Paper

# LONG-TERM STEWARDSHIP OF THE ENVIRONMENTAL LEGACY AT RESTORED SITES WITHIN THE DEPARTMENT OF ENERGY NUCLEAR WEAPONS COMPLEX

James R. Wells and Henry B. Spitz*

*Abstract*—**It is readily apparent, as the Department of Energy Office of Environmental Management proceeds in remediating its vast network of contaminated nuclear weapons facilities, that final cleanup at many facilities will not be performed to a level allowing unrestricted use of the facility. Instead, these facilities must rely on engineering, administrative, and institutional controls to ensure the level of cleanup performed at the site remains adequately protective of public health and the environment. In order for these controls to remain effective, however, a plan for long-term stewardship of these sites must be developed that is approved by the U.S. Congress. Although this sounds simple enough for the present, serious questions remain regarding how best to implement a program of stewardship to ensure its effectiveness over time, particularly for sites with residual contamination of radionuclides with half-lives on the order of thousands of years. Individual facilities have attempted to answer these questions at the site-specific level. However, the complexities of the issues require federal support and oversight to ensure the programs implemented at each of the facilities are consistent and effective. The Department of Energy recently submitted a report to Congress outlining the extent of long-term stewardship needs at each of its facilities. As a result, the time is ripe for forward thinking Congressional action to address the relevant issues and ensure the remedy of long-term stewardship successfully carries out its intended purpose and remains protective of public health and the environment. The regulatory elements necessary for the stewardship program to succeed can only be implemented through the plenary powers of the U.S. Congress.**
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## INTRODUCTION

Beginning during World War II and continuing throughout the cold war, the federal government operated a vast network of industrial and research facilities used for the development and production of nuclear weapons (U.S. DOE 1997). This network of facilities consisted of over 100 sites located in 30 states, most of which were originally operated by the Atomic Energy Commission. Other sites were privately owned but performed contract work for the government. The Atomic Energy Commission was abolished in the Energy Reorganization Act of 1974 and eventually replaced, in part, by the Department of Energy (DOE).

Relative to contemporary regulations that strictly limit sources of environmental contamination, radiological and chemical releases to the environment which occurred at the facilities throughout the early years of the cold war went largely unchecked (U.S. Congress 1991; U.S. DOE 1995). The result was widespread environmental contamination in the form of hundreds of thousands of acres of residually contaminated soils, contaminated groundwater, surface water and sediment contamination, and contaminated buildings at many sites across the country. The contaminants of concern at each of the facilities varied widely based on the history of the site but typically included an array of long-lived radioactive isotopes of uranium, thorium, plutonium, radium, technetium, and others, as well as a wide array of chemical contaminants (U.S. DOE 2001a).

Since 1989, the Department of Energy's Office of Environmental Management (EM) has been addressing this environmental legacy by initiating extensive studies and remediation at each of the affected sites (U.S. DOE 1998). To date, DOE is conducting extensive cleanup at many of the sites, with many phases of remediation completed. As remediation proceeds, however, it is becoming abundantly clear that in some of these facilities, final cleanup will not be performed to a level allowing for unrestricted use of the site. Instead, these facilities are implementing cleanup levels well above background and are relying on engineering, administrative, and institutional controls to ensure the level of cleanup performed at the site remains adequately protective of public health and the environment (Bauer and Probst 2000). In fact, in many cases, sites are establishing

* University of Cincinnati, Department of Mechanical, Industrial and Nuclear Engineering, 598 Rhodes Hall, Cincinnati, OH 45221-0072.

For correspondence or reprints contact: H. Spitz at the above address, or email at henry.spitz@uc.edu.

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their own on-site disposal cells for disposal of contaminated wastes relying on engineered barriers to isolate the wastes from the environment. In any case, in order for the controls implemented at the sites to remain effective and carry out their intended purpose, a plan for long-term stewardship for each of these sites must be developed (Probst and McGovern 1998).

