Plan of Action To Resolve Spent Nuclear Fuel Vulnerabilities

Phase III

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U.S. DEPARTMENT OF ENERGY

PLAN OF ACTION TO RESOLVE SPENT NUCLEAR FUEL VULNERABILITIES

PHASE III

OCTOBER 1994

U.S. Department of Energy

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FOREWORD

This report represents the third and final phase of a three-phased approach to develop specific plans to remedy vulnerabilities associated with the storage of spent fuel and irradiated materials. During the past nine months, the Department of Energy has been involved in an intense effort to develop a comprehensive plan of action to address the findings of the Spent Fuel Working Group Report. Additionally, this report demonstrates the continuing efforts of the Department to communicate with its stakeholders in an open and comprehensive manner.

The Department has made significant progress since the Phase I report was released in February of this year. Funding for these activities is set at $90 million for fiscal year 1995, which is indicative of the importance being assigned to this issue. Out of a total of over 430 actions designed to resolve the vulnerabilities associated with the storage of spent fuel and reactor irradiated nuclear materials, approximately 25 percent have been completed. As a result, 15 vulnerabilities identified have been completely resolved. One of the major initiatives that has been the cornerstone of our ongoing efforts is the Programmatic Spent Nuclear Fuel Management Environmental Impact Statement, which ensures environmentally responsible management of spent nuclear fuel. This Draft Environment Impact Statement was completed and made publicly available on June 24, 1994.

The Phase I report presented action plans to resolve vulnerabilities for which no major funding or policy issues existed. During the two months that followed, we worked hard at resolving the funding issues. The second phase of the report was issued in April and reflected resolution of the majority of those funding issues. Since issuance of the Phase II Report, we revised and updated the individual action plans that addressed all of the identified vulnerabilities, and developed a path forward to help resolve the critical policy and associated technical issues that were identified in Phase I.

The individual action plans provided in Phase III now address all 106 vulnerabilities. These action plans will be revised where necessary to reflect input from stakeholders, continued follow up by the Department, finalized funding for fiscal year 1997 and beyond, and refinement of the technical approaches to resolve critical policy issues.

Now that the Phase III report has been issued, we recognize that effective implementation of the individual action plans is the key to resolving the remaining concerns that have been raised by the individual vulnerabilities. Therefore, we are firmly committed to follow to completion all aspects of the plan that we have put in motion.

Thomas P. Grumbly
Assistant Secretary
Environmental Management

PLAN OF ACTION TO RESOLVE SPENT NUCLEAR FUEL VULNERABILITIES PHASE III

I. Executive Summary

A. Purpose and Content of Phase III Plan of Action

This Phase III Plan of Action, like the Phase I and Phase II Plans of Action, provides information in response to the *Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel and other Reactor Irradiated Nuclear Materials and Their Environmental, Safety, and Health Vulnerabilities*, which was presented to Secretary of Energy Hazel O'Leary and released to the public on December 7, 1993. That report, which was the result of an assessment by the multi-discipline Spent Fuel Working Group directed by the Assistant Secretary for Environment, Safety, and Health, identified a total of 105 vulnerabilities associated with the Department's spent nuclear fuel storage facilities.[1]

The vulnerabilities which the Spent Fuel Working Group identified were based on potential adverse conditions in the areas of nuclear criticality safety, radioactive material release, radiation exposure, and failure of institutional controls. Failure of institutional controls includes lack of programmatic ownership, no specified path forward for material disposition, or lack of current and approved authorization bases. Vulnerabilities were thus conditions or weaknesses that may lead to unnecessary increased exposure to the workers, release of radioactive materials to the environment, or radiation exposure to the public.

In addition to identifying the vulnerabilities at eight sites, the Spent Fuel Working Group characterized 33 vulnerabilities at five facilities and three burial grounds as warranting priority management attention. The remainder of the vulnerabilities not associated with these eight facilities were then grouped into one of three categories where management attention should be directed: less than one year, one to five years, and greater than five years. All the vulnerabilities and the actions being taken to address them are described in Section IV and Appendix A and B of this Phase III Plan of Action.

In all, the Plan of Action consists of a consolidation of individual action plans designed to address each of the individual spent nuclear fuel vulnerabilities in a manner that reflects the Department of Energy's

- sense of urgency;
- concern for worker protection;

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[1] After the report was released, another vulnerability was identified, bringing the total to 106.

- commitment to mitigate environmental impacts; and
- need for compatible long-term solutions.

Actions are underway at all sites to address the vulnerabilities as efficiently as possible. Unresolved funding, policy, and technical issues existed that prevented final development of all action plans simultaneously; therefore, the complete Plan of Action was developed and issued in three phases. Phase I was released on February 7, 1994 and Phase II on April 29, 1994. The Phase III Plan of Action addresses all 106 vulnerabilities and provides the Department's baseline corrective actions from which to move forward toward resolution of the identified vulnerabilities.

Phase I - The Phase I Plan of Action included those facility action plans for which no major outstanding policy or funding issues existed. For the 106 vulnerabilities identified, the Phase I submittal addressed 31 of 33 high-priority vulnerabilities and 48 lower-priority issues.

Phase II - Subsequent to the issuance of the Phase I report, the Department resolved a majority of the funding issues associated with spent fuel vulnerabilities. The Phase II Plan of Action included those individual action plans that had been developed based on resolution of the funding issues. It also provided a partial list of completed actions.

Phase III - The Phase III Plan of Action constitutes the second and final update to the original Plan of Action. This report finalizes individual site action plans that address a large majority of the identified vulnerabilities. A small number of site action plans are expected to be revised based on input from stakeholders or continued follow up by DOE. The Phase III Report also presents proposed paths forward to resolve critical policy issues.

To the extent possible, stakeholder comments regarding individual sites were taken into account when developing and updating the Phase II and Phase III individual action plans. Stakeholders also expressed broader programmatic concerns regarding such issues as the need for a decision on the final disposition of DOE-owned spent nuclear fuel, and the ways in which stakeholders will be involved in DOE's decision-making process regarding the overall spent nuclear fuel program. These broad policy concerns were carefully considered when developing the Phase III Plan of Action and were also relayed to those managers having broader responsibilities for decision making in the overall DOE spent fuel program. These policy issues will be addressed in the context of the SNF Strategic Plan which will be subject to a direct interactive process with stakeholders.

B. Updated Information Provided in the Phase III Plan of Action

This Phase III Plan of Action completes the integrated vulnerability assessment planning process and contains revised information on vulnerabilities addressed in the Phase I and Phase II Plans of Action. Facility action plans have been revised and fully developed as appropriate. Some action plans may be revised based on continued follow up by DOE.

This updated information reflects the resolution of funding issues for fiscal years 1994 through 1996. For fiscal years 1997 and beyond, approval of projected funding is anticipated; however, these projections will be subject to the normal Federal budgetary process. In Phase III, activities are no longer considered "unfunded" for fiscal year 1997 and beyond since the projected costs are now based on rough order of magnitude estimates that have a high probability of approval. In Phase II, complete individual action plans for 81 of the initial 106 vulnerabilities were provided. The individual action plans provided in Phase III now address all 106 vulnerabilities.

Individual corrective actions to resolve vulnerabilities are discussed in Section IV; the text has been revised based on the analogous sections in the Phase I and Phase II Reports. It should be noted that previously existing sections IV.B and IV.C of the Phase II Report have been combined to form a new section IV.B in Phase III titled "All other facility corrective action plans." Vertical lines in the text margin are used to indicate where substantive portions of text were changed or added in Sections I through IV. The tables in Appendix A and B contain Action Plans for all vulnerabilities and identify those actions that have been completed to date. Margin lines have not been used in the tables to indicate the changed portions.

Appendix C provides a summary of four critical policy issues that were previously identified in the Phase I report as having significant impact on the Department of Energy's future decisions regarding the overall Spent Nuclear Fuel Program. These issues are: 1) What is the path forward for geologic disposal of spent nuclear fuel? 2) Should new interim storage and new conditioning facilities be licensed by the Nuclear Regulatory Commission? 3) Should Hanford N-Reactor fuel be stored in a dry configuration? and 4) What should the approach be if some DOE-owned spent fuel is deemed unsuitable for extended interim, dry storage or direct geologic disposal? It should be noted that there are no "final" decisions on any of these issues. These issues all bear some relation to a number of Environmental Impact Statements that are currently under development within DOE, as well as the Spent Nuclear Fuel Strategic Plan. Interim approaches have been identified that will allow development of final individual site action plans; however, these approaches are preliminary in nature. Each of the four critical policy issues addressed in Appendix C concludes with a discussion of the recommended path forward or recommended technical approach. The present approaches allow for evaluations to be conducted to determine "preferred" courses of action and do not prejudice any decisions that are a part of the EIS process.

Appendix D contains an update of information previously provided in Phases I and II, which is a listing of all 106 vulnerabilities which identifies the initial priority (eight priority facilities, action less than one year, and action greater than one year) of all vulnerabilities.

C. Defense Nuclear Facilities Safety Board (DNFSB) Concerns Regarding Substances Formerly Used in the Manufacture of Nuclear Weapons

In its May 26, 1994 letter to the Secretary of Energy, the DNFSB forwarded its Recommendation 94-1 for consideration. The Board was ... "especially concerned about

specific liquids and solids containing fissile materials and other radioactive substances in spent fuel storage pools, reactor basins, reprocessing canyons, processing lines, and various buildings once used for processing and weapons manufacture." Many of the facilities of concern contain DOE-owned spent nuclear fuel and reactor irradiated nuclear material (RINM) that have vulnerabilities already identified in the Working Group Report. Therefore, the DNFSB concerns and associated recommendations were carefully considered when developing the Phase III of the Plan of Action.

In a letter dated August 31, 1994 to the DNFSB, the Secretary of Energy committed the Department to develop a plan that will include the following initiatives:

- A systems engineering approach to maximize the integration of facilities and capabilities while minimizing worker exposures and additional waste;

- Research programs required to fill any gaps in the technological information base;

- Identification of those facilities that may be needed for future handling and treatment of these materials;

- Ensuring operational readiness in accordance with DOE Order 5480.31.

All of these initiatives have applicability to the DOE-owned Spent Nuclear Fuel (SNF) Program and are therefore being carefully considered in developing the overall programmatic aspects of the spent fuel management program as articulated in: the SNF Strategic Plan; the Program Management Plan; the Technology Integration Plan; the Interim Storage Plan; and the SNF Requirements Document.

