.

Alan Simpson, both of whom were members of the Senate Committee on Environment and Public Works, ultimately led to agency action. The two Senators issued directly conflicting policy statements regarding mixed waste. According to Senator Chafee:

> The exclusion of Atomic Energy Act materials applies only to the radioactive materials themselves and not to any wastes with which the AEA materials may be associated. RCRA applies to hazardous wastes that are mixed with radioactive materials. Otherwise the mixing of small amounts of radioactive materials with hazardous wastes could transform the entire waste stream into an AEA material exempt from RCRA.[19]

Chafee further noted, regarding §1006:

> Section 1006(a) of RCRA does not in any way exempt mixed hazardous and AEA wastes from RCRA . . . except to the extent that application of RCRA would be inconsistent with specific requirements of the AEA. Thus, only in the rare case where compliance with both RCRA and the requirements of the AEA would be *physically impossible* are these materials exempt.[20]

Senator Simpson believed otherwise:

> It strains credibility to interpret . . . [RCRA] to mean that the mere presence of hazardous substances in a waste stream that is otherwise primarily made up of source, special nuclear and byproduct material, [subjects such a waste stream to RCRA requirements] since this would have the effect of rendering this particular exemption a nullity, . . . [thereby] effectively extend[ing] the requirements of [RCRA], as amended, to virtually all radioactive waste streams.[21]

Simpson noted that the language of §1006 "contemplates more than a demonstration of mere physical impossibility, . . . [i]ndeed I can envision a wide range of situations where compliance would not be a 'physical impossibility' but would nevertheless be inconsistent with the requirements of the AEA."[22] Simpson included a letter from NRC Chairman Nunzio J. Palladino that set forth numerous incompatibilities between RCRA and the AEA that were based largely on the different approaches taken by the NRC and EPA to minimize potential hazards from radioactive and chemically hazardous waste.[23]

Senator Chafee's views ultimately prevailed at EPA. On July 3, 1986, EPA published a *Federal Register* notice indicating that states with authorized RCRA hazardous waste programs must apply for permission to regulate the hazardous portion of mixed waste, thereby effectively asserting RCRA jurisdiction over mixed waste.[24] Subsequently, EPA explicitly extended its interpretation of its jurisdiction to include states without authorized RCRA programs, effectively admitting that EPA had not previously regulated mixed waste.[25]

EPA and the NRC also issued a document, *Joint Guidance on the Definition of Commercial Low-Level Radioactive and Hazardous Waste*, to all of the NRC's licensees in March 1987.[26] This document provides a method for identifying low-level mixed waste as mixtures of the LLRW and hazardous waste. According to EPA,

> NRC regulations exist to control the byproduct, source and special nuclear material components of mixed [LLRW], and EPA has the authority and continues to control, the hazardous component of mixed [low-level waste]. However, when the components are combined to become mixed [LLRW], neither agency has exclusive jurisdiction under federal law. This has led to a situation of dual regulations where both agencies, NRC and EPA regulate the same waste.[27]

The Paradox of Dual Mixed-Waste Regulation

Although initially appealing, component-by-component regulation of mixed radioactive and hazardous waste fails to reflect accurately the realities of mixed waste. This is apparent in EPA's statement that both the NRC and EPA "regulate the same waste."[28]

Although it is logically possible to distinguish between hazardous and radioactive components of a waste, in practice, each component is often one and the same. As the DOE explained in its final interpretation of its AEA/RCRA responsibilities:

> DOE assumed that the exclusion was intended by the Congress to be applied to radioactive wastes in their real world configuration. Virtually all radioactive waste substances are contained, dissolved or suspended in a non-radioactive medium from which their separation is impractical. Accordingly, DOE noted that in proposing the direct process approach, that unless some radioactive waste streams were considered to be byproduct material *in their entirety*, RCRA's exclusion of byproduct material might reasonably be perceived to have little effect, because RCRA's application to a nuclear waste's non-radioactive medium would appear to entail at least the indirect regulation of the radionuclides dispersed in the medium.[29]

Despite the DOE's recognition of the basic conflict between joint EPA and NRC/DOE regulation of the same material, the DOE's final rule defined byproduct material subject to the AEA to refer "only to the actual radionuclides dispersed or suspended in the waste substance."[30] According to the DOE, "the non-radioactive hazardous component of the waste substance will be subject to regulation under the Resource Conservation and Recovery Act."[31]

The DOE's acceptance of a position it had already rejected as impractical exemplifies the "Alice-in-Wonderland" at-

19. 130 Cong. Rec. S9269-70 (daily ed. July 26, 1984) (statement of Sen. Chafee).
20. *Id.* at S9382-83 (emphasis added).
21. 130 Cong. Rec. S9727-29 (daily ed. Aug. 6, 1984) (statement of Sen. Simpson).
22. *Id.*
23. *Id.*
24. 51 Fed. Reg. 24504 (July 3, 1986).
25. 53 Fed. Reg. 37045 (Sept. 23, 1988).
26. EPA, Policy Directive 9432.00-2, Joint Guidance on the Definition of Commercial Low-Level Radioactive and Hazardous Waste (1987).
27. *Id.* at 2.
28. *Id.*
29. 52 Fed. Reg. 15937, 15939 (May 1, 1987). *See also* 50 Fed. Reg. 45736, 45737 (Nov. 1, 1985) (noting that unless AEA §11(e)(1) byproduct materials include the entirety of the waste, RCRA exclusion for byproduct material would be "reduced to a virtual nullity").
30. 52 Fed. Reg. 15937, 15941 (May 1, 1987); 10 C.F.R. §962.3.
31. 52 Fed. Reg. 15937, 15941 (May 1, 1987).

titude of those involved in the mixed-waste dilemma. Taken to its logical extreme, acceptance of EPA's and the DOE's interpretation leads to atom-by-atom regulation of mixed waste and, in many key instances, effectively nullifies RCRA's exclusion for source, special nuclear, and byproduct material. As one commentator has stated:

> [I]f the phrase "radioactive material" refers only to radionuclides—the radioactive atoms—contained in a material, then there is no such thing as a pure byproduct material, except perhaps under controlled laboratory conditions for fleeting periods of time. All material yielded in or made radioactive by any technique will contain at least some nonradioactive atoms and during the passage of time, radioactive decay will gradually increase the ratio of nonradioactive to radioactive atoms. . . . The notion that an individual atom passes from the AEA to RCRA control at the instant of its decay is untenable.[32]

The DOE's endorsement of this view establishes the degree to which regulators have distorted physical reality as a result of EPA's assertion of RCRA jurisdiction over mixed waste.

EPA's RCRA rules have only added to the problem. Under EPA's mixture rule,[33] any mixture of a listed hazardous waste and any other material is considered, *in its entirety*, to be a listed hazardous waste. Thus, to the extent that a listed hazardous waste is mixed with any AEA material, the AEA material itself, including the wholly radioactive component, would become a hazardous waste under the mixture rule. As EPA, the NRC, and the DOE guidance have suggested, no distinction would exist between the AEA and RCRA components of the waste.[34] The DOE's rationale for accepting the largely fictitious notion that mixed waste can, in significant measure, be separated into its hazardous and radioactive components is revealing.

> RCRA is a remedial statute and as such must be liberally construed for the remedial purpose for which it was enacted. The intended comprehensive nature of RCRA's regulatory scheme is evident from the legislative history. The House Committee . . . regarded it as closing the last remaining loophole in the framework of environmental laws. . . . Accordingly, DOE decided that RCRA's definitional exclusion of source, special nuclear and byproduct material assumes a narrower significance than was suggested in the proposed rule.[35]

The notion of RCRA as a gap-filling environmental statute, which was meant to be broadly applied to all situations that are not clearly covered by another statute, has played a key role in the creation of the mixed-waste quandary. RCRA, drafted in the pro-environmental fervor of the 1970s, is intended to be a broad statute of general applicability, and EPA's implementation of RCRA has reflected this thrust. In contrast, while the AEA was always intended to be a comprehensive system for regulating specific radioactive materials, both Congress and the NRC have always resisted efforts to expand the AEA's scope and the mission of the NRC beyond these parameters. These differences in approach have allowed EPA to intrude into regulatory areas previously construed to be reserved entirely to the NRC under the AEA.