Although this sounds simple enough in the context of the present, serious questions remain regarding how best to implement such a program to ensure its effectiveness over the long haul, particularly for sites with residual contamination of radionuclides with half-lives on the order of thousands of years. What are the minimum standards necessary for maintenance and surveillance of the sites into the future? What record keeping is necessary? What are the minimum controls to be placed on the site to ensure residual contaminants remain undisturbed? Who should act as the steward of the site? Who should serve as the regulator of the steward? How is adequate funding for these activities ensured into the future? What degree of flexibility is necessary on a site-specific level to best meet the needs of the sites and to prevent over-regulation? What role should the states, local governments, and other stakeholders play in the long-term stewardship of these federal facilities? What enforcement mechanisms are necessary to ensure the stewardship plan is properly carried out? Are the existing federal environmental and radiation laws sufficient?

Individual facilities have attempted to answer these questions at the site-specific level (U.S. DOE 2001a). However, the complexities of the issues require federal support and oversight to ensure the programs implemented at each of the sites are consistent and effective. The DOE recently submitted a report to Congress outlining the extent of long-term stewardship needs at each of its facilities (U.S. DOE 2001a) and issued a final study report on their web site http://www.em.doe.gov/lts (U.S. DOE 2001b). As a result, the time is ripe for forward-thinking Congressional action to address the above questions and ensure the remedy of long-term stewardship remains protective of public health and the environment and successfully carries out its intended goals.

## DEFINING "LONG-TERM STEWARDSHIP" AND THE EXTENT OF STEWARDSHIP NEEDS

Long-term stewardship refers to all activities necessary to ensure protection of human health and the environment following completion of cleanup, disposal, or stabilization at a site or a portion of a site (U.S. DOE 2001a, b). Long-term stewardship includes all engineered and institutional controls designed to contain or to prevent exposures to residual contamination and waste, both in the short and the long term, after the cleanup of the weapons complex is considered "complete." The likely elements of a stewardship program are 1) site monitoring and maintenance; 2) application and enforcement of institutional controls; 3) information management; and 4) environmental monitoring. While defining stewardship and listing the likely elements is an easy task, the actual implementation can be rather daunting, considering the number of sites involved and the specific needs of each site.

DOE expects to conduct long-term stewardship activities at up to 129 sites (Table 1). Ninety-six of these sites are expected to have completed remediation by 2006 with the only remaining environmental management commitment at the site consisting of long-term stewardship. The remaining 33 sites will not complete remediation until after 2006. DOE has identified an additional 48 sites where it claims DOE is either not responsible based on legal agreements naming some other entity as being responsible for stewardship activities or DOE does not expect to conduct long-term stewardship activities other than record-keeping because the site was cleaned up to a level permitting unrestricted use (U.S. DOE 2001).

The extent of stewardship activities necessary at a site varies tremendously based on the history of the facility. DOE sites vary significantly from one another not only in size but also in past missions and the associated residual contaminants (U.S. DOE 1997). For instance, the Hanford Site in the state of Washington covers 375,000 acres with past missions consisting of fuel and target fabrication, production reactor operations, chemical separations, and component fabrications. In contrast, the Piqua Nuclear Power Facility in Ohio is a small site of approximately 0.5 acre, which formerly contained a relatively small demonstration reactor.

The level of stewardship activities may vary tremendously at different portions of the same site based on different cleanup levels attained and different end uses in mind. For instance, one portion of a site may be released for unrestricted use; another portion may have been remediated such that only minimal institutional controls are necessary; still another portion of the same site may require fencing, security, and extensive monitoring (NRC 2000).

Projected annual costs for long-term stewardship activities are expected to fluctuate each year until reaching a fairly steady state level by the year 2050 of approximately $101 million per year (U.S. DOE 2001). These cost estimates are in constant 2000 dollars and do not reflect life-cycle costs, only annual costs.

## MAKING THE CASE FOR FEDERAL CONGRESSIONAL ACTION

Stewardship requirements must initially be adequate and must then be implemented and followed for as long as