D. Efforts by the Department of Energy to Address the Five Common Fundamental or Generic Issues Identified

In addition to the specific site vulnerabilities, the Working Group identified five fundamental (generic) issues that are common to many DOE spent fuel storage facilities. These generic issues were taken into account when developing individual action plans at each of the sites (provided in Appendices A & B) and will continue to be carefully considered by all facilities during future planning and decision making activities. To give an indication of how these generic issues are currently being addressed, a summary follows for each of these five issues.

Lack of Approved and Current Authorization Bases

The need for approved and current authorization bases for facilities throughout the DOE complex is being addressed by a DOE-wide program under EM's Office of Safety and Health Oversight. As regards concerns relative to the authorization bases for spent fuel facilities, individual site action plans have been designed to expeditiously address known deficiencies in the areas of Safety Analysis Reports (SARs), Interim Safety Basis, and

Basis for Interim Operation (BIO). Work is currently in progress related to approximately 20 facilities throughout the DOE complex to provide approved and current authorization bases. For example, significant progress has been made at INEL at the CPP-603 facility. An updated Safety Analysis Report (SAR) has been drafted which meets DOE Order 5480.23. At Savannah River, work is being completed to address the Basis for Interim Operation for the RBOF facility and the K-, L-, and P-Reactor Disassembly Basins. Work is also in progress to develop updated SAR's for West Valley and a number of material storage facilities at Sandia. At Hanford, Interim Safety Basis evaluations are scheduled to be completed within the next year for the 200 West Active Burial Grounds, the K-Basins, and the T-Plant; the Interim Safety Basis has been completed for the 308 Building TRIGA Reactor facility.

Seismic Design Inadequacies

Seismic design inadequacies must be addressed on a case-by-case basis. Upgrading to current standards may not be either technically or fiscally prudent; in these cases retirement of particularly vulnerable facilities in the near term may be the action of preference. However, an aggressive program to evaluate known seismic questions has been integrated into the individual site action plans. Progress is being made in this area, with seismic evaluations underway for various facilities at INEL, Hanford, Savannah River, West Valley and Brookhaven. Studies are nearing completion for the HFBR facility at Brookhaven, and the CPP-603 Fuel Storage Facility at INEL. The seismic design has been found to be adequate with only minor modification needed at HFBR and possible modifications recommended at the CPP-603 Fuel Storage Facility.

In order to address potential concerns with regard to the adequacy of fuel storage facilities, fuel will be removed from both the TAN facility at INEL and the PUREX spent fuel pools at Hanford, and has been removed from the Omega West Reactor at Los Alamos. In addition, the INEL Fuel Consolidation Plan directs that over the next three to five years, all fuel will be consolidated at the Idaho Chemical Processing Plant in existing facilities or in a new dry storage facility. Finally, as part of the SAR upgrade process at Savannah River, seismic issues at the K-, L-, and P-basins, at RBOF and at the H-canyon are all being evaluated.

Lack of Programmatic Ownership

The problems that form the basis for this generic issue were generally known to the Department prior to the issuance of the Working Group Report. However, there was no central focal point within the Department to ensure that the problems were addressed in a systematic and coordinated manner. Therefore, in response to the Secretary's direction, the Assistant Secretary for Environmental Management initiated the development of the DOE-owned Spent Nuclear Fuel Program in 1993. The purpose of the program was to integrate DOE's existing spent fuel activities into one program to better manage reactor irradiated nuclear material and to address known deficiencies. The DOE-owned Spent Nuclear Fuel Program, managed by the Office of Spent Fuel Management, EM-37, developed this Plan of Action to Resolve Spent Nuclear Fuel Vulnerabilities which helps to establish the central focus for overall programmatic

ownership. The majority of the programmatic and budgetary responsibility rests within the Office of Environmental Management; however, certain selected activities have been retained by the Office of Defense Programs, the Office of Nuclear Energy, and the Office of Civilian Radioactive Waste Management (RW). For example, NE-44 within the Office of Nuclear Energy has accepted ownership for material at INEL in the Materials Test Reactor Canal and at the ARMF/CFRMF facility. The Department has now clearly established programmatic ownership of all spent nuclear fuel facilities and Reactor Irradiated Nuclear Material.

Lack of Material Characterization

Characterization of the various forms of DOE-owned spent nuclear fuel and reactor irradiated nuclear material is one of the cornerstones for this Plan of Action. The individual site action plans were designed with a view toward evaluating the location and condition of various forms of spent fuel and irradiated material. For example, significant progress has been made at Oak Ridge in establishing the location of spent fuel and irradiated materials that were buried on site. At INEL, video cameras have been utilized to establish the condition of several forms of underwater stored material and developmental work is underway to characterize the fuel from the CPP-603 Fuel Storage Facility that is already encapsulated. Work is in progress at Hanford to characterize material in the K-Basins. At Savannah River, characterization of the L Basin sand filter material and the sludge in the K-, L-, and P-Reactor Disassembly Basins has been completed. On a larger programmatic basis, a complex wide characterization plan, within the Integrated Technology Development Plan, is being developed to identify all fuel data needed to safely store the material for an interim period and to begin preparations for final repository disposition. This is being done through the EM-37 sponsored Technology Integration Technical Working Group.

Lack of a Specified Path Forward

This generic concern goes hand-in-hand with the "lack of programmatic ownership." Prior to establishment of the DOE-owned Spent Nuclear Fuel Program, there were valid questions within the Department as to which office or activity was responsible for the various forms of spent nuclear fuel and reactor irradiated nuclear material. Since ownership for these materials was not clearly defined, it then followed directly that no "path forward" existed to address the identified deficiencies. One of the purposes for establishing the Office of Spent Fuel Management was to correct this shortcoming. Subsequent actions initiated by this office to "define the path forward" include: development and implementation of this Plan of Action to Resolve Spent Nuclear Fuel Vulnerabilities, development of a validated inventory of spent nuclear fuel elements; formulation of program requirements and the Spent Nuclear Fuel Strategic Plan; and development of a process for placing DOE-owned SNF in a geologic repository.

Significant progress has been made in developing the Spent Nuclear Fuel Strategic Plan which is the cornerstone for long-range planning. Based on progress to date, it is anticipated that a draft document will be issued for stakeholder review in the Fall of 1994 and a final plan will be completed prior to the end of calendar year 1994. Efforts are

well underway to complete a validated inventory of spent nuclear fuel elements which should be completed by December 1994. Site specific plans under development include INEL's Spent Nuclear Fuel Consolidation Plan and the Hanford Spent Fuel Program Project Plan. In addition to the Programmatic SNF Management/INEL ER&WM EIS, EISs related to nuclear material disposition are also in preparation at Savannah River and Hanford.

And finally, this Phase III of the Plan of Action to Resolve Spent Nuclear Fuel Vulnerabilities constitutes the defined "path forward" to address the individual vulnerabilities identified in the Working Group Report. One of the four critical policy issues, Geologic Disposal of the Department's spent nuclear fuel, which is outlined in Appendix C, describes the process by which the Department could place some defense high level waste and DOE-owned spent nuclear fuel into the first repository, thus providing for ultimate disposal of some of the material. Also included in Appendix C is a discussion of the recommended path forward to resolve the other three critical policy issues that are facing DOE with respect to SNF management.

E. Activities in Progress that Address Identified Vulnerabilities

In the Executive Summaries of the Phase I and Phase II reports, there were discussions of activities already underway to address identified vulnerabilities. In order to update that information, provided below is a summary of the more significant activities that have been completed or are currently in progress. This summary reflects DOE's ongoing commitment to address the identified vulnerabilities in an expeditious manner.

Hanford

- Completed installation of new monitoring wells in the vicinity of the 105-K-West Basin.

- Two major studies are currently underway that will form the basis for future decisions regarding the disposal of N-Reactor fuel. The DOE sponsored Independent Technical Assessment team, which is evaluating dry storage options, issued its report in September 1994. The Westinghouse Hanford Company evaluation, which will comparatively evaluate both wet and dry storage options, is due to be completed in October 1994 and will recommend a path forward for N-Reactor fuel management, utilizing a systems engineering approach. A Departmental decision regarding the path forward for N-Reactor fuel storage is currently projected to be made in November 1994.

- At PUREX the frequency of monitoring basin water level has been increased from quarterly to daily.

- At the 200 West Active Burial Grounds, the small-scale demonstration of retrieval of selected transuranic (TRU) waste drums (242 total) is ongoing, with 10 drums retrieved and 48 more drums scheduled to be retrieved by the end of 1994

(weather permitting). Activities are on schedule to begin in situ examination of RINM containers in September 1995.

Idaho

- A number of activities are underway at the CPP-603 Fuel Storage Facility to reduce the impact of corroded spent fuel assemblies and minimize the release of fissile material to the basin.

  - Completed transfer of 199 spent fuel units out of the 603 basins.

  - Completed installation of higher accuracy level monitoring equipment and instituted trending analysis procedures.

  - Completed installation of redundant stainless steel fuel rigging equipment for the north and middle basin fuels to prevent additional carbon steel yoke and basket failures.

  - Completed replacement of the failed containers housing System for Nuclear Auxiliary Power (SNAP) with stainless steel overpacks. This action resolves an unreviewed safety question (USQ).

  - An updated Safety Analysis Report (SAR) which meets DOE 5480.23 has been drafted. The SAR updates the authorization bases to meet current requirements.

  - Completed video inspections of fuel stored in the north and middle basins. Video inspections of the south basin will be completed by the end of 1994.

- Completed video inspections of aluminum materials at the Materials Test Reactor, ARMF/CFRMF, and PBF Canals to monitor corrosion. Results indicate that material corrosion is not a concern.

Savannah River

- Installed and began operation of a portable zeolite ion exchange system in order to lower the Cesium 137 levels in the K-, L-, and P-Reactor Disassembly Basins.

- Characterization of the sludge for the K-, L-, and P-Reactor Disassembly Basins has been completed. Characterization of the isotopes in the existing sand filters has also been completed and a safety analysis performed which determined that there are no criticality concerns.

- Criticality analyses have been completed to allow the movement of fuel currently in vertical storage to horizontal storage in a three-deep array.

- Identified a path forward for management of "at risk" spent nuclear fuels. This includes the performance of the Interim Management of Nuclear Material Environmental Impact Statement and systems engineering studies that compare processes, technical risks, lifetime costs, and waste form volume and stability. The Record of Decision for the NEPA review is scheduled to be issued March 1995.

Oak Ridge National Laboratory

- A review of records has been completed in order to determine potential locations of buried spent nuclear fuel at Solid Waste Storage Areas 5 and 6. This review identified that spent fuel from a research reactor in Puerto Rico may have been buried at SWSA 6. It has been subsequently determined that the fuel had been processed and only structural, non-fuel bearing components were finally buried. The records review has determined that spent fuel has not been buried in the Classified Burial Ground.

