DSI-13
(27)

National Mining Association
Foundation For America's Future

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December 2, 1996

Mr. John C. Hoyle
Secretary
U.S. Nuclear Regulatory Commission
One Whiteflint North
11555 Rockville Pike
Rockville, MD 20852

Dear Secretary Hoyle:

The National Mining Association (NMA) is pleased to comment on behalf of its uranium recovery licensee members on the Nuclear Regulatory Commission's (NRC) Strategic Assessment Rebaselining Initiative (SARI). NMA commends NRC on its attempt to establish a "clear strategic direction" to achieve its mission more effectively. The strategic plan and decisionmaking framework developed through the SARI process should assist the Commission in addressing the complex, and often interrelated, issues that have affected and will continue to affect its licensees. NMA's uranium recovery licensees, although a limited subset of NRC's nuclear fuel cycle licensees, nevertheless, are faced with a number of complex interrelated issues that require some strategic overview at the Commission level. Therefore, in addition to considering NMA's comments on the SARI, NMA specifically requests that the Commission acknowledge its "placeholder" request to review such issues upon their presentation in a "White Paper" to be submitted to NRC by NMA.

NMA looks forward to a continuing dialogue with the Commission and its staff on the issues of concern to our uranium recovery licensee members.

Sincerely,

Richard L. Lawson

Richard L. Lawson

Enclosure

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THE NATIONAL MINING ASSOCIATION'S COMMENTS ON THE NUCLEAR REGULATORY COMMISSION'S STRATEGIC ASSESSMENT AND REBASELINING STRATEGIC PLANNING FRAMEWORK

DECEMBER 2, 1996

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I. INTRODUCTION

The Nuclear Regulatory Commission (NRC) states that in order to respond to changing conditions that present both challenges and opportunities, NRC is attempting to establish a "clear strategic direction" that will enable it to achieve its mission effectively. The strategic "plan" or "framework" developed by the Strategic Assessment and Rebaselining Initiative (SARI) will guide future NRC decision-making and provide a basis for aligning NRC's budget and organizational systems with its mission and goals. As part of this effort, NRC solicits active stakeholder input into this "work-in-progress" project.

The National Mining Association (NMA) is pleased to comment generally on the SARI and specifically on a number of the "Direction-Setting Issues" ("DSI") papers. NMA comprises the producers of most of the nation's coal, metals, industrial and agricultural minerals; the manufacturers of mining and mineral processing machinery, equipment and supplies; and the engineering and consulting firms, financial institutions and other firms serving the mining industry. NMA is providing comments on behalf of its uranium recovery licensee members whose interests will be affected by the final results of the SARI.

II. GENERAL COMMENTS

NMA recognizes that NRC has attempted to address major issues of agency-wide importance that impact, to a greater or lesser extent, all classes of the Commission's licensees and all of the core components of its regulatory mission in this SARI. NMA also recognizes that NRC's uranium recovery licensees constitute but one relatively limited sub-group of NRC materials licensees. Nevertheless, NMA's uranium recovery licensees believe that the concepts underlying the SARI justify a strategic review and reconsideration of a variety of issues affecting uranium recovery licensees.

NRC has over time addressed a variety of issues that affect uranium recovery licensees and will continue to affect them in the future. Since NRC's treatment of these issues over time has evolved essentially in response to the appearance of a given issue rather than as part of a coherent, strategic assessment, the result is inconsistent, conflicting and confusing regulatory applications. The short and long term implications of this regulatory maze are potentially significant for licensees, NRC, Department of Energy (DOE) and Agreement State programs that address uranium recovery facilities.

NMA will not attempt to discuss these issues in any great detail in these comments due to their complexity. However, several brief examples follow:

- NRC's decision to assert jurisdiction over in situ leach (ISL) uranium mining operations combined with the Staff Guidance on effluent disposal (DWM-95-01) has led to the treatment of "process" (i.e., production) wastes as 11e.(2) byproduct material

while "restoration" wastes are considered as mine wastes. These wastes have been and are being commingled at ISL facilities. Traditionally, ISL 11e.(2) wastes are disposed in uranium mill tailings facilities (Criterion 2, 10 C.F.R. Part 40, Appendix A) but non-11e.(2) wastes are not to be disposed in such facilities pursuant to the "Final Revised Guidance on Disposal of Non-Atomic Energy Act of 1954, Section 11e.(2) Byproduct Material in Tailing Impoundments." Thus, a regulatory dilemma that may impact NRC/Agreement State versus non-Agreement State jurisdiction and DOE acceptance of Title II uranium mill tailings facilities under the Atomic Energy Act (AEA), as amended by the Uranium Mill Tailing Radiation Control Act (UMTRCA), has been created.

- NRC Staff Guidance determining that non-Agreement States have concurrent jurisdiction with NRC under the AEA, as amended by UMTRCA, over the nonradiological components of 11e.(2) byproduct material threatens to create a "mixed waste-like" regulatory "sink" and is inconsistent with the maintenance of a "strong" Agreement State program. Additionally, this policy position may further exacerbate the problems noted in the preceding paragraph.

NMA is concerned that the dilemmas posed by NRC decisions, positions or guidance on a series of significant regulatory issues will affect uranium recovery licensees well into the future. Any attempt to address these issues in a patchwork fashion will only lead to more illogical, inconsistent and complex regulatory applications. A strategic reassessment and rebaselining effort to address these issues in light of current and likely future circumstances, including the

results of the agency-wide SARI, makes good sense. NMA, therefore requests that NRC consider these comments to constitute a "placeholder" for a strategic reassessment of these and other critical uranium recovery-licensee regulatory issues. At the present time, NMA's uranium recovery licensee members contemplate preparing a "White Paper" outlining these issues and identifying their significance to the uranium recovery program and, where relevant, to larger issues such as the Agreement State program, the low-level waste (LLW) program, risk-informed, performance-based regulation, the decommissioning of non-reactor facilities and the like.

Finally, NMA notes that, Director of the Utah's Division of Radiation Control, William J. Sinclair's testimony at the NRC's Colorado Springs hearing on the SARI echoes NMA's concerns regarding the necessity for a strategic assessment of uranium recovery issues as follows:

> Just another comment, and this is a State of Utah comment: One thing that I was disappointed in this area that I thought we might have looked at in more detail was the uranium mill program and some of the waste issues dealing with the uranium mill program. Even though it's not low-level waste -- call it a different thing -- there are a lot of issues in that program that I think would be valuable to look at as part of the strategic assessment, and I guess I was just disappointed that some of those issues that were raised and that I have seen raised at meetings such as the American Mining Congress meeting weren't raised as part of this paper.

In the interests of full disclosure, NMA notes that Mr. Sinclair's view regarding the uranium recovery issues that need to be strategically reassessed may differ substantially from those of NMA's uranium recovery licensee members.

III. SPECIFIC COMMENTS

a. DSI 2: Oversight of DOE

Question: Should NRC seek to expand its regulatory authority and responsibilities to include DOE facilities?

The DSI paper poses four options as follows:

Option 1: Support broad responsibility for NRC regulation of DOE:

- **a.** Advisory Committee framework;
- **b.** Existing division of responsibility for commercial nuclear facilities; and
- **c.** Modifying the existing division of responsibility to minimize jurisdictional conflicts;

Option 2: Support broad responsibility for regulating certain types of DOE facilities;

Option 3: Oppose broad NRC responsibility for regulating DOE facilities;

Option 4: Take no position on broad NRC responsibility for DOE facilities.

The Commission's preliminary views favor Option 4, but if asked, NRC could provide the necessary oversight with adequate resources and a reasonable time schedule.

NMA agrees that it is appropriate for the Commission not to actively seek oversight of DOE facilities, but should NRC be the outside regulator for DOE, NMA supports Option 1B which reflects the current division of responsibility for commercial facilities .

The current division of responsibility has been thrashed out over the past several decades in various legislative, judicial and regulatory fora. While the current division of responsibility is still somewhat problematical and far from perfect, it would not be cost-effective or useful to

begin anew. For example, it makes little sense to thrust the Occupational Health and Safety Administration (OSHA) into radiological protection for AEA regulated facility workers or the Environmental Protection Agency (EPA) into site specific regulatory oversight -- tasks which those Agencies are at best ill-prepared to perform, especially when compared with NRC. Mixed waste issues can be solved readily under the existing division of responsibility as well. (See "Mixed Waste: A Way to Solve the Quandary," Anthony J. Thompson and Michael L. Goo, 23 ELR 10705-10719 (December 1993) ["Thompson/Goo," Attachment A.] To the extent that there exists a need for external regulation of DOE facilities (and there is significant agreement with that proposition), NMA believes that NRC's expertise places it in the strongest position of any existing federal or State agency to assume such responsibilities. NMA believes that there may be questionable benefits and potentially significant problems associated with authorizing Agreement State regulation of federal DOE facilities.

As one further note, NMA supports the concept expressed in Suboption 1C regarding the appropriate way to address the "mixed waste" issue -- Whether the waste is DOE or commercial low-level mixed waste, (DSI 2 at p. 23), if radiation poses the primary hazard, then NRC's current LLW standards in 10 C.F.R. Part 61 (and/or any modifications thereto pursuant NRC becoming DOE's external regulator) should govern the disposal of the waste. The expensive and unnecessary efforts to treat the hazardous waste component of mixed waste pursuant to RCRA requirements could be obviated with great cost savings and no loss of protection for public health, safety and the environment. Id. Similarly, if the chemical or other nonradiological component of the waste poses the primary hazard, then relevant hazardous waste or hazardous materials disposal criteria should govern the disposal of the waste.

b. DSI 4: NRC's Relationship with Agreement States

Question: What should be NRC's strategy regarding States becoming and remaining Agreement states?

The DSI paper poses five options as follows:

Option 1: Turn the Agreement States Program over to EPA;

Option 2: Strongly encourage States to become Agreement States;

Option 3: Continue the current Agreement States program, including adopting current incentives;

Option 4: Treat Agreement States as co-regulators; and,

Option 5: Devolve regulation of AEA, Section 274 materials to the States.

The Commission's preliminary view favors Option 3 including encouraging more States to become Agreement States through intangible incentives although perhaps providing some "seed-money" or grants as tangible incentives. The Commission also favors providing training to Agreement States without charge on a "space available" basis.

NMA is opposed unequivocally to Option 1 because it would destroy decades of continuity in NRC/Agreement State regulatory oversight of uranium recovery facilities as well as those of other AEA licensees. Additionally, EPA does not have either the quality or depth of expertise (particularly operations-related experience) on these issues at headquarters or in its regional offices.

NMA questions whether it is appropriate or wise for NRC to "strongly" encourage states to become Agreement States. As NRC notes, as more states become Agreement States, it will be difficult for NRC to maintain a critical mass of technical expertise to oversee a national level,

national quality regulatory program. "Strongly" encouraging additional Agreement States would seem to be inconsistent with the goal of a national regulatory program for radioactive materials as envisaged under the AEA. While some current (and perhaps future) Agreement States may have relatively sophisticated programs, others do not and likely will not. It is difficult to believe that even the most sophisticated Agreement State programs can or likely will bring to bear the resources and expertise that NRC can and has on complex issues such as site decommissioning (DSI 9) and low-level waste disposal (DSI 5). The very fact that Agreement States (including those with sophisticated programs) have objected so vigorously to any cuts in NRC funding for training of Agreement State personnel essentially proves this point.

NMA further objects to giving Agreement States credit for performing NRC inspections or to allowing Agreement States to provide reimbursable services to NRC licensees. The potential for "disconnects" between the state inspectors and NRC rule and policymakers would be too great. If there was a downside to NRC's Uranium Recovery Field Office (URFO) operations, it was precisely such disconnects between the "field operatives" and headquarters rule and policymakers. NMA believes that a national regulatory program is necessary under the AEA, as amended, and that, while NRC may discontinue direct regulatory control over Agreement State licensees, Agreement States exercising their sovereign authority may do so only within the bounds of NRC's defined national regulatory policies. The greater the flexibility and discretion afforded States, the greater will be the inconsistencies between State regulatory programs. Thus, while Agreement States do and should have some autonomy and independence, they are not "Co-Regulators" nor should they be considered as such. For these same reasons, therefore, NMA opposes both Options 4 and 5.

NMA generally supports Option 3, but continues its objection to NRC licensees funding Agreement State oversight and training. NMA supports changes to the Omnibus Budget Reconciliation Act (OBRA) that would either fund such activities from appropriated funds or permit NRC to charge Agreement States for such activities. In the latter case, however, some basis for reduced charges could be justified in the name of preserving a consistent national regulatory program.

NMA believes that Option 3 does strike a balance between maintaining a coherent national program and allowing states some flexibility to "accommodate individual state preferences, state legislative direction, and local needs and conditions." On the other hand, a coherent national program requires that in some instances States must have "identical" regulatory requirements.

Finally, NMA notes that NRC's 1980 policy position to allow non-Agreement States to regulate the non-radiological constituents of 11e.(2) byproduct material runs directly counter to any policy to "strongly" support and maintain a viable Agreement State program. This issue is one that NRC should reconsider as part of the strategic reassessment of uranium recovery regulatory issues requested in several places in these NMA comments on NRC's SARI efforts.

c. DSI 5: Low-Level Waste

Question: What should be the role and scope of the NRC's low-level radioactive waste program?

The DSI paper poses six options as follows:

Option 1: Assume a greater leadership role;

Option 2: Assume a strong regulatory role in the National LLW program;

Option 3: Retain the current program;

Option 4: Recognize progress and reduce the program;

Option 5: Transfer the LLW program to EPA; and

Option 6: Accept "assured" long-term storage.

The Commission's preliminary views favor Option 2.

NRC has traditionally had a policy favoring disposal and discouraging long-term storage as a method of managing LLW. NMA concurs with this policy assuming that sound and cost-effective disposal alternatives are available. If such alternatives are not available then storage becomes a necessity for some period of time but long-term (i.e., permanent) storage should never become the goal both because of potential health and safety concerns and potential ongoing contingent liability concerns of licensees.

Option 6 ("assured" long-term storage) is a somewhat confusing concept. It raises questions of "perpetual" licensing that conflict with traditional assumptions regarding appropriate reliance on "institutional/active" controls. It could also cloud the issue of whether on-site disposal is a viable option and it appears to conflict directly with the assumptions underlying NRC's final regulations governing the "timeliness" of decommissioning. (59 Fed. Reg. 36026, July 15, 1994). (See also NEI Petition for rulemaking; 61 Fed. Reg. 43,193, August 21, 1996). Finally, it raises the obvious question that if "assured" storage is somehow different than long-term storage, how then is it different than disposal?

NMA believes that NRC needs to maintain a strong presence in the LLW field for a variety of reasons. First, as noted in its comments on DSI 4, NMA believes it is unlikely that any (or at best more than a few) Agreement states can bring to bear the necessary resources and expertise to maintain a sound, national quality program to address the many complex regulatory issues that are inherent in LLW disposal activities. As noted, NRC has done a significant amount of performance assessment work since the 1970's that should continue if LLW waste disposal practices are ever going to satisfy the concerns of the general public. Second, both NRC and Agreement State practices will have inevitable effects on uranium recovery licensee disposal practices and vice-versa and, finally, concerns about LLW disposal would only intensify greatly if NRC were to become DOE's external regulator.

If NRC were to withdraw from the field the resulting vacuum would almost inevitably be filled by EPA and not the Agreement States. NMA does not believe that EPA possesses the necessary experience and hands on expertise to handle such a program. NRC already has effective LLW disposal regulations in place that were developed in a major rulemaking proceeding involving all of the major stakeholders including DOE, EPA, Agreement States, industry and the general public. It makes no sense to abandon an existing program that is sound. Rather it makes more sense to aggressively address some of the LLW and related waste disposal issues (e.g., mixed waste, use of uranium mill tailings facilities for disposal of non-11e.(2) byproduct material and/or NORM, potential groundwater contamination issues, federal or state site ownership requirements, restricted use and on-site disposal) to find ways to resolve them with the Agreement States, DOE, EPA and the general public through Agency agreements or where necessary targeted regulatory or legislative changes.

NRC needs to take an active role in the continuing development of probabilistic and deterministic risk-informed, performance-based regulatory approaches to LLW disposal. In this regard, NRC and EPA have proposed radiological decommissioning criteria (15 mrem/y) to be effective for 1,000 years based on the cleanup of residual radioactive contamination and site use controls such as deed restrictions and zoning. The proposed 15 mrem/y limit is not a risk-informed regulatory limit. Additionally, these proposals ignore traditional assumptions regarding the reliability of institutional controls (even where government ownership is required), do not adequately consider the possibility of federal ownership of sites under §§ 151(b) and (c) of the Nuclear Waste Policy Act (NWPA) and leave unclear the credit for and undeniable benefits of engineered barriers and "waste form" requirements. As such, the NRC and EPA decommissioning proposals simplistically address the clean-up of residual radioactive contamination and arbitrarily ignore the "real world" implications that the proposals have for existing LLW disposal requirements and the potential impacts on existing and future LLW disposal capacity. NRC needs to work with its federal and state counterparts to encourage a coherent national approach to these issues and to explain to the general public how public health and safety is properly protected in the process.

d. DSI 9: Decommissioning -- Non-Reactor Facilities

Question: What should be NRC's strategy to take advantage of new and different approaches to optimize site remediation of the site decommissioning management plan and other problem sites?

The DSI paper poses nine options as follows:

Option 1: Continue the existing program;

Option 2: Change the decommissioning review process;

Option 3: Change residual contamination criteria and review scenarios;

Option 4: Adopt EPA's Superfund approach;

Option 5: Regulate source material consistently with naturally occurring and accelerator produced radioactive materials (NARM);

Option 6: Focus on decommissioning cases in which progress can be made; transfer stalled sites to the EPA's Superfund program;

Option 7: Take an aggressive position to develop regulatory frameworks for lower cost decommissioning waste disposal options;

Option 8: Develop a strong litigation strategy; and

Option 9: Seek Superfund authority.

The Commission's preliminary views favor a combination of options, including Option 2, Option 6, Option 7 and Option 8.

In combination, these options would place appropriate responsibility on licensees to remediate their sites while giving NRC appropriate tools to deal with problem sites and licensees. The Commission suggests that pilot projects be used to test implementation of Option 2 and with regard to Option 6, believes that, consistent with DSI 12, the staff should examine a level of risk associated with each site. Thus, the NRC would focus on the higher risk sites where progress is being made and place lesser emphasis on lower risk sites, while considering the feasibility of transferring the low risk, stalled sites to EPA's Superfund program on a case-by-case basis.