**Table 1.** One hundred twenty-nine sites requiring long term stewardship (U.S. DOE 2001).

| No. | State | Site | No. | State | Site | No. | State | Site |
|---|---|---|---|---|---|---|---|---|
| 1 | AK | Amchitka Island | 43 | MD | W.R. Grace & Co. | 87 | | Piqua Nuclear Power Facility |
| 2 | AZ | Monument Valley Site | 44 | MA | Shpack Landfill | 88 | | Portsmouth Gaseous Diffusion Plant |
| 3 | | Tuba City Site | 45 | MS | Salmon Site | | | |
| 4 | CA | Lawrence Berkeley National Laboratory | 46 | MO | Kansas City Plant | 89 | OR | Lakeview Mill |
| | | | 47 | | Latty Avenue Properties | 90 | | Lakeview Site |
| 5 | | Lawrence Livermore National Laboratory—Livermore | 48 | | St. Louis Airport Site | 91 | PA | Burrel Site |
| | | | 49 | | St. Louis Airport Site Vicinity Properties | 92 | | Canonsburg Site |
| 6 | | Lawrence Livermore National Laboratory—Site 300 | | | | 93 | PR | Center for Energy and Environmental Research |
| | | | 50 | | St. Louis Downtown Site | | | |
| 7 | | Sandia National Laboratories—CA | 51 | | Weldon Springs Site | 94 | SC | Savannah River Site |
| | | | 52 | ME | Hallam Nuclear Power Facility | 95 | SD | Edgemont Site |
| 8 | | Stanford Linear Accelerator | | | | 96 | TN | Oak Ridge Reservation |
| 9 | CO | Bodo Canyon Cell | 53 | NV | Central Nevada Test Area | 97 | TX | (Chevron) Panna Maria Site |
| 10 | | Burrow Canyon Disposal Cell | 54 | | Nevada Test Site | 98 | | (Conoco) Conquista Site |
| 11 | | Cheney Disposal Cell | 55 | | Project Shoal | 99 | | (Exxon) Ray Point Site |
| 12 | | (Cotter) Cañon City Site | 56 | NJ | DuPont & Co. | 100 | | Falls City Site |
| 13 | | Durango Mill | 57 | | Maywood Chemical Works | 101 | | Pantex Plant |
| 14 | | Estes Gulch Disposal Cell | 58 | | Middlesex Sampling Plant | 102 | UT | (Atlas) Moab Mill |
| 15 | | Fort St. Vrain Independent Spent Fuel Storage Facility | 59 | | Princeton Plasma Physics Laboratory | 103 | | (EFN) White Mesa Site |
| | | | | | | 104 | | Green River Site |
| 16 | | Grand Junction Mill 1 | 60 | | Wayne Site | 105 | | Mexican Hat Site |
| 17 | | Grand Junction Mill 2 | 61 | NM | Ambrosia Lake | 106 | | Monticello Mill Site and Vicinity Properties |
| 18 | | Gunnison Disposal Cell | 62 | | Bayo Canyon | | | |
| 19 | | Gunnison Mill | 63 | | Blue Water Site | 107 | | (Plateau) Shootaring Canyon Site |
| 20 | | (HECLA) Durita Site | 64 | | Gas Buggy Site | | | |
| 21 | | Maybell Mill Site | 65 | | Gnome—Coach | 108 | | (Rio Algom) Lisbon Valley Site |
| 22 | | Naturita Mill | 66 | | (Homestake) Grant Site | | | |
| 23 | | Naturita Site | 67 | | Los Alamos National Laboratory | 109 | | Salt Lake City Mill |
| 24 | | Naval Oil Shale Reserves Site | | | | 110 | | South Clive Disposal Cell |
| 25 | | Rifle (New) Mill | 68 | | Lovelace Respiratory Research Institute | 111 | | 11e.(2) Disposal Site |
| 26 | | Rifle (Old) Mill | | | | 112 | WA | (Dawn) Ford Site |
| 27 | | Rio Blanco | 69 | | (Quivira) Ambrosia Lake Site 2 | 113 | | Hanford Site |
| 28 | | Rocky Flats Environmental Technology Site | | | | 114 | | (WNI) Sherwood Site |
| | | | 70 | | Sandia National Laboratories—NM | 115 | WV | Parkersburg Site |
| 29 | | Rulison | | | | 116 | WY | (ANC) Gas Hill Site |
| 30 | | Slick Rock (North Continent) Mill 1 | 71 | | Shiprock Site | 117 | | (Exxon) Highlands Site |
| | | | 72 | | (SOHIO) LBAR Site | 118 | | Hoe Creek Underground Coal Gasification Site |
| 31 | | Slick Rock (Union Carbide) Mill 2 | 73 | | (UNC) Church Rock Site | | | |
| | | | 74 | | Waste Isolation Pilot Plant | 119 | | (Kennecott) Sweetwater Site |
| 32 | | (UMETCO) Maybell Site 2 | 75 | NY | Ashland Oil #1 | 120 | | Naval Petroleum Reserve No. 3 Landfill/Landfarm |
| 33 | | (UMETCO) Uravan Site | 76 | | Ashland Oil #2 | | | |
| 34 | CT | CE | 77 | | Bliss and Laughlin Steel | 121 | | (Pathfinder) Lucky Mc Site |
| 35 | FL | Pinellas STAR Center | 78 | | Brookhaven National Laboratory | 122 | | (Pathfinder) Shirley Basin Site 2 |
| 36 | ID | Idaho National Engineering and Environmental Lab | | | | | | |
| | | | 79 | | Colonie | 123 | | (Petrotomics) Shirley Basin Site 1 |
| 37 | | Lowman Site | 80 | | Linde Air Products | | | |
| 38 | IL | Argonne National Lab east | 81 | | Niagara Falls Storage Site | 124 | | Riverton Site |
| 39 | | Fermi National Accelerator Laboratory | 82 | | Seaway Industrial Park | 125 | | Rock Springs Oil Shale Report Site |
| | | | 83 | OH | Fernald Environmental Management Project | | | |
| 40 | | Madison | | | | 126 | | Spook Site |
| 41 | | Palos Forest (Site A/Plot M) Preserve | 84 | | Luckey | 127 | | (UMETCO) Gas Hills Site |
| | | | 85 | | Miamisburg Environmental Management Project | 128 | | (Union Pacific) Bear Creek Site |
| 42 | KY | Paducah Gaseous Diffusion Plant | 86 | | Painesville | 129 | | (WNI) Split Rock Site |