- Monitoring wells have been installed adjacent to the Homogeneous Reactor Experiment (HRE) Disposal Wells to monitor for potential migration of radioactive materials from the wells.

Argonne National Laboratory West

- Continued replacement of the Radioactive Scrap Waste Facility (RSWF) liners with corrosion resistant material to prevent potential adverse environmental impact. All spent fuel has been relocated to cathodically protected liners. This is an ongoing multi-year project.

Los Alamos National Laboratory

- Completed transfer of all fuel at the Omega West Reactor (OWR) to the Chemistry and Metallurgy Reactor (CMR) facility, in the interim, while awaiting a final DOE decision on a site that will manage the OWR spent fuel. The OWR has begun permanent shutdown.

West Valley Demonstration Project

- The "pool blocked" evaporation test has been completed. Results indicate that the spent fuel storage pool is not leaking.

- A computerized water accountability system was installed.

- To improve water quality in the fuel pool, installation and startup of the Submerged Water Filtration and Demineralization System was completed in June 1994.

- Instituted water chemistry trending analysis.

II. Introduction

A. Background

In August of 1993, Secretary O'Leary commissioned a comprehensive baseline assessment of the environmental, safety, and health (ES&H) vulnerabilities associated with the storage of spent nuclear fuel (SNF) in the DOE complex. During October 1993, a multi-discipline Spent Fuel Working Group, comprised of DOE employees and contractors, assessed 66 facilities spread across 11 sites. This assessment was performed to determine the inventory and the condition of the Department's Reactor Irradiated Nuclear Material (RINM) which includes spent nuclear fuel and reactor irradiated target material. The assessment also evaluated the condition of the facilities that store spent fuel and identified the vulnerabilities and problems that are currently associated with these facilities.

This assessment was performed under the direction of the Department's Office of Environment, Safety, and Health, with participation by the DOE Operations Offices, National Laboratories, the site management and operating contractors, and personnel from various DOE Program Offices and contractors. These organizations designated personnel with the best technical knowledge of the inventory data as well as an understanding of the operations and underlying safety bases for the storage facilities to form the Spent Fuel Working Group. The Working Group then planned, coordinated, collected, validated, evaluated, and characterized the material inventory and identified ES&H vulnerabilities.

Based on this evaluation process, a report to the Secretary, entitled Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel and Other Reactor Irradiated Nuclear Materials and Their Environmental, Safety and Health Vulnerabilities ("The Working Group Report," Volumes I, II, and III), was released to the public on December 7, 1993. Hereafter in this Plan of Action, Volume I of this report will be referred to as the "Summary Report."

B. Scope of the Problem -- Overall Plan of Action

The Working Group Report released in December 1993 identified a total of 105 vulnerabilities associated with the Department's spent nuclear fuel storage facilities. Subsequent to issuance of the report, a potential vulnerability was identified related to a question of whether or not there was buried fuel at the Savannah River Site, bringing the total number of vulnerabilities to 106. Eight facilities with major vulnerabilities were identified in the Summary Report, for which priority management attention was recommended. Volume II of the Working Group Report categorized all other identified vulnerabilities based on the time frame during which it was recommended that the vulnerability be addressed. In addition to the eight priority facilities, the vulnerabilities were grouped into one of three categories where management attention should be directed: less than one year, one to five years, and greater than five years.

An effort has been underway since issuance of the Working Group Report to develop a finalized Plan of Action to address all vulnerabilities, taking into consideration resources for implementation. This effort was also designed to determine which issues existed that might delay near term formulation of a definitive Plan of Action to resolve the identified vulnerabilities. It was determined that substantial unresolved issues existed in the areas of funding availability, critical policy decisions, and technology development. Accordingly, it was decided that the overall Plan of Action would be updated twice as programmatic decisions were made to resolve the outstanding issues, and based upon input from stakeholders. This report (Phase III) is the second and final update to the Phase I Plan of Action issued in February 1994. The "phased approach" is more fully explained in Section F of the Introduction.

The individual corrective actions to resolve vulnerabilities are discussed in Sections IV.A and IV.B. Detailed individual site action plans are provided in Appendices A and B which correspond respectively to sections IV.A and IV.B. As discussed in the Phase I and II Reports, some individual action plans provided were incomplete because of unresolved issues. In the Phase III Report, individual action plans for all the 106 vulnerabilities have been developed. A small number of facility action plans are expected to be revised based on input from stakeholders or continued follow up by DOE. Priority continues to be given to those vulnerabilities with the highest potential risk, particularly those associated with concerns related to worker health or safety.

Below is a table that summarizes, by category, the final status of efforts to address the 106 vulnerabilities.

Classification of Vulnerability	Action Plans Developed (Phase I & II)	Additional Action Plans Finalized (Phase III)	Totals
Eight Priority Facilities	30	3	33
To Be Addressed in less than 1 Year	10*	1*	11*
	27	8	35
To Be Addressed in greater than 1 Year	14	13	27
Totals	81	25	106

* These are associated with the eight priority facilities.

Appendix D contains a listing of all 106 vulnerabilities and identifies the initial associated priority (eight priority facilities, action less than one year, action greater than one year).

C. Eight Facilities With Major Vulnerabilities

The eight facilities identified by the Working Group as having major vulnerabilities are listed below by site. A summary of the vulnerabilities and the action plans for these eight facilities is provided in Section IV.A. The complete action plans are provided in Appendix A.

Hanford Site
- K-East Basin
- PUREX Canyon
- 200 West Active Burial Grounds

Savannah River Site
- L-Reactor Disassembly Basin
- K-Reactor Disassembly Basin

Oak Ridge Site
- Classified Burial Ground (Subsequently, this material was found to be located in Solid Waste Storage Areas 5 and 6)
- Homogeneous Reactor Experiment Disposal Wells

Idaho National Engineering Laboratory
- CPP-603 Fuel Storage Facility

D. Five Common Fundamental or Generic Issues Identified

In addition to the specific site vulnerabilities, the Working Group identified five fundamental (generic) issues that are common to many DOE spent fuel storage facilities. These generic issues will require careful consideration by all facilities during future planning and decision making activities and were taken into consideration when developing individual action plans.

The generic issues identified by the Working Group are:
- Lack of Approved and Current Authorization Bases
- Seismic Design Inadequacies
- Lack of Programmatic Ownership
- Lack of Complete Material Characterization
- Lack of Specified Path Forward

The Department has established an integrated Spent Nuclear Fuel Program under the Assistant Secretary for Environmental Management (EM) that will address these and other issues related to spent fuel management throughout DOE. The need for approved and current authorization bases for facilities throughout the DOE complex is being addressed by a DOE-wide program under EM's Office of Safety and Health Oversight. Concerns relative to the authorization bases for spent fuel facilities will be addressed in the larger context of the existing DOE-EM program. Material characterization and identification of a path forward are virtual cornerstones for this Plan of Action;

individual corrective actions are strongly dependent on material characterization, and the overall Plan of Action (Phases I, II, and III) is the defined "path forward." To address the need for long-range planning, the Spent Nuclear Fuel Strategic Plan is in the final stages of development. Seismic design questions must be addressed on a case-by-case basis. Upgrading to current standards may not be either technically or fiscally prudent; in these cases, retirement of particularly vulnerable facilities in the near term may be the action of preference. Issues regarding programmatic ownership of SNF facilities have been resolved by the Department.

E. Purpose and Scope of the Plan of Action

In conjunction with the preparation of the final report to the Secretary of Energy by the Spent Fuel Working Group, the Office of Waste Management (EM-30) brought together representatives from those sites identified as having the eight facilities with major vulnerabilities in order to determine what actions should be taken to address the vulnerabilities and the prioritization of these actions.

Many of the vulnerabilities were previously known, and action plans are in place to resolve them. However, some vulnerabilities had not been previously identified, or the severity of conditions had not been fully understood and acted upon accordingly. Therefore, on December 1-2, 1993, representatives from each affected site, along with DOE Headquarters personnel and representatives of the Spent Fuel Working Group, evaluated the major vulnerabilities. The plans that the sites had previously developed for the known vulnerabilities were reevaluated in light of the urgency to correct the situation, with specific emphasis on minimizing impact on worker health and safety. The need to mitigate potential environmental impacts and public safety and health was also considered.

Based on the evaluation of current plans, additional actions were determined to be appropriate in some instances. The schedule of implementation, funding requirements, and budgetary allocations for the current and newly identified actions were also established. The summary details of the action plans for all of the 44 identified vulnerabilities at the eight facilities having major vulnerabilities are contained in Section IV.A; the detailed corrective action plans are contained in Appendix A.

The vulnerabilities not associated with the eight priority facilities were initially categorized into three basic areas based on when action should be taken (less than 1 year, between 1 and 5 years, or greater that 5 years). Based on this categorization process, approximately 35 additional identified vulnerabilities not associated with the eight priority facilities were determined to warrant that action be taken within one year and 27 were determined to be less urgent. In Phases I and II, these were addressed as two separate groups. However, these groupings have now been combined. Phase III includes summary details of the action plans for these 62 vulnerabilities in Section IV.B; the detailed corrective action plans are contained in Appendix B. In summary, all 106 vulnerabilities are addressed in Phase III.

Some vulnerabilities are site-specific in nature and can be resolved through actions taken by the affected site and facility. However, vulnerabilities that impact multiple sites require integration at the national level for resolution. The Office of Waste Management (EM-30), with assistance from the Idaho National Engineering Laboratory (INEL), has coordinated the overall plan of action to address the vulnerabilities identified in the assessment report. Corrective action plans have been integrated with overall program direction to promote consistent and cost effective solutions. Knowledgeable Operations Office personnel, management, and contractor personnel have brought the individual action plans together and integrated the responses on a national basis as outlined in Section III.

F. The Phased Approach

The relative magnitude of the problem presented by specific vulnerabilities is a major factor when identifying the urgency in implementing corrective actions. Those problems having implications related to worker protection, or potential for adverse impact on the environment or the public, were assigned appropriate urgency based on: 1) RINM inventory, 2) failure potential of barriers designed to prevent release of radionuclides, 3) uncertainty of RINM storage conditions, and 4) adequacy of facility design conditions including whether the facility is being utilized in a manner for which it was not originally designed.

Every attempt was made to address the vulnerabilities associated with the eight priority facilities and those additional vulnerabilities requiring prompt management attention (less than 1 year) in as short a time frame as possible. However, as discussed previously there were unresolved funding, policy, and technical issues that prevented immediate development of all action plans. Therefore, the Plan of Action was issued in three phases. Phase I was issued in February 1994; Phase II in April 1994. Phase III, considered the final report, provides action plans that reflect funding, policy and technical decisions made subsequent to the initial issuance of Phase I. A brief discussion of each phase follows, as was described earlier in the Executive Summary.