With respect to Option 1, NMA believes that continuing the existing SDMP program is a reasonably viable option. It represents a comprehensive effort to address decommissioning problems on a site-specific basis, the only way in which such problems can be addressed meaningfully. The entire SDMP program, however, raises one major concern that ultimately led to the

"back fit" rule in the reactor sector and which has been called the "movable regulatory goal post" or in the Superfund context the "reopener." There is an ongoing concern as represented by the SDMP program, that one may never be able to finally decommission a site and terminate a license because some GAO report or EPA initiative will cause NRC to reopen decommissioning decisions. There must be some finality to these decisions. Barring some clearly identified imminent and significant threat to public health and safety, NRC cannot continue to reopen decommissioning decisions merely because policies or standards change at a later date. Accordingly, since throughout this strategic assessment document, materials licensee sites are routinely referred to as *low risk* sites, it would appear highly unlikely, absent extraordinary circumstances, that reopeners could be justified for such sites.

Option 2, at least with respect to the materials licensee sector, including uranium recovery licensees, likely would not be acceptable. Given the problem noted above with respect to the SDMP program, and given the experience of all NMA member company uranium recovery licensees with regulators, it is highly unlikely that licensees would proceed to develop decommissioning programs and to implement them without some NRC blessing. The potential for expending enormous resources and then having to "begin all over again" as a result of the Agency changing its view is simply too large a risk to accept. Additionally, the potential for continuing contingent liability unabated by a "blessed" closure plan is not something that most licensees would like to have hanging over them after license termination. Therefore, NMA members would expect and require NRC's "blessing" which finally will be demonstrated by termination of their licenses.

With respect to Option 3, NMA heartily agrees that NRC should modify its proposed residual contamination criteria in a number of respects including an exclusion for "uranium recovery facilities" as opposed to just uranium mill tailings facilities and a 500 mrem/y intruder dose associated with a failure of institutional controls at a "restricted use" site. NRC also should allow more realistic and less conservative dose assessment scenarios and it should not finalize its proposed 15 mrem/y annual dose limit. The 15 mrem/y dose limit is not "risk-informed" in any way. It is unreasonable because of implementation difficulties, because it represents a tiny fraction of annual average natural background exposure, and because NRC (and for that matter, EPA as well) has no evidence suggesting that members of the public are likely to receive multiple exposures from nuclear fuel cycle facilities (including decommissioned sites) the cumulative impact of which likely would exceed the 100 mrem/y per year annual dose limit. NMA recognizes that EPA has the authority to effectively force NRC to adopt a 15 mrem/y dose under its authority to set "generally applicable standards" under the Reorganization Plan #3 of 1970, however, it is up to NRC, perhaps with DOE as an ally, to forcefully argue within the higher councils of government for a realistic residual radiation limit.

NMA's view of Option 4 is that it would be absurd to adopt EPA's approach for site closure at sites involving radioactive contamination. Both EPA and NRC have developed extensive regulatory standards covering operations and decommissioning of uranium recovery facilities through a decade of rulemaking and judicial activities. NRC has developed and Agreement States are implementing the requirements of 10 C.F.R. Part 61 for regulation of low-level radioactive waste disposal facilities. NRC has vigorously opposed EPA proposing additional criteria for low-level waste sites. The standards for control of chemical contaminants are different and

and in many instances inconsistent with those for uranium recovery and low-level waste disposal facilities. [See Thompson/Goo, Attachment A].

With respect to Option 5, NMA categorically opposes the transfer of regulatory authority over source material to EPA and to the states. Again, with NRC having developed extensive regulatory programs over decades, and having the expertise and experience to manage a national level program for control of source material, it would make no sense to transfer jurisdiction over those materials from NRC to EPA, states or any other agency. If anything, it might make sense to modify the AEA to provide NRC with the authority to regulate *discreet* NARM as opposed to diffuse NORM, which is a component of NARM.

With respect to Option 6, NMA cautions NRC that it may not be a wise precedent to regularly transfer or attempt to transfer stalled decommissioning cases to EPA's Superfund program. At present, it is EPA's policy to not put NRC licensed sites on the National Priorities List (NPL). To the extent that NRC regularly seeks to have sites under its jurisdiction placed on the NPL list, it may erode the basis for EPA's current policy. In the end, it could lead to any and all NRC regulated sites, including reactor sites, becoming more readily subject to Superfund. This would pose an entirely unattractive alternative to reactor licensees and could lead to NRC becoming a somewhat useless governmental appendage over the long term. If absolutely necessary, NRC should seek to transfer sites only in situations where there are *no* funds available for site closure. A better alternative in such cases would be for NRC to seek to obtain funds from Congress to supervise closure of such sites. Solving the problem of lack of funding should be addressed directly with Congress rather than by conceding authority given to NRC by the AEA.

NMA supports the basic concept which underlies Option 7 which is to allow licensees to propose alternatives for final decommissioning of sites based on site specific circumstances. NMA will address some of the specifics associated with the discussion of Option 7 hereinafter.

With respect to Option 8, NMA is somewhat confused by NRC's discussion of this option. To the extent that NRC is suggesting that it can (or should) modify its basic regulatory approach (i.e., the so called "audit" approach), wherein it can react swiftly to imminent and acute threats to public health and safety, but otherwise must rely on the primary responsibility of the licensee to protect public health and safety, NMA would object. The NRC regulatory process, which has been in place for many years and applicable to a broad spectrum of licensees, is generally speaking more risk-informed and performance-based than that of most of its sister agencies, particularly that of EPA. NMA would object to any basic change in the NRC's regulatory posture. NMA would not object to NRC developing policies and guidance, or rules with the involvement of the regulated community, to address potential concerns about licensee bankruptcy, surety or other nonperformance issues to avoid situations in which the capability to decommission sites is dissipated actively or passively by a licensee.

With respect to Option 9, NMA does not believe that Congress is likely to give NRC Superfund authority in the same fashion as it has been so unwisely doled out such authority to EPA. However, as noted above, NRC may be able to make a case at some point in time for amendments to the AEA to allow NRC to request appropriated funds for decommissioning of some sites where there simply is no licensee or no licensee resources for site closure. It is presumed

that in virtually every case the risk to public health and safety would not be imminent or NRC would have moved to take some form of protective action.

As noted above, DSI 9 begins with an introduction and summary of Commission views. Included in the summary is the following statement:

> In decommissioning non-reactor facilities, NRC must balance the need to proceed expeditiously to provide assurance of long-term protection of public health and safety against the need to cost-effectively use its resources and, as appropriate, those of the licensees.

NMA takes exception to the above statement because it represents an inappropriate regulatory posture. This can be highlighted by asking the following question: When is it appropriate for the NRC to waste the resources of a licensee? NMA would expect that there may be times when NRC staff and a licensee disagree about the use of resources, however, arbitrarily and capriciously forcing a licensee to waste its resources is unacceptable regulatory action. In terms of licensees authorized to possess and dispose of byproduct material, Section 84a.(1) of the AEA, as amended, states:

> 84a. The Commission shall insure that the management of any byproduct material, as defined in section 11e.(2), is carried out in such a manner as (1) the Commission deems appropriate to protect the public health and safety and the environment from radiological and nonradiological hazards associated with the processing and with the possession and transfer of such material taking into account the risk to public health, safety, and the environment, <u>with due consideration of the economic costs</u> . . . (emphasis added).

NMA, therefore, recommends that the summary statement be amended as follows:

> In decommissioning non-reactor facilities, NRC must balance the need to proceed expeditiously to provide assurance of long-term

> protection of public health and safety against the need to cost-effectively use its resources, with due consideration of the economic cost to licensees.

NRC notes (DSI at p7) that where non-radioactive hazardous or solid wastes are involved, remediation time tables and options are sometimes dictated by state or EPA requirements. "Because non-radioactive hazardous and solid wastes requirements are based on somewhat different objectives and requirements, differences have resulted in project delays because of the use of schedules and administrative processes mandated by EPA requirements and technical provisions that placed additional conditions on licensees." Id. As NMA noted above, the differences in the approach to disposal of hazardous and solid waste versus low-level radioactive waste and uranium mill tailings, are significant and NRC needs to take a far more aggressive posture on these issues. The conflicts between the two systems have led to a virtual dead-lock in the disposal of mixed waste that is unnecessary and extremely costly. [See Thompson/Goo, Attachment A]. Additionally, the NRC's position with respect to non-Agreement State authority over the non-radioactive constituents in 11e.(2) byproduct material, poses the potential or developing a similar "mixed waste conundrum" for uranium recovery licenses. NMA is requesting, as part of these comments on NRC's strategic assessment, a reconsideration of a variety of regulatory issues and decisions effecting uranium recovery licensees on a strategic basis. Again, NMA is making this request for Commission consideration as a placeholding component of its comments in this proceeding.

NRC also notes (DSI at p.8) that in general, Agreement States use similar decommissioning criteria as NRC, but several have terminated licenses using deed or other zoning restrictions. It is also true that NRC has allowed the waiver by a state of one of the basic components of its 10

C.F.R. Part 61 regulations (the requirement for state or federal government ownership of low-level waste disposal sites) without a thorough examination of whether this precedent strikes at one of the fundamental underpinnings of the 10 C.F.R. Part 61 regulations. [See Umetco Minerals Corporation's comments to NRC's advanced notice of proposed rulemaking (ANPR) on land ownership requirements for low-level radioactive waste (LLW) sites, Attachment B]. For example, NMA believes that with respect to NRC's and EPA's proposed decommissioning regulations where complex sites are involved , the requirement to assure that no individual receives more than 15 mrem/y for 1,000 years based on institutional controls such as deed restrictions and zoning restrictions is fatuous.

Although the proposed rule does not purport to require (or proscribe) the use of any particular type of institutional control to achieve the 15 mrem/y or 100 mrem/y default standards, NRC does provide the following examples of possible controls: deed restrictions on future use, such as restrictive covenants, equitable servitudes and easements, land use regulation through zoning, deed notices, government ownership of property, trustee arrangements, other restrictions such as site-access restrictions, soil-excavations, and groundwater use restrictions, and cooperative agreements. (NUREG-1496, p. F-1.) In any event, as noted above, the proposed 100 mrem/y default standard should be changed to a 500 mrem/y default standard.

Some of these institutional controls are inherently speculative and clearly inadequate to provide the long term assurance of control and maintenance required for a "restricted use" site. For example, zoning restrictions can be easily modified by the local zoning authority (or the state legislature), meaning that zoning restrictions lack the durability needed to assure long-term

control over restricted use sites. Moreover, the zoning process is highly susceptible to political and economic pressures that may be completely divorced from any concerns for radiological safety. As one commentator has noted, "[t]he essence of modern zoning is the pervasive sacrifice of permanent property rights to transient property values." (James Bovard, "Lost Rights" as quoted by The Washington Times, June 11, 1994, p. D3.) These factors combine to make zoning particularly ill-suited for controlling the use of a site to provide long-term protection against possible exposure to radioactive materials.

Other types of controls discussed by NRC, in particular, equitable servitudes and easements, are facially more appealing and were viewed favorably by NRC. However, these two mechanisms also have substantial limitations. Broadly speaking, both of these mechanisms lack consistency and predictability. For example, the types of controls that can be imposed through an equitable servitude or easement, the mechanics of imposing a particular restriction, and the enforceability of restrictions imposed through these devices will vary from one jurisdiction to the next. In addition, the meaning and scope of a particular restriction imposed through an easement or servitude will depend entirely upon the intent of the drafters of the relevant property documents and on the local courts that interpret those types of documents.

At a more fundamental level, equitable servitudes and easements are inappropriate for assuring long-term control over restricted use sites because they permit, and in fact contemplate, that site ownership will remain in private hands following decommissioning. However, private ownership or restricted use sites is inherently unstable, particularly when compared with the option of government ownership.

Among other things, private ownership means that restricted use sites are owned by entities that are motivated by economic concerns and subject to economic pressures, which may at times conflict with concerns for long-term radiological safety. Moreover, in a system of private ownership, the same entities that own a decommissioned site will also be in a position to undermine the restrictions on site use imposed by these institutional controls. (For example, a state government might be lobbied to assume ownership of a site through exercise of its eminent domain powers, which could have the effect of nullifying any restrictions contained in an equitable servitude.)

In addition, there can be no assurance that the owner of a restricted use site will remain in existence over the extended time frame required for the control of the site. For example, NRC has not fully evaluated how the durability and enforceability of these institutional controls would be effected if a site owner declares bankruptcy. It is conceivable, and perhaps even likely, that a trustee in bankruptcy would not want to retain the restricted use site. NRC has not addressed the consequences of this scenario, and the possibility that the property in question might revert to the state -- which might not be bound by an equitable servitude, or which, as the beneficiary of an easement, might be in a position to terminate the easement.

Finally, private ownership has the potential to complicate enforcement of applicable site restrictions. To enforce a use restriction, the government would be required to bring suit against the private owner -- who could be expected to resist such an enforcement attempt. Indeed, NRC states that "[w]hatever type of [institutional] controls are proposed by the licensee, the licensee must demonstrate that the controls proposed have a reasonable expectation of enforcement." (59

Fed. Reg. at 43,225.) In light of the above discussion, how could a licensee comply with such a requirement? How could a licensee demonstrate that the likelihood of enforcement for 1,000 years is not "speculative" when the ultimate decision will be in the hands of an unknown federal, state or local judge?

Most, if not all, of these uncertainties about the "permanency of restriction" would be eliminated to the maximum extent practicable if the federal government were to assume ownership of restricted use sites following decommissioning. Under this scenario, the government would exercise direct control over the use of the site. Clearly, the federal government would be immune from the types of profit and loss motives that animate private owners, and that have the potential to conflict with concerns over the long-term control of exposure to radioactive materials from the site. Moreover, government ownership would provide a more durable and stable mechanism for control than could be achieved with shorter-lived private entities. For example, there would be no concerns over whether the actions of a trustee in bankruptcy would be compatible with the long-term controls required for restricted use sites. In addition, government ownership would largely eliminate potential difficulties pertaining to enforcement of the use restrictions against third parties, since the government would be the owner of the site in question.

Accordingly, NMA believes that the most effective and most appropriate mechanism for imposing long-term controls over restricted use sites (particularly those candidates for on-site disposal and/or indefinite licenses) would be for the federal government to be able to assume ownership of these sites following decommissioning. NRC should consider a mechanism similar to that already in place for government ownership of low level waste disposal sites under the

NWPA of 1982. (42 U.S.C. § 10,101 et seq.) Under Section 151 of this Act, the government is authorized to take ownership of a site after the licensee has met NRC's requirements for site closure and if the Commission determines that "federal ownership and management of the site is necessary or desirable in order to protect the public health and safety, and the environment" (42 U.S. § 10,171(b).) Land and waste acquired by the government must be maintained so as "to protect the public health and safety, and the environment." Id. NRC should consider seeking an interpretation of this legislation that would enable DOE to take title to decommissioned sites that are to be released for restricted use.

NRC acknowledges that "[g]overnmental ownership provides for ultimate controls over the use of land [for restricted use sites];" however, the Commission concludes that this option is too expensive -- presumably because of maintenance costs and potential the liability for off-site damages. (NUREG-1496, Vol. II, pp. F.15, F.17.) NMA disagrees with NRC's conclusion that government ownership of restricted use sites is "too expensive." In the first place, the proposed regulations would require the licensee to provide adequate financial assurance to enable a third party to "assume and carry out responsibilities for any necessary control and maintenance of the site." (59 Fed. Reg. at 43,229) These financial assurances should be adequate to address most if not all of the costs of site ownership that NRC contends are "too expensive." Thus, there is simply no support for NRC's conclusion that federal ownership of restricted use sites would be too expensive to implement.

It would be arbitrary for the Commission to dismiss this option without thorough analysis and adequate support in the record.

As another threshold matter, NRC should clarify that "passive," "engineering" controls as well as institutional controls should be permitted to be used to achieve the 15 mrem/y standard (and the default standard) for "restricted use" sites. As currently drafted, the proposed rule is ambiguous on this point.

For example, in addressing the 15 mrem/y standard, the proposed rule focuses solely on institutional controls, stating that a licensee seeking release of a site for restricted use must provide for "institutional controls that provide reasonable assurance that the [15 mrem/y limit will be achieved];" and that "[i]nstitutional controls must be enforceable by a responsible government entity or in a court of law." (59 Fed. Reg. 43,229 (emphasis added) Similarly, in the context of the 100 mrem/y default standard, the proposed regulations focus on institutional controls (or the breakdown of those controls), addressing passive engineering controls only in exclusionary terms. Specifically, the regulations would provide that residual radioactivity must be:

> reduced so that if the institutional controls were no longer in effect, there is a reasonable assurance that the [100 mrem/y limit will be achieved]. Calculations used to show compliance with this provision may not assume any benefits from earthen cover or other earthen barriers unless specifically authorized by the Commission. (59 Fed. Reg. at 43,230)

Despite this language in the proposed rule, there is some question whether NRC intended to exclude engineering controls when considering whether the 15 mrem/y and default standards for restricted use have been satisfied. First, in the preamble discussion of the restricted release provision, the Commission explains that one criterion that must be satisfied before a site can be released for restricted use is that "[t]here are adequate provisions for institutional and/or other passive controls to provide reasonable assurance that the [15 mrem/y standard will be met]." (59

Fed. at 43,220 (emphasis added). See NUREG-1500, p. E-2.) The clear implication of this language is that passive engineering controls may be used in addition to institutional controls in order to achieve the 15 mrem/y standard. Similarly, the language in the proposed rule that excludes the use of earthen barriers to achieve the default standard suggests, albeit by negative inference, that passive engineering controls other than the use of earthen barriers can be used to attain the default standard without the specific authorization of the Commission (and that earthen barriers can be used, with NRC's consent).

Moreover, it would be inappropriate and inconsistent for the Commission to exclude passive engineering controls in assessing whether a site satisfies the 15 mrem/y and default limits (or whatever final limit(s) might be established) for restricted use. In other contexts where NRC and EPA have sought to limit potential long term exposure to radioactive materials, both agencies have relied upon a mix of institutional controls and passive engineering controls. For example, the regulatory programs set out at 10 C.F.R. Parts 40 and 61 rely upon passive engineering controls to minimize potential long term exposure to radioactive materials. Implicit in both of these programs is the assumption that institutional controls alone, even government ownership of a site -- arguably the single most reliable and effective type of institutional control -- is inadequate to provide the requisite long term protection from potential public exposure.