Inconsistency and Incompatibility

The NRC's Initial View

The clear import of RCRA §1006 is that RCRA must yield where there is conflict between the AEA and RCRA. Yet EPA, the NRC, and the DOE have interpreted this section narrowly, insisting that it applies only where it is "physically impossible" to comply with both statutes.

Where regulatory requirements with built-in flexibility are involved, however, it is hard to imagine precisely the exact contours of such a conflict. For example, RCRA regulations that encourage regular opening and visual inspection of waste containers for sampling appear to conflict with the NRC's principle of keeping exposures "as low as reasonably achievable," which, if read fairly, forbids such practices. The word "reasonably," however, can be stretched to accommodate such a practice. Yet physically, it is impossible to sample radioactive wastes without increasing exposure, unless extreme methods, such as robotic sampling, are used. By insisting on "physical impossibility," regulators have committed themselves to the unenviable task of continually attempting to reconcile fundamentally inconsistent regulatory systems.

Many obvious inconsistencies have been identified since the start of the mixed-waste debate. In 1984, the NRC made the following statement to Congress.

> We believe regulation by EPA under RCRA of radioactively contaminated chemical wastes currently under NRC and agreement state jurisdiction is inconsistent with our regulatory requirements established pursuant to the Atomic Energy Act. Radioactively contaminated chemical wastes regulated by NRC and agreement states should not be regulated under RCRA.[36]

The current state of the mixed-waste system establishes that this statement has been given little attention.

The NRC/AEA Approach to Radioactive Waste Management

Radioactive waste and chemically hazardous waste are not the same. Systems for managing and permanently disposing of each differ significantly. The basic difference between radioactive and chemically hazardous waste is that hazardous waste can usually be destroyed by processes such as incineration, whereas radionuclides cannot be readily destroyed[37]—radioactive waste can only be eliminated by time and transmutation. Treatment or solidification alone is ineffective. As the NRC has noted, "because the hazard posed by low-level waste is of an atomic nature, its hazard is inherent, i.e., independent of its chemically bound state.

32. John-Mark Stensvaag, HAZARDOUS WASTE LAW AND PRACTICE at 4-62, 63 (Sept. 1986).

33. 40 C.F.R. §261.3.

34. The United States Court of Appeals for the District of Columbia Circuit invalidated the mixture rule in Shell Oil Co. v. U.S. Environmental Protection Agency, 950 F.2d 741, 22 ELR 20305 (D.C. Cir. 1991). The mixture rule remains temporarily in effect, however, until October 1, 1994, pending EPA's decision whether to promulgate the rule or abandon it.

35. 52 Fed. Reg. 15937 (May 1, 1987).

36. Letter from Nunzio J. Palladino, Chairman, NRC, to Morris K. Udall, U.S. Senator 1 (Mar. 16, 1984), *reprinted in* 130 CONG. REC. S9727-29 (daily ed. Aug. 6, 1984).

37. NRC, NUREG CR-4450, BNL NUREG 51944, MANAGEMENT OF RADIOACTIVE MIXED WASTES IN COMMERCIAL LOW-LEVEL WASTES 83 (1985).

Destruction of the [LLRW] hazard, aside from transmutation processes, is impossible."[38]

The need for long-term management of the LLRW is the primary influence on the NRC's Part 61 radioactive-waste disposal system. As NRC Chairman Palladino noted to Congress, in 1984:

> NRC has emphasized a *systems* approach to low-level waste disposal including consideration of site selection, site design and operation, waste form and disposal facility closure. In addition to focusing on disposal site performance, NRC has specified a number of requirements which must be accomplished by the waste generator, including requirements for waste form and content, waste classification and waste manifests.[39]

Because of both the unique hazards associated with exposure to radioactivity and because radioactive waste may remain hazardous for hundreds of years, the NRC's approach to the management of radioactive wastes uses "passive" rather than "active" systems to minimize and retard releases to the environment over the extremely long periods contemplated for control of radioactive material. The NRC's system relies on a performance-objectives approach by which control of hazards posed by a chemical waste (that may be equally as long-lived as radioactive hazards) is subsumed under the long-term hazard minimization framework for radioactive wastes.

The AEA's systems are designed to isolate the waste permanently from virtually all human contact. The use of institutional controls such as government site ownership, site security measures, and permanent monuments prevents such contact. "Natural materials," such as clay liners and covers or engineered surface barriers, that can last for long periods of time and permanently minimize contact of the radioactive waste with water are used to isolate the waste in the disposal unit.

The NRC performance objectives assume no "active" controls at the disposal site after 100 years and, further, depending on the waste classification, site stability for up to 300 to 500 years.[40] Intruder barriers are designed to prevent entry into the disposal unit even if "institutional memory" is lost at the site after the 300- to 500-year period following initial disposal. To minimize the potential for institutional memory loss, a state or federal government is expected to own the site in perpetuity.[41] The NRC sites use the area surrounding the site to retard releases to the environment. Thus the site itself, including the subsurface zones, is considered part of the containment mechanism, which by design slows the expected release of acceptably small quantities of radioactivity.[42]

RCRA's Approach to Radioactive Waste Management

By contrast, the RCRA "minimum technology" standards expressly require disposal units to be equipped with dual synthetic liners and leachate collection systems.[43] Regular and frequent groundwater and leachate sampling, monitoring, and analysis are conducted to confirm constantly the status and location of the waste.[44] The RCRA standards contemplate a normal time frame of approximately 30 years and rely on "active" controls to isolate the waste from any contact with the site or the surrounding environment. Releases to any part of the environment are prohibited, and prompt action to correct such releases are required.[45] After 30 years, the site may be sold.[46]

Inconsistencies Between the Two Approaches

Clearly, these two regulatory methodologies are fundamentally inconsistent and EPA has recently stated as much: "[U]nder the current regulatory framework, the disposal of mixed waste must satisfy both RCRA and AEA regulatory requirements, which are not entirely compatible."[47]

One inconsistency between the two systems is clear from the following scenario. Although it is physically possible to install a synthetic liner and leachate collection system in an AEA-type disposal unit, the NRC has consistently maintained that a synthetic liner prevents any infiltrating rainwater from escaping the disposal unit—hence the necessity under RCRA, which requires the liners, for an active leachate collection and pumping system to prevent the unit from filling up like a bathtub. A strong possibility exists, however, that over hundreds of years, pumping may be discontinued, and the unit will inevitably overflow, resulting in exactly the type of sudden, catastrophic release that the AEA's system is designed to prevent. Furthermore, assuming that pumping were to continue over the extended period, pumping of radioactive leachate creates additional human exposure to radioactivity—a clear violation of the NRC's long-adhered-to principle of maintaining exposures as low as reasonably achievable (ALARA).

Several other aspects of RCRA's system also violate the ALARA principle by creating more waste to dispose of. Active pumping of leachate generates additional radioactive mixed waste in liquid form. Moreover, under RCRA's mixture rule, treatment and disposal solutions are complicated and obstructed because, for instance, leachate containing listed wastes may carry listed waste codes for all listed wastes disposed of in a particular landfill. Finally, additional radioactive waste is generated through the treatment and packaging of radioactive waste which contaminates treatment and packaging facilities and equipment, because ra-

38. *Id.* at 3.

39. Letter from Nunzio J. Palladino, *supra* note 36, at 1.

40. NRC, NUREG 0945, Final Environmental Impact Statement: Licensing Requirements for Land Disposal of Radioactive Wastes Vol I, 5-18, 27 (1982).

41. 10 C.F.R. §61.59.

42. DOE, UMTRA-DOE/AL-400501.0000, Response to Standards for Remedial Actions at Inactive Uranium Processing Sites Proposed Rule 7-8 (1988).

43. 40 C.F.R. §264.301.

44. 40 C.F.R. §264.90-101.

45. *Id.* It is worth noting that waste that is considered "absorbed" under the NRC system would be considered "solidified" by the chemically hazardous waste handling community. *See* NUREG CR-4450, *supra* note 38, at 20. Indeed, some state laws for hazardous substances set release limits at detection levels without regard to any estimated risk to human health or the environment. The AEA's disposal scheme cannot truly be reconciled with such a system.

46. 40 C.F.R. §264.110-.120.

47. EPA, Office of Radiation and Indoor Air, Draft Issue Paper on Radiation Site Cleanup Regulations 6 (May 5, 1993). As EPA recently noted in the Draft Issues Paper on Radiation Site Cleanup Regulations, the Superfund national contingency plan "does not allow the use of passive institutional controls as a substitute for active response measures unless such active measures are determined to be not practicable." *Id.* at 21.

dioactive contamination occurs simply through contact with radioactive substances.