Phase I, the initial Plan of Action, included those facility action plans for which no major outstanding policy or funding issues existed at the time of issue in February 1994. For those action plans, general agreement already existed on the necessary actions and the availability of funding. "Partial" corrective action plans were included in the Phase I Plan of Action in cases where some outstanding funding or policy issues existed. Issues associated with these "partial" plans were resolved in the Phase II or III effort.

Phase II, the first update, included those individual action plans that were developed based primarily on resolution of outstanding funding issues.

Phase III is the second update and includes the development of an approach to fully address the remaining vulnerabilities; i.e., those vulnerabilities not fully addressed in Phases I or II. Phase III reflects the recommended courses of action to resolve critical policy issues. The report updates individual site action plans that address all of the identified vulnerabilities.

G. Activities Already in Progress That Address Identified Vulnerabilities

This finalized Phase III Plan of Action is comprised of a combination of previously reported activities and newly created individual action plans which address the identified vulnerabilities. In many instances, activities were already in progress that addressed, at least in part, vulnerabilities identified by the Working Group.

In some cases, the current spent nuclear fuel program is being expanded or modified in order to address identified vulnerabilities. If the strategy put forth in the individual action plan is new, the approach will be implemented as the funds to support the activities become available. The priority of the new individual action plans will dictate how funding is allocated. However, this plan does not directly identify those facility and site costs associated with routine operations and maintenance or for upgrading other facilities which provide the infrastructure needed to implement corrective actions. The infrastructure support will be identified through the integration of this plan with site and facility management planning. Note that funding for FY-97 and later years, although expected to be available, is subject to the Federal budget approval process.

From an overall programmatic standpoint, Section III outlines the Department's Spent Nuclear Fuel Program as it is currently being developed. Specific areas are highlighted where programmatic additions or modifications are anticipated. Broad-scope spent fuel program activities already planned or in progress will be integrated into this overall Plan of Action and individual action plans, where appropriate, to assist in addressing specific vulnerabilities.

H. Resolution of Policy Issues

As addressed in Phase I, there were a number of important policy issues before the DOE that directly affected the ability to develop action plans to address the identified vulnerabilities. Significant progress has been made in addressing the complexity and associated interrelations of these issues. An interim position has permitted the development of final plans to address the vulnerabilities at the individual sites. Currently, the first and second issues below continue to be addressed by Departmental management to determine the future direction of the DOE-owned spent fuel program in these areas. For the third and fourth issues, specific technical evaluations and/or appropriate NEPA reviews are underway that will determine the path forward in these areas. It should be noted that there are no "final" decisions on the specific tasks or actions to be implemented for any of these four activities. As the ongoing policy formulation, technical evaluations and NEPA reviews are concluded, specific program decisions will be identified. Additional program or site specific NEPA reviews and action plans will be performed as part of activities to implement these decisions.

Provided below is a summary of the current status or direction of Departmental actions to address the four issues identified in the Phase I report. More detailed discussions on each individual issue are provided in Appendix C.

What is the Path Forward for Geologic Disposal of Spent Nuclear Fuel? Under the proposed option, DOE-owned spent nuclear fuel and vitrified high-level waste (HLW) will have authority for disposal in the first repository with the limitation that the total quantity of DOE material does not exceed 10% of the repository capacity limit. Emplacement priority for disposal of DOE material in a geologic repository would be based on a systems approach that considers risk, cost, schedule, readiness and other factors to determine the mix of defense high level waste and DOE-owned spent nuclear fuel. This option will provide a path forward for the Office of Environmental Management to emplace material qualified and ready for geologic disposal without significantly impacting the Office of Civilian Radioactive Waste Management's schedule for a license application. DOE-owned spent nuclear fuel which could be qualified in time would be included in the initial license application. The mix of DOE-owned spent nuclear fuel and vitrified HLW in the first repository may be changed, if necessary, by submitting a license application amendment after the second repository decision is made.

Should New Interim Storage and New Conditioning Facilities be Licensed by the Nuclear Regulatory Commission (NRC)? Under the proposed option, NRC would conduct a licensability review for a selected Interim Storage Project. By using a selected Spent Nuclear Fuel Interim Storage Project(s), DOE can define the cost, schedule, and technical implications of potential future NRC licensing of DOE facilities. This option examines licensability in a way that satisfies concerns of DOE's "self-regulation," while at the same time provides needed experience to DOE for making future technical and licensing decisions. The experience and information gained will be invaluable to DOE as it strives to make future decisions on the approach to be taken with regard to NRC licensing of its facilities.

Should Hanford N-Reactor Fuel be Stored in a Dry Configuration? Dry storage of spent fuel is considered superior to wet storage; however, the knowledge base for dry storage of N-Reactor fuel is limited. An Independent Technical Assessment Team has evaluated whether dry storage is most beneficial in minimizing further fuel degradation and potential environmental insult. The Independent Technical Assessment Team report recommendations concerning dry storage will be included in the overall Westinghouse Hanford Company evaluation, and a proposed course of action on whether to proceed towards dry storage or maintain the fuel in wet storage will be developed in the context of the NEPA process. This consolidated report / recommendation is due to be completed in late October 1994. A Departmental decision regarding the path forward for N-Reactor fuel storage is expected to be made in early November 1994.

What Should the Approach be if Some DOE-Owned Spent Fuel is Deemed Unsuitable for Extended Interim, Dry Storage or Direct Geologic Disposal? "At risk" fuels are defined as those not expected to retain the necessary integrity during underwater or extended dry storage. The processing of some "at risk" spent nuclear fuel in the F and H Canyons at the Savannah River site is under evaluation. This alternative is one of several being considered in an ongoing NEPA review of management of "at risk" spent nuclear fuel for the purpose of ensuring safety and environmental protection and defining the path forward from the existing fuel management methods and the implementation of interim dry storage. Technical documentation such as technical risk evaluation studies;

process studies; cost studies; waste forms, volumes, and stability studies; and systems engineering studies will be utilized in the evaluation of "at risk" spent fuel. The Record of Decision for the NEPA review is scheduled to be issued March 1995.

III. DOE-Owned Spent Nuclear Fuel Program Approach

A. Spent Nuclear Fuel Program Overview

In 1992, the Secretary of Energy directed the Assistant Secretary for Environmental Restoration and Waste Management (EM) to develop an integrated, long-term SNF management program. In response, EM initiated the development of a DOE-owned SNF Program to define and ensure resolution of all associated issues starting with the quantification of DOE spent fuel inventories and fuel storage facilities; defining technology development and fuel characterization needs; conditioning; interim storage; and preparation for ultimate disposal in a geologic repository.

The purpose of the DOE-owned SNF Program is to integrate DOE's existing SNF activities into one program to better control and manage this material, and to ensure that all issues associated with SNF are resolved in a safe and cost-effective manner. The program will ensure full compliance with applicable executive orders; federal, state, and local environmental laws and regulations; national consensus standards; and orders, regulations and policies. The resolution of the identified vulnerabilities is an example of the ongoing complex-wide coordination prescribed by such an integrated programmatic approach. The corrective action plans contained in this report are the result of a complex-wide coordinated effort.

Four policy issues that greatly affect the future direction of DOE's spent nuclear fuel program have been identified. Resolution of these issues in the near term will permit significant programmatic decisions to be made and thereby establish a path forward to address identified vulnerabilities and related problems. These issues are: 1) definition of the path forward for the geologic disposal of spent fuel; 2) the adoption of Nuclear Regulatory Commission licensing and commercial industry standards for new interim storage and conditioning facilities; 3) options for dry storage of N-reactor fuel at Hanford; and 4) the approach to be taken if some DOE-owned SNF is deemed unsuitable for extended interim dry storage or direct geologic disposal and thus requires spent fuel dissolution or processing (e.g., at F & H canyons at Savannah River).

The DOE-owned SNF Program encompasses all existing and future DOE-owned SNF (of U.S. origin, whether held in international or domestic hands) except for commercial nuclear fuel, which is addressed under the Nuclear Waste Policy Act (NWPA).

The scope of the DOE-owned SNF Program consists of a wide variety of activities, two of which are specifically related to the actions described in this Plan of Action:

- Assessment/identification of all existing and potential fuel storage capabilities with associated issues and concerns;

- Development of action plans to address near term issues in order to support the budget formulation purposes.

In developing this Plan of Action, results of these two activities were fully incorporated

into the overall programmatic planning activities aimed at developing responses to the identified vulnerabilities.

B. Organizations, Authorities, and Responsibilities

The Deputy Assistant Secretary for Waste Management (EM-30) within the Office of Environmental Management maintains primary programmatic and budgetary authority and responsibility for the DOE-owned SNF Program. However, certain budgetary and program responsibilities for specific facilities covered in the Working Group Report continue to reside in other EM offices, as well as in DOE's Offices of Defense Programs, Nuclear Energy, and Energy Research. Program management integration has been assigned to the Office of Spent Fuel Management (EM-37) with support from the Idaho National Engineering Laboratory (INEL). Technical Working Groups have been established to address the major technical issues.

C. Defense Nuclear Facilities Safety Board (DNFSB) Concerns Regarding Substances Formerly Used in the Manufacture of Nuclear Weapons

In its May 26, 1994 letter to the Secretary of Energy, the DNFSB forwarded its Recommendation 94-1 for consideration. The Board was ... "especially concerned about specific liquids and solids containing fissile materials and other radioactive substances in spent fuel storage pools, reactor basins, reprocessing canyons, processing lines, and various buildings once used for processing and weapons manufacture." Many of the facilities of concern contain DOE-owned spent nuclear fuel and reactor irradiated nuclear material (RINM) that have vulnerabilities already identified in the Working Group Report. Therefore, the DNFSB concerns and associated recommendations were carefully considered when developing Phase III of the Plan of Action.

In a letter of August 31, 1994 to the DNFSB, the Secretary of Energy committed the Department to develop a plan that will include the following initiatives:

- A systems engineering approach to maximize the integration of facilities and capabilities while minimizing worker exposures and additional waste;
- Research programs required to fill any gaps in the technological information base;
- Identification of those facilities that may be needed for future handling and treatment of these materials;
- Ensuring operational readiness in accordance with DOE Order 5480.31.

All of these initiatives have applicability to the DOE-owned Spent Nuclear Fuel Program and therefore are being carefully considered when developing the overall programmatic aspects of the program as articulated in the supporting documents described below.

