Department of Energy Response to 1997 IEER Environmental Management Report

Office of Environmental Management

March 18, 1998

This response was prepared by the Department of Energy's Office of Environmental Management. If you have any questions concerning this response, please contact the Office of Strategic Planning and Analysis within the Office of Environmental Management at (202) 586-9280.

[Converted from paper copy to an electronic file by IEER, January 2005, for posting to the Web.]

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INTRODUCTION

On October 24, 1997, the Institute for Energy and Environmental Research (IEER) published a report on the U.S. Department of Energy's Environmental Management (EM) program. This report, *Containing the Cold War Mess: Restructuring the Environmental Management of the U.S. Nuclear Weapons Complex*, discusses in detail many issues and develops a series of recommendations aimed at improving cleanup activities and management practices within the Environmental Management program.

The Department of Energy appreciates the opportunity to respond to the issues raised by the IEER report and recognizes the amount of effort IEER put into its research and conclusions. Many of the issues raised in the report recognize the fundamental organizational and managerial challenges faced by the Department in executing the complex scope of the Environmental Management program. The Department hopes that this response document will not only aid IEER and the public in clarifying many of the issues relating to activities performed by the Environmental Management program but also offer opportunities for further dialogue about areas of concern to both DOE and IEER. The Department looks forward to working with IEER and others who have suggestions on ways to make its programs more effective.

IEER discussed a wide variety of programmatic and specific case study-related issues in its report. DOE has focused its response on what appear to be the most significant issues raised in the IEER report. The Department's response does not, therefore, address each and every issue raised in the IEER report. This response begins with a discussion of significant specific issues and then turns to more general significant issues presented in the report. Specifically, the Department of Energy's response is organized in the following manner:

1. Transuranic (TRU) Waste Management

- Ineffective Management of TRU Waste
- Mobility of TRU Radionuclides
- TRU Projects at Sites

2. Hanford High-Level Waste Tank Farms

- Major Safety and Environmental Issues
- Tank Farm Management

3. Radium- and Thorium-Contaminated Waste at Fernald

- DOE Oversight of Contractor Activities
- Vitrification Pilot Plant Management
- Silo Treatment Technology and Next Steps

4. Programmatic Issues

- National Remediation Standards
- Project Management
- Need for New Waste Classification System

1.0 TRANSURANIC WASTE MANAGEMENT

The IEER Report raises a number of issues regarding DOE's management of transuranic (TRU) waste. These include inconsistent and inaccurate data, lack of a comprehensive plan for managing TRU waste, inconsistent approaches toward management of “stored” vs. “buried” TRU waste, management decisions based on inaccurate information regarding the mobility of TRU radionuclides in the soil, and specific concerns about the implementation of TRU related projects at its sites.

The Department acknowledges that over the years, there have been data quality problems with published information regarding buried TRU. Some of the problems arose from inconsistent assumptions used from year to year to estimate quantities of buried TRU waste. For instance, in some estimates, quantities of TRU contaminated soils have been included in the estimate and in other cases contaminated soils have not been included when reporting the quantity of buried TRU. To correct this situation and provide confidence that decisions are based on the best information possible, the Department will undertake a review and update of its information on its inventory of buried TRU waste as well as the status of remedial decisions proposed or made to date. In updating this information, DOE will ensure that information on buried TRU waste is provided using consistent and documented assumptions.

The Department also agrees that the initial technical assumptions about the mobility of TRU radionuclides (e.g., plutonium) in soil and/or groundwater understated the mobility. Since that time, DOE's investments in radionuclide geochemistry have helped reveal not only a higher mobility rate for TRU radionuclides under certain hydro-geochemical conditions than previously estimated, but also, some fundamentally new transport mechanisms that have greatly enhanced our understanding of the movement of chemicals in the environment. We are now applying this new knowledge as we plan investigations and cleanup at the various sites where TRU wastes are buried. The new information about TRU radionuclide mobility indicates that TRU radionuclides are more mobile than previously believed, but that they are still less mobile in soil and ground water than many other contaminants, such as organic chemicals, and certain other radionuclides such as technetium or tritium. Based on this updated understanding of TRU radionuclide mobility, we continue to believe that neither stored nor buried TRU waste pose a near-term risk to human health and the environment. However, potential long-term risks need to be examined carefully.

The Department disagrees that it lacks a comprehensive TRU management program. The DOE plan and policy for managing both stored and buried TRU waste was first presented in “*The Defense Waste Management Plan*,” issued in 1983. This approach was further elaborated on in 1987, in a second report entitled “*Defense Waste Management Plan for Buried Transuranic-Contaminated Waste, Transuranic-Contaminated Soil, and Difficult to Certify Transuranic Waste*.” Still later, in 1988, DOE Order 5820.2A “*Radioactive Waste Management*” formalized buried TRU waste policies and guidelines. More recently, the Department issued *The National TRU Waste Management Plan (DOE/NTP-96-1024)* in September 1996 and a revision in December 1997.

In general terms, the plan calls for disposal of retrievably stored and newly generated defense TRU waste in a geologic repository. The management strategy for buried TRU waste is to monitor the waste and associated contaminated soil, take remedial action as necessary, and periodically re-evaluate the safety of the waste. The Department notes that this management strategy for stored and buried TRU waste is consistent with the different statutory frameworks governing management of stored and buried TRU waste. Cleanup of buried TRU is governed largely by the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), which emphasizes the need for site-specific approaches to decision-making. If as part of that process, it is determined that specific buried TRU waste poses a greater risk than now believed, a higher priority will be given to its remediation through the state and local priority setting process at each site.

The Department recognizes, however, that for full implementation of its plans, there needs to be better integration of the management of stored and buried TRU waste. As a first step, in addition to improving the quality of its data on buried TRU waste, the Department will prepare a summary and status of remediation activities at various sites for buried TRU. This information will be updated as needed as decisions regarding the disposition of buried TRU waste are made through the CERCLA process. EM will also take steps to improve communications and information exchange between the programs and sites responsible for management of stored and buried TRU to ensure that decisions regarding TRU management will be based on a comprehensive data set and common assumptions.

1.1 INEFFECTIVE MANAGEMENT OF TRU WASTE

<u>IEER Comment</u>

> "*The inconsistent reporting and accounting of TRU waste volumes and the separation of TRU waste management efforts between two EM programs (WM and ER) have led to ineffective TRU waste management at DOE sites.*" *pp. 58-61 and throughout the case studies (pp. 67-120*)

<u>DOE Response</u>

The Department acknowledges that over the years, there have been inconsistencies in published information regarding buried TRU waste. The accounting of buried TRU waste which was buried prior to DOE's adoption of a definition of TRU waste and the decision to place it under special control, has inherent uncertainties in determining where and in what quantities this waste exists. Prior to 1970 when the Atomic Energy Commission required that alpha-contaminated waste be placed in retrievable storage, this waste was routinely buried as low-level waste (LLW). In some cases, LLW wastes and other materials from multiple facilities (e.g., the Rocky Flats Environmental Technology Site and the Idaho National Engineering and Environmental Laboratory) were disposed of in the same burial trenches (e.g., at INEEL). Some of these wastes would be defined today as alpha-contaminated low-level wastes, while others would be defined as transuranic waste. At various times, the sites have estimated buried transuranic waste volumes to include the entire volume of waste disposed of in a trench, even though some of it did not contain alpha-contaminated materials. Other site estimates included the volume of soil used to cover the waste in the trench.

As indicated above, as a means of addressing and reducing these uncertainties, the Department will undertake a review and update of its technical data on buried TRU waste. The information to be updated will include locations, estimated volumes, and radioactive content. An important part of this update will be to ensure that information on buried TRU waste is provided using consistent and documented assumptions.

In recent years, DOE has taken a number of steps to improve the management and integration of its management of TRU waste. One important step in this regard was the creation of the National TRU Management Program in Carlsbad, NM. The Carlsbad Office published a National Transuranic Waste Management Plan in 1996. The Plan was recently updated and a revision issued in December 1997 (after the IEER Report was released). The Plan addresses the management and disposition of existing and future defense TRU waste, including buried TRU waste that may be exhumed and disposed of at WIPP. The Plan did not include, however, a complete compilation of all estimated buried TRU waste. The National TRU Program is also committed to the preparation of a Comprehensive Disposal Recommendation report that will identify all existing and potential sources of TRU waste, both defense and non-defense, under Department authority and the permanent disposal options for this waste.

In addition, EM has an ongoing effort to foster and improve system integration among DOE sites and facilities. Of note is the recently released *Draft Accelerating Cleanup: Paths to Closure.* This on-going strategic initiative seeks to integrate EM projects and develop complex-wide waste disposition maps, which are conceptual approaches to the remediation of contaminated soil, groundwater and buildings and for the storage, treatment, and disposal of waste and materials at all sites.

However, EM recognizes that additional steps are needed to improve the integration and coordination of its stored and buried TRU waste management programs. As a first step, the Department will prepare a summary and status of remediation activities at various sites for buried TRU. This information will be periodically updated as decisions regarding the disposition of buried TRU waste are made through the CERCLA process. EM also plans to take steps to improve communications and information exchange between the programs and sites responsible for management of stored and buried TRU to ensure that decisions regarding TRU management will be based on a comprehensive data set and common assumptions. In addition, the Department would like to continue the dialogue with IEER and other interested parties in exploring ways in which information regarding DOE management of TRU waste and technical data on TRU waste can better be integrated, summarized, and communicated.