Uncertainty also exists regarding the safety and durability of synthetic liners. Performance characteristics of synthetic liners used for more than 50 years are not well-known, such that their effectiveness over hundreds of years is certainly unclear. The DOE has noted that "synthetic materials incorporated into RCRA sites probably will not last for 200 to 1,000 years."[48] Synthetic liners eventually will "drain out" due to gravity, or fail because of subsoil settlement, puncture by rocks, splitting seams, or entrapped air bubbles.[49] EPA has acknowledged that "eventually, liners will either degrade, tear or crack and allow liquids to migrate.... [I]t is therefore important that liquids be removed during the time a liner is most effective."[50] Moreover, EPA recently stated "synthetic covers also have a limited life, especially in dry, sunny, windy areas."[51] Repair of ruptured liners is also a concern. When a synthetic liner ruptures, unlike a clay liner, it is not self-healing.[52] Ruptures are a significant concern with synthetic liners because synthetic liners pose the potential for more concentrated discharges of contamination by funneling all liquids in the landfill to the liner's breach. Finally, synthetic liners may cause moisture retention in waste materials disposed of in them, and, due to slower dehydration, cause differential settlement or cracking of both clay caps that cover disposal sites and the liners themselves, which can lead to either additional infiltration of rainwater or exfiltration of moisture.

The inconsistencies between the plans are not limited to the liners. The plans differ in their approach to intrusion. The NRC's controls are designed to eliminate any potential for intrusion into disposal units, however, standpipes and leachate collection systems, which are integral to the RCRA system, are designed to provide exactly such access. The plans' approaches to statutory state liability are also inconsistent. The NRC's disposal sites are required to have state or federal site ownership, which can raise serious questions of state liability under hazardous waste statutes such as RCRA and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Not surprisingly, states want to avoid such liability. At the Envirocare of Utah, Inc. site, in Utah, where mixed waste is being disposed of, the state of Utah flatly refused to accept site ownership based on RCRA- and CERCLA-type liability concerns, thereby forcing the Utah State Division of Radiation Control to waive the site ownership requirement specifically for the Envirocare site.

The NRC and Congress have been aware of the inconsistencies between the AEA and RCRA final disposal approaches for nearly a decade. As the NRC noted in 1984:

> the regulatory system embodied in 10 C.F.R. pt. 61, including generator responsibility, and reliance on packing, waste stabilization and site characteristics, provides a more effective long-term approach to minimizing the formation and migration of leachate from radioactive waste than a policy that relies heavily on the use of liners in burial trenches. EPA itself recognized the limitations of liners in its standards that ... only [require] liners [to] prevent migration during the "active life" and subsequent closure of the landfill.... EPA's approach may well be appropriate for ... chemical wastes ... [however] for burial of low level radioactive waste ... we do not believe that liners will totally eliminate the potential for groundwater contamination ... [and] we have concerns that liners will contribute to the accumulation of leachate, which will fill up the disposal unit and possibly overflow. Removal and treatment of this leachate will almost certainly involve a release of some of the contaminants to the environment.[53]

Despite the NRC's concerns regarding the incompatibility of using liners within the AEA's system, in 1987, the NRC and EPA released a joint guidance on the conceptual design for commercial mixed-waste disposal facilities.[54] According to the agencies, the design concept set forth in the guidance "demonstrate[s] the integration of EPA's regulatory requirements for two or more liners and a leachate collection system ... and the requirements of the AEA that require the contact of water with the waste to be minimized."[55] The design calls for an above-ground disposal unit with run-on controls, dual synthetic liners, a clay liner, and a leachate collection system.[56] Such a unit would be capped by either a clay cap or an engineered vault with a clay cap.[57] Both agencies, however, were careful to state that "the concepts proposed ... are presented as general guidance ... this guidance will not affect the requirements for waste disposal facilities to comply with all applicable NRC and EPA regulations."[58]

No facility meeting the design concept described above has been built.[59] Moreover, questions continue to arise regarding the suitability of synthetic liners for disposal units containing radioactive waste. For instance, in 1990, the NRC's State Programs Director, Carleton J. Kammerer, wrote to the California Department of Health Services regarding EPA Region IX's recommendation that California's proposed LLRW facility use a synthetic liner. The NRC's clear conclusion was that such an approach is ill-advised for a host of reasons. For instance,

> incorporating a liner and leachate collection system ... would require the applicant to demonstrate that the performance objectives would not be violated over the long-term (*e.g.*, 500 years or more) as a result of water

48. DOE, UMTRA-DOE/AL-400501.0000, Response to Standards for Remedial Actions at Inactive Uranium Processing Sites Proposed Rule 12 (1988).

49. NRC, NUREG 0706, NRC Final Generic Environmental Impact Statement on Uranium Milling Vol. I 9-16, 17 (1980).

50. EPA, EPA 520/1-83-008, Final Environmental Impact Statement, for Standards for the Control of Byproduct Materials From Uranium Ore Processing 8-13 (1983) [hereinafter FEIS].

51. EPA, EPA 402-D-93-0001, Technical Support for Amending Standards for Management of Uranium Byproduct Materials 6-14 (1993) [hereinafter Draft Bid].

52. NRC, NUREG 0706, *supra* note 49, at 12-25, 8-13.

53. Letter from Nunzio J. Palladino, *supra* note 36, at 2.

54. EPA, Policy Directive 9487.00.8, Joint NRC-EPA Guidance on a Conceptual Design Approach for Commercial Mixed Low-Level Radioactive and Hazardous Waste Disposal Facilities (1987) [hereinafter Joint NRC-EPA Conceptual Guidance].

55. *Id.* at 4.

56. *Id.* at 4-5.

57. *Id.* at 5.

58. *Id.* at 1.

59. Although mixed waste is being land disposed at the Envirocare of Utah, Inc. facility in Clive, Utah, the Envirocare disposal unit does not meet the joint NRC/EPA design criteria.

> accumulation within the disposal trenches. Such a demonstration could be difficult since water accumulation could theoretically result in a continuing need to pump and treat the leachate, in direct discharge of contaminated leachate to the land surface, or in a concentrated discharge of leachate to the vadose zone when the liner failed.[60]

The NRC's recommendation also questioned the long-term liner stability and the inability to deal both successfully and with certainty with the increased potential for rainfall infiltration caused by the use of synthetic liners. Thus, despite jointly releasing the report, the NRC specifically declined to endorse without qualification the joint EPA/NRC conceptual guidance. The NRC noted:

> It is important to recognize that the [Joint NRC/EPA] guidance presents a "conceptual" design only; any application adopting this design approach would have to demonstrate . . . that the disposal system does not suffer from the same limitations and potential problems described above for disposal units that include liners and leachate collection systems.[61]

In light of the NRC's other comments regarding liners, it is difficult to imagine such a demonstration. In fact, a 1987 DOE study concluded that an above-ground vault constructed in accordance with the *NRC/EPA Joint Guidance* would result in a peak dose of radionuclides approximately one order of magnitude higher than traditional AEA below-ground disposal units and would not meet the requirements of 10 C.F.R. part 61 for maximum effective dose limits.[62] Moreover, as the DOE has noted, in the context of requiring RCRA-type controls at uranium mill tailings sites:

> Longevity requirements have led to disposal designs that use only natural materials and that incorporate (or consider) the subsurface zone as an integral part of the natural disposal system. . . . The differences between RCRA sites and [Uranium Mine Tailings Radiation Control Act (UMTRCA)] project sites reflect different technological choices. . . . [T]hese different technological choices . . . have led to what the DOE believes are conflicting and mutually inconsistent requirements with respect to implementing longevity requirements and the meeting of proposed groundwater standards, [for UMTRCA sites] only natural material and systems have the properties and characteristics essential to such a design life.[63]

The DOE also notes that RCRA systems requiring leachate collection will be extremely difficult to reconcile with the NRC's passive-systems approach. According to the DOE:

> it would be necessary to relax the [UMTRCA] project requirements for minimum post closure maintenance before the concept of integrating the leachate for treatment can be applied on the [UMTRCA] project. It can be argued that [if] [UMTRCA] project wastes were placed on very low permeability liners and provided with underdrains or leachate collection systems, the leachate could be brought to evaporation ponds that could operate with minimum or no human intervention. To prevent inadvertent human access to the leachate, the leachate could drain into rock-filled, lined sumps or toe aprons. . . . However, it may be difficult to argue that such an approach could protect the environment and ensure human health and safety for periods extending to 1,000 years.[64]

Thus, not only is it the case that the joint NRC/EPA design concept may result in higher exposures than a traditional radioactive waste disposal unit, but, more importantly, with synthetic materials and active leachate collection, the long-term passive control necessary over the extremely long periods required for radioactive waste control may be impossible. As it exists, the *NRC/EPA Joint Guidance* remains unproven and provides a good example of an attempt by the NRC and EPA to mask an obvious incompatibility between the AEA and RCRA requirements identified by the DOE.