D. Supporting Documents

The Spent Nuclear Fuel Strategic Plan will articulate the mission, vision, objectives, and strategies for management of DOE-owned spent nuclear fuel. This plan will be developed through a cooperative effort between DOE Headquarters, Operations Office personnel, and stakeholders. It is scheduled for completion by December 31, 1994, but will be updated as appropriate based on the Programmatic SNF Management/INEL ER&WM EIS.

The program also involves a broad spectrum of activities requiring specific plans or implementation documentation. The documents listed below which are currently in preparation may require specific modification as a result of the development of this Plan of Action, as well as the Record of Decision resulting from the SNF Management/INEL ER&WM EIS.

- *Program Management Plan* - This plan outlines the SNF Program, including its scope, mission, strategy, approach, organizations involved, stakeholder participation, systems engineering management plan and schedule. This constitutes an integral part of the Spent Nuclear Fuel Strategic Plan.

- *Technology Integration Plan* - The technologies required for safe interim storage and final SNF disposition are being coordinated among DOE sites. A characterization plan will be included that identifies all fuel data needed to safely store the material for an interim period and to begin preparations for final repository disposition.

- *Interim Storage Plan* - An interim storage plan is being developed for all DOE SNF that considers retirement of obsolete storage facilities, new construction, existing fuel and fuel condition, a transportation plan and planned new facilities.

- *Spent Nuclear Fuel Requirements Document* - Presents the top-level requirements for the SNF Program and is based upon the principles established in the SNF Strategic Plan.

- *Quality Assurance Program Description (QAPD)* - The QAPD describes how the 18 criteria of DOE/RW-0333P, the standard selected to be the baseline reference for SNF QA Programs, are applied to Headquarters activities that affect SNF quality. Sites that handle SNF will also implement this standard for activities affecting quality. This document will be controlled as a SNF supplement to the EM-30 QAPD.

- *DOE Site-Specific Program Documents* - Site-specific SNF documents have been or will be developed at the principal DOE sites involved with the management and disposition of DOE-owned SNF. These documents will be comparable in nature to the national program documents with greater implementation detail consistent with site-specific requirements. Included with these site-specific SNF documents will be fuel movement and consolidation plans for each particular DOE site. These site-specific documents will be major contributors to the Program Management Plan discussed above. Examples of these site plans that are already in the draft phase are the Hanford Spent Fuel Project Plan and the INEL Integrated Spent Fuel Consolidation Plan.

IV. Facility Corrective Action Plans

This section summarizes those specific actions to be taken at individual facilities to resolve the identified vulnerabilities. The corrective action plans are presented in two sections: 1) Section IV.A, those eight facilities identified as having major vulnerabilities; and 2) Section IV.B, all other facilities identified as having vulnerabilities of a less urgent nature.

A. Facilities Having Major Vulnerabilities

As previously explained, vulnerabilities at eight facilities were identified as being of much higher priority than those at the remaining facilities. The current plans that sites had previously developed for the known vulnerabilities have been reevaluated in light of the urgency to correct the problems identified at these eight facilities, with specific emphasis on minimizing impact on worker health and safety and the expeditious completion of action plans.

The need to mitigate potential environmental impacts and to protect public safety and health was also considered. Based on the evaluation of current plans, additional actions were determined to be appropriate in some instances because of newly identified vulnerabilities or severity of conditions that were not fully understood previously. The schedule of implementation and corresponding funding requirements for the current and newly identified actions were established.

Summaries of the corrective action plans for each of the facilities with major vulnerabilities are presented in this section of the report. Information concerning specific actions, the schedule for such actions, or the funding requirements can be found in Appendix A.

Site: Hanford

Facility: K-East and K-West Storage Basins

The K-East Storage Basin was constructed in 1951 to provide interim storage of Single Pass Reactor fuel discharged from the K-East Reactor until its shutdown in 1970. It was reactivated in 1976 to serve as interim storage for spent N-Reactor fuel awaiting reprocessing. The basin is an unlined, concrete, 1.3 million-gallon water pool with an asphaltic membrane beneath it, and it presently stores approximately 1152 metric tons of heavy metal (MTHM), which equates to about 40% of the total DOE spent nuclear fuel inventory. The K-East Storage Basin inventory -- which is comprised of 50,683 assemblies of N-Reactor production fuel, and 138 assemblies of Single Pass Reactor production fuel, with a heavy metal weight of 0.4 metric tons -- has been stored under water in open-top canisters for periods ranging from 6 to 23 years.

The K-West Storage Basin was constructed at the same time frame as the K-East Storage Basin to provide interim storage of Single Pass Reactor fuel discharged from the K-West Reactor until its shutdown in 1971. K-West Basin was reactivated in 1981 to serve as interim storage for spent N-Reactor fuel awaiting reprocessing. The basin is an unlined, concrete, 1.3 million-gallon water pool with an asphaltic membrane beneath it. The inventory is comprised of 52,959 assemblies of N-Reactor production fuel, with a weight of 961 metric tons heavy metal, and 47 assemblies of Single Pass Reactor production fuel, with a weight of 0.1 metric tons heavy metal. The inventory equates to about 38% of the total DOE spent nuclear fuel inventory. The spent fuel was placed in closed canisters before shipment to and storage at the K-West Basin.

Vulnerabilities were identified as being either applicable to both facilities or unique to a specific facility. Only those aspects of vulnerabilities that are applicable to the K-East Basin were deemed major vulnerabilities warranting priority management attention.

The vulnerabilities identified for the K-East / K-West Basins are as follows:

- Sludge accumulation containing fissile and fission product material from damaged / degraded fuel is estimated to be several inches deep in most locations. Up to 50% of the fuel may have experienced cladding failure, and approximately 90% of the canisters that contain the fuel have at least one fuel assembly with breached clad, resulting in the release of significant amounts of fission products to the pool. (HAN-1-1 / K-East)

- An efficient method for encapsulation may be needed to avoid additional releases to the environment and to minimize worker exposures. (HAN-1-2 / K-East)

- K-East Basin has leaked noticeably on two occasions releasing fission products and tritium to the environment. The source is believed to be the basin discharge chute construction joint, which is also a potential seismic vulnerability due to lack of adequate reinforcement. (HAN-1-3 / K-East & K-West)

- Institutional control failures; lack of clear planning priorities for final disposition of material. (HAN-1-4 / K-East & K-West)

- An unreviewed safety question (USQ) exists concerning excessive plutonium accumulation in the filter backwash pit. (HAN-1-5 / K-East)

- Creation of TRU waste associated with basin operations. There is presently no disposal path for the mixed bed ion exchange resin waste. (HAN-1-6 / K-East)

- Monitoring wells in proximity of basin indicate increasing levels of tritium approaching -- and in one case, exceeding -- the safe drinking water limit of 20,000 picocuries/liter and also indicate possible migration to the Columbia River. (HAN-1-7 / K-East)

- Uncharacterized fuel is stored in unsealed canisters at K-East Basin; there is a lack of precise detail as to the material condition of some of the RINM in storage. (HAN-1-8 / K-East and K-West)

In addition to the specific vulnerabilities that were identified, one generic issue was found to be applicable:

- Lack of adequate authorization bases, including updated and approved Safety Analysis Report (SAR), that address long-term storage of RINM. (K-East and K-West)

Information will be provided for the K-East Basin first, and any supplementary information will be provided for the K-West Basin as appropriate. Cost and schedule information does not include normal operations/maintenance activities at the 105-K Basins.

K-East Storage Basin

Up to 50% of the fuel may have experienced cladding failure, and approximately 90% of the canisters containing the fuel may have at least one fuel assembly with breached clad. This has resulted in the release of significant amounts of fission products to the pool. The cladding failure is due to corrosion and/or damage from handling. Accumulation of sludge, containing radionuclides, corrosion products, and miscellaneous material, has occurred at the bottom of the basin at an estimated total volume of 500 to 1000 cubic feet. The depth of the sludge is uniformly several inches deep and is over a foot deep in the back wash sand filter pit.

Due to the deteriorated state of this fuel and the significant accumulation of sludge, concerns were raised that earlier plans for encapsulation of the fuel and sludge could have resulted in releases to the environment and attendant high worker exposures. At present, precise details are not known regarding the quantity of corroded fuel, the rate at which corrosion occurs, the potential effects of encapsulation on the corrosion rate, and the effects that corroded material may have on a vented sealed container of the type proposed to contain K-East fuel.

Water has leaked from the basin on at least two occasions, releasing fission products and tritium to the environment. The source of these leaks is believed to be the basin discharge chute construction joint, which is also a potential seismic-related vulnerability due to the lack of adequate reinforcement. The basin is suspected as being the source of tritium currently detected by monitoring wells in proximity to the facility. Although the number of existing monitoring wells near the facilities may not be sufficient to conclusively determine the state of groundwater

contamination which may exist in the proximity of the basin, these monitoring wells are detecting increasing levels of tritium that are approaching -- in one case, exceeding -- the safe drinking water limit of 20,000 picocuries per liter. The readings of the monitoring wells indicate that a migration toward the Columbia River may be occurring.

An unreviewed safety question (USQ) was determined to exist due to the plutonium concentration technical safety requirement (TSR) limit being exceeded in the sand filter backwash pit. It has subsequently been determined, by utilizing chemical analysis techniques, that the amount of plutonium was within authorized limits. The high concentration of plutonium in the basin has also resulted in the considerable accumulation of transuranic (TRU) waste as ion exchange resin columns become depleted and require replacement. Presently there is no specified disposal path for the mixed waste ion exchange resin. Additional problems exist, such as the potential for combustible conditions due to hydrogen generated in the spent resins media and the high radiation dose rates associated with spent resin handling.

It was determined that a significant vulnerability exists due to the lack of clear planning and priorities for final disposition of material in the K-East Basin, due to frequent organizational and personnel changes, and due to the lack of assigned accountability for resolution of environmental safety & health (ES&H) concerns.

In addition, although not identified as a specific vulnerability, one of the generic issues (i.e., an issue applicable to all facilities determined to require priority management attention) is applicable to the K-East and K-West Basins. It involves the lack of an adequate authorization basis, including an updated and approved Safety Analysis Report (SAR) that addresses long-term storage of SNF.

The Defense Nuclear Facilities Safety Board (DNFSB) report of January 27, 1994, describes observations and conclusions regarding activities to be undertaken to stabilize the degraded spent fuel at K-East Basin. The Board has requested that DOE prepare a response to this report addressing four specific issues, as follows:

(1) A description of the engineering alternatives that were considered in arriving at the previously planned fuel/sludge encapsulation approach.

(2) A list of the criteria used in making the selection for the previously planned fuel/sludge encapsulation approach.