Finally, NRC has not articulated any rationale for abandoning the use of passive engineering controls as a means of achieving the 15 mrem/y or the default standard for restricted use sites, and it would be arbitrary for the Commission to take that position in the final rule.

Despite NRC's intention to the contrary, many complex sites may become "de facto disposal sites because large volumes of waste will be generated as sites try to comply with the criteria." (59 Fed. Reg. at 43,215.) NRC does not consider the generation of large volume waste disposal issue in any depth except to note that "decommissioning to radiation levels approaching background may produce large volumes of low-level waste which could affect the availability of regional disposal capacity." (59 Reg. at 43,210.) Presumably, NRC did not evaluate this issue realistically because any such analysis would have to consider that there is not now, and is not likely to be in the near future, sufficient disposal capacity for any significant quantity of such wastes. NRC's generic analyses then would have to confront directly one of the numerous problems raised by setting a standard at the low end of the variations of natural background. Before these criteria are finalized, NRC must find real world solutions to the waste disposal problems created by the 15 mrem/y limit.

As noted, one solution is on-site disposal for sites with large volumes of low-level radioactive waste. Assuming the appropriate restrictions, passive and institutional, are in place and access to the site limited, on-site disposal may be the most viable means of protecting the public health and the environment. Such a scenario is particularly true where the risks and costs to the public and those involved in the removal and transportation activities of moving the contaminated material off-site outweigh the benefits to the public health and the environment.

Therefore, as discussed above, NMA suggests that Sections 151(b) and (c) of the NWPA or similar amendments to the AEA should be the focus of NRC and other federal agency activity with respect to assuring government ownership of complex sites where "restricted use" and on-

site disposal is expected. The provisions of the NWPA and the similar provisions of UMTRCA that respectively allow or require government ownership of such sites make entirely too much sense to be ignored. If the basic assumptions underlying the development of uranium mill tailings and low-level waste regulations are that institutional controls, including those of the federal government, cannot be relied upon for periods in excess of 100 years, then relying on deed restrictions and zoning restrictions is flimsy at best. Thus, either the fundamental assumptions need to be changed or looking to NWPA and UMTRCA precedent seems logical. It is time to recognize that restricted use (which may include on-site disposal areas) of major portions of large, complex commercial licensee facilities that have wide ranging contamination, as well as major portions of federal DOE facilities similarly contaminated, is a reasonable, cost-effective component of controls necessary to protect public health and safety. And, if there truly is concern about long term protection of public health associated with on-site disposal at such sites, then federal or perhaps state ownership makes the most sense.

NMA also notes that a very important open issue with EPA at materials licensee sites, including uranium recovery facilities, is groundwater protection. There is an extensive regulatory program under UMTRCA, based on EPA regulations to which NRC has conformed its 10 C.F.R. Part 40, Appendix A criteria, that addresses groundwater protection at uranium recovery sites. At a recent Commission briefing by the Uranium Recovery Branch staff, Chairman Jackson asked whether or not the uranium recovery staff's experience with groundwater protection and control issues could be relevant "to other parts of our program?" The staff acknowledged that it could and NMA agrees. The Title I and Title II uranium mill tailings programs have developed, and are continuing to develop, a great deal of experience with respect to addressing groundwater

protection issues including the use of "alternative concentration limits (ACLs)," "supplemental standards," and possibly other alternatives that give regulators and licensees significant flexibility in addressing what are likely to be the most problematic issues associated with site decommissioning at complex materials licensee sites. In keeping with the importance of groundwater issues, as noted above, NMA is requesting as part of a requested strategic review of a variety of uranium recovery licensee related issues, that NRC reconsider its policy to allow non-Agreement States co-regulatory authority over the non-radiological components of 11e.(2) by-product material.

NRC raises several subsumed issues for comment and discussion.

Subsumed Issue No. 1. What is the optimum rate of removal of sites from the SDMP?

The optimum removal rate is that rate which *finally* removes sites from the list in a cost-effective manner. Since there is no imminent hazard associated with virtually any of these sites, it is far better to take whatever time is necessary within reason to close such sites once and for all, than it is to develop some artificial "optimum rate" of removal.

Subsumed Issue No. 2. What is the best strategy to implement NRC's non-reactor decommissioning regulations?

NMA notes that NRC has promulgated timeliness in decommissioning regulations which ostensibly are designed to provide NRC the enforcement authority to promote and to alert licensees to the necessity to promote site decommissioning. NMA has noted in its settlement of

litigation with NRC and in its comments on NEI's petition for rulemaking that the timeliness in decommissioning regulations are unrealistic. They do not provide for "standby authority" for licensees who demonstrate through maintenance of appropriate surety and fulfillment of license requirements that they are adequately protecting public health and safety and that their operations are in the public interest. The concept of "assured storage" discussed in DSI 5 for Low-Level Wastes seems to raise the possibility (which also is discussed in NRC's proposed decommissioning regulations) of *perpetual licensing*, which is antithetical to the concept of aggressively using legal tools to promote prompt decommissioning. Thus, NRC has muddied the waters considerably as a result of its proposed decommissioning regulations versus the discussion in other portions of the SARI. As noted above, NMA would agree that developing tools to enable NRC to move quickly in the event of a "midnight dumper," or if a licensee to plans to "leave the keys in the mailbox" and jump ship, would be appropriate as long as there is adequate stakeholder involvement from the very beginning of the "scoping " process to develop such tools. This could include a reconsideration of the surety requirements, including ways to protect unused surety funds from bankruptcy proceedings, which may assist licensees in getting more reasonably priced surety arrangements.

<u>Subsumed Issue No. 3</u>. What is the best strategy for dealing with unlicensed possessors of licensable material?

It is NMA's understanding that NRC, (witness the SDMP program), asserts that it has the authority under the AEA to proceed against former licensees to require them to re-open sites or to complete decommissioning if left incomplete in some fashion. NMA again raises the concern

regarding the "movable goal post" which denies finality to the decommissioning process. With respect to property that is contaminated based on legal releases, NMA would assume that such releases would be essentially an anomaly and may no longer be subject to the authority of the NRC under the AEA. With respect to contamination of an innocent party's property by the illegal act of a former licensee, the NRC should certainly proceed against such licensee, however, if the licensee cannot be determined, it should be the responsibility of the federal or state government to clean up the site and not that of the innocent land owner.

Subsumed Issue No. 4. How can NRC assure the bankrupt or non-viable corporations appropriate use their assets to complete site remediations?

NRC cannot assure that bankrupt or non-viable corporations will appropriately utilize their assets to complete site remediation. NRC can, as noted above, consider modifying the provisions of the standby trusts and reevaluate its surety requirements to provide that surety funds are placed in a trust that is protected from bankruptcy proceedings. This would protect surety funds from being used for other purposes than site closure, and to the extent that funds left over from forfeiture of a surety instrument are returnable to the surety and are not subject to bankruptcy proceedings, it should improve the basis upon which licensees can get surety arrangements.

The other prime means by which NRC can assure that nonviable and bankrupt operations can achieve closure of sites is to provide those responsible whether it be a trustee or the "non-viable corporation" with the utmost flexibility to propose alternatives for site closure. NRC and Agreement States will have to be realistic with respect to what can be done with resources

available, and particularly in view of the low-level risk that is associated with a large number of materials licensee sites, including uranium recovery facilities. An example of NRC taking a flexible approach, can be seen in the context of the NRC's treatment of the State of Wyoming's efforts to decommission the formerly operated American Nuclear uranium mill tailings facility in Wyoming.

Subsumed Issue No. 5. How much flexibility should be given to licensees who want to propose alternative approaches for complying with decommissioning regulations?

NMA has noted above that much that has been learned in conjunction with the development, and more recently the application, of the uranium recovery decommissioning and reclamation regulations is relevant to other types of materials licensee decommissioning decisions. Experience at closing Title I and Title II sites indicates that flexibility is one of the most critical elements of licensee and NRC efforts to finally close sites. Section 84(c) of the AEA, as amended by UMTRCA, explicitly provides licensees with the authority to propose alternatives to requirements of the Commission, based on site-specific considerations such as local or regional conditions, including geology, topography, hydrology and meteorology, as long as the alternatives will provide essentially equivalent protection of public health and the environment. The provisions of 10 C.F.R. Part 40 Appendix A similarly provide for flexibility and licensee alternatives as follows:

> In many cases, flexibility is provided in the criteria to allow achieving an optimum tailings disposal program on a site-specific basis...Licensees or applicants may propose alternatives to the specific requirements in this appendix. The alternative proposals may take into account local or regional conditions, including geology, topography, hydrology and meteorology.

> Moreover, the Commission acknowledges that in making a licensing decision based upon the criteria set out in the Appendix (or based upon alternatives proposed by the licensee), it is appropriate for the Commission to consider economic costs as well as impacts on health, safety and the environment.
>
> All site specific licensing decisions based on the criteria in this Appendix or alternatives proposed by licensees or applicants will take into account the risk to the public health and safety and the environment with due consideration to the economic costs involved and any other factors the Commission determines to be appropriate. (10 C.F.R. Part 40, Appendix A)

As noted above, with respect to groundwater contamination and protection issues, the flexibility provided under the provisions of Appendix A which conform to EPA requirements is critical, particularly, where a licensee may be looking at on-site disposal which may be the only cost-effective means of decommissioning a complex materials site. Licensees should be able to seek to utilize ACLs, supplemental standards, some mix of the two, and perhaps other alternatives. Therefore, NMA urges NRC to consider modifying its rules or developing policy guidance for other materials licensees that would permit them to apply for ACLs, supplemental standards and other alternatives that the licensee can demonstrate provide an equivalent level of protection. This means either NRC must propose regulatory changes or change its current posture with respect to allowing exceptions and exemptions to the rules. If there is to be risk-informed, performance-based decommissioning, then this kind of flexibility is critical.

With respect to NRC (and EPA's) current proposed decommissioning standards, to the extent that they are relevant to the uranium recovery facilities, NMA urges that they be reconsidered. The facilities, as NRC acknowledges, essentially will not address decommissioning of complex sites. Thus, the Agency is in the position of proposing regulations which will be

effective for ninety to ninety-five percent of the sites that pose five to ten percent of the potential risk and totally inappropriate and ineffective with respect to those five to ten percent of the sites that pose ninety to ninety-five to ninety percent of the potential risk. That alone should raise a question about a usefulness of the current proposal. The Advisory Committee on Nuclear Waste (ACNW) has questioned the 15 mrem/y limit (as did AMC, now NMA) in its comments. NMA recommends a change in the proposed criteria. A good starting place would be to allow for a 500 mrem/y intruder dose at "restricted use" sites rather than the currently proposed default value of 100 mrem/y or EPA's proposed 75 mrem/y. To the extent that the standard is to be based on apportioning the 100 mrem/y annual dose limit for members of the general public, it should consider a more reasonable division of that dose limit based on some affirmative evidence, or at a minimum reasonable assumptions, regarding the likely exposure of members of the public to multiple nuclear facilities. Perhaps, as the ACNW suggests, the limit ought to be on the order of one-quarter or one-third of the 100 mrem/y dose. This would be reasonably compatible with the current 10 C.F.R. Part 61 public exposure limit. NRC should consider and discuss with sister agencies the applicability of sections 151(b) and (c) of the NWPA to provide satisfactory institutional controls through federal government ownership of some of the complex existing sites.

With respect to whether or not uranium mill tailings facilities can be utilized to dispose of some similar types of radiological wastes, NMA has noted this issue is a placeholder that should be part of a strategic reassessment of uranium recovery issues. Criterion No. 2 of Appendix A to 10 C.F.R. Part 40 suggests that it is NRC's policy not to encourage multiple disposal sites, and given the difficulties associated with permitting new sites, it only makes sense to utilize existing facilities which are subject to a comprehensive regulatory program such as that applicable to

uranium recovery facilities. This program involves NRC regulation not only of the radiological components of such facilities but also the non-radiological and components as well.

e. DSI 12: Risk-Informed, Performance-Based Regulation

Question: What criteria should NRC use in expanding the scope in applying a risk-informed, performance-based approach to rulemaking, licensing, inspection, and enforcement?

The DSI paper proposes four options as follows:

Option 1: Continue the current process;

Option 2: More rigorously assess the relationship to public health and safety;

Option 3: Perform a comprehensive assessment of NRC regulatory approaches; and

Option 4: Consider risk-informed, performance-based approaches/primarily in response to stakeholder initiatives.

The Commission's preliminary views favor Option 1, to continue current efforts in cooperation with industry (including pilot programs) and particularly in the context of the Agency's Probabilistic Risk Assessment (PRA) Implementation Plan. With regard to enhancing the PRA Implementation Plan, the Commission would direct the staff to move towards implementing elements of Option 3. In particular, the staff should perform a thorough review of the basis for nuclear materials regulations and process, and should identify and prioritize those areas that are either now, or can be made, with minimal additional effort/resources, amenable to a risk-informed, performance-based approach.

NMA agrees with the proposed preliminary approach and, in keeping with Option 4, specifically requests that the Commission consider NMA's proposal set forth in its comments on

DSI 13 to perform a comprehensive reevaluation of a variety of NRC regulatory decisions related to uranium recovery licensees with risk-informed, performance-based regulation as a component thereof.

NMA notes that statutory and regulatory provisions applicable to uranium recovery licensees (e.g., decommissioning of uranium recovery facilities to provide assurance of compliance with regulatory limits for radon emissions and groundwater impacts for 200-1,000 years primarily through "passive" rather than "active/institutional" controls) necessarily implicate the use of PRA in conjunction with deterministic and performance-based approaches to provide the necessary, "reasonable assurance" of defense-in-depth protection of public health and safety that is required. Radiological and nonradiological (e.g., seismicity, PMP/PMF, actuarial risks of reclamation, potential nonradiological groundwater contamination) risk assessment are already necessary components of evaluating new license applications and final decommissioning plans for uranium recovery licenses. [See "Risk/Cost Analysis: A Case Scenario in the Decommissioning of a Radiological Site," Article by Anthony J. Thompson and Douglas B. Chambers, attached hereto as Attachment C, and See Also, "Earthquake Hazards in the Intermountain U.S.: Issues Relevant to Uranium Mill Tailings Disposal," Article by Ivan G. Wong, Susan S. Olig, Bruce W. Hassinger and Richard E. Blubaugh, attached hereto as Attachment D.] It is also true that risk assessment in some measure has and will continue to drive enforcement decisions.

NRC has invested substantial resources since the mid-1970's in performance assessment methods for low-level and high-level waste disposal which are of necessity informed by PRA. 60 Fed. Reg. 42622, 42628 (August 16, 1995). Finally, if as ICRP has suggested, major

regulatory decisions such as those associated with final decommissioning of complex sites (particularly existing sites), "should do more good than harm" then risk-informed, performance-based decision making is an absolute necessity. (See, "1990 Recommendations of the International Commission on Radiological Protection, ICRP Publication 60 (1991), p. 28, 59; See Also Health Physics Society (HPS), "Scientific and Public Issues Committees Position Statement: Radiation Standards for Site Cleanup and Restoration (June, 1993) p. 7,9). In this regard, the NRC and EPA proposed decommissioning limit of 15 mrem/y is not a risk-informed regulatory limit. Neither is it performance-based in the sense that it may be difficult (and only at great expense), if not impossible, to determine compliance at complex sites involving significant soil or groundwater contamination with naturally-occurring radionuclides.

Thus, the suggestion on pages 21 and 23 that it is not apparent that nuclear materials licensees will benefit significantly from risk-informed, performance-based decisionmaking, at least with respect to NMA's uranium recovery facilities and materials licensees subject to the proposed decommissioning limit, simply is inaccurate. Although involving lower risk and less complexity than many reactor-related regulatory issues, materials licensees face many issues that allow for, and indeed often require, risk-informed, performance-based decisionmaking to provide the necessary flexibility to satisfy regulatory requirements.

A comprehensive initiative by NRC, as well as in response to stakeholder initiatives, to evaluate risk-informed, performance-based regulatory approaches will increase pressure on NRC to resolve dual regulation issues (e.g., risk harmonization, mixed waste, use of uranium mill tailings for non-11.e(2) byproduct material and diffuse NORM disposal), and to explain the

potential benefits and impacts through public communication efforts. NMA believes that NRC has both the responsibility and capability to do so. More efficient, cost-effective regulation that provides the necessary reasonable assurance of public health and safety will benefit all stakeholders.

f. DSI 13: The Role of Industry

Question: In performing its regulatory responsibilities, what consideration should NRC give to industry activities?

The DSI paper poses five options as follows:

Option 1: Continue the current program;

Option 2: Expand the role of industry;

Option 3: Increase accreditation and certification of licensee activities;

Option 4: Increase interaction with industry and professional groups, and

Options 5: Use a "designated industry representative."

The Commission's preliminary views favor Option 1, which is to continue to evaluate industry initiatives proposing further reliance on industry self regulatory activities as an alternative to NRC regulatory activities, on the basis of evaluation guidance to be developed by the staff describing process and decision criteria. Additionally, the NRC should increase interaction with industry groups, professional societies and technical institutes pursuant to Option 4. The Commission also thinks that Option 5 may have some potential where NRC oversight through inspection is infrequent.

On the one hand, the DSI paper suggests that NRC needs an overall policy "regarding the credit that should be given to industry activities that contribute to the achievement of necessary safety objectives." (DSI 13 at p.2) On the other hand, NRC notes that its recent enforcement policy expands credit to licenses that promptly identify and correct violations -- as it should! This raises the question of what is meant by the term "credit?" Credit in a specific enforcement context may be relatively easy to identify in both qualitative and quantitative terms. In addressing the broader question of how much reliance NRC can place on industry self-policing, the term credit may really mean "credibility." This will always be a difficult issue to address in light of the necessary tension between the prime objectives of the regulator as distinguished from those of the licensee. However, in the context of NRC's regulatory program, where the licensee has the primary responsibility to assure the protection of public health and safety and the NRC uses an "audit" approach to regulatory oversight, it should be more readily achievable than in some other regulatory contexts. Further, NMA believes it is a worthy goal that has led to and will in the future lead to more efficient and effective regulation. NMA believes that Option 1 with appropriate guidance, combined with Option 4, provide a platform for further progress.