Incompatibility From RCRA's Perspective: The Land Ban

From a RCRA perspective, the inconsistencies between the AEA and RCRA waste management approaches are as, if not more, dramatic. Perhaps the most compelling of these is the application of RCRA land disposal restrictions (LDRs) to mixed waste. Under the LDRs, the land management of certain untreated hazardous wastes is prohibited. This prohibition includes both the storage and disposal of untreated waste without a permit.[65]

Because treatment and disposal capacity for many mixed wastes is extremely limited and because the presence of radioactivity complicates required treatment solutions for mixed waste, incineration in particular, EPA has been forced to grant a "national capacity variance" for the DOE's mixed wastes.[66] Yet even this variance has already begun to expire, and all such variances will end by mid-1994.[67] For instance, in 1990, EPA granted a national capacity variance for "third-third" mixed wastes;[68] this variance expired in 1992.[69] Although the DOE has applied for an extension, EPA has not yet granted it. In any event, under RCRA it can only be renewed until May of 1994.[70]

Meanwhile, although the DOE has identified acceptable treatment technologies for approximately 75 percent of its mixed-waste stream volume, treatment *capability* for the re-

60. NRC, Response to California Department of Health Services Request for Technical and Regulatory Assistance on the Liner Issue 4 (1989). Although the NRC's staff has stated that a double liner and leachate collection system might offer "enhanced groundwater protection, it also noted that such protection might only be temporary. *See* Letter from Robert M. Bernero, NRC, to Alan Pasternak, California Radioactive Materials Forum (Mar. 8, 1989).

61. NRC, Response to California Department of Health Services Request for Technical and Regulatory Assistance on the Liner Issue 4.

62. DOE, DOE/LLRW-60T, Conceptual Design Report: Alternative Concepts for Low-Level Radioactive Waste Disposal (1987).

63. DOE, UMTRA-DOE/AL-400501.0000, Response to Standards for Remedial Actions at Inactive Uranium Processing Sites Proposed Rule 12 (1988).

64. *Id.*

65. *See* RCRA, 42 U.S.C. §6924, ELR Stat. RCRA 23-29.

66. 55 Fed. Reg. 22526, 22532, 22689 (June 1, 1990). *See also* 57 Fed. Reg. 57170, 57175 (Dec. 3, 1992).

67. 57 Fed. Reg. 57170, 57175 (Dec. 3, 1992).

68. Third-third wastes are the final third of hazardous wastes restricted from land disposal according to the schedule specified in §3004(g) of the Hazardous and Solid Waste Amendment Act of 1984. Final standards for the third-third wastes, including EPA's national capacity variance for third-third mixed wastes, were promulgated by EPA on June 1, 1990, at 55 Fed. Reg. 22520 (June 1, 1990).

69. 55 Fed. Reg. 22520 (June 1, 1990).

70. *Id.*

maining 25 percent does not exist and is hampered by a lack of technologies capable of properly managing the radioactive component of the waste.[71] Even assuming the existence of such treatment capability, treatment *capacity* for mixed waste is extremely limited.[72] Construction of future treatment capacity is estimated by the DOE to take between 5 and 15 years.[73] Disposal capacity for mixed wastes is also extremely limited.[74] The severe difficulty of obtaining a RCRA permit, particularly for incinerators and landfills, further complicates the picture. Thus, the mixed-waste dilemma has been described as a situation in which "EPA and the state authorities, via RCRA and the LDRs, are in the position of requiring the DOE and the other mixed waste generators to do something that everyone acknowledges is impossible and then makes the same generators subject to fines and penalties for not doing the impossible."[75]

Regardless of the fines and penalties, it is evident that for the foreseeable future, the DOE will continue to violate RCRA LDRs.[76] Recognizing this, Congress enacted the Federal Facilities Compliance Act of 1992 (FFCA).[77] Under this Act, Congress expressly revokes RCRA §6001's waiver of sovereign immunity as it applies to the DOE's compliance with the LDRs for mixed waste.[78] The DOE has three years to comply with the LDR's requirements. After that time, the DOE may still fail to meet the LDR's standards, but it must then meet other requirements under the FFCA.[79] Thus, although technically the mixed-waste situation causes the DOE to be in continuous violation of RCRA, Congress has decided that the DOE will not be subject to fines or enforcement for at least another three years.[80] EPA, in turn, has also indicated, via its RCRA enforcement policy, that mixed waste will be given a low priority.

The RCRA LDR situation presents a clear example of the absurdity of the current mixed-waste treatment and disposal system. Application of RCRA to mixed waste has resulted in an ongoing violation of RCRA itself that can only be cured by Congress and has forced EPA to give mixed-waste-related RCRA violations a low enforcement priority. Ironically, RCRA has been forced to yield, albeit temporarily, as is consistent with the spirit of RCRA §1006. Yet while the DOE, EPA, and the NRC remain hopeful that the situation can be resolved through the development of increased and innovative treatment capacity, such developments clearly will not occur by mid-1994, at the expiration date of the national capacity variance. Even if sufficient treatment capacity becomes available, all mixed-waste generators and storers will still face the root problem of finding sufficient disposal capacity that meets both RCRA's and the AEA's requirements.

71. *Id.*

72. *Id.*

73. *Id.*

74. *Id.*

75. *Summary of Discussion: Hazardous Waste Action Coalition, Mixed Waste Forum*, Washington, D.C. (Mar. 20, 1992) at 2 (on file with authors).

76. 57 Fed. Reg. 57170, 57175 (Dec. 3, 1992).

77. Federal Facilities Compliance Act of 1992, Pub. L. No. 102-386, 106 Stat. 1505 (1992).

78. *Id.*

79. *Id.*

80. *Id.*

The Importance of Waste Form

Another basic and significant difference between the NRC's and EPA's final disposal requirements is the importance the NRC scheme places on waste form. Although initially the NRC, like EPA, focused on the disposal unit itself, the NRC ultimately recognized that the form of the waste is equally important.[81] As the congressional Office of Technology Assessment (OTA) has noted, "NRC [LLRW] regulations are *based on* the stability of the waste and the stability of the disposal site."[82]

The NRC's standards require all Class B and C LLRWs to meet structural stability requirements and Class A wastes to be processed, as appropriate, to remove free liquids. Requirements for Class B and C wastes can be strict, requiring encasement of wastes in high integrity containers consisting of stainless steel and concrete.[83] The waste-form standards are designed to ensure that the waste does not degrade or subside within the disposal unit.[84] The NRC's requirements include standards for testing of waste form in accordance with leaching, compression, thermal cycling, and biodegradation parameters.[85] Structural stability is also required to provide greater protection against exposure to an inadvertent intruder.[86] Because the NRC's emphasis is on the entire disposal system's performance, which must provide long-term stability without active controls, disposal trench stability is achieved in large part by waste forms meeting long-term stability requirements.[87]

In contrast, RCRA does not specifically include waste-form requirements, emphasizing instead the overall ability of the disposal unit to isolate wastes completely, regardless of form, from any contact with the environment. Although EPA's regulations prohibit the addition of liquids to landfills and place restrictions on waste form, which are designed to eliminate subsidence, unlike the NRC's standards, they rely less heavily on waste form as an integral part of the overall containment method. Thus, while liners and leachate collection systems may be necessary for RCRA wastes disposed under relatively lenient waste-form requirements, for wastes meeting the NRC's waste-form requirements, such controls may not be necessary and may actually be harmful.

An example of the successful application of the NRC's waste-form requirements is instructive. By volume, the largest non-DOE category of mixed waste is the LLRW containing organic solvents and scintillation media, such as

81. NRC, NUREG 0945, Final Environmental Impact Statement on 10 C.F.R. Part 61 "Licensing Requirements for Land Disposal of Radioactive Waste" Vol. I, 2-7 (1982); NRC, NUREG 0782, Draft Environmental Impact Statement for 10 C.F.R. Part 61 "Licensing Requirements for Land Disposal of Low-Level Radioactive Waste" Vol. I, 6-15, -19, 7-4, -6 (1981).