the residual contamination at the site remains a threat to the public health if stewardship is to serve its intended purpose as part of the remedy at a particular site. In many cases, individual sites have implemented their own policies and procedures to ensure this outcome. Further, the DOE has taken steps to prepare itself for the development of its own policies regarding stewardship and has created the Office of Long-Term Stewardship (EM-51) within the Office of Environmental Management that has responsibility for dealing with long-term stewardship issues.

Although these actions on implementing long term stewardship taken to date by the DOE have merit, the regulatory elements necessary for the stewardship program to succeed can only be implemented through the plenary powers of the U.S. Congress. Any single governmental agency, such as the DOE, lacks the authority

to satisfy the comprehensive needs of the program. For example, proper operation of the program will require commitment of funding, which requires Congressional action. Recognition of this principle is not necessarily widespread. For instance, Congress has continually and rightfully placed a fair amount of political pressure upon the DOE to demonstrate its progress in the cleanup arena, seemingly in expectation of an end date for such vast budget appropriations toward cleanup (Probst and Lowe 2000). Although proposed stewardship budgets pale in comparison to the actual remediation costs, it is still a substantial allocation of funds when considered over the period needed. Congressional recognition of the duration and magnitude of this funding commitment is necessary to ensure the success of the long term stewardship program. In the absence of committed funding, states and local stakeholders are less likely to approve of less costly institutional controls, resulting in all wastes being removed and shipped offsite—potentially raising cleanup costs by the billions of dollars.

Further, Congressional action is needed to ensure a proper study is done to evaluate all of the options for development and implementation of the program. This requires evaluating existing regulations, evaluating potential roles, if any, for all of the existing agencies such as the Nuclear Regulatory Commission, the Environmental Protection Agency, the Department of Energy, the Bureau of Land Management, the U.S. Army Corps of Engineers, and others. Minimum acceptable criteria for the operation of the sites need to be established, including acceptable and consistent risk criteria, monitoring methods and periodicities, record keeping, etc.

External enforcement mechanisms need to be established, possibly involving citizen enforcement suits vis-à-vis the Clean Air Act (42 USC 85 1970). In most of the major environmental statutes, citizens are provided standing to bring civil suits against violators of the environmental acts. As such, citizen's groups and individual citizens are given power to act as their own private attorney general. This has proven to be a very effective and inexpensive enforcement tool. Alternatively, an independent enforcement group can be established similar to that used by the DOE with the Defense Nuclear Facilities Safety Board (DNFSB). The DNFSB is a rather unique oversight group developed by Congress for technical oversight of some of the DOE facilities. Although this board has no true enforcement, permitting, or licensing authority, it does provide formal review and advice on many of the DOE activities. In any case, a thorough evaluation on the Congressional level is in order with the desired result being a well-researched and comprehensive legislative framework.