NMA, however, heartily disagrees with the DSI paper's rather negative assessment of materials licensee industry groups' involvement (See DSI 13 at pp. 6,12,14; App. A, pp. 23-37) -- particularly, with respect to uranium recovery licensees. NMA has participated actively on behalf of its uranium recovery licensees in legislative, judicial and regulatory proceedings relating to its members for several decades. In that time, NMA and its licensee members have developed technical and regulatory expertise on relevant issues second to none, including that of NRC staff.

In keeping with its comments on DSI 14 (Public Communication Initiatives), NMA believes that the best way to establish credibility (on both sides of the regulatory equation) is to seek early and ongoing involvement on regulatory issues of generic importance with relevant industry groups like NMA. An ongoing dialogue that preserves the necessary dichotomy between the regulator and the licensee can contribute substantially to a mutual understanding of the critical issues and, thus, inevitably to more efficient and effective regulation in the public interest.

It is worth, noting in this regard, a number of success stories that are not reflected in the DSI paper. First, after NRC, over NMA's strenuous objections, closed the Uranium Recovery Field Office (URFO) in Denver, a collaborative effort developed between NMA on behalf of its members, some individual licensees, and NRC's Waste Management Division staff to minimize the inevitable delays and confusion caused by the loss of institutional memory at NRC as a result of URFO's closure and the obvious cost increases associated with dealing directly with NRC headquarters in the Washington, D.C. area. NRC formed a transition oversight team (TOT) that joined with NMA and others to attempt to make the new system work. As part of this effort, NMA suggested and ultimately co-sponsored with NRC a conference in Denver, Colorado in March, 1994 to introduce NRC's new uranium recovery staff to licensee and Agreement State personnel and issues, and vice-versa. This joint conference has been held each year since that initial effort and has attracted over 100 participants annually from the licensee community, NRC, Agreement States, DOE and EPA. There have been additional ongoing formal and informal meetings between NRC staff and NMA representatives which continue to address preexisting and "cutting edge" issues of regulatory concern. This process has stimulated creative efforts on the part of all involved that have resulted in, or will result in, reduced regulatory oversight where

appropriate. For example, the concept of performance based license conditions (PBLC's) was addressed and a policy to encourage them ultimately developed for uranium recovery licensees.

In another context, the Fuel Cycle Facilities Forum (FCFF), a materials licensee group, co-sponsored a "tabletop" exercise to assess the feasibility of compliance with NRC's proposed 15 mrem/y residual radioactivity standard for decommissioned sites. This excellent exercise demonstrated to NRC staff that, at complex sites with naturally occurring radionuclide contamination, compliance with the proposed limit may be essentially impossible and certainly extremely difficult without largely unwarranted costs for the benefit to be derived.

Thus, NMA, on behalf of its uranium recovery licensees, and other groups such as FCFF believe that they have participated effectively and aggressively with NRC to address cost-effective regulatory oversight. In that regard, NMA notes that a variety of NRC decisions regarding regulatory issues affecting uranium recovery operations under the AEA, as amended by UMTRCA, are leading to a series of complex and puzzling problems for uranium recovery licensees. These NRC decisions (e.g., NRC's assertion of jurisdiction over ISL wellfields, NRC's decision to afford non-Agreement States jurisdiction over the nonradiological component of 11e.(2) byproduct material, NRC's staff guidance on effluent disposal, NRC's policy guidance on placing non 11.e(2) byproduct material in uranium mill tailings pile, etc.) were made a differing times and for differing reasons without the benefit of a strategic overview. The result is that uranium recovery licensees are facing a bewildering, crazy-quilt of regulatory contradictions and inconsistencies in the uranium recovery program. NMA has proposed to NRC staff that NMA present a White Paper or petition to the Commission outlining these issues and their related problems with

a proposal that the Commission reevaluate its positions as part of a "strategic" reassessment of uranium recovery regulatory issues. NMA believes that it is entirely appropriate to note this proposal as a "placeholder" in its comments on NRC's overall strategic reassessment.

NMA will continue its dialogue with NRC and develop a timeframe for presenting such a proposal to the Commission. NMA, therefore, specifically requests that the Commission take note of this comment and provide an opportunity as a part of, or as an adjunct to, this proceeding to reconsider these critical issues for uranium recovery licensees.

g. DSI 14: Public Communications Initiatives

Question: What approach should NRC take to optimize its communication with the public?

The DSI paper poses three options as follows:

Option 1: Continue the existing approach;

Option 1(a): Focus on maximizing effectiveness and economy;

Option 2: Place a priority on early identification of public concerns and methods for public interaction; and

Option 3: Place a priority on expanding general public outreach.

The Commission's preliminary views favor Option 2 and Option 1(a).

NMA is of the view that all of the options are essentially subsumed in Option 1 which reflects a "maximum" dissemination of agency documentation to the public, timely and professional response to inquiries, and structuring of NRC activities to facilitate public participation. NMA believes that public participation cannot be facilitated effectively without "early

identification" of public concerns and methods for public interaction -- this is true for the "licensee" public and the general public as well.

The failure to develop public input at the earliest stages not only leads to less useful input, but also to less efficient use of resources and often public resentment. For example, NMA has continually expressed its desire to be included in "scoping" discussions on proposed regulatory guidance (e.g., effluent disposal guidelines) and other relevant NRC efforts (e.g., the Lawrence Livermore study regarding seismicity concerns at uranium mill tailings facilities). The failure to involve the "licensee" public at early stages of both of the cited documents has led to less competent documents and, by definition, wasted resources.

NMA also believes that it is important for NRC to expand its general public outreach per Option 3. Those who deal regularly with NRC understand its statutory authority and resulting regulatory posture. Most members of the media and general public (which apparently often includes sister federal and state agencies) do not! The DSI paper acknowledges this in the discussion on public confidence in paragraph 4 on page 7. For example, the general public is not aware that "the Commission's role in protecting the radiological health and safety of the public is a limited one, confined primarily to granting applications with or without conditions or denying applications and does not include authority to undertake developmental programs." (49 Fed. Reg. 9352, 9356, March 12, 1984; See also DSI 13 at pp. 2-3.)

NMA also agrees that as NRC develops risk-informed, performance based regulatory approaches, the need for effective communication will be increased substantially. For example, the public needs to understand the difference in regulatory approaches taken by NRC and EPA. The

public will not understand that although NRC's regulations may appear less restrictive then EPA's regulations, the final result is much the same when NRC guidance documents and the ALARA principle are factored into the equation. [Thompson/Goo, Attachment A, p. 10715-16; See also; "Status of Risk Harmonization with the EPA under the 1992 MOU," SECY-93-134, p.7-8].

While NMA encourages general public involvement at an early stage, in certain circumstances such involvement can be premature and destructive of an effective dialogue between the regulator and the licensee. NRC's public meeting policy goal is designed to provide meaningful opportunities for the public to be informed but without unduly affecting open and candid discussions between licensees and NRC staff. As NMA has stated in the past, if the public becomes involved at the stage when "preliminary" ideas, proposals and data are the focus of the dialogue, it could have a "chilling" effect on the willingness of licensees to work with NRC staff to solve regulatory problems. Additionally, since NRC does not regard inspections as public meetings, NMA unequivocally objects to public participation in enforcement conferences resulting from such inspections.

With respect to NRC's proposed standards for site decommissioning, NMA again states its opposition to any requirement that formalizes the mode of public involvement such as by requiring Site Specific Advisory Board (SSAB). NRC should follow its basic approach to performance based regulatory requirements and allow licensees the flexibility to develop the most appropriate site specific mode for public involvement.

h. DSI 21: Fees

Question 1: In making decisions about what activities the NRC should perform in support of its mission, to what extent should fees be considered?

The DSI paper poses four options as follows:

Option 1: Continue existing approach;

Option 2: No consideration of fees for mandated activities;

Option 3: No consideration of fees; and

Option 4: Fees for service.

The Commission's preliminary views favor option 2.

NMA also supports Option 2. Under this option, NRC would 1) not consider fees when making programmatic decisions in response to NRC mandates; 2) require those requesting NRC to perform non-mandated activities to reimburse NRC for the cost of performing such activities; and 3) seek to have Congress explicitly address the payment of fees when adding new statutory responsibilities to NRC. NMA believes that where NRC has a statutory mandate to conduct certain activities, NRC must perform such activities, regardless of fees. NMA also supports reimbursement from parties requesting non-mandated activities; reimbursement would insert appropriate fairness into the fee process by ensuring that the party who benefits from the NRC action also pays for the cost of pursuing the action. NRC, under this option, also addresses some of the inequities of the fee system by attempting to deal with Congress regarding new statutory mandates. In this way it is possible that Congress may either exclude these costs from the fee base or grant NRC the authority to assess charges for new activities from any party benefiting from the activity.

While NMA believes that pursuing Option 2 could permit NRC to address some of the inequities inherent in the fee system, NMA still has some serious concerns about the underpinnings of the fee structure. In particular, the inequities caused by the OBRA-1990 mandate that NRC recover approximately 100 percent of its budget each year. Without legislative changes to OBRA, there is no way to alleviate completely NMA licensees' major concerns about the fairness and equity of the NRC fee schedule.

In the second major issue raised in the DSI on fees, NRC discusses legislative changes to OBRA as a possible solution to the inequities in the fee system. The Commission does not support the approach and would instead continue current policies.

Question 2: What funding mechanism should the NRC pursue, in addition to annual appropriations with fee recovery, to fund activities that are not required to be funded through appropriations, for example, certain international activities?

The DSI paper poses four funding mechanisms as follows:

Funding Mechanism 1: Recover the cost of providing requested services from the requestor, using fees and reimbursable agreements. The cost of activities that serve the interest of the general public would be recovered from general revenues raised from taxes;

Funding Mechanism 2: (Current Approach) NRC applicants and licensees would continue to pay for approximately 100 percent of the appropriated budget authority. Reimbursable agreements would be used to fund all non-mandated activities;

Funding Mechanism 3: Amend OBRA-1990 and AEA of 1954 to give the NRC maximum flexibility to assess fees;

Funding Mechanism 4: Rescind the Independent Offices Appropriation Act of 1952 (IOAA) and OBRA-90 so that the NRC would be fully funded through taxes, as was the case until 1968.

The Commission's preliminary view is to support Funding Mechanism 2.

NMA supports a mix of funding mechanisms 1 and 3. By pursuing these options, NRC would put into effect the recommendation made by the Commission in its Report to Congress that OBRA be modified to relax the 100 percent budget recovery requirement and remove certain costs from NRC's fee base, thereby eliminating many of the inequitable burdens imposed on NRC licensees. (NRC, "Report to Congress on the U.S. Nuclear Regulatory Commission's Licensee Fee Policy Review Required by the Energy Policy Act of 1992," February 1994 (NRC Report.) In its report to Congress, NRC acknowledges the problems, both real and perceived, with its present fee structure but claims that it is not authorized to undertake the changes noted in its report to Congress without express modification to OBRA or the AEA. NMA believes it is time therefore, for NRC to actively pursue a legislative agenda with Congress by drafting specific language to modify OBRA or the AEA. NMA is committed to assisting NRC in this endeavor. NMA acknowledges that the pressure on the Federal Government to achieve a balanced budget may make this legislative solution difficult to achieve but believes that fairness issues and the impact of the current system on competitiveness require that the attempt be made.

Too heavy a burden is falling on uranium recovery facilities, particularly those sites on standby or awaiting approval of reclamation plans or approval to resume operations, without a comparable benefit. The realities of the uranium market have forced many cease operations to

either go on standby or to begin the decommissioning process. Sites that are awaiting NRC approval of reclamation plans or are on standby require considerably less active NRC supervision, yet they must continue to pay an annual fee that is not commensurate with the benefit of holding a license. In fact, uranium recovery licensees even have to seek extensions of standby status in light of the timeliness in decommissioning rules apparently to some extent as a result of decreased NRC oversight.

This problem of the lack of a reasonable relationship between annual fees and services rendered by NRC, moreover, will be exacerbated in future years as more states become Agreement States, leaving fewer NRC licensees to bear an even greater share of the burden. The state of the domestic and international uranium markets, however, cannot support the imposition of even heavier financial burdens on NRC licensees. The number of operating sites can be expected to decline if NRC does not find a more equitable means of assessing annual fees on its licensees. The current system also, in effect, gives preferential treatment and therefore, a competitive edge, to licensees in Agreement States.

If the attempt to achieve a legislative solution fails, NMA recommends that NRC pursue its current approach to recovery of fees. NMA agrees with NRC that within the current system some improvements can be made administratively. NMA has supported several NRC proposed administrative changes that help make the fee system more equitable including: 1) changes to the method for allocating budgeted costs by treating some of NRC costs that do not directly benefit NRC licensees as if they were "overhead;" 2) changes to the methodology for calculating

annual fees; 3) pursuit of reimbursable agreements with agreement states, DOE and DOD; and 4) attempts to stabilize fees by establishing a base fee.

Question 3: In performing reimbursable work, how should the NRC address the full-time equivalent (FTE) constraints that limit the number of NRC staff?

No specific options for dealing with the FTE question are posed but the Commission's preliminary view is to support the NRC's identification of FTEs associated with reimbursable activities as "business-like" activities, thus removing FTEs used for such activities from the NRC ceiling.

NMA agrees with the Commission that it is inappropriate for the Federal Workforce Restructuring Act of 1994 (FWRA) to limit the number of NRC FTEs available to do reimbursable work. Since the reimbursement arrangement will provide NRC with the funds to do the work requested, no ceiling should be placed on the FTE levels for accomplishing such work and thus, may fit under FWRA's "business-like" organization exception. NMA adds however, that the same reasoning applies to most of the work done by NRC, not just the work that is reimbursable. Since NRC is required by OBRA to recover nearly 100 percent of its budget from its licensees, NRC will be reimbursed by its licensees for the actions it takes in any given year. Therefore, NMA believes all work done by NRC that is recovered through licensee fees may also be considered "business-like" activities and not affected by the FWRA ceiling on FTEs.

Other fee issues that merit attention during the Strategic Assessment Process

Lack of Oversight

Problem: Lack of oversight is a problem that might exist even without OBRA, but the existence of OBRA exacerbates the problem. A system that allows an agency to recover 100 percent of its costs, in essence, is an invitation to regulatory abuse. There is little oversight or quality control. These are serious flaws that can lead to gross inequities in the system. For example, uranium recovery facilities are charged an hourly rate for inspections, but there are no limits for how often a facility can be inspected leaving open the possibility for excessive inspections and, accordingly, excessive fees.

The regulations have no provisions to allow licensees to object to unreasonable costs. Without such a mechanism, the licensees are at the mercy of the regulators and must pay for services rendered, regardless of the necessity, efficiency, advisability or value of such "service". There is no assurance that any given regulatory function performed by NRC will be completed expeditiously, efficiently or within a reasonable range of costs.

Proposed Solution: The fees charged by NRC are intended to recover operating costs. The licensees, accordingly, should be given the ability to oversee and have input into the NRC budget. If licensees are to be charged for the costs incurred by the regulatory agency for their own regulation, the licensees should be able to have some control over the costs incurred by that agency through, for example, a licensee review board established to review NRC fees annually and to make recommendations to the Commission.

Hourly Rates

Problem: The professional hourly rates established annually are arbitrary and do not reflect the costs of providing regulatory services to licensees. NMA believes the hourly rate is too high for NRC staff and cannot be justified. The current $116 hourly rate equals or exceeds the hourly charges of senior consultants, principals or project managers at major consulting firms and exceeds the generally accepted rate for similar work in the private industry.

Proposed Solution: As NMA has advocated in previous comments, NRC should, at a minimum, set certain standards for the "services" provided by the Commission. These standards would help insert more fairness in the fee system and can be implemented without any modifications to OBRA. For example, standards regarding consistency in charges, deadlines for completion, and itemization of bills should be adopted.

IV. CONCLUSION

NMA is pleased to have the opportunity to participate on behalf of its uranium recovery licensee members in NRC's SARI process. NMA hopes that its comments will be considered as intended -- that is, as constructive input into NRC's Agency-wide process. NMA also again requests that the Commission recognize the "placeholder" request for a strategic reassessment of uranium recovery regulatory issues which NMA believes is both appropriate and necessary in light of the SARI process.

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ATTACHMENT A

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ARTICLES

Mixed Waste: A Way to Solve the Quandary

by Anthony J. Thompson and Michael L. Goo

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 repromulgate 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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> * * *
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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.

Encl DSI-13
(27)

ATTACHMENT B

Umetco Minerals Corporation

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October 3, 1994

Mr. Samuel J. Chilk
Secretary
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852
Attn: Docketing Branch

Re: Land Ownership Requirements for Low-Level Waste Sites

Dear Mr. Chilk:

Umetco Minerals Corporation (Umetco) submits these comments in response to the Nuclear Regulatory Commission's (NRC) advanced notice of proposed rulemaking (ANPR) on land ownership requirements for low-level radioactive waste (LLW) sites. 59 Fed. Reg. 39485 (August 3, 1994). Umetco is a uranium recovery licensee located in Grand Junction, Colorado.

Umetco has some questions about whether private ownership of LLW sites will provide the equivalent level of protection to the public health and safety as provided by Federal or State land ownership requirements. In any event, NRC has not sufficiently explained in the ANPR why it is considering a change to long-standing Commission policy or discussed the

relevant policy issues or the impact of the proposal on existing and proposed regulatory programs. Thus, it is difficult to comment on the proposal in a meaningful fashion.

These comments first address several general considerations with respect to NRC's proposed amendment to 10 C.F.R. § 61.59(a) to permit private ownership of LLW disposal sites. These comments then briefly look at the specific questions raised by NRC in the ANPR.

I. General Considerations

A. The NRC Framework for Radioactive Materials

The primary purpose of the Atomic Energy Act (AEA) - the source of NRC's statutory authority - is to comprehensively address control over radioactive materials. Radiation, unlike chemical substances, poses potential hazards that cannot be seen, felt, smelled, heard or tasted. Mere proximity to radiation, in contrast to typical chemical wastes, could expose an individual to potential harm. NRC's rules (including government land ownership requirements) have been designed to permanently (within reason) isolate the waste from virtually all human contact while it poses a potential radioactive threat. Radioactive waste, unlike chemically hazardous waste, cannot be neutralized or destroyed, such as by incineration. Potential radioactive hazards are eliminated only by time and transmutation. As 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. Destruction of the [LLW] hazard, aside from transmutation processes, is impossible."[1/] .