82. OTA, GPO Stock No. 052-003-01171-9, OTA Report: Partnerships Under Pressure: Managing Commercial Low-Level Radioactive Waste 7 (1989) (emphasis added).

83. NRC, NRC Branch Technical Position on Waste Form 1 (1991).

84. *Id.*

85. *Id.* at app. A.

86. *Id.*

87. *See* NRC, NUREG CR-4450, BNL NUREG 51944, *supra* note 37, at 4.

toluene and xylene.[88] The organic solvents in these wastes are precisely the types of constituents that present the chemical hazards the RCRA program is designed to eliminate through controls on leaching and migration. Although the great majority of this waste is suitable for incineration without regard to its radioactive content, in the past, some of these wastes were disposed of at existing LLRW land disposal sites. Notably, this disposal does not appear to have resulted in significant environmental contamination. Indeed, a 1986 NRC analysis suggests that mixed waste that is solidified or absorbed[89] in accordance with the NRC's waste-form requirements at 10 C.F.R. §61.56 is unlikely to leach and be released from wastes buried in a part 61 facility.

> Water (including or carrying with it acquired materials) is assumed to be the principal leachate to which wastes will be exposed (it should be noted that a large part of the rationale behind the required NRC Class B and C waste stabilization in 10 C.F.R. Part 61 was based on minimization of contact of waste packages with water). Dissolution of organics in water is unlikely as the mechanism of removal (based on the concept of chemical dissimilarity and immiscibility of aqueous and organic phases); this is further substantiated by the documented ability of many absorbents to retain sorbed organics in the presence of, or even surrounded completely by, water.
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> * * *
>
> In summary, removal of sorbed organics should be considered from the point of view of being caused by thermal gradients, pressure, agitation or vibration, leaching by "pure" water, and water containing acquired components. It is not clear whether thermal or pressure forces can effect removal of these materials but, in any event, for the removal to occur, the conditions must be different (and, most likely more severe, *i.e.*, higher temperature and pressure) from those under which the sorption process originally occurred. It is not likely that higher temperatures would be encountered by sorbed wastes for significant periods of time and *certainly not at all after burial.*[90]

Thus, the NRC waste-form requirements may well provide significant protection against the migration of chemical (as well as radiological) hazards, thereby further calling into question the need for dual EPA/NRC regulation of mixed wastes that contain significant amounts of radioactivity.

Increased Occupational Exposure

Yet another key inconsistency between RCRA and the AEA's requirements is that the RCRA regulations encourage and require extensive sampling and manual inspection of waste in order to characterize the material.[91] Under the NRC's guidelines, radioactive waste storage requirements are designed to minimize and discourage human access and exposure to the waste since radiation cannot be perceived by human senses and can have potential effects long after exposure. Furthermore, RCRA wastes are generally more uniform then AEA's wastes and thus can be more effectively characterized through sampling. Because of these differences, compliance with EPA's RCRA standards could lead to increased occupational and, perhaps, public exposure to dangerous radioactivity. A report by the Nuclear Power Industry notes that EPA requires a 100 gram sample of waste for testing that could increase worker radiation exposure and the need for visual inspection under RCRA could also increase such exposure.[92]

Although the NRC and EPA have released a *Draft Guidance: Clarification of RCRA Testing Requirements for Mixed Waste* (March 1992), which acknowledges these problems, EPA attempts to resolve the difficulty by simply noting that: "a combination of common sense, modified sampling procedures and cooperation among . . . regulatory agencies will minimize any hazards associated with sampling and testing mixed waste."[93] Unfortunately, EPA fails to provide any support for this convenient conclusion.

Dual Regulatory Regimes: A Lack of Corresponding Benefit

As RCRA becomes increasingly stringent and complex, the readily apparent inconsistencies caused by joint EPA, NRC, and DOE regulation of mixed waste can only multiply. The NRC and EPA insist, however, that there are no regulatory inconsistencies and that they have not found a situation that requires the application of RCRA §1006. They support this claim by noting that nearly all RCRA and AEA requirements are potentially subject to case-by-case waivers that provide the flexibility needed to resolve any inconsistencies. To make such a claim, however, the NRC and EPA must continually abrogate their own regulations. The LDR's situation plainly shows this. For regulators to claim that Congress intended such a result is to change the meaning of "not inconsistent" to "not impossible," as suggested by Senator Chafee.[94] Yet where EPA and the DOE are authorized to waive requirements on their own, nothing can ever be considered "impossible," and, therefore, RCRA's §1006 inconsistent standard will never apply.

Despite the agencies' attempts to dismiss the conflicts, the inconsistencies and burdens created by dual regimes are well-recognized. In 1990, NRC Commissioner James Curtiss asked the NRC's Advisory Committee on Nuclear Waste (ACNW) to compare the NRC's and EPA's disposal requirements for mixed waste. In response, the ACNW identified a number of "fundamental differences between the requirements of the two agencies."[95] These differences included the use of synthetic versus clay liners, the use of active versus passive waste management systems, means of packaging and treating radioactive wastes, disposal time frames (for example, 30 versus 500 years), and the rapidly evolving nature of RCRA requirements that is not typical

88. *See* NRC, NUREG/CR-4406, AN ANALYSIS OF LOW-LEVEL WASTE: REVIEW OF HAZARDOUS WASTE REGULATIONS AND IDENTIFICATION OF MIXED WASTES, Summary at 1 (1985).

89. Waste that is considered "absorbed" under the NRC's system would be considered "solidified" by the chemically hazardous waste handling community. NRC, NUREG 1183, NONRADIOLOGICAL GROUND WATER QUALITY AT LOW-LEVEL RADIOACTIVE WASTE SITES 32 (1986).

90. NRC, NUREG CR-4450, BNL NUREG 51944, *supra* note 37, at 32, 33 (emphasis added).

91. *See generally* 40 C.F.R. §§264.15, 265.15.

92. NUCLEAR MANAGEMENT AND RESOURCES COUNCIL, INC., REPORT ON THE MANAGEMENT OF MIXED LOW-LEVEL RADIOACTIVE WASTE IN THE NUCLEAR POWER INDUSTRY 3-51 (1990) [hereinafter NUMARC REPORT].

93. EPA/NRC, DRAFT GUIDANCE, CLARIFICATION OF RCRA HAZARDOUS WASTE TESTING REQUIREMENTS FOR MIXED WASTE 16 (1992).

94. *See supra* text accompanying note 21.

95. Letter from Dade W. Moeller, Chairman, the ACNW, to Kenneth Carr, Chairman, the NRC, 2 (Feb. 28, 1991) (on file with author).

of the more stable AEA standards.[96] The ACNW also noted that although "staff members of the EPA and NRC have been attempting for some time to develop an approach through which dual regulation could be made more practicable . . . the efficacy of these [EPA/NRC] joint guidance reports is not entirely clear."[97] According to the ACNW, "discussions with state representatives indicate that additional guidance is necessary . . . [and the joint guidance reports] do not alleviate the dual regulation burden."[98] As is evident, EPA's and the NRC's attempts to paper-over the conflicts caused by the dual regulatory regime have generally not been successful.

Significantly, the mixed-waste quandary may also be based on the different configuration of EPA's and the NRC's regulatory frameworks. EPA's RCRA regulations are extremely prescriptive and extremely complex, frequently imposing extraordinarily precise standards and methods and even specifying particular materials. The NRC's regulations *appear* less complex and less prescriptive, because they focus more on overall and long-term *system performance*. The NRC's regulations, however, are supported by a large body of the NRC's regulatory guides and technical position papers that detail acceptable methods or requirements to meet the regulations' performance goal. The combined effect of the regulations and supporting criteria documents ultimately achieves an equivalent or greater level of protection.

The differences in the two programs may make sense if one considers that while EPA must permit and license hundreds and even thousands of hazardous waste sites, the number of NRC-licensed sites, particularly new sites, is significantly smaller (approximately 7,500). The smaller burden affords the NRC the opportunity to scrutinize more carefully individual licensing decisions. The level of detail actually found in the NRC's regulations might lead one to conclude that the NRC's regulations are generally less stringent, and, further, to conclude erroneously that the more prescriptive EPA regulations can be imposed without conflict and will result in an additional level of protection. As described below, this is not the case.