## EXISTING STATUTES AND REGULATIONS GOVERNING STEWARDSHIP

Before embarking on a path of creating new legislation, existing laws should first be examined to determine if they are sufficient to cover the potential issues and to understand how the present issues fall within the context of the existing regulatory structure as a whole. Further, where existing laws contain stewardship elements, the effectiveness of such elements should be examined for possible applicability in new legislation.

There are numerous federal environmental and nuclear laws on the books, parts of which may have relevance to long-term stewardship. The most common federal environmental laws on point are the Resource Conservation and Recovery Act (RCRA 1976) and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA 1980), although other more general environmental laws such as the Clean Water Act (33 USC 26 1977) and the Clean Air Act (42 USC 85 1970) may also have some import.

In addition to the above general environmental laws, many existing nuclear laws could have potential impact on stewardship sites. The type of waste and the mission of each site prior to remediation typically govern the applicability of these laws. For instance, the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) (42 USC 88 1978) specifically regulates uranium mill tailings sites while the Nuclear Waste Policy Act (NWPA) (42 USC 108 1982) governs only disposal of high-level nuclear waste.

Within this myriad of environmental laws and regulations, several different regulatory frameworks have evolved that incorporate various elements of long-term stewardship. Since any new legislation could best be developed utilizing some or all of these elements, the applicable portions of each of the relevant statutes will be discussed in turn.

### RCRA and CERCLA

In the typical regulatory framework involving a DOE weapons site, corrective and remedial actions are governed by RCRA (42 USC 6901), CERCLA (42 USC 9601), or both. These federal laws govern situations where hazardous wastes or substances exist on site requiring management and/or remediation. However, RCRA has no authority over radioactive material unless it is combined or in contact with another regulated hazardous constituent (i.e., mixed waste). CERCLA, on the other hand, retains jurisdiction over radioactive material as a regulated hazardous substance.

Although CERCLA provides a preference for permanent remedies such as complete cleanup to unrestricted use, both CERCLA and RCRA allow for hazardous waste to remain on site. The degree to which this is permitted depends upon the future land use. In such cases, institutional controls become part of the remedy. The rules implementing CERCLA provide that institutional controls can be used "to supplement engineering controls as appropriate for short- and long-term management to prevent or limit exposure to hazardous substances, pollutants, or contaminants" (40 CFR Part 430).

Where hazardous substances are permitted to remain on-site as part of the CERCLA remedy, the remedial action must be reviewed "no less often than each 5 years" to ensure that the remedial action is protective of human health and the environment.[†] This review would include institutional controls. Further, under Executive Order 12580, DOE is the lead agency responsible for conducting the 5-y reviews at DOE sites.

Under RCRA, a post-closure permit for the facility or other enforceable document governs post closure operation of on-site burial areas containing residual contamination. These areas are called disposal units. Neither CERCLA nor RCRA preclude transfer of contaminated property, although both Acts place specific conditions on such a transfer. Under CERCLA, deeds transferring such property must provide 1) notice of the type and quantity of hazardous substances stored, released, and disposed at the site; 2) notice of the time at which the storage, release, or disposal took place; and 3) a description of remedial action taken. The deed of transfer must also contain covenants warranting that all remedial action necessary to protect human health and the environment has been taken before the property is transferred and that any additional action necessary after the transfer will be conducted by the federal government.[‡]

Federal property may also be transferred under CERCLA even if remedial action has been deferred. The EPA or state governor, as appropriate, determines for each specific situation that the property is suitable for the intended use and that other conditions specified in the Act are satisfied. Where a federal agency closes a disposal unit under RCRA, a survey plat must be provided that indicates the location and dimensions of landfill cells or other hazardous waste disposal units with respect to permanently surveyed benchmarks to the local zoning authority with jurisdiction over the site (40 CFR Part 264.119). The federal agency must also make such recordations in the deed or other instruments normally examined during a title search. Depending on local property laws, a title search would notify, in perpetuity, any potential purchasers that the property was used to manage hazardous waste, that its use is restricted to maintain remedy integrity, and that a survey plat has been filed (40 CFR Part 264.119).