A fundamental assumption of existing NRC regulatory programs in 10 C.F.R. Parts 61 and 40 has been that even the government cannot be relied upon past 100 years for active maintenance of disposal sites. As a result, in developing Parts 61 and 40 regulatory programs the emphasis has been on highly conservative, engineered "passive" control systems intended to last for long periods of time (300 to 500 years and 200 to 1,000 years respectively). The purpose of the 100 year period for institutional controls, such as monitoring and maintenance by a government agency, is to preclude human contact with low-level radioactive waste and require a continuing social order to take responsibility for the site. 10 C.F.R. § 61.7(b)(4). Control by a government body "minimizes the potential for possible abandonment of the site." NUREG 0782, Vol. 2 at 4-47, 48. Therefore, to the extent that social systems could be relied upon for <u>periods beyond 100 years</u>, government ownership was necessarily preferred. Government ownership and passive controls help to ensure that motives such as profit and loss do not lead to

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[1/] NRC, NUREG CR-4450, BNL NUREG 51944, "Management of Radioactive Mixed Wastes In Commercial Low-Level Wastes", 83 (1985)

abandonment, sale or inappropriate use of property used for disposal of radioactive waste. Id. at 4-49. NRC has noted that the most significant elements of "passive" long-term institutional control measures are control of the land by a government entity, land use restrictions and multiplicity of records. Thus, the government ownership requirements provide important long-term health and safety protection at LLW disposal sites in contrast to private entities with more limited lives and commercial goals making them potentially unfit to accept such responsibility.

The ANPR proposes to allow private ownership as a substitute for government land ownership requirements. The ANPR does not explain how private ownership could provide an equivalent level of protection to public health and safety as that provided by government ownership. It may be that an alternative package of controls could reasonably be expected to be effective. NRC's proposed amendment to 10 C.F.R. §61.59, however, does not offer an adequate explanation of why a change would be appropriate.

NRC must exercise leadership as the primary implementor of the AEA. It cannot simply ask a series of questions as part of a post-hoc rationalization of prior actions without any discussion of statutory authority or the bases for and impact of the proposal on existing and future regulatory programs. NRC does not address the impact of the proposed

amendment on existing regulations, including not only Part 61, but also Part 40 as it applies to mill tailings facilities. Even with government landownership, Parts 61 and 40 are based on the fundamental assumption that institutional controls cannot be relied on beyond a 100 year timeframe and, therefore, primary reliance must be placed on passive/engineering controls. If NRC decides to allow private land ownership, then presumably, the Commission would have to take a very different view of the appropriate institutional controls for LLW sites, how long they are likely to be viable, and may need to consider even more stringent closure requirements and increased surety amounts. NRC also does not discuss the significant impact this change in policy could have on NRC's proposed decommissioning criteria. 59 Fed. Reg. 43,200 (August 22, 1994). Indeed, the ANPR does not even reference the decommissioning rulemaking proceeding.

It is not clear from the ANPR whether NRC no longer considers the potential hazards from radioactive materials to be different than those of chemicals and, therefore, to no longer require radiation hazard driven controls. Does NRC's proposed amendment to the land ownership requirements suggest that NRC now thinks that the potential radiation hazards caused by LLW are less significant than NRC has portrayed them in the past or than the public views them? If so, then the extremely conservative passive controls required for LLW and mill tailing sites could presumably be relaxed. If this is

now NRC's position, NRC should explicitly say so and explain the change in position. If, however, NRC continues to believe that radioactive materials pose a different hazard than chemical hazards, it must explain what authority over these materials is appropriate and not abdicate leadership in radiation health protection to individual licensees and States (Agreement States or non-Agreement States). It is NRC's responsibility to assert AEA's preeminent authority over control of radioactive materials and not to merely rely on a State's exercise of police power to protect public health and safety in granting an exemption to an important control (i.e., government land ownership) without explanation. To fail to make the requirements less stringent for LLW and mill tailings facilities, as NRC apparently intends to do for Envirocare, would be arbitrary and capricious.

The ANPR contains questions without any substantive discussion of the pros and cons of the proposal, including any reason why the land ownership issue needs to be reviewed or modified. As a result, it is difficult to offer meaningful comment on the proposal. As a first step in the rulemaking process, this ANPR is inadequate.

B. <u>Alternative Controls</u>

NRC has not fully analyzed the issue of potentially effective alternative controls. For example, it is

questionable whether zoning is a viable alternative as zoning regulations tend to be based more on local political and economic considerations and can be amended at will by local governments.

Similarly, there is some question whether deed restrictions, while better than zoning restrictions and a potentially useful control, can by themselves substitute for government land ownership requirements as they are directed only at the transfer of property and not at active control over the site. A deed restriction may not prevent transfer of a LLW site. Nor do deed restrictions address site abandonment and possible site reuse by an uninformed intruder occupying the land without title to the property.

NRC also has not analyzed in depth what happens when a licensee declares bankruptcy and abandons the property. NRC appears to have assumed that with bankruptcy there will be some entity to rely upon to control the site. However, a trustee may have a different agenda than NRC such as trying to generate money out of the site (by rezoning and selling the property) to pay off debts. NRC does not address who will be around to bring an enforcement action against the site. The recent declaration of bankruptcy by American Nuclear Corporation, though, demonstrates that NRC is not as prepared to handle the bankruptcy of a licensee as it could or should be.

Whatever the mix of controls relied upon, a related issue that should be addressed involves a licensee's ability to decommission and remediate a site, terminate its license, and walk away from the site. Predictability in closure and license termination should be a goal of NRC's regulatory program. If there is no government entity, however, to take the license, the licensee will have the long-term burden. NRC, therefore, must consider in detail what type of private entity could likely fulfill such a burden adequately.

There is also some concern over whether sureties can be an effective, long-term means of control in the private ownership context. Even with a significant surety there is no assurance, and certainly no requirement, that a private corporation (or its surety) will exist after 50 to 100 years. Sureties also do not provide long-term hazard minimization. While sureties are valuable, they are held by private entities who often are under commercial and financial pressures and may need to be combined with some other mix of controls including ownership by an entity that may be less subject to commercial and financial pressures.

Furthermore, it is questionable whether the mere assertion by a State that it will exercise its police state authority to protect public health and safety over a site is sufficient. First, state administrations can change, making them less than constant in their positions as has been the

case in Michigan and Nebraska with the LLW siting problems. Politics at the state level may even override "legal" obligations as it did at one site where the State put a LLW site on the Superfund list to avoid its long-term responsibility for the site. This would seem to be especially true when a State currently denies it has the authority to take title to the disposal site. If it is not required by law to take the land, and perhaps even if it is, despite what a State may say, NRC may not be able to rely on the State to enforce passive controls. Of course, where a state obligates itself under state law to take responsibility for long term protection of public health and safety, as with the case of federal responsibilities, the comfort level simply has to be greater than with private ownership. For example, the State of Colorado has made its decision and the basis for it as follows:

> It is recognized by the general assembly that any site used for the construction, disposal, or storage of radioactive materials and the contents thereof will represent a continuing and perpetual responsibility involving the public health, safety, and general welfare and that ownership of said site and its contents must ultimately be reposed in a solvent government, without regard for the existence of any particular agency, instrumentality, department, division, or officer thereof. To this end ... [all such lands, buildings and grounds] shall be owned in fee simple absolute by the

> state and dedicated in perpetuity to such purposes, and all radioactive material received at such facility, upon permanent storage therein, shall become the property of the state and shall be in all respects administered, controlled, and disposed of, including transfer by sale, through the department, unless the general assembly shall designate another agency, instrumentality, department, or division of the state so to act. Colorado Revised Statutes, 25-11-103 (1993).

Reliance on a State's assertion that it will control a site through the exercise of its police power also raises questions about the ongoing legitimacy of NRC's Agreement State program. If NRC were to rely merely on such an assertion by a State, what is the necessity for the Agreement State program? If NRC is not going to assert the preemptive authority of the AEA, then <u>any</u> state can claim it has the authority to regulate radioactive waste disposal. NRC reliance also might be troublesome in light of the General Accounting Office's report that NRC does not even exercise adequate control over Agreement State regulatory programs.

C. <u>Envirocare</u>

Other questions are raised in the ANPR by NRC's treatment of Envirocare of Utah, Inc. (Envirocare). NRC states in the ANPR that the Commission "found acceptable" the exemption for Envirocare. NRC, however, does not explain why the exemption

for this particular entity is acceptable. Nor has NRC explained who decided Envirocare was "special", what the criteria for the decision were, or why Envirocare should be given the exemption. Thus, the public can only speculate as to why an exemption is warranted and why Envirocare is receiving preferential treatment from NRC. Without some basic understanding of these issues, it is impossible to make a judgment on whether the circumstances leading to the exemption will reoccur. NRC appears to have made a decision to grant the exemption without an adequate explanation and is now issuing an ANPR post-decision to attempt to justify its decision. Such a course of action is not reasoned rulemaking.

In the final analysis, NRC's failure to analyze meaningfully the impact of the proposed rule on existing and proposed regulatory programs, the long-term effects of private ownership and the ability of private entities to protect the public health and safety at these sites over several hundred years makes the ANPR fatally deficient as a component of reasoned decisionmaking.

Response to Specific Questions

The following are Umetco's comments to several of the specific questions raised by NRC in the ANPR.

(1) The Commission considers that an amendment to 10 C.F.R. Part 61 as described in this ANPR could facilitate the objectives of the Low-Level Radioactive Waste Policy

Act of 1985, as amended, by allowing States additional flexibility in developing new low-level radioactive waste disposal facilities. Would this change be useful for other LLW disposal sites or is it likely that the Utah exemption is a one of a kind?...

It is not clear what the Commission means by this question. As noted above, it is not possible to analyze the proposed change without first understanding what the implications of the phrase "the Utah exemption is one of a kind."

The proposed change to the land ownership requirements may appear to make it easier for more LLW sites to be developed in a state where political problems make it difficult for the state to assume ownership. But what are a private citizen's long term promises worth? For example, what happens if the waste business is not profitable?

As a matter of policy, EPA currently does not place NRC sites on the Superfund list. If under private ownership requirements, a site is abandoned, a site could end up as a Superfund site if the State does not step in to take responsibility. It is possible such a step would open the door for EPA to draw every NRC facility into the Superfund web.

(4) Would the responsible regulatory agency lose any control over the disposal site if it is not owned by the Federal or State government?

Without federal government ownership, NRC would have to take action against a private entity, which may no longer exist, and if it exists, might resist an enforcement action, or which, if it exists, does not respond until the NRC takes action at the site and then challenges such actions as a trespass without authorization and seeks damages. Under the private ownership scenario, how would NRC assure that site obligations are being fulfilled? Who takes care of a site if the private owner goes into bankruptcy? As noted above, NRC may not always be able to rely on States to step into the fray absent an ownership stake in the property. Even then, NRC may not have any effective control over Agreement States. NRC has no control over non-Agreement States.

(6) How would private ownership affect liability for a disposal site?

One of the main purposes of the government land ownership requirements is to provide a means for a government entity to become the long-term site licensee after closure of a site. There are no guarantees that a private entity will exist over the 100 year timeframe, much less a longer timeframe, necessary to maintain a site licensee against whom either NRC or a State could take action. After closure, there may not even be a licensee (and, thus, no license) and the only requirements then applicable to the site would be those that the State chooses to impose.

Without a licensee, there is no agreement by anyone (including the State) to do anything at the site to protect the public. The license binds a licensee to long-term monitoring and site care and provides a legal basis for enforcement actions by both the regulating entity and the public. Without such a binding commitment, the State has complete discretion to decide what, if anything must be done at the site. Such unfettered discretion is at odds with the AEA's policy on control of potential risks to public health from radiation.

While a State may insist it would bring enforcement measures to require an owner to control a site, there may not be anyone for the State to pursue if, at the time of abandonment, the entity that owned the property declares bankruptcy and no longer exists and, accordingly, there is no license. Under these circumstances, State enforcement actions could be meaningless. Where a State, such as Colorado, requires state ownership of LLW sites, there is a higher comfort level that the public health and safety will be protected. As noted above, though, even state legislation does not guarantee that the authority will be exercised.

To ensure long-term responsibility and care of a site, <u>some</u> long-lived entity must accept the responsibility of becoming the site licensee in perpetuity. Without such a licensee, there is no discernible legal means for imposing

control requirements at the site over the hundred year timeframe (much less a longer timeframe) that may be deemed necessary to protect the public health and safety. NRC needs to address these issues in the decommissioning context. It may be necessary before the federal government can take over a property to have legislation authorizing such action as is the case under the Nuclear Waste Policy Act.

(7) Would States' concerns about assuming liability for a disposal site be alleviated by this proposal?

It is not clear how over the long term the States' concerns could be alleviated by the proposed amendment. At first the proposal may address some of their concerns. Utah has said that it cannot take ownership of a LLW site now but admits it would have to step in later if a problem arises. Local citizens will look to the State to address any concerns, even if they initially had wanted the site. The proposal appears to be taking States down the road that led to Superfund sites with all of their expense and corresponding problems. NRC's proposal as presently drafted could leave LLW sites in an undefined relationship with the government.

(9) Should NRC consider allowing a site owner to be only the licensee, or broaden the proposal to allow other private ownership?

Again, it is not clear what NRC means by this question. Is NRC referring to multiple site owners? Lessors/lesees?

Trust entities combining multiple entities such as private, local government, state government, and environmental organizations)? Who would want to assume the responsibility and the liability?

(10) Should there be a time period after which the licensee can request termination of the license, even though the land might remain in private ownership?

To the extent the property is released for "unrestricted use" and the decommissioning criteria have been satisfied, then termination of the license would be appropriate. If the site is to be released for "restricted use," then there are a series of questions NRC must consider, including the site-specific nature of compliance with the decommissioning criteria. Where site use is to be restricted for 1,000 years, if federal or State ownership is not required and deed restrictions and zoning are considered adequate controls, then the time period after which a licensee can seek termination of the license is anybody's guess.

(11) If the NRC were to implement this proposal, are the surety requirements contained in 10 CFR Part 61m Subpart E, sufficient?

As discussed above, it is questionable whether surety can be viewed as a substitute for government land ownership or some other well thought out combination of control measures, if such exist. Unless NRC intends to change its long-term hazard minimization policy for radioactive material, the

Commission may need to increase the surety amounts required by NRC regulations to protect against the dissolution of the responsible private entity and to provide sufficient funds for implementing control methods. Surety cannot be viewed as an adequate control in and of itself, but must be part of a combination of other controls.

(12) Under § 61.80(e), all records are to be transferred to Federal and/or State agencies at the time of license termination. If the license remains in effect during the active institutional control period (licensee is site owner), would there be a need for this records transfer?

If there is no licensee, then the records must be transferred. If there is a licensee, then the records should remain with those who have management responsibility for the site.

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Umetco supports the issuance of an ANPR as a means of gathering information if NRC is considering changing its policy under the AEA regarding closure and ownership of radioactive waste sites. NRC's ANPR, however, raises far more questions than it answers without any explanation for the basis for the proposed change. The Commission has taken far too simplistic an approach for a meaningful rulemaking proceeding.

If you have any questions or if we can be of assistance, please contact me at (303)245-3700.

Sincerely,

John S. Hamrick

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Manager of Health, Safety and
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ATTACHMENT C

RISK/COST ANALYSIS: A CASE SCENARIO IN THE DECOMMISSIONING OF A RADIOLOGICAL SITE

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Abstract

The explosion of environmental rules, regulations, and environmental liability assignments over the last dozen years has heightened corporate awareness of the need to characterize potential environmental liabilities, to develop a proper perspective on these liabilities and to take appropriate measures with respect to managing potential environmental remediation costs and liabilities.

Defacto environmental management considerations including standard engineering design and costs to meet evolving regulatory criteria need to be expanded to encompass a broader decision framework explicitly including assessment of regulatory and legal options, contingent environmental risks and the benefits of proactive management of the environment. The use of a probabilistic framework for the assessment of the various design options, resulting consequence analysis, and the potential social and political responses to these possible options provides a dynamic approach that empowers decision makers with new insights into the underlying assumptions, their uncertainty, and the stability of the resulting predictions.

This paper, illustrating the application of such a probabilistic analysis framework to the multivariate risk analysis and alternative option cost analysis related to the decommissioning options of a licensed uranium recovery facility, provides an interesting and current case study of the methodology of such an approach. In addition, the paper provides a discussion of the organizational mode that is critical to the successful realization of such an effort (namely the creation of a project team providing the key legal, environmental, financial, engineering and scientific expertise and practical experience). The paper describes the formulation of the problem, the development of necessary data in the form of probability distribution and the results of the case study which describes the potential environmental liability in the form of (subjective) probability distribution of current (i.e. 1995) dollars. Specifically, the focus is on a comparison of the risk and costs for an on-site versus a relocation alternative.

The screening analyses of the risks of reclamation of the material on site versus removing it from the site was a multi-variant/net benefit analysies that assessed all the costs and benefits associated with a planned course of action and the potential alternative. The components of the analysis included site characterization, estimates of costs to achieve "reasonable assurance" of regulatory compliance, comparisons of reductions in radiation doses (e.g. workers, nearby homes, transport accidents), comparisons of costs from removal of soil, disposal of the waste and radiation surveys, comparisons of impacts on the surrounding plant and wildlife environment and the physical environment (noise and aesthetics) and socioeconomic impacts, and the disposal capacity on and off site. The risks from radiation were placed in the context of natural background radiation exposures, radon exposures and gamma exposures from the material at issue, indoor radon exposures, and collective and individual doses.

The radiation risks were compared to the nonradiation risks from the intervention alternatives under consideration. Nonradiation risks include those associated with transportation, treatment and disposal of wastes, the use of chemicals for decontamination, structure demolition, material handling and packaging, fire and explosions, and the operation of heavy equipment.

The potential radiological risks were estimated (radon risk probabilistically) and added to the nonradiological risks which resulted in a range of risks for the relocation alternative that were 5-15 times higher than on-site *in situ* reclamation.

In addition, conceptual cost estimates were developed for the on-site reclamation plan and for the relocation alternative. It was clear from preliminary estimates, that costs of relocation would significantly exceed those of inplace reclamation. As part of this process, reviews of completed, in progress and planned tailings reclamation programs were undertaken to determine the range of reclamation costs for similar plans. The cost estimates were subjected to a sensitivity analysis based on worst case critical design criteria, as well as a probabilistic, Monte Carlo sensitivity analysis of worst-case hypothetical events or reasonable worst-case and additional potential design requirements. These analyses showed that the facility's cost estimates were appropriate.