The NRC's standards are designed to protect against potential public health and safety threats for periods of time that are several orders of magnitude longer than the RCRA standards. By necessity, the NRC's site-selection parameters are more stringent. The NRC's waste-form requirements are more integral to the NRC's program and are significantly more stringent than are relevant EPA standards. As the NRC has noted, "overall the part 61 regulatory system provides a more effective, long-term approach to minimizing formation of leachate from radioactive wastes than a policy that relies heavily on liners."[99] Both the DOE and the Nuclear Management and Resources Council, Inc. (NUMARC), have also indicated that the NRC's regulatory scheme may provide protection against public exposure to radioactive waste that is superior to that at a joint AEA/RCRA facility.[100]

> Projected long-term performance of the [RCRA] 40 C.F.R. 264 facility . . . may be inferior to that of the 10 C.F.R. 61 facility assuming mixed waste commingled with [LLRW] is disposed at the latter. . . . [T]he effect of imposing 40 C.F.R. 264 requirements on disposal of mixed waste may be to increase the potential individual doses from what they would have been had the waste been disposed as [LLRW] without regard to its hazardous content.[101]

A recent study of tank requirements under the AEA and RCRA reached a similar conclusion regarding hazardous waste/radioactive waste tanks.[102]

EPA's scientific basis for asserting RCRA jurisdiction over many mixed-waste streams is thin. In most instances, the AEA's system alone has adequately controlled both the chemical and radiological hazard from mixed waste. For instance, one of the most frequently encountered mixed wastes at the AEA's sites is scintillation vials containing toluene. The risk of potential off-site groundwater contamination from toluene is often used to justify dual mixed-waste regulation. Yet a 1986 NRC study noted that toluene has previously been detected in groundwater from trench sump samples at particular sites, but concentrations decrease over short time periods, indicating a relatively brief persistence in groundwater.[103] Thus, it does not appear that toluene, known to be disposed of at existing LLRW sites, has actually presented a significant environmental hazard that would require EPA to assert RCRA jurisdiction.[104]

The NRC's study of nonradiological groundwater quality at existing LLRW sites supports the notion that concern about the effect to off-site groundwater of chemically hazardous constituents found in the LLRW disposed in the AEA's regulated facilities is overstated. According to the NRC, at the Sheffield, Illinois, site, where significant amounts of chemically hazardous LLRWs are known to be disposed of, "the sample results do not indicate that contamination from toluene and xylene scintillation liquids, chromate wastes or lead is occurring. . . ."[105] These wastes comprise the largest volume of known mixed wastes.[106] Notably, the closed Sheffield site was actually less stringently controlled than a current site regulated under 10 C.F.R. part 61, primarily because of part 61's waste classification system and related waste-form requirements.

At the Barnwell, South Carolina, site, which the NRC stated essentially meets 10 C.F.R. part 61 requirements, the NRC reached the same conclusion: "[T]he [LLRW] dis-

96. *Id.*

97. *Id.* at 4.

98. *Id.* at 5.

99. Letter from Nunzio J. Palladino, *supra* note 36, at 2.

100. NUMARC REPORT, *supra* note 92, at 7-26; DOE, DOE/LLW-60T, *supra* note 62 (1987).

101. NUMARC, *supra* note 62, at 7-26.

102. Envirosphere Company, *Comparative Assessment of the Environmental Protection Agency's Regulations for Hazardous Waste Tank Systems and Comparable Nuclear Regulatory Commission Requirements*, Envirosphere Co., New Jersey (July 1988). According to this report, "there is little or no incremental safety benefit to be derived from applying the [RCRA] Subpart J standards to nuclear power plant radwaste tank systems and applicable NRC provisions, overall, provide an equivalent level of protection of human health and the environment." *Id.* at 88. Indeed, the report also notes that "application of a large percentage of the EPA provisions to mixed-waste storage and treatment tank systems at nuclear power plants would provide no incremental safety benefit or would result in unnecessary exposures to radioactive materials." *Id.* at 6.

103. *See* NRC, NUREG 1183, *supra* note 89, at 43.

104. *See also* NRC, NUREG CR-4450, BNL NUREG 15944, *supra* note 38, at 32-33.

105. NRC, NUREG 1183, *supra* note 89, at 27.

106. *See* NRC, NUREG CR-4450, BNL NUREG 15944, *supra* note 38.

posal units have had a very minor effect on the nonradiological quality of on-site groundwater. . . . [C]oncentrations of individual organics are very low in on-site wells and are below detection at boundary wells."[107] Thus, the best available evidence suggests that EPA's concerns regarding substantial groundwater contamination from mixed waste at the LLRW's disposal sites are misguided.

As these examples demonstrate, the principal hazard from land disposal of mixed waste stems from the long-term radioactive hazard, not from chemical constituents. The mixed-waste regulatory system, however, does not reflect this fact. The current mixed-waste regulatory system arises from the failure of regulators to acknowledge the unique properties of radioactive wastes and to affirm that for such wastes, RCRA and the AEA cannot be reconciled. This failure has led to a multitude of conflicting guidance, statements, and policies aimed at reducing the appearance of conflict.[108] The mixed-waste situation has spawned an entire generation of environmental professionals seeking to develop treatment technologies that are intended to solve by physical means what is essentially a legal infirmity.

The only two credible reasons for imposing RCRA requirements on non-treatable AEA regulated wastes—to enhance groundwater protection and alleviate concerns regarding impermissible mixing of hazardous and radioactive wastes—are easily dealt with in ways that avoid forcing mixed-waste generators to run the gauntlet of RCRA requirements. EPA's RCRA rules already prohibit impermissible dilution and mixing of hazardous wastes[109] and could easily be modified to provide additional protection. In addition, the ACNW has concluded that "the disposal of mixed wastes can be accomplished under the umbrella of NRC requirements for [LLRWs] if these requirements are modified to provide for enhanced groundwater protection."[110]

Finally, a resounding lack of corresponding benefit from the dual regulatory regime arises from the expected overlap that often results in duplicative reporting and paperwork requirements. Both the NRC and EPA require a comprehensive manifest and recordkeeping system. They also require strict security protections that are not always identical, and both the NRC and EPA have financial assurance requirements, which can force site operators to commit large sums of money to the NRC and EPA for essentially the same purposes.

107. NRC, NUREG 1183, *supra* note 89, at 39.

108. Thus far, EPA and the NRC have issued the following joint guidance: GUIDANCE ON THE DEFINITION AND IDENTIFICATION OF COMMERCIAL MIXED LOW-LEVEL RADIOACTIVE AND HAZARDOUS WASTE AND ANSWERS TO ANTICIPATED QUESTIONS (1987); DIRECTIVE NO. 9480.00-14, COMBINED NRC-EPA SITING GUIDELINES FOR DISPOSAL OF COMMERCIAL MIXED LOW-LEVEL RADIOACTIVE AND HAZARDOUS WASTE (1987); DIRECTIVE NO. 9487.00-8, JOINT NRC-EPA GUIDANCE ON A CONCEPTUAL DESIGN APPROACH FOR COMMERCIAL MIXED LOW-LEVEL RADIOACTIVE AND HAZARDOUS WASTE DISPOSAL FACILITIES (1987); EPA/530-SW-90-057, LOW-LEVEL MIXED WASTE, A RCRA PERSPECTIVE FOR NRC LICENSEES (1990); DIRECTIVE NO. 9555.00-01, MEMO TO ALL NRC LICENSEES: GUIDANCE ON THE LAND DISPOSAL RESTRICTIONS' EFFECTS ON STORAGE AND DISPOSAL OF COMMERCIAL MIXED WASTE (1990).

109. *See, e.g.*, 40 C.F.R. §268.3.

110. Letter from Dade W. Moeller, *supra* note 95, at 7.

Developing a Solution

The Uranium Mill Tailings Model

The illogic of imposing RCRA on the LLRWs that pose significant radioactive hazards is perhaps best seen by comparing the status of mixed waste with an AEA counterpart, uranium mill tailings. Although many uranium mill tailings piles are composed of radioactive waste containing significant amounts of chemically hazardous components, including acids, solvents, and heavy metals, they do not fall within the scope of the mixed-waste system and EPA's RCRA requirements. This disparity of treatment derives mainly from the language of §11e(2) of the AEA.