[†] CERCLA § 121[c]
[‡] CERCLA § 120[h][3][A]

### Uranium Mill Tailings Radiation Control Act of 1978

The Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) was established to regulate uranium mill tailings sites (42 USC § 2022). This act contains two titles: Title I addressed abandoned or orphaned mill sites; Title II addressed commercial tailings facilities with current NRC licenses at the time of the legislation. Congress mandated that EPA promulgates regulations dealing with the cleanup and remediation of contamination associated with the mill sites and that the NRC enforces the EPA regulations. The Title I facilities were assigned to the DOE for cleanup while Title II facilities remained the responsibility of the individual licensee. Following completion of cleanup of the Title II facilities, the Act requires transfer of the property to the federal government for long-term care.

The EPA established regulations governing mill tailings in 40 C.F.R. Part 192. These regulations require, among other things, a disposal cell design life of 200 to 1,000 y, release limits for tailings covers, and establishment of groundwater protection standards for each site. The EPA also promulgated groundwater clean up standards for the mill tailings sites. The principal result of these regulations is that tailings are to be placed in stable, capped piles with controlled releases of gases (principally radon) and water-leached materials. Design requirements under UMTRCA are based on an added lifetime risk of fatal lung cancer of 1 in 1000 for someone living 600 meters from the center of a model pile (48 Fed. Reg. 45926 1983).

The NRC established the technical criteria for tailings disposal in 10 CFR Part 40 Appendix A. The NRC also established 10 C.F.R. Parts 40.27 and 40.28 to license DOE for custody and long-term care of Title I and Title II sites. Further, the NRC established a variety of guidelines for design of tailings disposal cells, including requiring the disposal cells to withstand a variety of natural forces, such as probable maximum floods and maximum credible earthquakes. The DOE Grand Junction Operations Office is assigned responsibility to maintain custody of the sites for long-term care.

### Low-Level Radioactive Waste Policy Act of 1980

The Low-Level Radioactive Waste Policy Act (LLRWPA) established state responsibilities in the management and disposal of commercial low-level radioactive waste (42 USC § 2021). Wastes generated at DOE sites,

however, remain the responsibility of DOE and commercial waste classified as Greater than Class C (GTCC) is the responsibility of DOE under the 1985 amendments.

Under this Act, low-level waste disposal facilities are required to implement a post closure plan that is funded by the licensees. The state is responsible for post closure care of the facilities for at least 100 y post closure. Design criteria on the disposal cells require at least 500 y of protection with a risk protection standard of 0.25 mSv $y^{-1}$ maximum permissible dose to the whole body to any member of the public. Regulations establishing closure requirements and financial assurances for low-level waste facilities post remediation were promulgated by the NRC in 10 CFR Part 61.

**Nuclear Waste Policy Act (NWPA)**

The Nuclear Waste Policy Act (NWPA) established the requirements for a deep geologic repository to dispose of high-level radioactive waste (42 USC § 10101). Under this framework, DOE is the steward of the geologic repository and is required to meet regulations promulgated by both the EPA and the NRC as described in 40 CFR Part 197 and 10 CFR Part 60, respectively. Post closure funding is provided by the Nuclear Waste Disposal Fund to which commercial utilities make mandatory contributions. Post closure performance standards are prescribed at 10 CFR 60.113.

**Atomic Energy Act (AEA)**

Regulations governing commercial low-level waste disposal have been promulgated by the NRC in 10 CFR Part 61 under the authority of the Atomic Energy Act (AEA) as well as the LLWPA previously discussed. NRC and agreement states are assigned the responsibility to oversee low level waste burial sites. Post closure care is assigned to the DOE or the state entity for a minimum of 100 y post closure.