<u>IEER Comment</u>

> "*EM does not have a clear management plan nor enough resources to implement the National Transuranic Waste Management Program as it relates to buried TRU wastes and TRU-contaminated soil. Decisions about TRU waste management are not tied to risk or evaluation of environmental impacts.*" *pp 66 and 119*
>
> "*DOE has no comprehensive plan for dealing with buried transuranic wastes and transuranic contaminated soil.*" *p. 11*
>
> *"...we have no hesitation in saying the DOE has made a huge mistake in focusing its short-term efforts and most of its resources disposing of stored TRU waste in WIPP and giving buried TRU waste and TRU soil a far lower priority."* *p. 84*

<u>DOE Response</u>

The DOE plan and policy for managing TRU waste was first presented in *"The Defense Waste Management Plan,"* issued in 1983. In addition to proposing disposal of stored TRU waste in a geologic repository, the plan for buried TRU was to monitor the waste and associated contaminated soil, take remedial action as necessary, and periodically re-evaluate the safety of the waste. This same buried waste management approach was described further elaborated in 1987, in response to an information request from the General Accounting Office, in the form of a second report described above. The 1987 report stated that "The DOE plan for buried waste and contaminated soil is to characterize the disposal units; assess the potential impacts of the waste on workers, the surrounding population, and the environment; evaluate the need for remedial actions; assess the remedial action alternatives; and implement and verify the remedial actions as appropriate."

This management strategy for stored and buried TRU waste is consistent with the different statutory frameworks governing management of stored and buried TRU waste. TRU waste that is retrievably stored is regulated under the Resource Conservation and Recovery Act (RCRA). The RCRA regulatory framework, the fact that the waste is already in storage, and that there is generally good technical information on the waste, make management of stored TRU waste more amenable to a national strategy.

Cleanup of buried TRU, however, is governed largely by CERCLA which emphasizes the need for site-specific approaches to decision-making. As such, the decision to retrieve, and treat buried TRU wastes and TRU-contaminated soils is jointly made by EPA, state regulators, and DOE under the provisions of CERCLA or its state analogues. This process significantly influences both the initiation of remedial activities and the amount of waste generated during environmental restoration activities. Any national strategy must be consistent with the CERCLA decision-making process.

IEER criticism related to inconsistencies among site decisions and application of risk appears to be premised on the assumption that the similar waste should be treated/managed in a similar manner irrespective of environmental setting. However, the location of waste whether it is buried or stored above ground clearly has an impact on management decisions. National Environmental Policy Act (NEPA) and CERCLA regulations require environmental assessments that are based on site-specific assessments. Further, each site has a degree of latitude, and a responsibility, to work with their regulators, interested Tribal Nationals, and stakeholders in establishing site-specific plans. Differences among DOE sites are therefore to be expected.

DOE believes that the policy and general plans for stored and buried TRU as expressed in the 1983 and 1987 reports (and DOE Order 5820.2A) are still valid. However, as indicated previously, the Department believes that improvements in program integration are needed and is proceeding with the activities noted above.

The Department takes issue with IEER's conclusion that the Department is placing inappropriate emphasis on dealing with stored waste and developing WIPP at the expense of buried wastes and contaminated soil projects. DOE does not agree with this characterization and does not agree that the current mix of priorities is inappropriate. The management and disposition of all waste (whether it is buried or stored above ground) is a concern to the Department. The Department believes its management of these wastes is appropriate given the technical and regulatory framework in which these decisions are made.

More specifically with respect to the buried TRU programs at the five major DOE installations where it occurs, two of the five sites are in the process of actively addressing their buried TRU sites: the Idaho National Engineering and Environmental Laboratory and the Savannah River Site. For the other three installations, the buried TRU disposal sites will be addressed within the next ten years. Exhibit 1 illustrates the schedule for making final decisions on remediation of the buried TRU waste.

EXHIBIT 1
SCHEDULE FOR BURIED
TRU WASTE DECISION MAKING

SITE	DATE
Oak Ridge National Laboratory	2000
Savannah River Site	2001
Idaho National Engineering and Environmental Laboratory	2002
Hanford	2008
Los Alamos National Laboratory	2008

These schedules are considered reasonable and appropriate by the DOE Field Offices, state and federal regulators, and other stakeholders who were involved in their development. In addition, should the need or justification arise (such as new information that would significantly alter the current assessment of the immediate threat posed by the buried waste), there is flexibility at the local level to negotiate for faster cleanup schedules.

Additional resources could be expected to accelerate the cleanup of waste sites. However, there are many demands for limited resources and these are allocated through the budget process in a manner that attempts to balance risk, cost, regulatory requirements, stakeholder concerns, and Congressional allocations.

The establishment of a TRU waste disposal site, Waste Isolation Pilot Plant (WIPP), is a critical path action for the cleanup and closing of DOE sites and the disposition of new waste that may result from Environmental Restoration activities. There are enforceable milestones in a number of compliance agreements into which DOE has entered with states that require shipment and disposal of TRU waste to WIPP. While there are often competing views concerning the appropriate balance and prioritization of programs and projects, the Department firmly stands by its decision to open and operate WIPP as soon as the regulatory processes are completed.

1.2 MOBILITY OF TRU RADIONUCLIDES

IEER Comment

> *Rapid migration of transuranic elements from the soil into the groundwater has been documented at several sites* (*e.g., Maxey Flats, Oak Ridge, Hanford, Idaho, NTS*). *This suggests blanket assumptions regarding the immobility of transuranic radionuclides should be abandoned, and groundwater and risk assessment models which rely on these assumptions be thoroughly revised to reflect actual experience. All pits and trenches containing substantial amounts of long-lived radionuclides should be excavated, and the wastes they contain should be put into retrievable storage.*

DOE Response

The Department agrees that the initial technical assumptions about the mobility of TRU isotopes (e.g., plutonium) in soil understated the mobility. Since that time, DOE's investments in radionuclide geochemistry have helped reveal not only a higher mobility rate for TRU isotopes under certain hydro-geochemical conditions than previously estimated, but also some fundamentally new transport mechanisms that have greatly enhanced our understanding of the movement of chemicals in the environment. The research has also revealed new mechanisms that retard radionuclide migration, such as matrix diffusion and mixing in fractured media. We are now applying this new knowledge to plan investigations and cleanup at the various site where

TRU waste are buried. The new information about TRU isotope mobility indicates that TRU isotopes are more mobile than previously believed, but that they are still less mobile in soil and ground water than many other contaminants, such as organic chemicals, and certain other radionuclides such as technetium or tritium. In addition, the Department understands much more about the limitations of laboratory-derived distribution coefficients (known as K_d's) than was previously the case.

In performing risk assessments, the Department does not adhere to past "optimistic" assumptions about the immobility of transuranic isotopes today. For the most part, DOE's work is now subject to external regulation and, any such potentially dominant assumptions would receive critical review. For instance, the groundwater and risk assessment model done for Pit 9 at INEEL uses conservative assumptions about plutonium distribution coefficients. (Specifically, a range of 22 to 2200 ml/g was examined in a groundwater model sensitivity study, and a value of 22 was used in the draft risk assessment. This value is at the low (conservative) end of the range of values that could have been assumed)

IEER correctly notes that DOE has detected low levels of TRU elements on occasion in some of its on-site groundwater monitoring wells at the sites with buried TRU wastes. However, the Department disagrees with the IEER conclusion that all buried TRU waste should, therefore, be exhumed and placed into storage. As discussed above, DOE believes that remediation of the buried TRU waste on a site by site basis through the CERCLA process is appropriate. In addition, the extensive monitoring programs on and around the installations with buried TRU wastes, the results of which are made publicly available annually, will continue to assure the protection of the health and safety of the public and the environment as the remediation process continues.

The Department also notes that over the past 25 years, several reviews have indicated that TRU-contaminated wastes disposed prior to 1970 do not pose a hazard to public health or the environment. Further, these reviews urged careful consideration be given to the risks of exhuming and retrieving the buried waste as opposed to leaving it in place. For example, *"The Shallow Land Burial of Low-Level Radioactively Contaminated Solid Waste*" (a report issued by the National Academy of Sciences, August 6, 1976) stated: "The Panel [on Land Burial] is not satisfied that the plan to exhume and rebury the presently buried solid low-level transuranium radioactive waste can be accomplished without a measurable degree of hazard to the employees so engaged. We see no merit in the concept. As a consequence of our concern, we urge a reexamination and reevaluation of the possible risks and possible benefits to be obtained before such a project is undertaken."

In 1993, the National Academy of Sciences published "*Comments and Recommendations Based on the Report "Shallow Land Burial of Low-Level Radioactively Contaminated Solid Waste*", in which they noted "Exhumation may indeed prove necessary for some of the waste, but it should be undertaken only after a thorough risk-cost-benefit analysis and comparison with alternative strategies, particularly the possibility of leaving some portion of the waste in place."

1.3 TRU PROJECTS AT SITES

<u>IEER Comment</u>

> *The planned schedule for capping the Old Burial Ground at Savannah River Site is too slow to prevent further ground water contamination.*

<u>DOE Response</u>

The Department is remediating the Old Burial Ground (OBG) in accordance with a tri-party Federal Facility Agreement with EPA and South Carolina. Cleanup activities include remediating the groundwater at the OBG as well as a parallel effort to reduce infiltration using a cap. The feasibility of eliminating hot spots using in-situ and other technologies is also being studied. The Department believes the current schedule for this activity is reasonable. Discussions with the regulators (EPA and South Carolina) are taking place on a regular basis and the schedule and current plans have been open to comment by and coordinated with stakeholders.

<u>IEER Comment</u>

> "*In-situ vitrification of seepage pits and trenches at ORNL could lead to explosion, releasing radioactive materials.*" *pp.* 130-131

<u>DOE Response</u>

In April 1996 an in-situ vitrification demonstration was being conducted at the Oak Ridge National Laboratory. The demonstration progressed well for the first two weeks. When the melting of the contaminated soil was almost complete, the melting soil encountered groundwater and an explosion occurred. This event caused a momentary lifting of the large hood which was on top of the site of the melting soil and resulted in a small amount of radioactive material being released to the environment. The released radioactive material was cleaned up and no contamination from this release remains.

The in-situ vitrification effort conducted at ORNL demonstrated that, due to the site's hydrogeology, this technology was unsuitable for this particular situation without first conducting dewatering. The in-situ vitrification (ISV) technology is being considered for possible future use at ORNL for areas with different hydrogeology. For example, ISV is included in the Feasibility Study for Melton Valley cleanup and was discussed as a remediation option at a recent public meeting concerning the Melton Valley Watershed.