In seeking to obtain a positive net benefit, the disposal of radioactive waste off-site must be viewed in the context of all the benefits, risks and costs associated with remediation of the site and not looked at as an isolated action. Given this context, this paper will examine the components of such a multi-variant risk/cost analysis for this site and the two clean-up alternatives under consideration.

Background

In the late 1940s, a uranium mining boom occurred on the Colorado Plateau and, by 1956 over 600 producers were shipping ore from the area. As ore production exceeded milling capacity, the Atomic Energy Commission (AEC) encouraged private development of processing facilities.

In response to this encouragement, the Uranium Reduction Company constructed the Moab Uranium Mill in 1956 and began operation. Atlas Corporation purchased the mill in 1962 and formed Atlas Minerals Division to operate the facility. Between 1956 and 1984, the mill processed over 10.5 million tons of ore and deposited approximately that amount of tailings into the existing pile.

Throughout this period, the Atlas Mill was the major employer in Moab and Grand County and, at the peak of its operation the work force totalled 500 people. During the uranium boom, Moab was one of the wealthiest towns in that part of the country and the Atlas Mill played a key role in the creation of the infrastructure of today's Moab.

As the demand for uranium fell and depressed the uranium market, the Atlas Mill was put on standby in 1984. The domestic uranium market did not improve and the company shut down the mill in 1988.

Radiological Issues

The ore contained radioactive uranium which was removed in the milling process and shipped out to nuclear facilities for conversion to fuel. However, the ore also contained a series of radionuclides that are products of uranium which remain in the tailings pile and in wastes in and around the uranium mill. Atlas has begun the mill reclamation phase and is currently dismantling, decontaminating and salvaging or burying (in the tailings pile) the buildings, foundations and equipment. After completion of mill reclamation, the tailings pile reclamation phase will address the residual radioactivity in the tailings pile. The tailings pile must be remediated as the radioactivity in it can result in radiation exposures in the following ways:

- direct gamma radiation to those standing on top of the waste;
- wind can resuspend tailings dust and transport it off-site resulting in inhalation and ingestion of contaminated dust;
- radon gas can escape from the surface of the pile and be transported off-site resulting in inhalation of radon progeny (or daughters); and
- rainfall can permeate the tailings pile and seep into the soil and groundwater beneath.

Proposed Reclamation Plan

The reclamation plan proposed for the tailings pile and surrounding area is designed to mitigate foreseeable potential hazards and to provide safe reclamation with reasonable assurance for 200 years, and to the extent practicable, for 1,000 years. Contaminated materials and soils on the site will be placed in the 130 acre tailings area. The site will be recontoured, capped with both clay and sandy soil layer and then covered with rock armoring.

- The clay layer will prevent penetration of precipitation into tailings and the (uncontaminated) runoff will be directed off the pile via contoured channels. This will reduce seepage into groundwater from the tailings pile.

- The clay layer and other cover materials will prevent the resuspension of contaminated dust by the wind and eliminate the inhalation and ingestion of dust as potential exposure pathways.
- The clay layer and cover will reduce the escape of radon gas from the pile below the regulatory standard of 20 pCi $m^{-2} s^{-1}$ and reduce the potential exposures to radon daughters to a rate that is considered presumptively safe (provides an "ample margin of safety").
- Regrading of the tailings embankments will reduce the slope to meet design specifications.
- The tailings pile will be dewatered by pumping from wells drilled at several locations to stabilize the pile and reduce seepage into groundwater.
- Rock armor will stabilize the clay cover and reduce penetration by wildlife.
- The site will be fenced, monitored and inspected.

Review Process

Commencing in 1988, the existing and approved plan for the on-site reclamation of the Moab tailings pile has been undergoing revisions to incorporate new NRC guidelines and criteria. NRC had previously reviewed and approved Atlas' plan for on-site reclamation in 1982. The most recent review (i.e. 1996) by NRC addresses Atlas' revisions (requested by NRC) to the approved reclamation plan and requests additional information pursuant to NRC's 1994 environmental impact statement (EIS) proceeding which followed from NRC's reversal of a Finding of No Significant Impact (FONSI) and environmental assessment (EA) related to the proposed license revisions.

As part of the process of reviewing reclamation alternatives, conceptual cost estimates were developed in 1993 by Atlas for the revised on-site reclamation plan, as well as for the NRC requested alternative reclamation concept in which tailings would be relocated to a new site some 18 miles from the existing locations. These 1993 cost estimates, indicated that on-site reclamation could range from $13 to $16 million, while off-site reclamation could range from $94 to $114 million. These costs were provided to NRC as reasonable (lower limits) appropriate for purposes of comparison of the alternatives as defined at that time. Based on these preliminary estimates, it was evident that the financial implications of relocation would significantly exceed those of on-site reclamation and would far exceed Atlas' capacity to fund. Thus, the relocation option would likely result in Atlas' bankruptcy and transfer of significant liability to other potentially responsible parties, possibly including the United States government.

As noted, the 1996 NRC evaluation resulted from questions raised during the response period following NRC's publication of the FONSI, and its subsequent withdrawal. An NRC mandated EIS and accompanying technical evaluation report (TER) has required further reconsideration of site reclamation through relocation to the alternate potential site as well as the resolution of a number of outstanding technical issues related to on-site reclamation.

The technical issues that have the potential to affect the on-site estimate primarily relate to final engineering design for physical stability under seismic events and long-term surface stability requirements to ensure protection against physical erosion and to minimize groundwater and air pathway impacts. These issues have been, and continue to be under investigation and technical development as part of the ongoing EIS/TER process. The issues that can dramatically affect the cost of off-site reclamation are primarily related to excavation and material handling, hauling, excavation, transport and placement of the fine tailings (slimes).

Overall, the issues identified as needing a critical review included radiation dose estimates, engineering and cost impacts and legal/regulatory issues.

Legal and Policy Issues

The Atomic Energy Act (AEA) as Amended by the Uranium Mill Tailings Radiation Control Act (UMTRCA), governs reclamation of uranium mill tailings piles such as the Atlas Moab pile. EPA and NRC have developed extensive regulatory programs pursuant to UMTRCA to address the potential radiological *and nonradiological* hazards associated with mill tailings. Given the long time frames involved (200 to 1,000 years) the regulatory criteria set forth in 10 CFR Part 40, Appendix A of NRC's regulations must be satisfied with "reasonable assurance". Thus in addressing reclamation alternatives the alternative recommended must provide such "reasonable assurance" and the analyses performed must adequately consider the environmental issues relevant to each alternative, even though not necessarily choosing the "environmentally preferred" alternative. UMTRCA also requires a reasonable balancing of risks with costs of controls.

It is within this statutory/regulatory framework and the framework of recommendations of expert, independent organizations regarding "optimization" of benefits versus costs (i.e. do more good than harm) that analyses of reclamation alternatives must proceed.

The context for this analysis begins with reference to the system of radiological protection recommended by the International Commission on Radiological Protection (ICRP) which is based on the principle that "the proposed intervention should do more good than harm, i.e. the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including social costs, of the intervention." The "net benefit" must be considered in determining the best alternative for remediating a site. The Health Physics Society (HPS) describes this type of analysis as a means of "optimizing" risk. HPS explains that "the application of the 'ALARA' (As Low As a Reasonably Achievable) or the optimization principle is not a mechanism for assigning a value to human life, but is a process for optimizing the use of limited resources for improving life expectancy and health benefits when all risks are considered

The Nuclear Regulatory Commission (NRC) acknowledges "there is a point at which the net risk to future populations from residual radioactivity is lower than the risk from remedial action. In other words, the clean-up may do more harm than good." Another factor weighed into the consideration is potential public concern over the risks. HPS cautions, though, that "the amounts spent specifically to achieve health benefits should be in the same range as is acceptable for any other health protections program that is undertaken voluntarily by the public. Expenditures for other categories of benefits, e.g. aesthetics, public goodwill, and a proper evaluation, etc. should be separately identified and justified.

The screening risk analyses involved here considered recommended exposure levels for intervention by expert radiation protection organizations, existing exposure scenarios versus future scenarios, and the overall integrated waste management system. Probabilistic assessments of the risk consider long time frames, the nature of the potential risk, and the best estimates of risk.

Is there a reasonable alternative?

It should be noted that wherever reclamation is to be undertaken, the criteria to be met are the same.

As noted, it has been suggested that a conceptual alternative for the final reclamation of the Atlas tailings pile near Moab is relocation of the contaminated materials to an appropriate alternate site. Such a site has been identified approximately 18 miles northwest of the existing site in an area known as the Klondike Flat (2.5 miles from the Moab Canyon Lands airport). Ground surfaces on the site slope up steeply to the north, and are relatively flat to the south, east and west. The site is underlain by Mancos Shale consisting primarily of marine shale and some marine and non-marine sandstone units. The primary components and activities associated with reclamation to the off-site location as developed by Smith Environmental include:

- construction of new rail load-out facilities at existing site, rail unloading facilities at the alternate site, 3.5 miles of rail siding and improvements on 14 miles of the existing main line;
- excavation and loading of 7.8 million cubic yards (10.5 or more million tons) of tailings; and
- transport of tailings by rail to the alternate site.

During evaluation of the original (late 1970s) reclamation plan, Atlas and NRC considered the option of transporting the tailings to an alternate site. Both agreed that there was no demonstrable incremental public health or environmental benefit in spite of the greatly increased cost of tailings relocation. In addition, the relocation options directly conflict with NRC's stated policy which is to avoid a proliferation of regulated sites. Moving the tailings could create two sites that would need to be reclaimed, secured and monitored.

Of the 19 Title II sites where reclamation plans have been approved, there has been only one site (Edgemont, SD) where relocation of tailings was proposed by the licensee and that was done voluntarily by the Tennessee Valley Authority.

Multi-variant Risk Analysis

The potential radiological impacts on workers and members of the public from two reclamation options were estimated using accepted dose and risk models. The magnitude of predicted impacts of on-site reclamation were clearly lower in every category, even considering all foreseeable delays, when compared to corresponding impacts from alternate site reclamation.

The relative impacts of the two alternatives were evaluated for a range of assumptions regarding the time necessary to reclaim the tailings *in situ* or at an alternative site. Once the tailings have been reclaimed in accordance with EPA/NRC longevity (200-1,000 years) and radon flux criterion of 20 pCi m^{-2} s^{-1}, the tailings are presumptively safe with an "ample margin of safety". Therefore, the relative, or differential risks will continue to accrue for either alternative from present until the tailings have been reclaimed.

In the comparative analysis of the potential risks from reclaiming the Moab tailings *in situ* or by relocation, estimates were developed of potential societal (i.e. population) risks arising from radiation doses to the public and to workers as well as nonradiological actuarial risks to workers arising from potential construction and transportation accidents from the reclamation activities.

For comparative purposes, the multi-variant analysis added the potential stochastic radiation risk (to the population and workers) and the actuarial risks from construction and transportation (to workers). In doing this, it should be acknowledged, that at the calculated level of radiation dose, the uncertainty about the associated risks includes the possibility that the risks could actually be zero. This is in contrast to the actuarial risks from construction and transportation accidents where experience indicates that such risks are indeed likely to occur.

Table 1 shows a summary of the calculated risks to the population and to workers. To consider overall risks and costs the various types of risks must be added. Before adding the population (stochastic radiation) risk of cancer mortality to the risk of mortality from construction and transportation, it is necessary to convert the annual population risk (fatalities per year) to lifetime risks by multiplying by 70 years, the assumed (nominal) lifetime of the exposed population. The results are tabulated below. In addition to the on-site reclamation option and the relocation option, risks for the "no action" option are also presented. For present purposes; the risk for the "no action" option were calculated by assuming that the interim (current) situation continues for 30 years.

From the risk perspective, it is evident that overall the relocation scenario carries about five times the risk of on site reclamation and is roughly comparable on a risk basis to the no action alternative.

Estimates of dose and risk impacts described in this report are inherently uncertain. The uncertainty is attributable to many factors such as measurement inaccuracy, and temporal and spatial variability in environmental parameters and human behaviour.

To illustrate the significance of the uncertainty in predicted values of impacts, estimates of radiation dose to the nearest residents attributable to radon and dust emissions from the tailings pile were made using a probabilistic model. Dose calculations were made using environmental pathways algorithms embedded in a computer spreadsheet and Crystal Ball® which facilitates the repeated calculation (Monte Carlo

Table 1
COMPARISON OF TOTAL RISK

		On-Site	Relocation	Do Nothing (Interim)
Population cancer risk	low high	0.06 0.15	0.31 0.66	0.44
Cancer risk to workers		0.015	0.16	0
Risk of fatality from construction accident		0.006	0.09	0
Risk of fatality from transportation accidents		0.03	0.046	0
Total risk of fatality	low high	0.11 0.2	0.6 1.0	0.44

analysis) of the spreadsheet, with new values randomly selected for each input variable on each trial. The output, in this case dose, may be interpreted as a probability distribution which quantitatively represents the uncertainty (interpreted as subjective probability) associated with the calculation.

The mean dose to the maximum individual during the Interim Phase was predicted to be 38 mrem/y (standard deviation of 21 mrem/y) and the 95th percentile on dose (78 mrem/y) was approximately 2.1 times the mean dose. The mean dose to the maximum individual during post-reclamation was predicted to be considerably less at 3.8 mrem/y (standard deviation of 2.1 mrem/y) and the 95th percentile on dose (7.8 mrem/y) was also approximately 2.1 times the mean dose.

Costs of Reclamation

Preliminary cost estimates also were developed for both reclamation options. The 1993 estimate of the cost for on site reclamation was in the range of $13 - $16 million compared to costs of $94 - $114 million for the relocation alternative. Thus, based on preliminary cost estimates, costs for relocation exceed those for on site reclamation by between $80 million to $100 million. Confidence in the magnitude of this difference is critical to any net benefit analysis.

To test these estimates, a review of the engineering designs and cost considerations for both *in situ* and relocation options was performed. This assessment was performed to capture uncertainties in both cost and schedule, and included review of:

- completeness and state of design considerations;
- completeness of estimates and confirmation of rates;
- identification of potentially critical omissions or potential fatal flaws; and
- statistical analysis of sensitivity assessment of estimates.

Major uncertainties associated with this assessment include specific timing of events resulting from non-engineering factors and the consequent impact of inflation, sector specific constraints or other economic related effects that may result from assumptions about performance of the work at various times in the project life cycle.

Comparative Reviews

A review of completed, in progress, and planned uranium tailings reclamation programs was undertaken to ascertain the range of reclamation costs for similar programs. This review confirms that the Atlas estimates for on-site reclamation are reasonable when compared to other Title II site operations.

The results of the review show that for comparable Title II sites the total estimated cost of on-site reclamation plans range from $0.65/ton to 4.45/ton. When considered from a perspective of similar sized sites, it can be seen that the sites with similar surface area have an average cost of $2.49/ton, while sites with similar tailings volume have an average cost of $2.01/ton. From the information reported, a comparison of decommissioning costs related only to the reclamation of the tailings proper at these sites indicates a maximum range of $0.34/ton to $2.55/ton. When comparing the tailings reclamation costs at sites with similar surface areas, an average cost of $1.48/ton results as compared to sites with similar volumes where an average cost of $1.13/ton is reported.

Sensitivity Analysis

In an attempt to better quantify uncertainties in costing assumptions a probabilistic Monte Carlo analysis of 5,000 trials was performed for the alternatives. In this analysis, input parameters (e.g. unit costs for haulage, interest rates, labor rates, etc.) were assigned a range of values rather than single (point estimate) value. These ranges were input into the costing model in the form of probability distributions, and a distribution of possible costs for reclamation was estimated. The resulting probabilistic (worst case) analysis for reclamation of Moab tailings indicates a potential range of costs at the lower 5th and upper 95th percentile of $1.62/ton and $2.43/ton with a mean of $1.91/ton (see Figure 1).

The 1993 cost estimates showed that a significant increase of reclamation costs would be incurred if off-site reclamation to an alternate site was to be undertaken. For comparison purposes, information provided by DOE on costs of off-site reclamation was reviewed and analysed in the same manner as previously illustrated for on-site reclamation. The results of this review show that for sites having similar off-site reclamation requirements, in comparison to the alternate Moab site, reclamation costs range from $17.33/cubic yard to $34.74/cubic

yard and have an average cost of $22.45/cubic yard. By comparison to these costs, the Atlas 1993 relocation estimates were on the low side and ranged from $11.92/cubic yard to $14.36/cubic yard with an average of $13.14/cubic yard.

As was done for the cost of on-site reclamation estimates, uncertainty analyses were undertaken. These analysis reflected additional uncertainties over and above those considered in the base case, and in particular attempted to reflect the cost uncertainty associated with materials handing of slimes, excavation, and seismicity. The results of these analysis show an average worst case cost in 1995 dollars of $19.93/cubic yard with a range from $15.38/cubic yard to $24.49/cubic yard for the probabilistic analysis. In either case, the analyses indicated that Atlas estimates for relocation are at the low end of actual cost for similar sized tailings piles.