**State laws**

In addition to the federal statutes described above, states also have a role in managing cleanup of federal sites within their boundary through EPA authorized state RCRA and CERCLA programs. For instance, federal facilities not on CERCLA's National Priority List (NPL) are subject to state laws on remediation and removal actions.[§] Further, where sites are located on the NPL, Congress provided states the opportunity to participate in the development of remedial investigations and feasibility studies along with DOE and EPA.** Other state statutes and regulations could be applicable based on local regulatory agreements or by identification as an applicable relevant and appropriate requirement (ARAR) under the CERCLA process. Further, under the Federal Facilities Compliance Act (FFCA), DOE is required to adhere to state, interstate, and local government hazardous and solid waste management requirements (42 USC § 6961). Relevance of state statutes, therefore, in many instances, must be reviewed on a case specific basis.

In reviewing all of the laws cited above, it appears DOE is presently responsible for its own radioactive waste, UMTRCA sites, deep disposal of high-level waste generated by nuclear power plants, and waste generated by the United States Enrichment Company. Although NRC regulates some of these activities through licensing, DOE retains a great deal of authority to self regulate. Of course, the EPA retains external oversight in instances where other general environmental laws are invoked such CERCLA or RCRA.

None of the above laws, either by themselves or in combination, adequately addresses DOE's stewardship program. In fact, it appears the only statute that would directly impose a legal duty of stewardship on the DOE at its non-UMTRCA sites (the majority of their sites) is the CERCLA process and its requirement for review for adequacy of the remedy every 5 y. Thus, it is difficult to identify what, if anything, regulates the DOE in its present choices with regard to stewardship. This, in itself, suggests there is a hole in the present legal framework. This is not to say, however, that the above statutes have no merit. To the contrary, final legislation on this issue should incorporate those sections of the prior laws which have been proven effective. Further, after evaluation, legislators may find amending an existing law is the most effective means of achieving their objective.

## CONCLUSION

As DOE progresses in its remediation of its nuclear weapons facilities, it is apparent that, for a variety of reasons, residual contamination hazards will remain at many of the sites following completion of site cleanup. Sites having residual contamination are relying on institutional and engineering controls as stewardship measures to protect the public and the environment.

Without constant attention, however, stewardship measures imposed today are not likely to remain effective for as long as residual contamination presents risk. Assuring adequate attention is given over time is part of the present challenge. Common sense reveals that even the best engineering, administrative, and institutional controls will fail without proper maintenance over the hundreds or thousands of years necessary for these controls to last at the nuclear weapons sites. Engineering barriers could fail, the fate of contaminants in the

[§] CERCLA § 120 [a][4]
** CERCLA § 120[e]

environmental media could differ from that predicted, signs will weather and may become vandalized, fences may break, etc. The responsible stewards of the site will be unsuccessful in intercepting such failures if proper maintenance and surveillance is not mandated by legislation. Even if a mandate is given, it must be adequately funded. Even if the funding is provided and the maintenance and surveillance is mandated, it still is not properly performed if there is no penalty for non-performance.

The point is simply that a broad regulatory framework is needed to ensure controls implemented today are adequate through the future. In most cases, only Congress has the power to create such a comprehensive framework.

As with all environmental legislation, however, care must be taken to ensure the appropriate balance is struck to avoid over-regulation. For instance, as was previously emphasized, each site has its own characteristics with its own unique stewardship needs. Thus, whatever federal level action is taken should provide sufficient flexibility to permit the site to implement the appropriate degree of stewardship commensurate with the risk potential at the site. This, of course, can only be done at the local level. Therefore, federal lawmakers should strive to establish the legal framework that includes such things as establishing minimum standards, assigning responsibilities to the appropriate agencies, creating enforcement tools, and creating a method of funding. Details of site-specific stewardship plans, to the extent possible, should be delegated to the local level.

Once the legal and regulatory framework for the long-term stewardship program is established, actual implementation and oversight should be rather simple. However, care must also be taken to ensure the bureaucratic machine is kept in check such that it does not overrun its intended purpose. Bureaucrats in charge of the program must be cognizant of this and avoid the temptation to overstaff and overcomplicate matters to the point that the program loses sight of its objective. Lessons learned from past governmental programs have proven this may be a difficult task in itself.

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40 Code of Federal Regulations § 197.

40 Code of Federal Regulations § 264.119.

40 Code of Federal Regulations § 430.

42 United States Code § 2021.

42 United States Code § 2022.

42 United States Code § 6901.

42 United States Code § 6961.

42 United States Code § 9601.

42 United States Code §10101.

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