IEER Comment

> *The Pit 9 Project is experiencing major technical and managerial difficulties, significant cost increases, schedule delays, and disputes over the terms of the contract. p. 76 and pp. 131-137*

DOE Response

The Department agrees that the Pit 9 project is experiencing major technical and managerial difficulties that are associated with the subcontractor, LMAES, and its ability to implement the terms and conditions of the fixed-price contract. Under the terms of the Pit 9 subcontract, LMAES bears responsibility for performance, including design of the project, management of the construction, and fabrication of the project systems.

Given the present situation regarding Pit 9, DOE believes it would be inappropriate to provide a more detailed response at this time.

2.0 HANFORD HIGH-LEVEL WASTE TANK FARMS

The IEER report raises a series of significant issues about the management of high-level wastes at Hanford. These include the overall complexity of high-level waste management at Hanford, waste characterization in the storage tanks, waste storage in the tanks, waste disposal technology, specific health and safety issues, and the environmental impacts of soil and groundwater contamination associated with storage of high-level wastes in tanks. The Department agrees with IEER that high-level waste management at Hanford represents one of DOE's most complicated, important, and expensive challenges. The Department also agrees with the IEER recommendation to continue transferring the waste from single shell to double shell tanks, the need for continued research and development on high-level waste management technologies, and the importance of soil and groundwater contamination associated with the tank farms. DOE respectfully disagrees with IEER on some high-level waste matters such as the desirability of proceeding with waste vitrification, on-site disposal of Class C low-level waste, and the ability to “privatize” high-level waste management.

DOE concurs with the need to maintain programmatic flexibility as it implements tank waste cleanup at the Hanford Site. A point of departure between DOE and IEER is the extent to which the tank waste remediation program should retain flexibility in research and development of tank waste treatment and immobilization technologies. IEER advocates production of an interim waste form, a calcined high-level waste, that would be stored indefinitely at the Hanford Site while new treatment technologies are investigated. DOE has spent many years in research and development throughout the DOE complex and in specific studies on Hanford Site tank waste remediation. The Department believes that the technical uncertainties have been reduced to a manageable level.

The Tank Waste Remediation System (TWRS) environmental impact statement (EIS) considered an alternative that would not separate tank waste into a low-activity and high-level waste stream prior to immobilization. In the evaluation DOE considered both immobilization through vitrification of the tank waste and calcining the waste. The human health and environmental impacts of this alternative were compared to impacts associated with nine other alternatives considered in the EIS.

The DOE approach to maintaining programmatic flexibility consists of implementing a phased approach to tank waste remediation. During the first phase, DOE would initiate waste retrieval and treatment of a portion of the tank waste that is well characterized and easily retrievable. Lessons learned during the first phase would be used in implementing full-scale waste retrieval and treatment. The first phase, which will last approximately 10 years, gives DOE time to address key areas of programmatic uncertainty, some of which were identified in the IEER report (e.g., nature and extent of tank farm soil contamination). The phased approach meets all regulatory requirements and limits DOE's financial risk of building large treatment and immobilization facilities before the processes are proven to be effective.

2.1 MAJOR SAFETY AND ENVIRONMENTAL ISSUES

IEER Comment

> *"The Hanford high-level radioactive waste tanks are the single most complicated and expensive component in the Environmental Management program of the U.S. nuclear weapons complex."* p.12

DOE Response

DOE agrees that the Hanford high-level waste tanks pose large technical and financial challenges. DOE has invested major resources in the past few years to meet the challenges associated with the safe management, retrieval, treatment, and disposal of Hanford' s tank waste, These investments have allowed DOE to extensively study alternative technologies and their associated health and environmental impacts. DOE has selected a tank waste remediation path forward that allows DOE to proceed with waste retrieval and treatment while providing the flexibility for future changes in the program to accommodate new technologies and information regarding waste inventory, retrieval, treatment, and disposal.

Because of the complexity of this multi-decade remediation program, there are inherent uncertainties in estimating long-term costs. Much of this uncertainty is related to the unique inventory of tank waste and development and the implementation of new technologies. However, DOE's cost estimate for management and treatment of the waste accounts for these -uncertainties and includes costs associated with continued management of the waste, research and development, construction and operation of treatment facilities, decontamination and decommissioning of facilities, tank farm closure, long-term post-closure monitoring and maintenance, and interim storage and disposal of tank waste, including disposal costs associated with a geologic repository .

IEER Comment

> "*Since* 1989, *DOE has made progress in characterizing the contents of the high-level waste tanks. However, despite huge expenditure, deadlines for characterization relating to safety issues have not been met.*" p.13

DOE Response

It is true that DOE has missed several deadlines for tank characterization for technical, organizational, and budgetary reasons. Technical difficulties with the rotary mode sampling system have been particularly difficult to solve. Nevertheless, since 1992, DOE has sampled more than 126 high-level waste tanks and issued final characterization reports for 109 of the 177 high-level waste tanks. As a result, DOE was able to resolve and close numerous Unreviewed Safety Questions (USQs) and safety issues. Specifically, the data from tank characterization were critical to the closure of the ferrocyanide USQ and safety issue, allowing greater time for Hanford to meet future milestone requirements. Secondly, using data from the sampling of the high-level waste tanks, DOE will be able to close the organics USQ and safety issue during fiscal year 1998, ahead of schedule. DOE recognizes that in one case, the flammable gas USQ, a small delay from the original milestone is probable. This delay, however, reflects an increase in scope, whereby DOE will address 176 tanks, 151 more than the watchlist commitment of 25 tanks.

The program has also missed some tank waste characterization milestones under DNFSB 93-5 due to the need to address flammable gas safety issues and how they are managed through the authorization basis for tank farm operations. Tank sampling involves intrusion into the tank waste by sample collection tools. Prior to implementing a sampling campaign DOE must ensure that appropriate safety controls are implemented to ensure worker and public safety based on the unique tank and tank waste characteristics of each tank being sampled.

Tank waste characterization is a complex problem requiring implementation of sophisticated sampling tools, advanced analytical techniques, and extensive consultation with regulators to ensure data quality objectives are met. One byproduct of the need for appropriate safety measures and the sampling complexity are occasional delays in meeting characterization milestones for specific tanks. However, DOE has maintained a close working relationship with its regulators and has performed characterization to their satisfaction. Because of this working relationship and the shared interest by DOE and the Washington Department of Ecology in a characterization program that meets the cleanup needs of the program, DOE and the Washington Department of Ecology renegotiated the tank waste characterization strategy in 1997 to redefine the goals and milestones for the program. Rather than minimum numbers of samples from each tank, the new strategy requires data collection to meet specific programmatic and safety needs. This change in approach was incorporated into the Tri-Party Agreement and reflects the underlying confidence that Hanford's regulators have in DOE's tank waste characterization program.

<u>IEER Comment</u>

> *"Moving the waste from single shell tanks to double shell tanks solves some problems and raises new concerns."* p. 14
>
> "*DOE should continue the transfer of the liquids in single shell tanks to the double shell tanks with far greater attention to safety issues.*" p. 268

DOE Response

DOE is aware of potential concerns associated with waste transfers and carefully manages the transfer of waste to minimize potential risks. Retrieval of single shell tank (SST) liquids (interim stabilization) and transfer to double shell tanks (DSTs) is nearing completion (liquids remain in only 31 of 149 tanks). In developing the interim stabilization program, DOE, Washington Department of Ecology, and the U.S. EPA had to evaluate the risks of not pumping free standing liquids from SSTs to DSTs against the potential risks associated with waste transfers (i.e., waste incompatibility, high temperatures, leaks and corrosion) (Reference: Final Tank Waste Remediation System Environmental Impact Statement, August 1996). The agencies considered each set of risks and determined that retrieval of the liquids posed less overall risk to the environment and human health than continued storage in SSTs.

Single shell tank waste transfers are begun following careful consideration of safety issues for a given tank and application of appropriate administrative and operational controls to ensure safety. Among the safety issues addressed prior to initiating liquid retrieval and transfer are criticality, organic, high-heat, ferrocyanide, and waste compatibility. DOE has evaluated the risks of waste transfers in the TWRS Basis for Interim Operations and the Final Safety Analysis Report and has developed controls and operating procedures to ensure that all waste transfers are completed in a manner that is protective of worker and public health and safety and compliance with applicable environmental laws and regulations. Specific administrative and operational controls address waste transfers to manage the potential for incompatible waste transfers, corrosion control, heat generation in the source and receiver tanks, transfer of plutonium in tank waste, and leak losses in the source tank. Through careful project planning, including a safety analysis prior to waste transfers, and administrative and operational controls, Hanford's goals of safe tank waste management and moving SST waste to DSTs to support resolving safety issues (e.g., waste transfer from tank C-106 to address high-heat safety concerns) and waste immobilization and disposal can be realized.

DOE is continuing to transfer the liquids from single shell tanks to double shell tanks to reduce the availability of liquids that could be lost to the environment in the event of a single shell tank leak. This program is an important part of DOE's effort to ensure that tank farm operations do no further harm to the environment. DOE has successfully completed interim stabilization, which includes liquid transfers from single shell to double shell tanks, for 118 of the 149 single shell tanks. In Fiscal Year 1998, an additional four tanks will have liquid removal completed and all tanks are scheduled to be stabilized by the end of Fiscal Year 2000. In addition, all watch list tanks will continue to be monitored for protection of human health and the environment until all safety concerns are closed and all tank wastes are retrieved.

IEER Comment

> "*In October* 1996, *DOE declared the ferrocyanide safety issue closed. However, not all of the tanks that were once on the safety "watchlist" of tanks were sampled.*" p.14

DOE Response

With the publication and public release of the document "Assessment of the Potential for Ferrocyanide Propagating Reaction Accidents" (WHC-SD-WM-SARR-038, Rev. 1), all relevant technical data relating to ferrocyanide initial concentrations and degradation through aging processes were presented and discussed. Both the Defense Nuclear Facilities Safety Board (DNFSB) and Washington Department of Ecology (as well as DOE Headquarters and the Chemical Reactor Subpanel of the Tanks Advisory Panel) concurred with the conclusions in this document. This document presents a thorough technical justification for not sampling all the ferrocyanide watchlist tanks.