Section 11e(1) of the AEA defines "byproduct material," which encompasses the LLRW, as "any *radioactive material* yielded in or made radioactive by exposure to the process of producing or utilizing special nuclear material."[111] Section 11e(2) defines "uranium mill tailings byproduct material" as "the tailings *or wastes* produced by the extraction of uranium or thorium from any ore processed primarily for its source material content."[112] While the §11e(1) definition applies only to radioactive materials, the §11e(2) definition applies not only to radioactive tailings, but to any *wastes* produced by the extraction or concentration of uranium or thorium. This small difference in wording has meant that under RCRA's exclusion for byproduct material,[113] §11e(1) byproduct material falls within the purview of the mixed-waste system, whereas §11e(2) material does not.[114] In many instances, §11e(1) and §11e(2) byproduct materials may be virtually identical, physically, chemically, and radiologically.[115] The fact that physically identical materials presenting essentially identical potential radiological hazards can be subject to disparate regulatory requirements establishes clearly the overall absurdity of the current mixed-waste legal framework.

The legal framework that Congress created for uranium mill tailings sites is instructive in the mixed-waste context. Under the Reorganization Plan No. 3 of 1970,[116] EPA acquired the AEC's authority to promulgate "generally applicable environmental standards" including "limits on the radiation exposures . . . in the general environment outside

111. 42 U.S.C. §2014e(1).

112. *Id.* §2014e(2).

113. 42 U.S.C. §6903(27), ELR STAT. RCRA 13.

114. See Memorandum from Paul Lohaus, NRC, to all NRC Uranium Recovery Licensees 1 (Mar. 5, 1989), noting that all §11e(2) *wastes*, including *nonradioactive* ore residues and process fluids are byproduct material falling outside the definition of solid waste. *See also* NRC, NRC SEC'Y DOCUMENT 91-347, URANIUM FEED MATERIALS OTHER THAN NATURAL ORES (1991). Note, however, that the addition of hazardous waste to §11e(2) material after and outside the uranium or thorium extraction and concentration process would cause the material to become a mixed waste. Because of this fact, the DOE and the NRC have made clear to owners and operators of uranium mill tailings piles that they should take care to prevent the addition of hazardous waste and materials containing hazardous wastes into §11e(2) tailings piles.

115. An NRC's document notes that many bulk non-11e(2) wastes are similar enough to mill tailings to be disposed in mill tailings piles. NRC, SEC'Y DOCUMENT 91-243, DISPOSAL OF MATERIAL OTHER THAN ATOMIC ENERGY ACT OF 1954, AS AMENDED, SECTION 11e(2) BYPRODUCT MATERIAL INTO URANIUM MILL TAILINGS IMPOUNDMENTS 4 (1991).

116. Reorg. Plan No. 3 of 1973, 35 Fed. Reg. 15623 (1970), *reprinted in* 5 U.S.C. app. at 3, *and in* 84 Stat. 2086 (1970).

the boundaries of locations under the control of persons possessing or using radioactive material."[117] The AEC (and later the NRC) retained exclusive responsibility for the implementation and enforcement of on-site radioactive standards through its licensing authority. Under this plan, EPA was to promulgate standards that would protect against off-site releases of radioactive materials, and the AEC/NRC would regulate on-site activities in accordance with these requirements and its own responsibilities under the AEA.

In 1981, Congress used essentially the same framework for uranium mill tailings in the Uranium Mill Tailings Radiation Control Act (UMTRCA).[118] Under the UMTRCA, all uranium mill tailings are disposed of on land owned or to be owned by a state or the DOE in perpetuity.[119] At inactive uranium mill tailings sites, described in Title I of the UMTRCA, the DOE owns and regulates a site until closure, at which time the site is licensed in perpetuity by the NRC. The NRC reviews the DOE's site closure plan to determine if it will meet the NRC's perpetual licensing requirements. At active sites, which fall under Title II of the UMTRCA, a private operator is licensed by the NRC until closure. At closure the DOE or a state becomes the site owner. Thereafter, the site is licensed in perpetuity by the NRC.

Under the UMTRCA, and using essentially the same language as it did in the 1970 Reorganization Plan, Congress imposed on both active and inactive uranium mill tailings sites "generally applicable" EPA standards "for the protection of public health and safety from radiological and non-radiological hazards."[120] Congress decreed that these standards "shall, to the maximum extent practicable, be consistent with the requirements of the Solid Waste Disposal Act."[121] Congress also specifically noted that for active sites, "no permit is required under the Solid Waste Disposal Act."[122] Thus, at active uranium mill tailings sites, the NRC licenses the sites in accordance with its own regulations found at 10 C.F.R. part 40, Appendix A. The NRC's licensing of the sites must conform to EPA's "generally applicable" standards found at 40 C.F.R. part 192.

Given the identity of language used in both the Reorganization Plan and in the UMTRCA for "generally applicable" standards, it was plain that Congress intended for EPA's part 192 regulations to provide protection only for off-site release at mill tailings sites, especially given that the AEA-licensed tailings piles, like 10 C.F.R. part 61 sites, expressly contemplate and use on-site releases as part of the containment mechanism. In *American Mining Congress v. Thomas*,[123] however, the United States Court of Appeals for the Tenth Circuit held that EPA could promulgate "generally applicable" standards that have on-site effects.[124] As a result of that decision, the current legal framework for uranium mill tailings piles is flawed in one important respect.[125] Nonetheless, it provides an important model for use in the mixed-waste context.

The High-Level Waste Legal Framework Model

The concept of having the NRC license the DOE in perpetuity at a DOE-owned and operated site was also used by Congress in creating a regulatory framework for high-level waste. Under the Nuclear Waste Policy Act, the DOE is responsible for selecting and establishing permanent disposal facilities.[126] Generators and owners of high-level waste are to contribute to a fund to pay for the DOE's costs.[127] The DOE is to be licensed at the site by the NRC.[128] EPA is to promulgate "generally applicable standards for protection of the general environment from off-site releases from radioactive materials."[129] These standards are found at 40 C.F.R. part 191. The NRC implements them through its licensing authority.

EPA's proposed part 191 standards are designed to protect against off-site releases but are also designed to be consistent with the overall design concept of the high-level waste repository. In particular, like other radioactive waste disposal sites, the high-level waste sites will use the area within the disposal unit as part of the containment structure. As noted in the House Report for the Nuclear Waste Policy Act, "the primary feature of the site . . . consists of a rock medium about 1,000 feet or more underground that will provide one of the primary containments of the waste." EPA's proposed standards are consistent with this approach and allow limited releases to the accessible environment over a 10,000-year period.[130]

According to the standards, and consistent with the NRC's long-term approach toward radioactive waste, the

> performance assessments [for calculating releases] need not provide complete assurance that the requirements of 191.13(a) will be met. Because of the long time periods involved . . . there will inevitably be substantial uncertainties in projecting disposal system performance. Proof of . . . future performance is not to be had in the ordinary sense of the word in situations that deal with much shorter time frames, what is required is a reasonable expectation . . . that compliance with [40 C.F.R.] 191.13(a) will be achieved.[131]

Thus, the proposed EPA high-level waste standards recognize the very different and long-term nature of radioactive waste and work within the NRC framework. Accordingly, the NRC's licensing of the high-level waste site to be managed by the DOE must be consistent with EPA standards.[132]

A Solution to the Mixed-Waste Quandary

The legal framework of the high-level waste management

117. *Id.*

118. Uranium Mill Tailings Radiation Control Act, Pub. L. No. 95-604, 92 Stat. 3022 (codified in scattered sections of 42 U.S.C.).

119. *See, e.g.*, 42 U.S.C. §7914.

120. 42 U.S.C. §2022(a), (b).

121. 42 U.S.C. §2022(b)(2).

122. *Id.*

123. 772 F.2d 640, 16 ELR 20069 (10th Cir. 1985), *cert. denied*, 476 U.S. 1158 (1986).

124. *Id.* at 647-48, 16 ELR 20072.

125. As a practical matter, significant regulatory conflicts between the AEA's and RCRA systems have been limited under the UMTRCA system.

126. 42 U.S.C. §10131.

127. *Id.*

128. 42 U.S.C. §10141(b).

129. 42 U.S.C. §10141(a).

130. *See* 40 C.F.R. §191.13.

131. 40 C.F.R. §191(b).