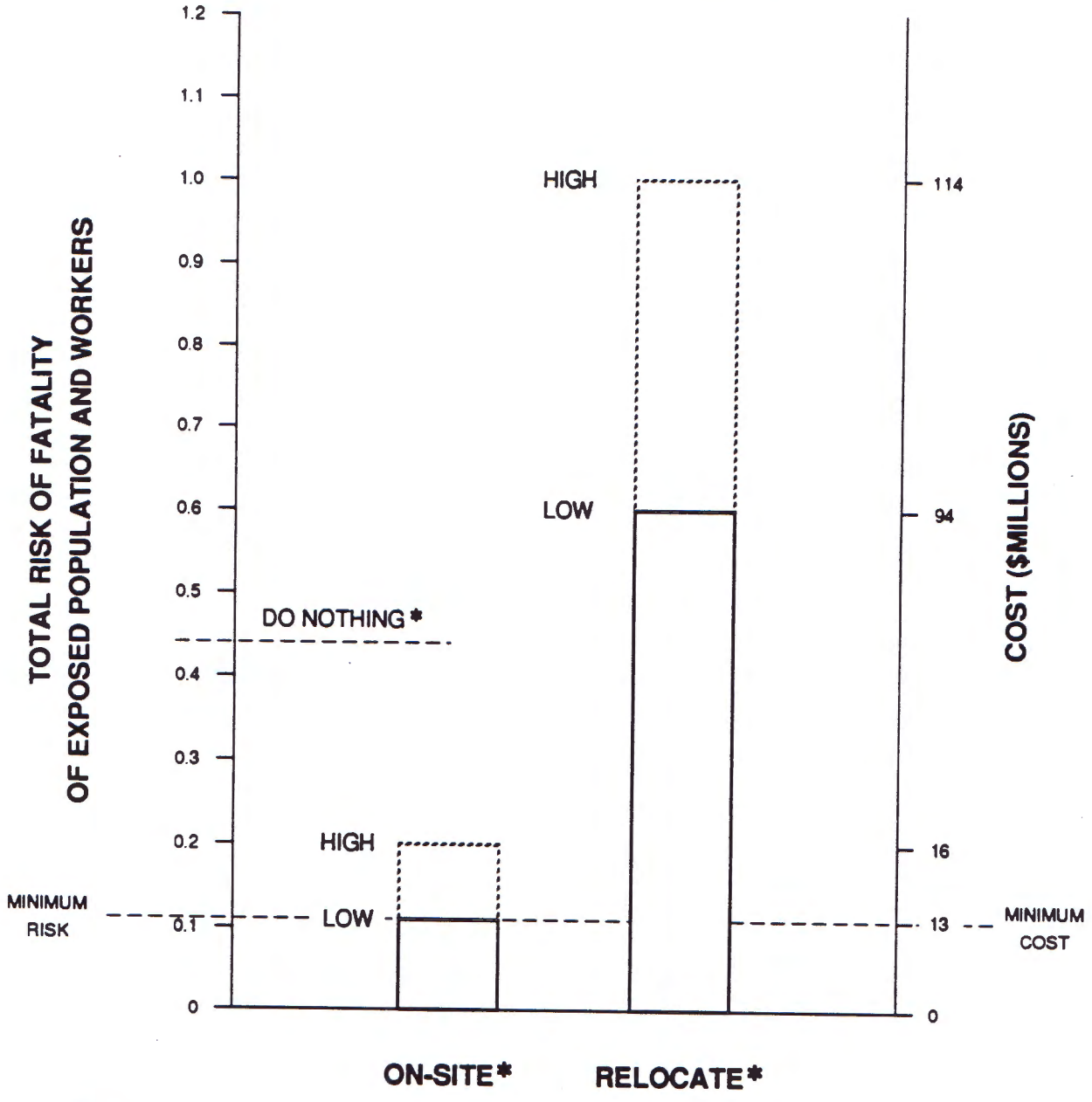
Conclusions

In 1992, the NRC reviewed and approved Atlas' plan for on-site reclamation of the Moab tailings. Subsequently, in 1994 NRC reversed their FONSI which lead to a review of the reclamation alternatives, the associated risks and the associated costs.

This paper summarizes the results of studies performed on behalf of Atlas. These studies considered many factors including: legal, policy, risk and cost. As discussed above, the overall risk, to the public and remediation workers combined, is about five (5) times greater for the relocation alternative than for *in situ* reclamation. A screening level uncertainty analysis on risk from radon-222 after *in situ* reclamation indicates such risk is small and likely to be less than about 4 mrem/y. Similarly, cost estimates for *in situ* reclamation versus relocation demonstrated that the cost for relocation would be about 6-9 times larger than the costs for *in situ* reclamation. Thus by either metric, risk or cost, *in situ* reclamation is the preferred alternative.

FIGURE 1

RISK / COST BENEFIT SUMMARY * FOR MOAB UTAH TAILINGS



NOTE:

1. SEE TEXT FOR DEFINITIONS *

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ATTACHMENT D

Earthquake hazards in the Intermountain U.S.: issues relevant to uranium mill tailings disposal

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ABSTRACT: In the past two decades, a tremendous amount of new information and data has emerged on seismic sources in the Intermountain United States and their associated processes of earthquake generation. Consequently, the seismic safety of U.S. uranium mill tailings sites, which are located almost exclusively in this region, are being reviewed by the U.S. Nuclear Regulatory Commission (NRC). Based on a deterministic and probabilistic re-evaluation of potential seismic hazards at a Title II site in southeastern Utah, three significant issues have been raised which will impact other sites in the Intermountain U.S. required to revisit their seismic design criteria by the NRC. These issues are: (1) whether the NRC's required use of a deterministic approach for assessing seismic hazards is appropriate for Title II uranium mill tailings sites in a region such as the Intermountain U.S.; (2) is the alternative approach of probabilistic seismic hazard analysis acceptable to the NRC for uranium mill tailings sites; and (3) what is the appropriate return period that should be used. Based on our evaluation, we conclude that deterministic ground motion approaches such as the NRC's 10 CFR 40 Appendix A can result in overly conservative seismic design criteria for Title II sites in the Intermountain U.S. and that instead, probabilistic seismic hazard analysis should provide the bases for such criteria. Additionally, as in all decisions of this nature, the selection of a return period for a specific site should be based on what is deemed an acceptable level of risk. Such levels may vary from site to site depending on the consequences of radionuclide release into the environment. However, the values of 200 and 1000 years cited in the Environmental Protection Agency's (EPA) 40 CFR 192.02 and NRC's Appendix A Criterion 6(1) should form the basis for the selected return period.

1 INTRODUCTION

Many portions of the Intermountain region of the western United States (Figure 1) exhibit geologic evidence for large prehistoric earthquakes although they may lack even low levels of historical and/or contemporary seismicity. Such areas are subject to future seismic hazards. Large events such as the 1959 magnitude (M) 7.3 Hebgen Lake, Montana and 1983 M 6.8 Borah Peak, Idaho earthquakes attest to the earth's potential to damage both natural and man-made environments. The recurrence intervals of such large events on a specific fault in the Intermountain U.S., however, may span from a few thousands to more than 100,000 years. Hence, one of the most significant problems

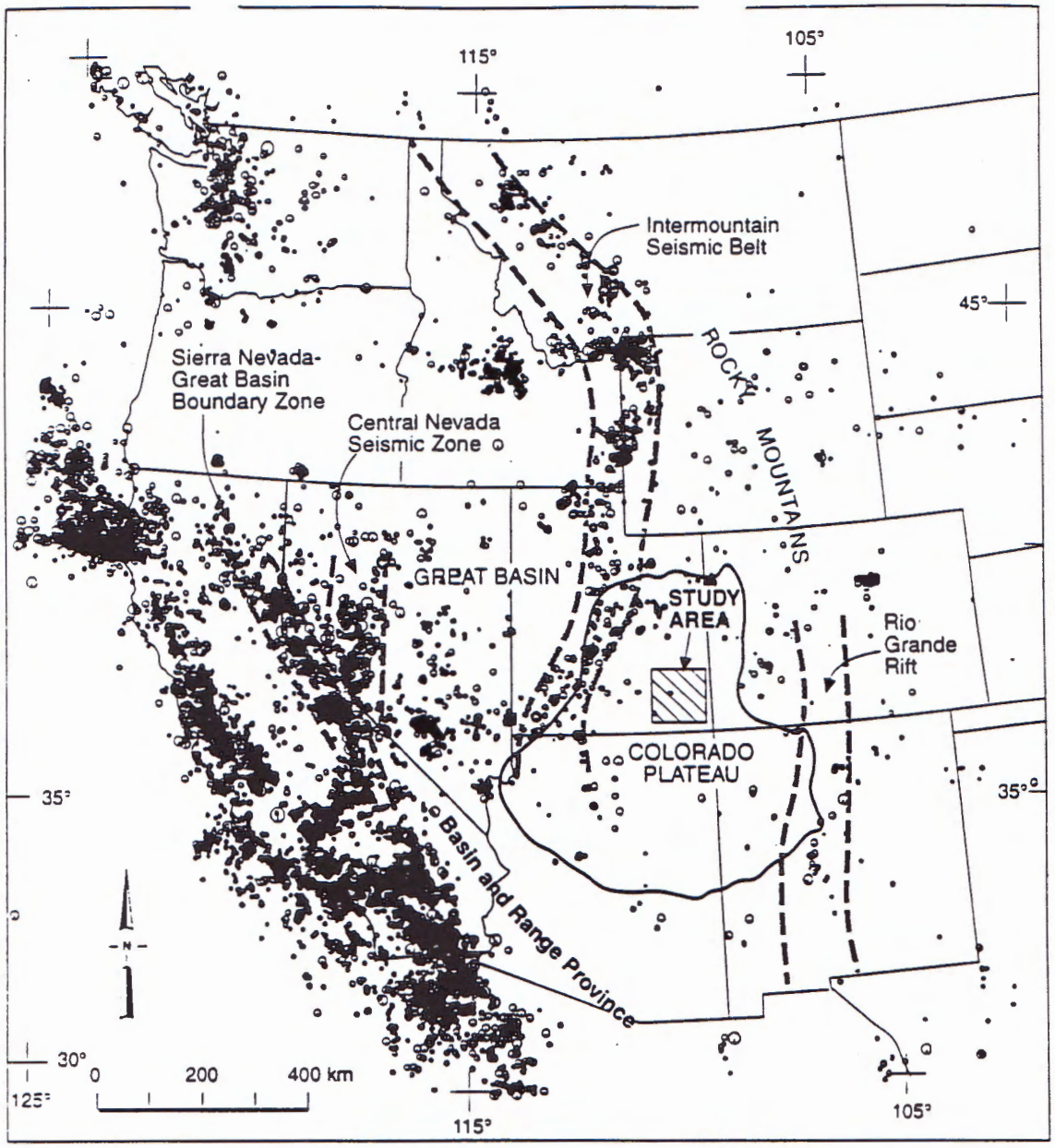


Figure 1. Seismicity of the western U.S. (1808 to 1996) and physiographic provinces and major seismic source zones located in the Intermountain U.S. Also shown is the study area around the Moab site in southeastern Utah. Earthquake data courtesy of the National Earthquake Information Center.

facing the community involved in earthquake hazard mitigation is how to address the hazard from large but infrequent earthquakes. In contrast, there also exist portions of the Intermountain U.S., such as the interior of the Colorado Plateau, where the earthquake potential is low based on both recent geologic and seismologic data.

In 1978, Congress enacted the Uranium Mill Tailings Radiation Control Act (UMTRCA) to provide for the disposal, long-term stabilization, and control of uranium mill tailings. The NRC, which regulates UMTRCA uranium mill tailing sites, has initiated a program of re-evaluating the seismic design criteria of Title II (licensed) sites based on the results of a recent study performed by Lawrence Livermore National Laboratory (LLNL) (Bernreuter *et al.* 1995). In the LLNL study, "simplified" site-

specific probabilistic seismic hazard analyses were performed for 19 Title II sites located in Utah, Wyoming, South Dakota, and New Mexico based on readily available information. Bernreuter *et al.* (1995) concluded that at most sites, their estimates of probabilistic peak ground acceleration at return periods of 2,000 years and more were higher than the values used in design.

In a recent re-evaluation of a Title II site in Moab, Utah, three key seismic hazard issues have emerged in our interactions with the NRC. These issues will significantly impact most, if not all, other sites in the Intermountain U.S. This paper describes these issues and our approach to resolving them.

2 EARTHQUAKE HAZARDS IN THE INTERMOUNTAIN U.S.

The Intermountain U.S., as defined in this paper, consists of the states of Idaho, Nevada, Arizona, Utah, Montana, New Mexico, Colorado, and Wyoming. Physiographically, the region consists principally of the Basin and Range province, Colorado Plateau, Rocky Mountains, and Great Plains. Four major seismic zones are located within or border the Intermountain U.S. including: (1) the Sierra Nevada-Great Basin boundary zone; (2) the Intermountain seismic belt including the Centennial Tectonic Belt; (3) the Central Nevada seismic zone; and (4) the Rio Grande rift (Wong *et al.* 1982) (Figure 1). Elsewhere, away from these zones, the level of historical seismicity is more subdued but there still exists the potential for the occurrence of large but infrequent earthquakes as indicated by the presence of late-Quaternary faults. For example, the 1887 Sonoran earthquake of estimated M 7.4 occurred as a result of rupture along the Pitaycachi fault just south of the Arizona-Mexico border (Bull and Pearthree 1988) in an area characterized by a low level of historical and contemporary seismicity.

Of greatest relevance to the Intermountain Title II sites are the Intermountain seismic belt and Rio Grande rift. The Intermountain seismic belt is one of the most extensive zones of seismicity within the continental United States (Figure 1). It trends 1300 km northward from northwestern Arizona through central Utah, straddles the Idaho-Wyoming border, and turns northwestward through Montana in the vicinity of Yellowstone National Park (Smith and Sbar 1974; Smith and Arabasz 1991). Much of the Intermountain seismic belt is characterized by generally north- to northwest-trending normal faults. Prominent fault zones include the Sevier and Hurricane faults in northern Arizona and southern Utah, the Wasatch fault zone in central Utah, and the Madison and Hebgen faults near Yellowstone. Since the beginning of the historical record in the mid-1800's, about 25 earthquakes of M 6 or greater have occurred along the Intermountain seismic belt (Smith and Arabasz 1991). The largest event in historical time was the 1959 Hebgen Lake earthquake.

The Rio Grande rift extends for approximately 600 km from south-central New Mexico northward to south-central Colorado (Figure 1). Most of New Mexico's population is concentrated along the Rio Grande rift in cities such as Albuquerque and Santa Fe. The earliest report of earthquake activity was a sequence of 22 events felt in 1849 to 1850 near the town of Socorro (Sanford *et al.* 1991). The largest earthquakes observed to date are three events that occurred on 12 and 16 July and 15 November 1906 near Socorro. The estimated size of the latter event, the largest of the trio, is about M 6.

3 SEISMIC HAZARD EVALUATION OF THE MOAB SITE

In response to a request by the NRC, an up-to-date seismic hazards evaluation of the Title II Moab site was performed (Wong *et al.* 1996). This site, owned by Atlas Corporation, consists of a 130-acre pile consisting of 10½ million tons of processed tailings derived from the past operation of the Atlas uranium mill. The tailings were emplaced over alluvial soils and the disposal area was developed from 1956 to 1984. The site is in the process of final closure and the Remedial Action Plan (Reclamation Plan) requires NRC approval.

According to the Standard Review Plan (SRP June 1993), "there are no NRC regulatory guidelines directly applicable to the geologic and seismologic aspects of the UMTRA Program". However, the basic acceptance criteria pertinent to the geologic and seismic stability aspects are provided in the EPA's 40 CFR Part 192, Subpart A and according to section 192.02, "control of residual radioactive materials and their listed constituents shall be designed to be effective for up to 1000 years, to the extent reasonably achievable, and in any case, for at least 200 years". NRC staff has interpreted this standard to mean that certain geologic and seismic conditions must be met in order to have reasonable assurance that the long-term performance objectives will be achieved (NRC 1994).

The SRP states that NRC staff review of seismotectonic stability must conclude whether the information and investigations in the Remedial Action Plan provide an adequate basis for selection of the Maximum Credible Earthquake (MCE) and determination of the resulting vibratory ground motion at the site. The NRC defines the MCE as the "earthquake which would cause maximum vibratory ground motion based upon an evaluation of earthquake potential considering the regional and local geology and seismology and specific characteristics of local subsurface material" (10 CFR 40 Appendix A). The NRC's Appendix A approach, which basically requires the determination of the 84th percentile MCE ground motions, is a deterministic approach. It requires the use of the worst case earthquake with no consideration for its frequency of occurrence.

Although Appendix A stipulates that a tailings pile be designed for the MCE, the Introduction to Appendix A allows for alternatives to be proposed by the licensee. These alternatives "may take into account local or regional conditions, including geology, topography, hydrology, and meteorology. The commission may find that the proposed alternatives meet stabilization and containment of the site concerned, and a level of protection for public health, safety, and the environment from radiological and non-radiological hazards associated with the sites, which is equivalent to, to the extent practicable, or more stringent than the level which would be achieved by the requirements of this Appendix and the standards promulgated by the EPA in 40 CFR Part 192." Furthermore, Appendix A Criterion 6(1) specifies that the regulatory standard is "reasonable assurance" of stability of the tailings disposal for the 200 to 1,000 year period.

Moab is located within the interior of the Colorado Plateau which has been generally considered to be seismically inactive and devoid of large earthquakes. Seismological studies performed in the past decade, however, indicate that seismicity is fairly widespread throughout the Plateau interior, albeit at a low to moderate level, and that earthquakes up to M 6 have occurred in historical times (Wong and Humphrey 1989). Although detailed fault studies have not been performed to date within the Colorado Plateau, the available geologic data suggests that only a few significant late-Quaternary

faults may exist in the Plateau interior (Hecker 1993). Thus there appears to be at least a low level of earthquake hazard within the Plateau.