Based upon scientific evaluation, DOE does not believe that "the potential exists that some of the ferrocyanide tanks could still present explosion risks." For all tanks sampled, the concentration of ferrocyanide present was found to be degrading due to physical processes (i.e., dose rates, waste temperature greater than 129°F, etc.) These physical processes are present in all the ferrocyanide watchlist tanks. The sampling data confirmed that more than 90 percent of the ferrocyanide has degraded. In addition, the nature of the ferrocyanide tanks as sludge waste tanks inhibits propagation of a reaction because of the high water content. Results for all of the tanks that were sampled indicated ferrocyanide concentrations well below the 8% wt safety criterion (and far below the 15% wt concentration required to support propagating a reaction).

IEER Comment

> *"DOE "closed" the criticality safety issue in March* 1994, *stating that there was a very small risk (an "incredible*" *risk) of accidental criticality in the tanks under present configurations. However, this statement was not based on conservative assumptions regarding the concentration of plutonium in the sludge (where almost all the plutonium resides).*" p.15

DOE Response

DOE closed one part of the criticality safety issue, the Unreviewed Safety Question (USQ) for tank storage, in March 1994. A team of senior technical personnel, whose expertise covered all relevant aspects of fissile material chemistry and physics, developed and reviewed the technical basis for nuclear criticality safety of waste stored in the 177 underground tanks at the Hanford , Site. The team concluded that under current plutonium inventories and operating conditions, a nuclear criticality accident is incredible (i.e., probability of less than one in a million) for any of the Hanford single shell, double shell, or double contained receiver tanks (DCRTs). The finding of the team are discussed in more detail in “Tank Farm Nuclear Criticality Review” (WHC-SD-WM-TI-725), dated September 11, 1996.

To establish a technical basis for safe subcritical storage of wastes in SSTs, DSTs, and DCRTs, the team examined both the neutronics of the waste tank system and chemical and hydraulic factors related to initial deposition of wastes in the tanks, aging of the wastes, and behavior of the wastes under established operating conditions (e.g., salt well pumping, etc.). From a neutronics standpoint, nuclear criticality is a function of four important parameters:

- Fissile material concentration;
- Type and amount of neutron absorbers;
- Neutron moderation; and
- Waste geometry.

The first two parameters, fissile material concentration and type/amount of neutron absorbers, are particularly important with respect to the conclusion that, under current plutonium inventories and operating conditions, it is incredible (i.e., probability of less than one in a million) that a nuclear criticality accident could occur in any of the Hanford SSTs, DSTs, or DCRTs. Collectively, the Hanford SSTs and DSTs contain an estimated 500 to 1,000 kilograms (kg) of plutonium (Pu). Analysis of many samples of tank wastes clearly established that the Pu content of the waste in any tank is associated with the sludge phase from a criticality perspective. The maximum measured Pu concentration in a sludge phase is about 0.2 grams Pu/liter, conservatively derived for tank waste conditions. In most SSTs and DSTs, the Pu concentration in the sludge is 100 (or more)” times less than the 2.6 grams Pu/liter minimum critical concentration specifically derived for the Hanford waste tanks. This situation reflects the deliberate controls always exercised throughout operation of fuel reprocessing and purification facilities to maintain Pu concentrations in waste streams to very low levels to assure subcritical operations. All of these parameters will receive appropriate consideration by DOE in closing out the criticality safety issue.

Abundant analytical data exist to show that Pu in SST and DST sludges is closely associated with large amounts of iron, manganese, chromium, and other metals which are known to be good neutron absorbers. These metals precipitate along with Pu when initially acidic wastes are neutralized. Absorber(s)-to-Pu ratios are typically well above those needed to ensure subcritical conditions. Washing and dissolution tests with representative sludges confirm that it is very difficult to separate Pu from associated iron and other sludge constituents.

Water (i.e., hydrogen atoms) present in the tanks addresses the third parameter, neutron moderators, by serving to moderate neutrons by reducing their thermal energy loads. Water also serves as a neutron absorber when in excess of a certain amount (optimum moderation). The stored tank wastes are, in general, over-moderated which adds to the conservatism in the derived 2.6 g Pu/liter minimum critical concentration.

Regarding the fourth parameter, geometry, the most likely configuration of the sludge and fissile material in the Hanford site storage tanks is as a slab or cone. At a concentration above 2.6 g Pu/liter, well above the maximum observed waste concentration, a slab can be made critical. However, large amounts and concentrations of Pu (e.g., 5,000 kg at 3 g Pu/liter or 1,500 kg at 6 g Pu/liter) would be required, which are not achievable under current waste storage conditions. Additionally, chemical mechanisms have been studied whereby the Pu might enter sludge phases. No mechanism has been identified to concentrate the plutonium sufficiently to exceed the minimum critical concentration in the sludge. For alkaline conditions in the waste tanks, Pu concentrations in the supernate will be less than the minimum critical concentration by more than a factor of ten.

DOE believes that the estimate of Pu in tank waste used for the analysis of safety issues, consideration of tank farm operations (in the TWRS Basis of Authorization and Final Safety Analysis Report) and for tank waste retrieval, treatment, immobilization, and disposal (in the TWRS Environmental Impact Statement) used conservative estimates of Pu and the accidents associated with management of Pu in the tank waste. This conservatism has resulted in implementation of safety measures that ensure that even if DOE' s best basis estimate of Pu is lower that the actual content of the waste, appropriate safety measure will protect worker and health and safety.

<u>IEER Comment</u>

> *"While DOE is developing new technologies for removing wastes from the tanks, the only technology that has actually been used is "sluicing" which uses a large volume of water to mobilize the waste. Reliance on this technology could also create new leaks or reopen new ones that have become plugged over time by solid constituents in the waste."* p.15

> *"DOE should expand its program of technological research and development into safely emptying the tanks of hardened waste."* p.269

<u>DOE Response</u>

DOE concurs with the IEER that technology research and deployment to address uncertainties with retrieval of single-shell tank waste should be a priority of the TWRS program. In the TWRS Record of Decision, DOE committed to expanding its efforts to develop new technologies that would address the uncertainties associated with hard-to-retrieve waste and retrieval from tanks that are known or suspected leakers.

In Fiscal Year 1996, DOE implemented a three-year technology development effort known as the Hanford Tanks Initiative (HTI), to support research, development, and deployment of technologies capable of safely retrieving hardened residual tank waste and waste from tanks which are known or suspected leakers. This technology demonstration program has the support of DOE's regulators and stakeholders and was endorsed by the National Research Council in its 1996 review of the TWRS Draft Environmental Impact Statement.

The HTI program is supporting SST retrieval by demonstrating alternative technologies to hydraulic sluicing that limit or eliminate the use of sluicing fluid (i.e., remote crawlers, mechanical arms) for waste removal. Successful tests have been completed on simulated wastes using both remote crawlers and low volume, high pressure water jets. These technologies may be employed to remove waste from tanks where leaks have occurred or for removal of residual waste remaining in tanks following retrieval using sluicing. In addition, DOE has the flexibility to develop new retrieval technologies if current HTI activities prove to be environmentally unsound, cost prohibitive, or technologically inefficient.

Early results from HTI indicate that several alternative technologies may be practical for deployment at Hanford. In Fiscal Year 1997, HTI issued contracts to four vendors to develop alternate retrieval technologies. The contracts required the vendors to complete design of retrieval systems that use low volumes of liquids and are capable of retrieving hard tank waste. Contractors also completed cold demonstrations of their technologies. In Fiscal Year 1998, HTI will select two vendors to proceed with technology development and demonstration. These contracts will support DOE's final selection of a vendor to support hot demonstration of an alternate retrieval technology on Tank C-l06 hard waste following completion of sluicing of the tank in Fiscal Year 1999.

While HTI develops better waste retrieval technologies, TWRS is proceeding with SST waste - retrieval at Hanford using hydraulic sluicing, similar to what was accomplished on 53 SSTs in the past, as the baseline technology. Hydraulic sluicing is being demonstrated via Project W-320 on Tank 241 C-106 in order to resolve the high-heat safety issue. The baseline sluicing technology uses large volumes of liquid at low pressure to mobilize waste for removal by a transfer pump. This retrieval approach is in accordance with Tri-Party Agreement requirements, which also include provisions for removal of 99 percent of the tank waste, establishing leak detection, monitoring, and mitigation measures to allow for hydraulic sluicing operations.

Current plans are to utilize this technology in tanks that are not anticipated to leak during retrieval operations. This approach would minimize that potential of leakage losses during the retrieval of the initial 36 single shell tanks. Prior to initiating retrieval of the remaining 113 SSTs, including the 67 tanks that are know or assumed to be leakers, DOE will complete the evaluation of alternative retrieval technologies that would limit or eliminate use of sluicing liquid. DOE and the Washington Department of Ecology will establish allowable leakage levels and leak detection measures for the remaining tanks.

IEER Comment

> *"The* 99 *percent removal goal is arbitrary and environmentally unsound. The one percent of the waste volume in the high-level waste tanks will likely contain millions of curies of radioactivity."* p.16

> *"Amend the Tri-Party Agreement to discard the* 99 *percent retrieval goal and replace it with new goals."* p.3

DOE Response

The 99 percent goal cited by IEER does not accurately represent the Department's goal. It is a minimum, not a maximum goal. DOE is committed to remove as much waste from the tanks as is technically feasible. The Tri-Party Agreement interim retrieval goal for Hanford's tank waste specifically states, "... retrieval of as much tank waste as technically possible, with tank waste residues not to exceed 360 cubic feet (cu. ft.) in each of the 100 series tanks, 30 cu. ft. in each of the 200 series tanks, or the limit of waste retrieval technological capability, whichever is less." For tank waste, therefore, the goal is to retrieve all tank waste practicable with a maximum of one percent residual waste. The goal does not preclude the requirement for additional waste retrieval to support closure of the tank farms. Regardless of the volume of residual waste remaining in the tanks, prior to closing the tanks, DOE must demonstrate through a performance assessment of the residual waste and closure systems (e.g., barriers) that any long-term releases of residual tank waste to the environment would be within regulatory limits established to protect human health and the environment.