132. 42 U.S.C. §10141. *See also* H.R. REP. No. 97-491, 97th Cong., 2d Sess., at 57 (1982).

program provides an excellent model of a system in which the NRC has lead authority in licensing the DOE for a radioactive waste site pursuant to, and consistent with, EPA's requirements for the protection of the general environment from off-site releases. A similar legal framework could be applied to all the DOE and commercial mixed wastes in the United States that contain more than de minimis amounts of radioactivity. Disposal of mixed waste (including the relatively small volumes of commercial mixed waste) could occur either at the DOE-owned and operated disposal sites licensed in perpetuity by the NRC or at privately operated commercial LLRW sites (such as the existing Compact sites)[133] on land owned (or to be owned) by a state or the DOE and subject to perpetual licensing by the NRC. These sites would be subject to a single set of the NRC's standards that could be drafted to include enhanced groundwater protection and to conform to EPA's standards of general applicability for protection against off-site releases.

Under such a system, mixed waste with very low levels of radioactivity (such as those identified by the NRC in its recently withdrawn below-regulatory-concern policy) would be exempt from the AEA's regulation and would fall under exclusive EPA jurisdiction. Nearly all other mixed wastes would be subject to exclusive AEA jurisdiction and perhaps some enhanced NRC standards reflecting current chemical waste control practices.[134] For wastes that are easily treated, such as scintillation fluids, some provisions for incineration, prior to final disposal could be included. These wastes would remain the AEA's regulated wastes subject to exclusive NRC jurisdiction, however, unless levels of radioactivity were below the NRC's regulatory concern.

This program design is logical for several important reasons. First, most, if not all, mixed waste would become subject to a single set of regulations. This has long been sought by many in the mixed-waste field, including the DOE, the NRC, some members of Congress, and virtually all generators and holders of mixed waste. Not only would it put a permanent end to inconsistency and duplication of mixed-waste regulation, it would also bring badly needed predictability to the mixed-waste field. This result would ultimately benefit the environment.

Although the RCRA regulations would need to be amended to make it clear that RCRA subtitle C requirements do not apply to mixed waste managed by the NRC/DOE, such a proposal has already been suggested by the DOE and entertained by EPA in EPA's recent deliberations regarding the definitions of solid and hazardous waste. In the context of that proposed rulemaking (which EPA later withdrew entirely), EPA stated that it

> expects that the general approach in today's regulation would allow for exemption of mixed wastes that contain very low concentrations of chemically hazardous constituents . . . there is also a suggestion that for mixed wastes with higher concentrations of chemically hazardous constituents regulated because of RCRA listings, regulation under the AEA already requires measures intended to control exposure to, and releases of, radioactive hazards that would also protect human health and the environment by limiting exposure to, and release of, chemically hazardous constituents from mixed waste. EPA solicits comments as to whether it . . . [should] develop . . . an approach for mixed waste where the conditional exemption criterion would be compliance with regulations that exist to control the radioactivity hazards.[135]

It appears reasonable to assume that EPA would not reject this idea out of hand, because EPA, like others in the mixed-waste arena, recognizes the potential benefits to be derived from applying a single set of regulations to some, if not all, mixed waste. In addition, it would make sense for the DOE to revisit its own definition of byproduct material to see if the "direct process" approach, or some similar concept, could be used to eliminate the applicability of RCRA to much of the DOE's (and perhaps some commercial) mixed-waste streams.

Given the large volumes of mixed and radioactive wastes already at the DOE's sites, it makes little sense to move these wastes off-site in violation of the NRC's ALARA principle. Thus, the DOE's wastes would be disposed of at on-site DOE disposal units licensed by the NRC. Or, because some commercial LLRW disposal capacity already exists, some DOE wastes could be disposed of at the existing commercial sites (two of which are located near major DOE facilities). For commercial mixed wastes, disposal could take place at either the on-site DOE facilities (for a fee) or at the commercial LLRW sites sanctioned or created under the Low-Level Radioactive Waste Policy Amendments Act.[136] Primarily hazardous mixed wastes could be disposed of at RCRA facilities, particularly where the relative radioactive half-lifes involved are short and the radioactivity levels pose little or no health risk (such as at background).

The NRC has already suggested to the DOE that it should consider accepting commercial low-level mixed waste at the DOE's sites. The NRC has stated that it does not believe that serious impediments exist to the DOE's acceptance of commercial mixed waste from the NRC's licensees.[137] On August 2, 1991, the Chairman of the NRC wrote the Secretary of Energy to suggest such a plan, which the NRC's and the DOE's senior officials are in the process of discussing.[138] The creation of such a plan can easily occur in the context of, and be consistent with, the DOE's plan to develop a long-term national compliance strategy for all of the DOE's mixed wastes.[139]

The addition of commercial mixed wastes to either the

133. Under the Low-Level Radioactive Waste Policy Amendments Act, 42 U.S.C. §2021d, Congress authorized the creation of regional compacts for the development of sites for the LLRW's disposal. When Congress amended the Act in 1985, the three existing sites in Washington, Nevada, and South Carolina were required to remain open until 1993, when new disposal capacity was to be in place. Although no new compact sites are yet operational, only the South Carolina site remains open to the LLRW from throughout the nation. The Nevada site is closed and the Washington site now only accepts waste from within the Northwest Compact Region. A noncompact site in Utah accepts some limited types of the LLRW.

134. The NRC's LLRW regulations at 10 C.F.R. §61.56(a)(8) already require "maximum treatment" to reduce nonradiological hazards.

135. 57 Fed. Reg. 21450, 21463 (May 20, 1992).

136. 42 U.S.C. §2021(b).

137. Government Accounting Office, GAO/RCED 92-61, Government Accounting Office Report: Slow Progress Developing Low-Level Radioactive Waste Disposal Facility 5 (1992).

138. *Id.* at 28.

139. *See* 57 Fed. Reg. 57170, 57181 (Dec. 3, 1992).

DOE's or commercial sites would not increase the potential overall public health or environmental hazard for the reasons previously discussed. Moreover, the overall volume of such commercial mixed wastes could easily be accommodated at either the existing commercial LLRW sites or at the DOE's sites. Ultimate ownership by the DOE of commercial LLRW sites is already required by 10 C.F.R. §§61.14 and 61.59, and virtually permanent (i.e., 100 years) DOE ownership of the DOE's sites is also already assured. Thus, the DOE's legal relationships to these wastes would remain essentially unchanged—except that it would not be forced to contend constantly with on-going RCRA requirements.

The principal benefit of such a system would be that the applicable disposal requirements would acknowledge once and for all that the primary focus of control for mixed wastes that cannot easily be incinerated and that contain significant amounts of radioactivity should be on eliminating the long-term radioactive hazards.[140] Thus, the NRC, which possesses the greatest amount of expertise in the field of radioactive material control, would once again assume the dominant role in the management of the AEA-regulated wastes. EPA's concerns regarding the need for enhanced groundwater protection could be met, and EPA would maintain a consultative role regarding these wastes consistent with its authority under the 1970 Reorganization Plan No. 3.[141] The process of permanently disposing of mixed waste that is not amenable to treatment could begin in earnest. The result would be increased protection of the environment and an overall conservation of scarce government and industry environmental protection resources.

140. The NRC could also be provided the statutory authority to amend its regulations to allow wastes below regulatory concern containing hazardous waste to fall outside the AEA's system and be dealt with solely as hazardous waste.

Conclusion

Dual regulation of mixed waste provides no discernible benefit to either human health or the environment and is grounded in legal and jurisdictional concerns rather than scientific reality. The insistence of regulators on dismissing and obscuring clear conflicts between the AEA and RCRA has led to increasingly outlandish use of joint guidances, variances, waivers, and exemptions as relief valves for alleviating the pressure between systems that are philosophically, conceptually, and technically distinct. Ultimately, Congress is responsible for this situation and it is Congress that should provide the leadership necessary to eliminate it. The solution proposed in this Article is one suggestion that is risk-based, scientifically justifiable, economically beneficial, and environmentally sound. Accordingly, there is no good reason for failing to adopt it or a similar program.

141. Presumably, under the NRC/DOE licensing scheme, opportunity for public participation would be legally required as part of the license issuance and environmental impact statement process. Because of the controversy surrounding such a process, however, it might also be advisable to create an independent mixed-waste oversight and advisory board, similar to the Nuclear Waste Advisory Board. This would allow for additional public participation, comment, and review.