(3) A description of any additional systems engineering studies planned to ensure that personnel radiation exposure and radionuclide releases to the environment are maintained at levels as low as are reasonably achievable.

(4) The anticipated radiation doses and dose commitment from the previously planned fuel/sludge encapsulation.

The activities that are underway or have been completed related to the DNFSB's concerns are: the engineering review of the encapsulation process and the establishment of an independent As

Low As Reasonably Achievable (ALARA) assessment team. These are described further under Objective 2.

In the Department's April 28, 1994, response to the DNFSB, a detailed description was provided of the engineering alternatives and the criteria utilized in arriving at the previously planned fuel/sludge encapsulation approach. Direct overpacking minimizes handling and thus the actual total radiation exposure to operating personnel might be less than that for encapsulation. However, the present basin storage racks cannot accommodate an overpack, thus a storage system redesign and installation would be required. Thus the potential radiation exposure savings in process operations may be offset by the removal of the old racks and installation of the new design. Additionally, continued wet storage will lead to continued fuel degradation which will eventually have to be addressed when the fuel is moved to long-term interim storage. In summary, alternatives considered to the previously planned fuel/sludge encapsulation included overpacking of the existing fuel canisters (placing the existing canisters into larger canisters without having to empty them), placement of the fuel directly into dry storage, or delaying the effort until better guidance could be established.

Placement of the fuel into dry storage has been evaluated by an Independent Technical Assessment team, which included industry experts, sponsored by DOE-RL. While many dry storage systems exist for commercial spent fuel, N-Reactor fuel has unique properties not found in commercial spent fuel. For example, N-Reactor fuel must be analyzed to determine what conditioning, if any, is required before it can be safely stored in a dry configuration. The Independent Technical Assessment team has evaluated this potential concern and identified a fuel conditioning process which would stabilize the fuel for long-term interim dry storage. Results of this evaluation indicate that pyrophoricity is not of major concern and that the fuel can be readily conditioned prior to placement into dry storage, thus eliminating the concern prior to placing the fuel into dry storage. They have also defined the steps and related schedule which could be followed for demonstrating that dry storage of N-Reactor fuel is safe and that the current fuel degradation could be arrested. Their final report was completed in September 1994.

The Westinghouse Hanford Company (WHC) is further evaluating the feasibility of maintaining N-Reactor fuel in wet storage. This evaluation includes alternatives to the previously planned process of re-encapsulating the fuel and placing it directly back into wet storage. They include alternative containerization techniques, with the fuel being stored either wet or dry within new containers that are stored underwater, fuel passivation - wet or dry fuel oxidation - performed at different site locations, as well as alternate site locations for fuel passivation and wet storage.

The Independent Technical Assessment team report recommendations concerning dry storage, the WHC wet storage alternatives, and containerization of the spent fuel at the K-Basins for interim storage will be included in a formal Westinghouse Hanford Company decision process on the path forward for the removal of the fuel and sludge. A WHC report / recommendation to DOE, based on the decision process, is due to be completed in late October 1994. A Departmental decision regarding the path forward for N-Reactor fuel storage is expected to be made in early November 1994.

Additional engineering studies are underway to ensure that personnel radiation exposure and radionuclide releases to the environment are maintained at levels as low as are reasonably achievable. These studies are scheduled to be completed in early FY-95. The current estimate for the sum of all personnel whole body exposures for fuel/sludge encapsulation is 102 Rem based on previous experience and calculations based on existing data.

An action plan has been developed to resolve these vulnerabilities while proceeding to achieve the goals of meeting those milestones and target dates established in the Tri-Party Agreement (TPA) between the U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology, and DOE, and ensuring a minimum impact on the worker, the public, and the environment. The Agreement identifies that removal of SNF, sludge, and tritium from the basin water should be completed by December 2002. It should be noted that many of these actions had been planned prior to the performance of the assessment. Seven main objectives have been identified in order to achieve this goal.

1) Reduce the potential environmental and health consequences of the current mode of fuel storage in open canisters by encapsulating the fuel material, thereby reducing environmental risks and the rate of radionuclide release into the basin pool.

   Hanford initially developed an aggressive program to begin encapsulating fuel in the K-East Basin (in stainless steel canisters similar to the latest Mark II canister used to encapsulate spent fuel in the K-West Basin) by June 1994. Instead, a pilot run will be performed to provide process information to support implementation of the path forward for fuel and sludge removal from the basins. A revised pilot run schedule projects the start date as March 1995. Primary reasons for the delay are conduct of operations issues resulting from the facility plant readiness process and revisions to the readiness review process in conducting a WHC and DOE Operational Readiness Review and relocation of operations due to seismic issues in the discharge chute area. In addition, the need to conduct a systems engineering evaluation of reasonable alternatives to encapsulation was deemed appropriate.

   The technical solution for sludge encapsulation needs to be identified and selected. Engineering assessments will be performed in 1994 and 1995 with the purpose of selecting a baseline approach for sludge containment by September 1995. Sludge disposition is contingent on finalization of the definition of what material is spent nuclear fuel, and the decision process for the path forward to remove spent fuel and sludge from the K-Basins. Similarly, fuel management decisions at the K-Basins are contingent on the results of the alternative evaluation process for the path forward.

2) Minimize worker exposures by evaluating the potential radiological impact of planned encapsulation activities.

   The K-East Basin operating staff established an independent formal ALARA (As Low As Reasonably Achievable) assessment team to ensure that potential personnel radiation exposures resulting from previously planned encapsulation activities would be minimized. The ALARA assessment team, which includes plant personnel, will evaluate alternative actions. The assessment team will also evaluate issues such as potential work

improvements, special training, and design considerations for reducing worker exposure during basin operations. To reduce staffing needs during encapsulation, requirements such as those for special nuclear material accountability have been evaluated to determine if waivers or changes are warranted, because in some cases the fuel is not, or may not be when moved, in an accountable form. In addition, it is expected that the pilot run will identify many process enhancements to minimize worker exposure during any subsequent operations to support the path forward. An initial ALARA assessment has been completed, and further assessments will be performed as necessary.

3) Establish a plan to mitigate environmental insult from basin leakage -- while not impacting TPA goals of providing a barrier for the fuel -- by removing fuel and sludge from the basins by 2002. In addition, minimize the consequences of leakage which may be caused by a seismic event or construction joint degradation.

Efforts are being made to define and characterize the potential leakage of the K-East Basin. Information to date shows that the leak rate from the basin may be as little as 5 to 10 gallons per hour. Since the groundwater samples to date have not contained radionuclides, eg., cesium and strontium found in the basin water aside from tritium -- and the samples have contained carbon-14, which is not found in the basin water, some doubt exists as to the source of the radioactivity in the well samples. An evaluation of the hydrology surrounding the K-Area will be performed, and an analysis to define the source of tritium and C-14 in the groundwater will be conducted. An evaluation will be performed to determine the optimum means of lowering the tritium concentration in the basin water which may be leaking into the environment.

Past leakage from the basin was determined to be associated with a construction joint for the basin discharge chute (between the foundations for the K-Reactor and the basin), and the joint had previously been patched. However, the groundwater samples taken from monitoring wells surrounding the basin contain tritium contamination, which may be the result of basin water leakage into the soil. An unreviewed safety question (USQ) was recently determined to exist because the potential basin leakage caused by a seismic event exceeds that previously analyzed. An evaluation is presently in progress to bound the impacts of a seismic event. Based on this evaluation, current leak mitigation plans may have to be revised to account for the potential of increased basin leakage as the result of a seismic event.

A leak mitigation plan has been developed for use in the event of a renewed basin leak. The plan calls for protection of the construction joint. Cofferdams will be installed in the discharge chute area of the K-Basins to minimize potential for leakage from a seismic event. Installation of the cofferdams precludes use of the discharge chute area for the pilot run or any subsequent containerization of the SNF and sludge, because it prevents access the discharge chute area. Therefore, the pilot run and any subsequent containerization would be conducted in alternate locations at the basins.

4) Resolve the USQ involving the high concentration of plutonium in the filter backwash pit in a timely manner which does not impact fuel encapsulation and ensures worker safety.

Resolution of the Sand Filter Backwash Pit USQ is complete. The issue concerned a lack of adequate characterization of sand filter backwash pit contents. A rigorous Sampling Analysis Plan was developed and it was determined that the pit contained 97 grams Pu, which puts it within the limit of 225 grams. The analytical results verified that a USQ did not exist. Operational controls are being implemented to prevent exceeding the present 225 gram limit.

5) Provide effective basin water cleanup systems that do not create waste forms not readily acceptable by current practices.

A waste plan is in development. K-Basin has identified a container to store the cartridge filters as TRU waste at the Hanford Central Waste Complex. The used ion exchange columns stored at K-Basin are vented and have minimal heat generation from internal radiation sources. An initial analysis was performed and it has determined that the levels of hydrogen in the ion exchange columns were below flammable limits. However, upon more detailed review, it was determined that some hydrogen generation from radiolysis of the moisture contained in the ion exchange resins would occur and potentially reach flammable or explosive levels with a dose consequence exceeding the bounds of the K-Basins Safety Analysis Report. An Unreviewed Safety Question (USQ) determination is in the process of being performed. The existing ion exchange columns have been classified as low-level waste. A waste plan is being developed, and it includes the following:

- Begin utilization of container identified to store the cartridge filters as TRU waste at the Hanford Central Waste Complex.
- Determine whether the ion exchange columns are either TRU waste or low-level waste (LLW).
- Dispose of the LLW ion exchange columns at the Burial Ground.
- Develop a waste form and containers for the TRU waste from the ion exchange columns.
- Store the TRU waste at the Hanford Central Waste Complex until the WIPP repository is available for disposal.
- Identify alternative clean-up systems to minimize the generation of TRU waste.
- Reevaluate canister disposal and implement recommendations, as appropriate.

6) Characterize fuel in the K-East Basin.

Perform the technical evaluations and fuel characterization tests necessary to assist in development of the path forward for removal of fuel from the facility. Work activities will include development of a fuel characterization test plan, completion of test implementation activities, performance of test, and analysis and documentation of test results. The tests will provide analytical information sufficient to evaluate the effects of wet containerization and will identify minimum conditions necessary for dry storage, for preparation for dry storage, and for transport of the fuel. Information will support establishment of safety envelopes, process selection and development, and regulatory compliance. The test results will also be used to establish direction for follow-on waste form performance tests and other steps necessary to develop a path forward for fuel disposition.

7) Define planning and priorities for interim disposition of material in K-East, and assign accountability for resolution of ES&H concerns. Also, update the authorization basis for the facility.