2.2 TANK FARM MANAGEMENT

IEER Comment

> "*DOE's plans to manage the Hanford tanks is seriously flawed, incomplete, and has incorrect priorities.*" p.13

DOE Response

The Hanford high-level tank waste management practice for the past 50 years has been to continue to store the waste in tanks. This practice led to many environmental and safety problems, including tank leaks that have contaminated the vadose zone, drying of potentially reactive chemicals and the attendant safety issues, and obsolete and deteriorating equipment. For the past 25 years or more, there has been a debate on whether to commence waste immobilization and disposal or to delay until better technology is available. Recently, the Department chose to commence waste immobilization and disposal because this path presents fewer safety and environmental risks than continued storage until the time at which alternative technologies are developed. Our regulators and stakeholders strongly endorse the Department's position.

The Department believes fully satisfactory technology is available now to move forward with the demonstration phase of tank waste immobilization and disposal. This assessment is based, in part, on evaluation of technology deployments within the DOE complex and in Europe. DOE's position was affirmed when two teams of companies chose to bid on the construction and operation of tank waste treatment and immobilization facilities. The teams were free to select technologies that would produce a waste form that met DOE specifications. The teams also were required to assume much of the financial risk of constructing the facilities because DOE specified it would only pay for waste product that met its specifications. The fact that the two teams have proposed technologies that have been successfully implemented elsewhere within the DOE complex or in Europe supports DOE's position that existing technology is available to move forward with Hanford Site waste retrieval and immobilization.

Concurrent with moving forward with the demonstration phase, DOE has implemented initiatives to reduce uncertainties in support of the TWRS program including:

- The Hanford Tanks Initiative, which will provide data on the characterization of tank residuals, technologies for waste retrieval, technologies for removing tank residuals, and criteria for closing tanks;
- Completion of the tank waste characterization program, which will provide data relative to tank waste safety issues and the contents of the tanks;
- Resolution of the high priority tank safety issues;
- Determination of the degree of contamination in the vadose zone from past practice releases and tank leaks;
- Development of a comprehensive plan to integrate tank waste remediation with tank farm closure and other remediation activities related with the TWRS program;
- Integration of TWRS program implementation with plans for developing a national geologic repository for high-level waste; and
- Demonstration of the efficiency and effectiveness of retrieval sluicing technologies to support the tank waste remediation activities.

If and when better technologies become available, decisions can be made at that time whether or not to implement them.

IEER Comment

> *"The decision to separate tank waste into high-level waste and "low-level" waste is unsound because it will result in the shallow land disposal of missions of curies of long-lived radioactivity."* p.16
>
> *"DOE should abandon the plan to dispose of Class* C *"low-level" waste on site and adopt a goal to process all high-level waste tank contents for management as high-level waste."* p.269

DOE Response

The Department is required under existing State and Federal laws and regulations to retrieve, immobilize, and dispose of Hanford's tank waste. Because the tank waste consists of both hazardous and radioactive constituents, DOE must comply with State of Washington Dangerous Waste Regulations, DOE's requirements under the Atomic Energy Act and requirements of the Nuclear Regulatory Commission (NRC) under the Atomic Energy Act (if the waste disposed of is non-low-level waste) in disposing of the immobilized tank waste. The NRC has determined and DOE concurs that non-high-level waste can safety be disposed of in near surface disposal facilities. To determine if the immobilized tank waste is non high-level waste, DOE must consult with the NRC. If, based on those consultations, the waste is determined to be non high-level waste, DOE must dispose of the waste in a manner that is protective of human health and the environment and complies with State and Federal regulations. For Hanford's tank waste, DOE is fully complying with each of these requirements. Additionally, DOE has committed, through the Tri-Party Agreement, to only dispose of immobilized low-activity waste at the Hanford Site in a retrievable waste form. This commitment provides DOE the flexibility to change its disposal strategy if new information indicates that the waste should be disposed of in an alternative manner (e.g., in a deep geologic repository).

In June 1997, the Nuclear Regulatory Commission (NRC) concluded a review of Hanford' s approach to low-level waste separation, classification, and disposal. The NRC staff reviewed the "Technical Basis for Classification of Low-Activity Waste Fraction from the Hanford Site Tanks" and supporting documents, including the Hanford Low-Level Tank Waste Interim Performance Assessment. The NRC concluded that "…available separation processes have been extensively examined to determine those that are both technically and economically practicable." The staff also concluded that, "...the vitrified waste form [for low-level waste] is expected to meet the limit for Class C or less" and that "wastes are to be managed, pursuant to the Atomic Energy Act, so that safety requirements comparable to the performance objectives set forth in 10 CFR Part 61, Subpart C are satisfied." Among these safety requirements are ensuring that near surface disposal facilities are constructed and operated in a manner that is protective of human health and the environment and is compliant with all applicable Federal and state environmental protection laws and regulations.

Disposing of low-level waste on site is a decision that allows DOE to address tank waste while meeting existing Federal laws and regulations and minimizing risk to human health and the environment. Many technical analyses performed by DOE indicate that low-level waste separation and on-site disposal do not pose a substantive risk to human health and the environment. In addition, processing low-level waste using the same technology and strategy as high-level waste could expose DOE to substantial program delays and increased costs. DOE believes these delays could actually increase potential risks to human health and the environment resulting from continued management in high-level waste in aging tanks.

Analyses provided in the Final Tank Waste Remediation System Environmental Impact - Statement (dated August 1996), the Hanford Low-Level Tank Waste Interim Performance Assessment, and other Hanford site documents demonstrate that:

- Vitrified waste forms combined with engineered systems would be protective of human health and the environment;

- The vitrified waste forms combined with engineered systems would meet the performance objectives of 10 CFR Part 61 and all other applicable Federal and State laws and regulations which address potential risks of intrusion into the waste form as well as limiting long-term release of contaminants to the environment to levels that would be protective of human health and the environment; and

- The Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) Major Milestones M-90-00, "Complete Acquisition of New Facilities, Modifications of Existing facilities, and/or Modifications of Planned Facilities, as Necessary" commit DOE to designing and constructing low-level waste storage facilities for the immobilized waste.

DOE has evaluated the cost differential between disposal of all of the immobilized tank waste in a deep geologic repository and disposing of a portion in a repository and the remainder in near surface disposal at the Hanford Site. The cost difference, based on the best available current estimates of repository disposal requirements and costs, indicate that geologic disposal of all waste would increase the disposal costs for the Hanford tank waste from $8 to 33 billion above the cost of the current plan to dispose of a portion of the waste in a geologic repository while disposing of the larger portion of the waste at the Hanford Site. If at some latter date the cost of repository disposal is substantially reduced or if near surface disposal is found to not be sufficiently protective of human health and the environment, DOE could revise its disposal strategy because the low-activity waste disposed of at the Hanford Site will be in a retrievable waste form and will be in a waste form that meets current waste acceptance criteria for deep geologic disposal.

The current total high-level tank waste volume is approximately 210,000 m^3 and the volume of low-activity waste is estimated at 240,000 m^3 (Reference: Final Tank Waste Remediation System Environmental Impact Statement, August 1996).

IEER Comment

> "*DOE is rushing into the vitrification option for Hanford high-level waste without sufficient consideration of the obstacles and without having learned from problems at other sites.*" p. 17
>
> "*DOE should initiate two parallel programs for solidification of high-level waste. One program should develop methods for calcining the high-level waste coupled with research into ceramic immobilization forms for calcined waste. This program should be implemented along with a program of vitrification research and development for calcined waste forms, The second should pursue the development of pretreatment and specific glass-making approaches that would not require calcining.*" p.269
>
> *"DOE should immediately expand existing laboratory work and initiate small pilot-plant programs that would thoroughly test all technologies and waste forms using non-radioactive materials.*" p. 269

DOE Response

DOE believes that the many years of technology evaluation of vitrification and implementation of the technology throughout the DOE complex and internationally have reduced the technological uncertainties to a manageable level. At the Hanford Site alone, more than a decade of research and evaluation of the vitrification of high-level waste has been accomplished. The research and evaluation has included consideration of calcination (i.e., turning the waste into an oxide powder) and ceramic waste forms. The Tank Waste Remediation System Environmental Impact Statement (August 1996) analyzed the impacts associated with an alternative that would result in the calcination of the tank waste inventory. In both cases, vitrification of the tank was determined to be a preferred alternative in terms of implementability of the technology, waste form performance, and/or acceptability of the waste form for disposal. The Hanford Site has carefully considered the lessons learned from site evaluations and the experience from other DOE sites, including Savannah River and West Valley, and has developed a process for implementing waste treatment that allows for those lessons learned to be applied to the Hanford Site and for Hanford to benefit from successful implementation of high-level waste vitrification in England and France.

DOE based its decision to proceed with vitrification of Hanford's tank waste on consideration of the large body of laboratory, pilot and full-scale plant research regarding calcining, vitrification, and ceramic immobilization. This body of research included years of DOE experience in calcining similar waste and research into vitrification. Additionally, DOE considered research, laboratory, pilot, and full-scale vitrification plants from other nations before reaching a decision on Hanford tank waste immobilization. The privatization approach implemented by DOE at the Hanford Site requires industry to share the risk associated with technology development and implementation. Under the privatization initiative, industry will only be paid for waste that meets DOE's waste form specifications. Two major contractor teams, representing the companies with extensive experience in vitrification of high-level and mixed waste in the United State and Europe are competing to assume the risk of constructing and operating pretreatment and vitrification facilities that will produce a vitrified waste form that meets or exceeds DOE's performance standards.