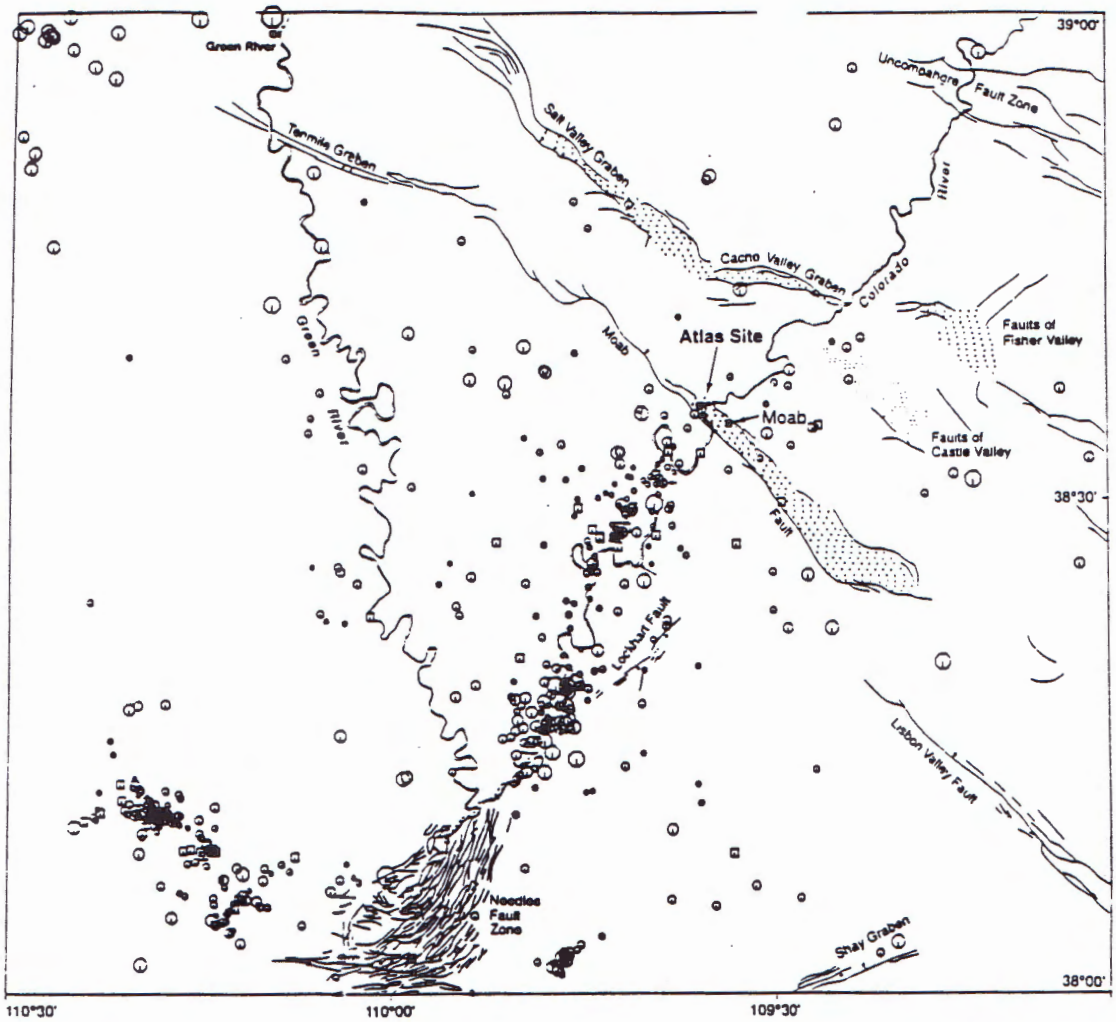
In our seismic hazard evaluation of the Moab site, potentially seismogenic faults and seismic source zones (areal sources) significant to the site were identified, characterized, and considered in the analysis. These seismic sources included 11 faults, a zone of microseismicity along the Colorado River southwest of Moab, and a seismic source zone for the Colorado Plateau which represents unknown earthquake sources having no geologic surficial expression (Figure 2). The closest fault to the site is the Moab fault which trends beneath the northeastern corner of the site. Available geologic and geophysical evidence, however, indicates that the fault is not capable of producing significant earthquakes (Olig *et al.* 1996). In fact, 10 of the 11 faults considered in our evaluation are associated with salt structures and are probably not seismogenic (Wong *et al.* 1996).

Based on an Appendix A approach, ground motions, as characterized by peak horizontal acceleration, were estimated for three potential earthquake scenarios: (1) a M 5.0 earthquake at a source-to-distance of 30 km, our proposed largest event along the Colorado River seismicity trend; (2) a M 6½ earthquake along this same zone at a distance of 5 km from the site as proposed by the NRC; and (3) a "floating" earthquake of M 6¼ at a distance of 15 km. In the absence of any nearby capable faults, the NRC's policy requires that the MCE be represented by a floating (random) earthquake. For the second scenario, the NRC assumed that half of the seismicity zone along the Colorado River could rupture in a single large earthquake. Based on geological and seismological arguments presented in Woodward-Clyde Federal Services (1996), we consider this scenario to be extremely unlikely.

Given a maximum magnitude and source-to-site distance, empirically-based attenuation relationships can be used to estimate median (50th percentile) and median plus one standard deviation (84th percentile) ground motions for a site. The NRC-stipulated 84th percentile peak horizontal accelerations at the Moab site were 0.06 g, 0.63 g, and 0.29 g, respectively for the above earthquake scenarios. Based on this analysis, the MCE for the site would be the NRC's M 6½ earthquake occurring along the Colorado River seismicity trend at a source-to-site distance of 5 km.

As an alternative approach, we evaluated the earthquake hazard at the Moab site probabilistically similar to, but in a more rigorous manner than was done by LLNL. In a probabilistic seismic hazard analysis, levels of ground motions associated with a probability or likelihood of being exceeded in a specified time period (or inversely, return period) can be calculated. This approach also allows for the explicit inclusion of the range of possible interpretations and uncertainties in components of the model including seismic source characterization and ground motion estimation. The probabilistic seismic hazard model used in our study is similar to the hazard model originally developed by Cornell (1968) and refined by McGuire (1974).

All seismic sources within a distance of about 150 km from the site were characterized and input into the analysis (Wong *et al.* 1996). This included the 11 faults such as the Moab fault, the Colorado River seismicity trend, and the Colorado Plateau source zone. Ten of the 11 faults were assigned low probabilities of being seismogenic because they show no evidence for Quaternary activity except deformation related to shallow salt dissolution and flowage (Wong *et al.* 1996). The attenuation of ground motions was addressed through the use of state-of-the-art empirical relationships for peak horizontal acceleration and stiff soil conditions.



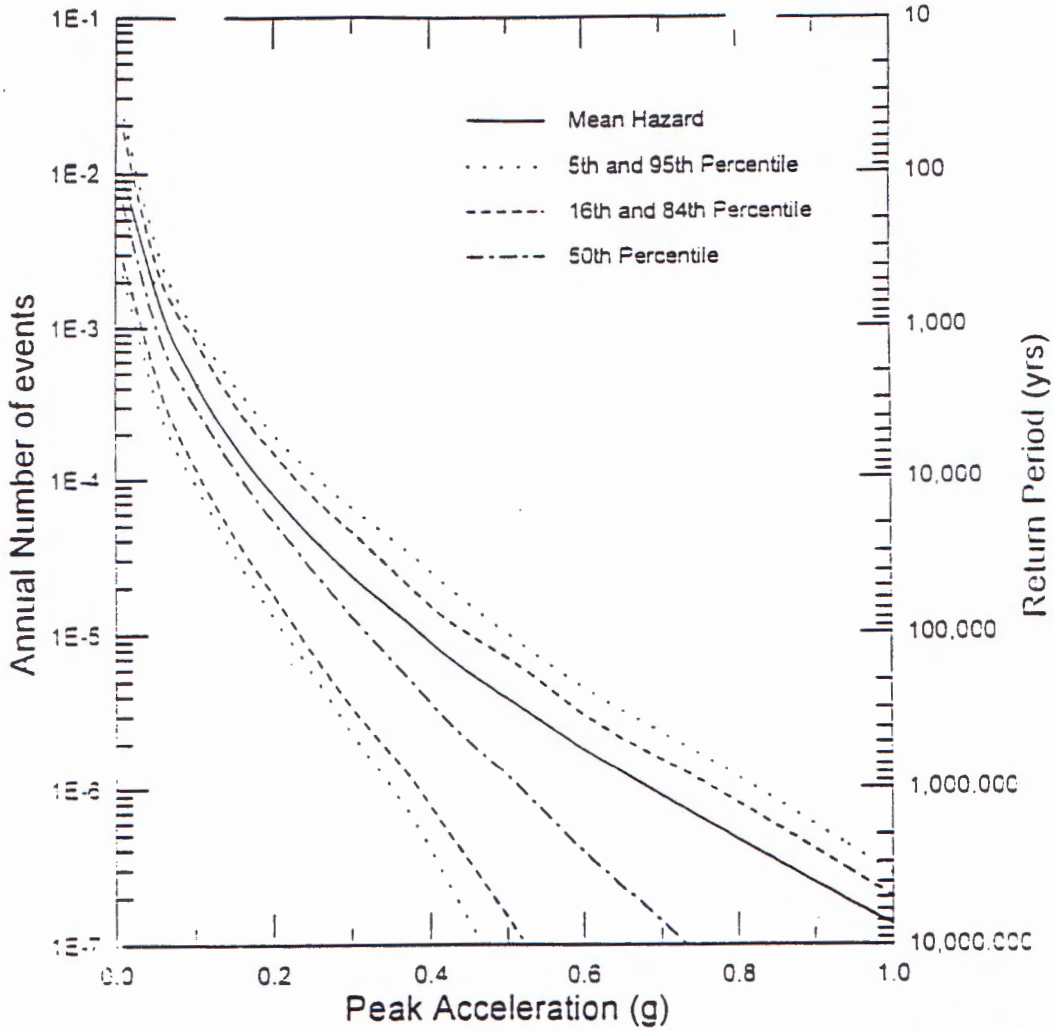
(Source: Wong et al. 1996)

Figure 2. Seismicity (1953 to 1994) and selected Cenozoic faults (after Hecker 1953) in the Moab study area. Stippled areas represent areas of distributed deformation due to salt dissolution. Ball on normal faults is on downthrown side.

The probabilistic seismic hazard analysis resulted in peak horizontal accelerations at the Moab site of 0.05 to 0.18 g for return periods ranging from 500 to 10,000 years (Figure 3). The MCE 84th percentile peak horizontal acceleration of 0.63 g has a return period of about 750,000 years (Figure 3) or 750 times greater than the 1000-year design life stipulated in 40 CFR 192.02 and Appendix A Criterion 6(1). The major contributor to peak acceleration hazard at 10,000 years is the background earthquake in the Colorado Plateau source zone. The Colorado River seismicity trend and the Moab fault contribute little to the hazard at the Moab site at this return period (Wong *et al.* 1996).

4 SEISMIC HAZARD ISSUES IN THE INTERMOUNTAIN U.S.

In the seismic hazard evaluation of the Moab site, three significant issues were raised due to NRC regulations governing Title II sites. The first issue stems from the NRC's current



(Source: Wong et al. 1996)

Figure 3. Probabilistic seismic hazard curves for the Moab site. The fractile curves give the range of uncertainty about the mean or median (50th percentile) values. The peak horizontal acceleration of 0.18 g at a 10,000 year return period, our recommended seismic design value, can be read from the mean hazard curve.

position of requiring the seismic design of Title II sites be based on a deterministic Appendix A approach incorporating the concept of the MCE. In such an approach, the 84th percentile ground motions generated by the MCE provide the basis for the Design Basis Earthquake. Intertwined in this issue is also the issue of the reasonableness of the 15 km source-to-site for the floating earthquake in areas of low seismicity.

We believe the MCE peak horizontal acceleration for the Moab site (0.63 g) and even the value estimated for the floating earthquake (0.29 g) are overly conservative for seismic design purposes given the low seismic potential that exists within the interior of the Colorado Plateau. This latter observation is supported by the available seismological and geological data. In particular, the location of the Moab site in the Canyonlands region where many precariously balanced rocks occur throughout the area, some very delicately, suggests that this portion of the Colorado Plateau interior has not been subjected to strong earthquake ground shaking for at least several thousands of years (Wong *et al.* 1996).

As described ·lier, the NRC's policy specifies the 15 k. ·ource-to-site distance for the floating earthquake. This distance is rather arbitrary because it is independent of the seismic potential of the region being considered. Thus whether a site is located along the more seismically active Wasatch Front in central Utah or the much less active Moab area, the 15-km distance is fixed. In general, deterministic approaches such as dictated in the NRC's Appendix A can result in overly-conservative seismic design criteria in areas of low earthquake potential. Even for sites in more seismically active areas of the Intermountain U.S., deterministically-based ground motions can also be too high for seismic design because the majority of late-Quaternary faults are characterized by long recurrence intervals far exceeding the lifetimes of engineered structures.

The second issue is whether probabilistic seismic hazard analysis is acceptable to the NRC as an alternative to their Appendix A deterministic approach for developing seismic design criteria at Title II sites. The NRC has endorsed the use of probabilistic risk assessment in nuclear regulatory matters as specified in their final policy statement in the Federal Register (16 August 1995). At this time, however, the NRC has not officially established a policy for Title II sites. Probabilistic analysis has become increasingly used in seismic hazard analysis for a wide range of facilities and structures. It provides the basis for the Uniform Building Code and is now become acceptable for evaluating the potential seismic hazards to nuclear reactors.

Given the uncertainties in seismic source characterization and ground motion estimation in the Intermountain U.S., probabilistic seismic hazard analysis is well suited to addressing these uncertainties. For example, given the observation that the largest known earthquake along the Colorado River is less than M 3, there is considerable uncertainty in the assumption that the maximum earthquake for this zone is M 5 relevant to the Moab site. As previously discussed, the NRC's position that a maximum earthquake of M 6½ could occur within this zone is even more uncertain. Additionally, because the acceptable risk of Title II sites has been defined in terms of time (200 to 1000 years), it is best evaluated through probabilistic analysis which incorporates the recurrence of earthquake sources.

If probabilistic analysis is acceptable for Title II sites, a significant issue is at what return period (or alternatively a probability of nonexceedance) is deemed appropriate by the NRC. It was our recommendation that the seismic design criteria for the Moab site be based on a return period of 10,000 years (corresponds to a 10% chance of exceedance in 1000 years). We selected and recommended this very conservative return period based on the fact that the Moab site is located adjacent to the Colorado River and that radionuclide release into the major water source, if possible, might be considered higher risk than other Title II sites. In the probabilistic seismic hazard analysis performed by Bernreuter *et al.* (1995) for Title II sites, they calculated peak horizontal accelerations assuming a return period of 10,000 years. They adopted this value because, in their opinion, it satisfied the criteria cited in Appendix A. Furthermore, they stated that such a probability of exceedance may be too conservative for design because of the "relatively low risk posed by the tailings piles." For comparison, the current design life for the proposed underground nuclear waste repository at Yucca Mountain, Nevada is 10,000 years.

Because we considered a 10,000 return period to be very conservative compared to the required 1,000 years cited in 40 CFR 192.02 and Appendix A and because both EPA and NRC considered but explicitly rejected a 10,000 year control period for uranium mill tailings, our recommended seismic design value of 0.18 g for the Moab site provides

"reasonable assurance" of a level of protection "equivalent to, to the extent practicable" stipulated in Appendix A. We believe that selection of longer return periods, which correspond to lower probabilities of exceedance, would certainly result in overly conservative seismic design criteria not consistent with the available geologic, seismologic, and geophysical data pertinent to earthquake hazards in the vicinity of the Moab site and the interior of the Colorado Plateau.

5 CONCLUSIONS

Probabilistic seismic hazard analysis has been increasingly accepted as an approach often superior to deterministic methods alone for evaluating seismic hazards for a wide variety of facilities and structures. The probabilistic methodology is particularly well suited in applications for uranium mill tailings sites because of their generally lower risk and locations in the Intermountain U.S. In this region, large damaging earthquakes are possible but relatively infrequent. There are also considerable uncertainties in characterizing seismic sources and estimating ground motions which can be explicitly incorporated into probabilistic seismic hazard analysis. Finally, because the level of acceptable risk for Title II sites has been expressed in a time frame of 200 to 1000 years (40 CFR 192.02), probabilistic seismic hazard analysis is better suited to providing the basis for seismic design criteria than deterministic approaches, which are time independent.

6 ACKNOWLEDGMENTS

The seismic hazard evaluation of the Atlas site was performed by Woodward-Clyde Federal Services for Smith Environmental Technologies on behalf of Atlas Corporation. Our thanks to Jacqueline Bott, Andy Gorton, Ann Becker, Clark Fenton, Bob Green, Jeff McCleary, Sue Penn, Doug Wright, Richard Ely, Jim Cooksley, Fumiko Goss, and Sadako McInerney for assistance in this study. We also benefited greatly from interactions with NRC staff particularly Phil Justus, Bakr Ibrahim, Joe Holonich, Myron Fliegel, Ted Johnson, and Dan Rom. We greatly appreciate review of this paper by Tony Thompson.

REFERENCES

Bernreuter, D., E. McDermott & J. Wagoner 1995. Seismic hazard analysis of Title II Reclamation Plans. Unpublished report prepared by Lawrence Livermore National Laboratory for the U.S. Nuclear Regulatory Commission.

Bull, W.B. and P.A. Pearthree 1988. Frequency and size of Quaternary surface ruptures of the Pitaycachi fault, northeastern Sonora, Mexico, *Bull. Seismol. Soc. Am.*, 78: 956-978.

Cornell, C.A. 1968. Engineering seismic risk analysis, *Bull. Seismol. Soc. Am.*, 58:1583-1606.

Hecker, S. 1993. Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization. *Utah Geol. Surv. Bull.* 127:157 p.

McGuire, R.K. 19 Seismic structural response risk analysis i. .porating peak response regressions on earthquake magnitude and distance, *Massachusetts Institute of Technology Dept. of Civil Engineering/Research Report* R74-51.

Olig, S.S., C.H. Fenton, J. McCleary & I.G. Wong 1996. The earthquake potential of the Moab fault and its relation to salt tectonics in the Paradox Basin, Utah. In C. Huffman (ed.) *1996 Symposium and Field Conference on the Geology and Resources of the Paradox Basin* (in press).

Sanford, A.R., L.H. Jaksha & D.J. Cash 1991. Seismicity of the Rio Grande rift in New Mexico. In D.B. Slemmons, E.R. Engdahl, M.D. Zoback & D.D. Blackwell (eds.), *Neotectonics of North America, Geol. Soc. Am. Decade Map* 1:229-244.

Smith, R.B. & W.J. Arabasz 1991. Seismicity of the Intermountain seismic belt. In D.B. Slemmons, E.R. Engdahl, M.D. Zoback, M.L. Zoback & D. Blackwell (eds.), *Neotectonics of North America, Geol. Soc. Am. Decade Map* 1:185-228.

Smith, R.B. & M.L. Sbar 1974. Contemporary tectonics of the interior of the western United States with the emphasis of the Intermountain seismic belt. *Geol. Soc. Am. Bull.* 85:1205-1218.

U.S. Nuclear Regulatory Commission 1994. Final safety evaluation report to license the construction and operation of a facility to receive, store and dispose of 11e.(2) byproduct material near Clive, Utah. *NUREG-1486.*

Wong, I.G. & J.R. Humphrey 1989. Contemporary seismicity, faulting, and the state of stress in the Colorado Plateau. *Geol. Soc. Am. Bull.* 101:1127-1146.

Wong, I.G., S.S. Olig & J.D. Bott 1996. Earthquake potential and seismic hazards in the Paradox Basin, southeastern Utah. In C. Huffman. (ed.) *1996 Symposium and Field Conference on the Geology and Resources of the Paradox Basin* (in press).

Wong, I.G., F. Swan III & L.S. Cluff 1982. Seismicity and tectonics of the Basin and Range and Colorado Plateau provinces: Implications to microzonation. In *Third International Earthquake Microzonation Conference Proceedings* 1:53-69.

Woodward-Clyde Federal Services 1996. Evaluation of potential seismic and salt dissolution hazards at the Atlas uranium mill tailings site, Moab, Utah. Unpublished final report prepared for Smith Environmental Technologies and Atlas Corporation.