The Hanford SNF Project Plan is being developed to address the scope and schedule for tasks and sub-tasks which will contribute to the future decision-making process. The purpose of this plan is to (1) generate the technical information needed to make decisions; (2) address the vulnerabilities related to encapsulation, basin leakage, and basin water treatment; and (3) plan and implement program activities that coordinate near term actions with longer range safe storage options for the spent fuel. Any proposed future locations for the storage of all the spent fuel at Hanford, NEPA documentation, and descriptions of K-East Basin activities (pilot run, sludge retrieval and packaging, characterization, ALARA planning, and new facility acquisition) will be incorporated into the plan, at the appropriate date.

To support near term DOE decisions, DOE-Richland commissioned an independent technical assessment to evaluate requirements needed for safe, long-term interim storage of the SNF presently contained in K-East Basin in a dry storage medium. (This assessment is also adaptable to other fuel stored at Hanford such as K-West Basin, and PUREX). A feasibility report identified the conditioning steps necessary to stabilize the SNF from the open-top canisters in K-East, the packaging and transportation requirements, and a preliminary scope of new facility requirements. Preliminary results indicate that dry storage of N-Reactor fuel is feasible. A final report with recommendations on how best to proceed was completed in September 1994.

A Basin Consolidation Study will be performed to determine whether single-basin occupancy (K-West Basin only) or dual-basin occupancy (K-East and K-West) will be used for temporary storage of the fuel presently at K-East and K-West Basins and of the encapsulated sludge at the K-East Basin for the period through 2002. Based on the results of the Basin Consolidation study, a schedule will be developed for the K-East Basin Water Tritium Reduction Program.

A Hanford Site-wide Environmental Impact Statement for the long-term management of spent fuel at Hanford will be developed, and a Record of Decision will be issued by June 1996. This will implement the site specific aspects of the work already in progress for the Programmatic SNF Management/INEL ER&WM EIS, which is scheduled for the issuance of a Record of Decision by June 1995.

Reorganization for more effective management of the K-Basin program was requested of the contractor by the Operations Office during the last fiscal year, and the contractor responded by establishing the SNF Project Organization to manage more effectively disposition of SNF for the Hanford Site. Increased staffing levels are being provided to accommodate efforts such as fuel characterization, engineering studies, and NEPA documentation preparation.

An Interim Safety Basis will be developed in order to establish the current authorization basis for the K-East Basin.

K-West Storage Basin

The condition of the spent fuel in the K-West Basin is unknown, since the fuel was placed in closed canisters before shipment to and storage at the K-West Basin. There is essentially no sludge in the K-West Basin because all of the fuel is in closed containers. The K-West Basin is not known to have leaked, but it is similar in design to the K-East Basin in that there is a discharge chute construction joint, which is believed to be the source of previous leakage at the K-East Basin. This joint also poses a potential seismic-related vulnerability due to the lack of adequate reinforcement. A cofferdam will be installed in the discharge chute area of the K-West Basin to reduce the possibility of a seismically induced leak at the K-West Basin. In order to detect potential future basin leakage more effectively, three groundwater monitoring wells in the vicinity of the K-West Basin have been installed.

The Basin Consolidation Study will evaluate the merits of using single basin occupancy (K-West Basin only) or dual basin occupancy (K-East and K-West) for temporary storage of the fuel presently at K-East and K-West Basins and the encapsulated sludge at the K-East Basin for the period up to 2002. The fuel characterization activities being performed for the K-East Basin fuel will also be performed for the K-West Basin fuel.

The independent technical assessment to evaluate requirements needed for safe, long-term interim storage of the SNF presently contained in K-East Basin in a dry storage medium will also be utilized to address the fuel stored at the K-West Basin.

The path forward decision process will also establish the direction for removal of spent fuel and sludge for the K-West Basin.

An Interim Safety Basis will be developed in order to establish the current authorization basis for the K-West Basin.

All activities are included in Phase III of this report.

Site: Idaho National Engineering Laboratory (INEL)

Facility: CPP-603 Fuel Storage Facility (FSF)

The CPP-603 FSF is an underwater fuel storage facility which was built in two phases (1951 and 1959) for storage of spent metal clad nuclear fuels pending reprocessing. It consists of three unlined concrete storage basins, two cask handling areas, a fuel element cutting facility, a structural steel/transite superstructure, and assorted basin water treatment areas which were added individually in the 1960s and 1970s. The CPP-603 Irradiated Fuel Storage Facility (for dry fuel storage) was added in 1974 and shares a cask handling area. The two basins that were built in 1951 used a monorail and yoke storage system for fuel storage, and the basin built in 1959 used an open basin filled with free-standing underwater storage racks. At the time of the assessment, the facility contained approximately 1.96 metric tons heavy metal of Naval, research reactor, and commercial spent nuclear fuel. This fuel is predominantly zirconium-, aluminum-, and stainless steel-clad; some fuels are canned because of cladding breaches or for fuel handling economy.

The following vulnerabilities were identified for this facility:

- Corroded spent fuel, some clad with aluminum or in corroded aluminum canisters, causes increasing amounts of fission products and transuranics (TRU) to be released into the basin environment. (ID.W-1-1)

- There is a lack of complete characterization of material in storage, and the condition of encapsulated material is unknown. (ID.W-1-2)

- Institutional criticality control of stored RINM is a concern; fuel containers and Engineered Safety Features providing criticality controls were degraded and administrative controls were not met, so the facility was outside of its safety basis. (ID.W-1-3)

- Facility lacks the capability to repack corroded fuel. (ID.W-1-4)

- Since a path has not been established for ultimate disposal of the stored fuel, multiple interim actions requiring fuel handling will be necessary, increasing the risk of exposure to the workers and the public. (ID.W-1-5)

- Excessive corrosion of storage equipment has occurred. (ID.W-1-6)

- Facility lacks the capability to detect basin water leakage and does not perform trending (e.g., ...r basin water makeup) to determine if leakage is occurring. If water leaks from the basin, the potential exists that it would be undetected. (ID.W-1-7)

- Fuel encapsulation activities may result in the following: fragmenting some of the fuel causing a release of radionuclides to the basin water, the sludge, and the environment; accidental criticality; and increased worker exposure. (ID.W-1-10)

APPENDIX A
Action Plans for Major Vulnerabilities

Identified Vulnerabilities		Corrective Action Plans		Schedule
HAN 1-1	Sludge accumulation containing fissile and fission product material from damaged / degraded fuel is estimated to be greater than 14 inches deep in some locations. Greater than 50% of the fuel may have experienced cladding failure, releasing significant amounts of fission products to the pool. (105-KE)	HAN 1-1a	Provide WHC recommendation based on a formal decision process for a path forward to remove fuel and sludge from the 105-K Basins.	10/94
		b	Perform pilot run of K-East Basin fuel to support future process for isolation of fuel from basin water, including potential removal from basins.	
			Begin pilot run.	3/95
			Complete pilot run.	4/95
		c	Perform Basin Consolidation Study (see Item 1-4b) to provide basis for decision on relocation of all fuel from 105-KE to 105-KW and for schedule to reduce tritium concentration in 105-KE Basin water.	
		d	Initiate fuel and sludge characterization to develop options for fuel and sludge management at basins and to develop path forward for removal of both from 105-KE Basin (see Item 1-4c).	
		e	Complete sludge retrieval and packaging system development.	4/96
		f	Complete installation and startup of sludge retrieval and packaging system.	7/98
		g	Implement actions necessary to identify and develop a path forward for removal of all fuel and sludge from 105-KE Basin by 12/02 (see Items 1-1a and 1-1k).	
		h	Action deleted.	
		i	Complete packaging of sludge.	4/00
		j	Initiate removal of all fuel and sludge from 105-KE and 105-KW Basins.	12/00*
		k	Remove all fuel and sludge from K-Basins.	12/02*

* Note: Requirements for a path forward to remove all SNF and sludge for the 105-K Basins are currently being developed and are contingent on the outcome of the decision process identified in Item HAN 1-1a. Schedules and associated costs shown are based on previous estimates and will be revised at a later date, pending completion of the decision process. Schedules are not resource loaded and will be further refined by 1/95.

Identified Vulnerabilities		Corrective Action Plans		Schedule
HAN 1-2	An efficient method for encapsulation may be needed to avoid additional releases to the environment and to minimize worker exposures. (105-KE)	HAN 1-2a	Provide evaluation of encapsulation approach, through an independent group, to identify whether encapsulation should proceed and to recommend improvements to the planned encapsulation approach. Initial review completed 12/93.	12/93
		b	Provide review of plans for encapsulation in EM-37 Comprehensive Technical Assessment and identify findings and recommendations related to encapsulation. Completed 2/94.	2/94
		c	ALARA assessment team complete development of encapsulation ALARA plan. Preliminary ALARA plan completed on schedule. Revised plan to incorporate change to pilot run is anticipated in 1/95.	4/94
		d	Implement recommendations of various assessments for fuel encapsulation and sludge packaging (see Items 1-1a and 1-2a, b & c).	TBD by Item 1-1a
		e	Evaluate basic requirements such as SNM accountability requirements for waivers or changes to minimize personnel exposure during encapsulation and implement recommendations. SNM waiver request transmitted to RL on schedule.	4/94
		f	Raise basin water level to provide additional shielding. Delayed due to seismic issues. Being compared to other shielding approaches in conjunction with system engineering. Conceptual design review will be held in 11/94 to select dose reduction methodology. Implement dose reduction methodology. Complete by 9/96.	9/96
1-3	105 KE Basin leaked noticeably on two occasions, releasing fission products and tritium to the environment. Source believed to be the basin discharge chute construction joint, which is also a potential seismic vulnerability due to lack of adequate reinforcement. (Generic Issue, 105-KE and 105-KW)	1-3	Install K-East Basin construction joint protection in the basin during the encapsulation activities. Fabricate cofferdams to be installed if necessary for mitigation should significant leakage occur, until the appropriate repairs can be performed. (Cofferdam installation precludes encapsulation of the SNF and sludge in the discharge chute.)	
		-	Installation of construction joint protection in K-East Basin. Completed 12/93.	12/93
		-	Cofferdam prepared for installation in K-East Basin. Anticipate fabrication completion in 10/94. Anticipate installation in 11/94, contingent on decision for readiness review requirements. Date revised to 11/94.	11/94
		-	Fabricate cofferdam and install in K-West Basin to reduce the possibility of a seismically induced leak at the K-West Basin. Installation schedule contingent on decision for readiness review. Anticipate installation in 11/94. Date revised to 11/94.	11/94