The decision to proceed with Hanford tank waste remediation allows DOE to begin waste retrieval and treatment using demonstration-scale facilities to treat six to 13 percent of the tank waste before proceeding with full-scale plants. This approach will allow DOE to begin to remove and immobilize high-level waste tank waste to protect human health and the environment in the short term. DOE can then apply the lessons learned during the demonstration phase of the project and any new technologies that emerge to the full scale facilities that will be constructed to treat the remainder of Hanford's tank waste.

In conjunction with the Washington Department of Ecology, the U.S. EPA, Tribal Nations, and major stakeholders, DOE has adopted a long-term strategy that will focus efforts on achieving ultimate TWRS remediation goals while continuing to characterize tank wastes, evaluating new technologies, and improving risk assessments. DOE intends to implement its program in a manner that is flexible enough to accommodate appropriate mid-course corrections in the tank waste remediation strategy, based upon lessons learned in the pilot studies or from other new information. In the TWRS Record of Decision, DOE committed to formally reevaluating its program and considering new information and technologies prior to proceeding with the next phase of the program. These evaluations will occur prior to authorizing contractors to proceed with design and construction of Phase I treatment and immobilization facilities, prior to the hot start of Phase I facilities, and prior to requesting companies to bid on the design, construction and operation of Phase II facilities.

<u>IEER Comment</u>

> *"The "privatization " program for treating the high-level waste in the tanks is inappropriate, ill-conceived, and is unlikely to yield good results either on technical or economic grounds. DOE is attempting to turn a poorly-defined scope of work into a privatization operation."* p.17
>
> *"DOE should not pursue "privatization" for Hanford tanks. It is fraught with risks for the government and likely to create new problems, disputes, and delays."* p.270

DOE Response:

The DOE believes that privatizing portions of the TWRS program is feasible. It is conducting privatization in a staged, sequenced approach, and is constructing a well-defined contract scope with clearly specified deliverables. In defining the scope of the contracts entered into in September 1996, DOE identified a portion of the Tank Waste Remediation System (TWRS) work scope that would be amenable to fixed price contracting. This process involved selecting scope that: 1) could be specified in terms of a well-defined product or service; 2) could be accomplished using mature technology; and 3) would result in a “bankable deal” (one that could be financed). The process limited the scope of the current contracts to waste pretreatment and immobilization, and excluded other areas of TWRS scope, such as waste retrieval and facility decontamination and decommissioning.

In addition, at the time of contract award, the TWRS contracts were structured into two Phases: a 20 month Part A, ending in May 1998 and an optional Part B. The purpose of Part A was to establish the technical, operational, regulatory, business, and financial elements. The review of contractor work products prepared under Part A is currently underway within the Department. Based on this review, DOE will decide if it should continue to proceed with an approach involving private contractor financing or whether it should return to a more traditional cost-plus contracting approach. The contractor proposals are being evaluated to assess price reasonableness, confidence that the contractor can meet Part B requirements, and value to the government. The contracts also required the contractors to propose alternative business and financing approaches that might be advantageous to the government, and those approaches are also being evaluated by the Department. During the current “Authorization-to-Proceed” decision-making process, DOE also has the opportunity to refine its strategy further by reviewing contractor technology for appropriateness and maturity.

This scope of the current contracts for Tank Waste Remediation placed limits on the percentages of waste to be processed in order for DOE to take advantage of technical lessons learned in the start up and processing phases. DOE plans to complete additional work in areas such as technology development and waste characterization during this period. The results of this work may provide DOE with the information that will allow, at a later date, scope expansion, technology growth, and revision of financial mechanisms, if appropriate.

IEER Comment

> “*Contamination of the soil, or vadose zone, as well as the groundwater beneath the tank farms pose serious problems. Yet, DOE has not developed a plan to address such contamination.* “ p.18
>
> *“In light of investigations into contamination of the vadose zone..., groundwater models need to be more thoroughly revamped. Further, decisions regarding remediation of the environmental contamination due to the tank farms should be*

integrated with the tank waste program. DOE should greatly expand its program to characterize the vadose zone and the migration of contaminants within it to the groundwater and thence to the Columbia River." p.269

DOE Response

DOE agrees with IEER that the issues associated with contaminated soil and groundwater at the tank farms are important. Accordingly, DOE has invested substantial resources into groundwater characterization and monitoring programs at the Hanford site. The Resource Conservation and Recovery Act (RCRA) groundwater monitoring network alone includes more than 800 wells across the site and more than 50 wells that monitor groundwater quality in the tank farms. DOE is working closely with the State of Washington to ensure full compliance with RCRA groundwater monitoring requirements.

DOE has also taken strides to improve its understanding of the nature and extent of contamination of tank farm soils due to past practices, including surface spills and leaks from tanks or ancillary equipment. The TWRS program is completing a four year effort to log more than 800 boreholes at the tank farms to establish a baseline understanding of contamination migration. Additionally, in August 1997 a Memorandum of Agreement (MOA) was signed between the three Hanford Site programs with waste management and cleanup responsibilities. The MOA established a framework for integrating the efforts of each program into a comprehensive site-wide vadose zone characterization program. The Environmental Restoration program was given lead responsibility to formulate a comprehensive plan and ensure that vadose zone characterization was integrated and addressed the programmatic and regulatory requirements associated with waste management and cleanup. This effort has the direct involvement of Undersecretary Moniz, Site Manager John Wagoner, the Site Assistant Managers of TWRS, Environmental Restoration, and Waste Management, and the major Site contractors (e.g., Bechtel Hanford Company, Fluor Daniel Hanford, and Pacific Northwest National Laboratory). It reflects the importance DOE places on ensuring that a program is implemented at the site that is protective of groundwater and the Columbia River and enables DOE to meet all applicable State and Federal regulations.

Contamination of the vadose zone and groundwater does not present a near term human health risk, but, because of the importance of these issues, DOE has implemented a number of activities to improve the understanding of the nature and extent of past waste tank releases to the environment. Among the issues being addressed at the Hanford Site are chemical and hydrogeologic processes that may influence the mobility of contaminants (e.g., cesium, plutonium) in the vadose zone. DOE's actions to address vadose zone contamination include the following:

- Complete in Fiscal Year 1999 the current bore hole logging baseline characterization program which has resulted in logging of more than 750 tank farm boreholes since 1994 and improving DOE's understanding of the extent of vadose zone contamination associated with past tank leaks;

- Implement improvements to the borehole logging program, including shape factor analysis, to enhance the value of the data produced by the program and to provide additional data needed to support prioritization of future characterization activities;

- Continue the Resource Conservation and Recovery Act (RCRA) groundwater quality monitoring program for seven tank farm waste management areas. This program includes regular sampling of more than 50 groundwater monitoring wells in the tank farms and Phase II RCRA groundwater quality assessments for three waste management areas;

- Continue integration of the vadose zone and groundwater characterization issues between programs at the Hanford Site to ensure consistency and efficient expenditure of resources across the Hanford Site;

- Identify and evaluate mitigation measures that should be implemented to minimize future tank farm infiltration and other factors that could contribute to migration of contaminants in the vadose zone;

- Continue in Fiscal Year 1998 saltwell pumping of liquids from SSTs known or suspected to have leaked to DSTs to minimize the potential for tank leaks to the surrounding soils;

- Continue to analyze soil and groundwater samples from the recently completed extension of a borehole in the SX tank farm to improve the site's understanding of the depth of contamination migration and hydrogeologic characteristics on the vadose zone;

- Implement research and field characterization programs including an effort to consider near-term and long-term vadose zone characterization needs required to support programmatic needs and regulatory compliance;

- Refine screening analysis of AX and SX tank farm vadose zone transport properties to incorporate new data from the borehole logging program and SX tank farm bore hole extension to aid in prioritizing future characterization efforts; and

- Continue to expand the use of independent expert panels to provide input on the vadose zone characterization program and expand the participation of stakeholders and Tribal Nations.

These efforts will substantially contribute to refining DOE's understanding of the nature and extent of vadose zone and groundwater contamination, support revision of site models for transport of contaminants in the vadose zone and groundwater, and provide information needed to determine what additional characterization activities are required to support retrieval and remediation decisions.

IEER Comment

> *"Characterization of facilities used to support storage of waste in the* 177 *high-level tanks* (*such as pipes, junction boxes, valves, pumps, and auxiliary tanks) has taken a back seat to the characterization of the tanks themselves.*" p.18
>
> *"DOE should accelerate its efforts aimed at characterizing inactive and improperly abandoned tanks and the soil around them.* " p.270
>
> *"Auxiliary facilities such as transfer pipelines, junction boxes, and pumps need to be investigated to determine the extent of contamination and the scope of decontamination and decommissioning.*" p.270

DOE Response

In prioritizing Hanford cleanup activities, DOE, Washington Department of Ecology, and the U.S. EPA, with input from stakeholders and Tribal Nations, determined to first focus limited resources on those cleanup issues that posed the greatest potential risk to human health and the environment. Among the highest priorities were safe management of waste and identifying for earliest characterization and remediation waste sites nearest the Columbia River and tank wastes. These priorities serve as the guide for allocation of funding at the site. As waste sites close to the river and tank wastes are characterized, treated, and finally closed, other lower priority cleanup activities will be addressed. In keeping with these priorities, the highest priority for the tank farms is to resolve safety issues associated with watch list tanks and continue safe and regulatory compliant management of the tank waste until the waste can be safely retrieved from the tanks, treated, and disposed.

As issues associated with safe waste management and retrieval and treatment are resolved, other important tank farm cleanup activities will receive more attention and funding. Among these other activities are characterization of ancillary equipment, auxiliary tanks, pipes, junction boxes, valves, and pumps. In the meantime, DOE has implemented efforts to determine the contents of the miscellaneous underground storage tanks, determine the risks associated with the tanks, and implement appropriate safety controls and mitigation measures to ensure worker and public safety. DOE is working with the Washington Department of Ecology and EPA Region X to review Hanford's site-wide priorities and to make adjustment if necessary.

3.0 RADIUM- AND THORIUM-CONTAMINATED WASTE AT FERNALD

The IEER report raises concerns about DOE's management of radium-contaminated and thorium-contaminated wastes in silos and bentonite remediation at the Fernald site. The Department has considered all the silo management issues raised in the IEER report in developing its current path forward on silo management. The Department agrees with IEER on a number of its recommendations including the need for further waste characterization work and for continuing independent cost reviews on the silo management project. With respect to the desirability of the vitrification waste management alternative, the position of the Department and IEER are not far apart. DOE may disagree with IEER on the extent to which the silo management project can be effectively "privatized." The Department has plans for further studies of remediation treatment options and preparation work for the removal of the bentonite layer.

3.1 SILO WASTE MANAGEMENT

<u>IEER Comments</u>

(a) *DOE should implement the tornado-resistant enclosure option...*

(b) *...a thorough independent review of both accounting and engineering aspects needs to be carried out before any cost increases are granted...*

(c) *The waste in all three silos should be more thoroughly characterized... Development of vitrification techniques for the waste in Silos 1 and* 2 *should proceed along a focused, targeted effort in the 1-2 year timeframe...*

(d) *Vitrification of Silo 3 waste, the remedy selected in the Record of Decision, should be placed ahead of any other technical approaches to stabilization of Silo 3 waste...*

(e) *A modular approach to vitrification, which would allow for operating flexibility in order to treat a potentially heterogeneous waste feed, is advisable...*

(f) *DOE should not rush into alternative treatments, such as cementation, given DOE's own evaluation of problems and difficulties with such technologies...*

(g) *Privatization is not an appropriate contracting mechanism for the remediation of the waste in the silos...* p.270-271

DOE Response

All of the above recommendations had been previously identified in some manner through recent internal and external evaluations of the Silos project (i.e., Independent Review Team, Corps of Engineers Phase 2 Critical Analysis, Melter Incident Review, GAO review, etc.). The current path forward clearly addresses each of these issues.

The Silos Project is in the process of planning a strategy to accelerate the retrieval of wastes from Silos 1 and 2 into temporary storage tanks. This approach provides several benefits: addressing the uncertainty associated with the silo integrity, allowing DOE to work out potential retrieval problems and uncertainties before final remediation, and placing waste in a more homogenized form, thus reducing uncertainties associated with treatment. This information has been presented to the Fernald Citizens Advisory Board Waste Management Committee and the U.S. and Ohio EPAs. The temporary storage tanks will be designed to meet the requirements identified by the safety analysis, which addresses the possibility of a tornado. Furthermore, additional integrity testing of the silos is being performed to provide additional data on the structural integrity of the silos, including the domes. In addition, to mitigate the exposure and risk associated with a potential silo or dome collapse, the Fernald Environmental Management Project has implemented an Emergency Recovery Plan that identifies the actions to be taken.

Responses to specific issues raised are as follows:

(a) The recommendation of the tornado-resistant enclosure may mitigate the potential dome collapse in the short term; however it does not mitigate the overall silo structural integrity issue. Accelerating waste retrieval from the Silo 1 and 2 addresses the concern with the overall silo structural integrity and the radon head space concentration. Not only does this acceleration address the silo structural integrity issue, but it also provides advantages in preparation for the final remediation of the Silo contents.

(b) As the new path forward is implemented, independent technical experts will perform continuous technical and cost review of all aspects of the project (design, construction, operations, safety and management) will be performed by independent technical experts. In addition, cost, schedule, and technical implementability of remediation of the waste in the Silos l and 2 will be formally examined during the revised Feasibility Study/Proposed Plan process. During this process the public will continue to have an opportunity to review and provide input.

(c) Further characterization work is underway. Silo 3 has a project underway for a small scale waste retrieval activity to remove material from Silo 3 to be provided to qualified vendors to demonstrate the technology being proposed. Silos 1 and 2 have a project involving the accelerated waste retrieval of the material for placement in transfer tanks until the full-scale remediation facility is available. In addition, specific proof of principle testing will be conducted in support of the revised Feasibility Study/Proposed Plan and Record of Decision amendment. All of these projects will provide additional characterization data.

In addition, a review was conducted on the characterization of Silos 1 and 2 residues to date. The result of that evaluation found that characterization data are adequate to identify the Silos 1 and 2 constituents and to describe a predictable variation of specific elements. The process knowledge for the K-65 material has been found to be consistent with the analytical data. It is expected that transferring the material from the silos into storage tanks (transfer tanks) will provide more accessible sample ports for future sampling, and a more homogenized waste stream that will be further characterized for the final treatment vendor. These steps are expected to reduce bottlenecks in the process and minimize downtime during the treatment process.

Under EPA CERCLA guidance, DOE is required to gather new information and update the current Feasibility Study/Proposed Plan (FS/PP) and subsequently the ROD Amendment. In support of development of the revised FS/PP, “Proof of principle” contracts to four categories of treatment technologies will be awarded (two on Vitrification and two on Chemical Stabilization). The objective of the Proof of principle is to focus on technologies where the vendors could provide their technical expertise on the most current and implementable treatment technologies available. The Proof of principle test results will be utilized in the evaluation of treatment alternatives in a detailed comparative analysis for the revised FS/PP. This strategy to proceed with the Proof of principle testing contracts, to update the FS/PP, and to amend the ROD Amendment was discussed and agreed upon by the stakeholders and the EPAs during the OU4 Dispute Resolution period. It was also agreed that the stakeholders' participation during the Proof of principle Request for Proposal (RFP) would be ensured. This agreement has been fulfilled satisfactorily to this date. The ROD Amendment process will continue to provide opportunities for stakeholder input.

(d) The Explanation of Significant Differences (ESD) for Silo 3 documents the decision to identify an alternative to vitrification for Silo 3 waste. Dilution of the Silo 3 waste is needed to be able to control the sulfate level in the vitrification process, resulting in an increase in waste volumes and total project cost. In addition, the sulfates in the feed, as evidenced and experienced during the VitPP campaign, present foaming events and other operational difficulties which cause potentially difficult operational and safety concerns. Although a vitrification process could potentially be developed to accommodate these conditions in order to effectively vitrify Silo 3 waste, the cost and the significant extension in cleanup time required to develop two independent melter designs does not appear to be practical. This is the reason DOE recommended that treatment of Silo 3 waste be evaluated and implemented separately from treatment of waste from Silos 1 and 2.

(e) The operation of the final treatment facility will be optimized and made flexible during the design, construction, and system operability testing. A modular approach has been evaluated and remains an option that will be considered by the vendor selected to perform the design, construction, and operation.

(f) The current path forward establishes a Proof of principle process which will allow several commercially available and proven treatment technologies to be tested and evaluated at a pilot scale. This process will provide data on implementability, cost, schedule, and any problems or uncertainties associated with the technologies. These data will be evaluated in a revision to the OU4 Feasibility Study and Proposed Plan and will provide a basis for selecting a treatment strategy.

(g) The current path forward reflects an implementation strategy which involves placing financial accountability of the design, construction, and operation on a vendor. This vendor will be selected through a competitive process and will be awarded a fixed price contract. The vendors will be provided with all current characterization and technology information to consider and validate prior to use. In addition, the vendors will be provided all site-specific requirements, with which they will be required to comply. DOE and the Management and Integration contractor will provide oversight to ensure these requirements are met. In addition, independent technical experts will review and validate engineering and safety during all phases of the project.

<u>IEER Comment</u>

> *"Current plans to manage the silo wastes still face critical engineering design and feasibility issues as well as cost and schedule challenges."*
>
> "*These failures show an appalling lack of engineering judgment and a lack of elementary procedures to ensure that the basic parts to make the system work would match.*" p.233
>
> "*We have been unable to find an engineering justification for such huge cost increases.*" p.248

<u>DOE Response</u>

The current path forward for the management of the silo wastes reflects a new management strategy which involves placing the financial accountability of the design, construction, and operation on a vendor. This vendor will be selected through a competitive process and will be awarded a fixed price contract. All current characterization, site conditions, technology information will be made available for the selected vendor to consider and validate for use.

Cost and schedule challenges are evident for this project and have been recognized by both the Independent Review Team and a recent review of the project by the Army Corps of Engineers. The findings from both of these independent groups have been shared with all Fernald stakeholders.

Management Strategies for Silos 1 and 2. The approach for the remediation of Silos 1 and 2, which was formally agreed upon in the dispute resolution, involves two phases. The first phase involves the proof of principle testing of several treatment alternatives (e.g., vitrification, chemical stabilization/solidification, etc.). The purpose of this phase is to collect cost, schedule, and implementability information in order to evaluate remediation strategies in the revision of the Feasibility Study and Proposed Plan. The remediation strategy selected may lead to an amendment of the Record of Decision and will be implemented in Phase 2 (i.e., design, construction, and operation of the full-scale treatment facility).

As the new path forward is implemented, continuous technical and cost review of all aspects of the project (design, construction, operations, safety and management) will be performed by independent technical experts. In addition, cost, schedule, and technical implementability of remediation of the waste in Silos 1 and 2 will be formally examined during the revised Feasibility Study/Proposed Plan process. During this process the public will have an opportunity to review and provide input.

Management Strategy for Silo 3. The overall remediation will be performed separately from Silos 1 and 2. The treatment of the waste will be accomplished using chemical stabilization/solidification and polymer/sulfur encapsulation. This approach is in the process of being formalized in an Explanation of Significant Differences, which is currently out for public review and comment.

The challenges associated project costs are being addressed by competitively bidding the design, construction, and operation. In addition, a government check of estimate will be performed as the basis for evaluating the cost of the bids.

3.2 BENTONITE REMEDIATION

<u>IEER Comment</u>

> "*Other than noting that the bentonite option would increase the volume of waste, there was no analysis of how the additional material might impact the eventual retrieval and treatment of the waste in the silos.*" p. 217
>
> "*Thus, the bentonite remediation has not been very effective as an interim measure and it has complicated considerably the problem of retrieval of the waste from Silos 1 and* 2." p.218

DOE Response

Studies and preparation work for the removal of the bentonite layer and treatment options are currently underway. These actions have been discussed with the Fernald Citizens Advisory Board Waste Management committee, as well as with the U.S. and Ohio EPAs.

A competitively bid fixed price contract will be awarded to a qualified commercial vendor to design, construct, and certify operability. All available characterization, rheology, and hydraulic information will be provided to the vendor for consideration and validation. The vendor will be held financially accountable for design, construction, and operability of the retrieval system. Their design must address any impacts the bentonite might have on retrieval. Independent technical experts will be called in during design, construction, and system operability testing to evaluate safety and engineering.

4.0 PROGRAMMATIC ISSUES

The IEER report raises a number of programmatic issues and concerns with the EM program. These include lack of national remediation or low-level waste management standards, lack of an adequate project planning process, and the need for a revised waste classification system.

IEER Comment:

> "*EM does not have national remediation or low-level waste management standards.*" *p.* 32

DOE Response:

The Department of Energy conducts its cleanup activities in collaboration with its regulators, interested Tribal Nations, and stakeholders, and consistent with applicable laws and regulations. Expected land use is also considered when deciding on a cleanup alternative. The National Contingency Plan (NCP), the implementing regulation under CERCLA which guides most of EM's cleanup, provides for a "flexible," approach to decision making and individual site remediation methods used. The NCP and the Department do not regard this approach as "ad hoc." Rather, the approach provides a consistent, national framework for site-specific decision making. EPA and DOE have taken steps to improve the consistency of action without usurping local control.

With protection of human health and the environment as primary objectives, the NCP provides for consideration of site-specific factors, including the physical characteristics of a site, which are critical in determining risk and appropriate remedies, the permanence and cost effectiveness of a remedy, and the views of the affected community and state. While these and additional factors influence decisions regarding the degree of cleanup and the most suitable remedy, the intent is to provide a level of protection consistent with applicable or relevant and appropriate standards (ARARs) from other environmental statutes, or in the absence of such standards, commensurate with residual, incremental lifetime risk levels for developing cancer of between one-in-a-million and one-in-ten-thousand. Even if DOE were to develop national cleanup standards, the NCP, not DOE cleanup standards, would dictate cleanup objectives for DOE remediation actions under CERCLA. Furthermore, a flexible approach to decision-making, while perhaps lacking in uniformity, is essential in situations where a number of factors must be balanced at a site-specific level, to ensure that protective, efficient, cost-effective, and compliant cleanup decisions are made.

DOE's management of low-level waste is governed by *DOE Order 5820.2A "Radioactive Waste Management.* " This Order states that "Radioactive and mixed wastes shall be managed in a manner that assures protection of the health and safety of the public, DOE, and contractor employees, and the environment. The generation, treatment, storage, transportation, and/or disposal of radioactive wastes shall be accomplished in a manner that minimizes the generation of such wastes across program office functions and complies with all Federal, State, and local environmental, safety, and health laws and regulations and DOE requirements." The Order provides comprehensive and consistent requirements, standards, and a framework for the management of low-level waste across the DOE complex.

<u>IEER Comment:</u>

> "*Large projects are implemented with minimal pre-project preparatory work.*" *p.* 32

<u>DOE Response:</u>

DOE respectfully disagrees that large projects are implemented with minimal pre-project preparatory work. However, the Department acknowledges that problems with specific projects do arise and takes appropriate action to correct the situation when problems occur. The Department's approach to problem solving is discussed further later in the response.

In general, all DOE projects are managed according to the requirements and principles of *DOE Order 430.1 "Life cycle Capital Asset Management".* This directive and the associated "good practice guides" provides a comprehensive yet flexible approach to project management. As indicated in the Order, project implementation and management are divided into three phases: pre-conceptual, conceptual, and execution. As implementation of a project proceeds, there are formal review and decision points (called Critical Decisions) to determine if a project should proceed to the next phase. These reviews also serve as a forum to raise and discuss issues and recommendations for modification of a project's scope or approach based on better information or new concerns.

Pre-conceptual activities include identification of a need for the project and preparation of the formal mission need documentation. This documentation includes preliminary estimates of the technical scope, schedule, and cost of the project. In addition, a preliminary risk assessment is generally performed. The analysis performed during this phase usually serves to identify issues and opportunities to address during the conceptual phase. Based on this preliminary information, a formal decision is made on whether to proceed with the project (Critical Decision # 1, Approval of Mission Need). If approval is granted, the project proceeds to the conceptual phase.

Conceptual activities focus on developing a conceptual design and establishing a project baseline. During this phase, systems engineering and value engineering evaluations occur to investigate alternatives, assess project risk, and provide a better life-cycle cost estimate. In addition, issues and concerns that have been raised in the pre-conceptual phase are generally investigated and resolved at this stage in the process. Additionally, preliminary safety assessments are generally performed at this stage. For large projects, the extent and scope of these planning and evaluation activities can be extensive and last for several years. The conceptual phase ends after the project baseline has been approved. (Critical Decision #2)

Execution activities include preparing National Environmental Policy Act (NEPA) documentation and performing the detailed design. Extensive safety assessments are also performed during this phase. Actual construction of the project begins after approval to proceed (Critical Decision # 3). The execution phase ends with approval of Critical Decision # 4, (Approval of Project Completion), after which the project is ready to begin operations.

In addition to the requirements of DOE Order 430.1, all projects performed under EM's purview are managed under the Department of Energy's Integrated Safety Management System (ISMS). This system requires Authorization Protocols which communicate DOE acceptance of the contractor's integrated plans for hazardous work. The elements of the ISMS are to define the scope of work, analyze hazards, identify the requirements needed for performing the work, including those necessary to mitigate or minimize to an acceptable level the hazards associated with the work, implement hazard controls, perform the work within established requirements, and give feedback for continuous improvement. This approach represents the level of preparatory effort that DOE endorses as its expected way to do work. EM senior management requires this approach and also mandates that all those in charge of site remediation and waste management activities will “do work safely or not at all”.

The Department manages unique projects that are sometimes large and complex. Given the many unknowns associated with these first-of-a-kind projects, unexpected problems sometimes occur. Whenever problems occur, however, the Department takes appropriate action to evaluate the situation and solve the problems. For example, an independent review team is being formed to evaluate the situation regarding the Inter-Tank Precipitation Facility at the Savannah River Site which was recently shut down. In addition, DOE is taking steps to improve its overall project management system including the need for independent reviews of all major projects as recommended in a recent National Research Council report.

IEER Comment

> *“Create a new, rational, environmentally-protective system of radioactive waste classification according to longevity and specific activity, so that comparable hazards are managed comparably.” p.* 254

DOE Response

The current waste classification system, which IEER recommends changing, is based on Congressionally legislated definitions of high-level, transuranic, and low-level waste. This system is the basis for waste management activities within both DOE and the commercial sector. DOE does not have the authority to change the definitions in the current system.

The IEER report recommends DOE create a new, environmentally-protective system of radioactive waste classification according to longevity and specific activity, so that comparable hazards are managed comparably. While DOE agrees that half-life and specific activity are important aspects to managing radioactive wastes safely, they are not the only attributes of radioactive waste to which attention should be given. Additionally, management or classification of waste based only on these two attributes will not ensure that wastes with hazards of comparable levels are managed comparably, or that such a system of waste classification would be environmentally protective. In determining safe and proper management strategies which protect the public, workers, environment, and future generations, attention should also be given to toxicity, solubility, mobility, and volatility, among other characteristics. Additionally, site-specific characteristics such as hydrology, geology, and climate, and waste-form and engineering considerations play significant roles in determining the correct strategies for safe management of radioactive waste, and cannot be adequately reflected in any waste-specific classification system.

Any waste classification system is at best a screening tool. Regardless of how a waste is classified, a safe, acceptable, and proper method of managing radioactive waste requires that attention be given to the above mentioned parameters. Additionally, strategies for management of wastes should be suited to the breadth of hazards associated with the waste and the performance attributes of the location at which the waste will be managed. Focusing on each waste stream and its characteristics and associated hazards promotes the development of case-specific approaches to managing radioactive waste which provide the necessary assurances that prescribed thresholds for protection of workers, the public, and environment are not exceeded.

While legitimate criticisms can be made of the current radioactive waste classification system used in the U.S., it is not clear if the IEER recommendation would provide a better solution for waste classification. Even if DOE had the authority to change the waste classification system as recommended, significant costs and impacts would be associated with making such changes. It is not clear that accommodating such a change would result in a net benefit to society due to the costs and other impacts associated with such changes.

Although the current approach to high-level, spent fuel, and other higher activity wastes differs from that of other International Atomic Energy Agency (IAEA) participants (in particular, the lack of an “intermediate” waste category for higher activity wastes which are otherwise classified as low-level waste in the U.S.), DOE believes that if existing requirements and standards are implemented faithfully, then the classification system proposed by IEER would not be likely to result in significant improvement over the current system.

Current DOE policy regarding LLW is to dispose of it at the site at which it is generated, if practical, or at another DOE site. Over 80 percent of DOE's non-remediation LLW and mixed low-Ievel waste (MLLW) is stored or generated at one of six sites which currently dispose of waste. Regardless of whether there is a classification system, all of the waste disposed at these sites must meet the waste acceptance criteria for that disposal site derived from the analysis of the site's specific characteristics (geology, hydrology, climate, infiltration, vadose zone, etc.)

waste specific characteristics (radionuclides, concentrations, half-lives, etc.), and contribution of any engineered or administrative features applied to the disposal activity at the site. The purpose of such analysis is to provide the best possible understanding of the behavior of the site and the wastes to establish limits on the types, concentrations, and volumes of waste that may be disposed at a site without violating limits established for the protection of workers, the public, and the environment. Given this approach, a new classification system or changes in the definitions of high-level, transuranic, or low-level waste would provide little benefit and would not significantly alter the analysis outlined above.