Identified Vulnerabilities	Corrective Action Plans	Schedule
HAN 1-4 Institutional control failures; lack of clear planning priorities for final disposition of material. (Generic Issue, 105-KE and 105-KW)	HAN 1-4a Develop Hanford SNF Project Plan to establish long-term interim storage plans for management of all spent fuel presently stored at Hanford.	
	- Develop preliminary draft of Hanford SNF Project Plan to establish long-term interim storage plans, available for review and comment. Completed 3/94.	3/94
	- Issue Hanford SNF Project Plan. Draft submitted 8/94.	8/94
	- Implement project control system for Hanford SNF Project Plan.	10/94
	- Maintain project control system for Hanford SNF Project Plan.	12/02
	b Perform Basin Consolidation Study to decide between utilizing single basin occupancy (105-KW) or dual basin (105-KE and 105-KW) occupancy for temporary storage of fuel and sludge for the period up to 2002.	9/94
	c Perform technical evaluation and fuel characterization tests to develop path forward for removal of fuel; develop fuel characterization test plan, analyze test performance and document results. The tests will provide analytical information in order to identify the minimum conditions necessary for storage (including stabilization) and transport of the fuel. Information will support establishment of safety envelopes, process selection and development, and strategy for regulatory compliance.	
	- Initiate sludge / fuel characterization. (In-situ characterization initiated 7/94.)	10/94
	- Complete sludge / fuel characterization.	9/00*
	- Perform activities to support Title II design.	3/96*
	- Perform technical evaluation for wet storage option.	9/95*
	d Perform evaluation to determine the appropriate location for acceptable long-term interim storage of fuel removed from K-Basins. Complete by 3/96.	3/96
	e Develop Hanford site wide EIS and issue Record of Decision for long-term management of SNF at the Hanford Site (SNF storage siting and configuration, path forward for ultimate disposition, etc).	
	- Initiate development of Hanford SNF EIS. Strategy being reevaluated due to Programmatic SNF Management EIS and DNFSB Recommendation 94-01.	6/94
	- Complete Hanford site wide SNF EIS and issue Record of Decision.	6/96
	f Provide initial report to EM-37 of DOE-RL commissioned independent technical assessment of the feasibility of placing the N-Reactor fuel into dry storage in the near term. Completed 6/94. Final report issued 9/94.	5/94

* See note on Item HAN 1-1j

Identified Vulnerabilities		Corrective Action Plans		Schedule
HAN		**HAN**		
1-4 (Continued)		1-4 (Continued)		
		g	Design and construct alternate storage facility based on Item 1-1a decision.	
			- Initiate conceptual design of alternate storage facility.	6/95*
			- Complete advanced conceptual design of alternate storage facility.	10/96*
			- Develop Title II design of alternate storage facility.	11/96*
			- Start construction of alternate storage facility.	1/98*
			- Complete construction of alternate storage facility.	9/99*
			- Initiate operations of alternate storage facility.	12/00*
		h	Remove all fuel and sludge from K-Basins including stabilization, as necessary, to prepare fuel for storage (see Item 1-1k).	
1-5	An unreviewed safety question (USQ) exists resulting from excessive plutonium accumulation in filter backwash pit. (105-KE)	1-5a	Obtain representative samples of sand filter backwash pit sludge and analyze for plutonium content. Completed 3/94.	3/94
		b	Disposition USQ using plutonium concentration data and Safety and Criticality Analyses information. Completed 3/94. (Note: Results demonstrated that less than 97 grams of plutonium are present compared to a limit of 225 grams. Therefore, this occurrence did not involve an Unreviewed Safety Question.)	3/94
1-6	Creation of TRU waste associated with basin operations. There is presently no disposal path for the mixed bed ion exchange resin waste. (105-KE)	1-6a	Perform an analysis to determine whether the degradation of the ion exchange resins results in the generation of explosive or flammable levels of hydrogen. Initial analysis completed 12/93 determined that the levels of hydrogen were below flammable limits. Final report to determine whether the situation involves a USQ will be completed 10/94.	10/94
		b	Develop a waste plan which includes the following:	
			- Begin utilization of container identified to store the cartridge filters as TRU waste at the Hanford Central Waste Complex. Completed 3/94.	3/94
			- Determine whether the ion exchange columns are either TRU Waste or Low-Level Waste (LLW). Completed 3/94.	3/94
			- Transfer the LLW ion exchange columns to the Burial Ground.	10/94
			- Develop a waste form and containers for the TRU Waste from the ion exchange columns.	4/95
			- Transfer the TRU Waste to the appropriate storage facilities.	6/95
			- Identify alternative clean-up systems to minimize the generation of TRU Waste. Deferred pending resource availability for high priority, near term corrective activities.	TBD
			- Re-evaluate canister disposal and implement disposal process. (Anticipate initiation of canister removal in 10/94.)	8/96

* See note on Item HAN 1-1j.

Identified Vulnerabilities		Corrective Action Plans		Schedule
HAN 1-7	Monitoring wells in proximity of basin indicate increasing levels of tritium approaching (in one case, exceeding) the safe drinking water limit of 20,000 pCi/l and possible migration to the Columbia River. (105-KE)	HAN 1-7a	Analyze the present Ground Water Monitoring Program to determine what enhancements would better define the source of the tritium in the wells. Completed 3/94.	3/94
		b	Implement recommended enhancements which may include installation of new monitoring wells. Completed 5/94. Installation of new monitoring wells complete.	5/94
		c	Perform Basin Consolidation Study (see Item 1-4b).	
		d	Based on the results of Basin Consolidation Study, investigate tritium removal options.	
			- Initiate investigation of options for tritium removal.	10/94
			- Complete investigation of options for tritium removal.	3/95
		e	Issue a schedule for 105-KE Basin water tritium reduction program.	10/94
		f	Implement 105-KE Basin water tritium reduction program. Schedule TBD by study.	TBD
1-8	Uncharacterized fuel is stored in unsealed canisters lack of precise detail as to the ma :rial condition of some of the RINM in storage. (Generic Issue, 105-KE and 105-KW)	1-8	See Item 1-4c.	
S-1	Sitewide classification of DOE Spent Nuclear Fuel (SNF) and Special Nuclear Material (SNM) materials as Hazardous Waste.	S-1a	EM-37 develop a list of spent fuel types, based on process knowledge, that are potentially ignitable or reactive, to which RCRA requirements might be applicable.	9/94
		b	Perform selected Toxicity Characteristic Leaching Procedure (TCLP) testing for selected fuel from Item S-1a.	FY95
		c	EM-37 / INEL perform a cost impact assessment of applying RCRA requirements for the storage of fuels identified in Item S-1a.	
			- Complete draft.	9/94
			- Complete final version.	12/94
		d	RL determine cost impact on a case by case basis after identifying applicable fuels that would be dealt with as waste based on Items HAN S-1a, b & c.	TBD

Identified Vulnerabilities	Corrective Action Plans	Schedule
HAN **S-1 (Continued)**	**HAN** **S-1 (Continued)** e Based on the results of Items HAN S-1a, b, c & d, which identifies those spent fuel types that may need to fall under the auspices of RCRA regulations and assesses the associated costs, commence a dialogue with interested stakeholders on how best to proceed for the selected fuels. Note: It is anticipated that only a limited number of spent fuel types will require detailed evaluations for potential applicability under RCRA requirements.	TBD
Generic Issue: Lack of adequate authorization bases, including updated and approved SAR that address long-term storage of RINM. (105-KE and 105-KW)	**Generic Issue:** - See Item 1-4 - Complete development of Interim Safety Basis.	 12/94

Year	Item No.	Planned Action(s)	Schedule	Funding (from EM-30)
FY '94	HAN			
	1-2a	Provide evaluation of encapsulation approach, through an independent group, to identify whether encapsulation should proceed and to recommend improvements to the planned encapsulation approach. Initial review completed 12/93.	12/93	
	1-3	Installation of construction joint protection in K-East Basin. Completed 12/93.	12/93	
	1-2b	Provide review of plans for encapsulation in EM-37 Comprehensive Technical Assessment and identify findings and recommendations related to encapsulation. Completed 2/94.	2/94	
	1-4a	Develop preliminary draft of Hanford SNF Project Plan to establish long-term interim storage plans, available for review and comment. Completed 3/94.	3/94	
	1-5a	Obtain representative samples of sand filter backwash pit sludge and analyze for plutonium content. Completed 3/94.	3/94	
	1-5b	Disposition USQ using plutonium concentration data and Safety and Criticality Analyses information. Completed 3/94. (Note: Results demonstrated that less than 97 grams of plutonium are present compared to a limit of 225 grams. Therefore, this occurrence does not involve an Unreviewed Safety Question.)	3/94	
	1-6b	Begin utilization of container identified to store the cartridge filters as TRU Waste at the Hanford Central Waste Complex. Completed 3/94.	3/94	
	1-6b	Determine whether the ion exchange columns are either TRU Waste or Low-Level Waste (LLW). Completed 3/94.	3/94	
	1-7a	Analyze the present Ground Water Monitoring Program to determine what enhancements would better define the source of the tritium in the wells. Completed 3/94.	3/94	

Year	Item No.	Planned Action(s)	Schedule	Funding (from EM-30)
FY '94 (Continued)	HAN 1-2c	ALARA assessment team complete development of encapsulation ALARA plan. Preliminary ALARA plan completed on schedule. Revised plan to incorporate change to pilot run is anticipated in 1/95.	4/94	$100K
	1-2e	Evaluate basic requirements such as SNM accountability requirements for waivers or changes to minimize personnel exposure during encapsulation and implement recommendations. SNM waiver request transmitted to RL on schedule.	4/94	$10K
	1-4f	Provide initial report to EM-37 of DOE-RL commissioned independent technical assessment of the feasibility of placing N-Reactor fuel into dry storage in the near term. Completed 6/94. Final report issued 9/94.	5/94	$500K
	1-7b	Implement recommended enhancements which may include installation of new monitoring wells. Completed 5/94. Installation of new monitoring wells complete.	5/94	$300K
	1-4e	Initiate development of Hanford SNF EIS. Strategy being reevaluated due to Programmatic SNF Management EIS and DNFSB Recommendation 94-01.	6/94	$800K
	1-4a	Issue Hanford SNF Project Plan. Draft submitted 8/94.	8/94	$400K
	1-4b	Perform Basin Consolidation Study to decide between utilizing single basin occupancy (105-KW) or dual basin (105-KE and 105-KW) occupancy for temporary storage of fuel and sludge for the period up to 2002.	9/94	$600K
	S-1a	EM-37 develop a list of spent fuel types, based on process knowledge, that are potentially ignitable or reactive, to which RCRA requirements might be applicable.	9/94	N/A
	S-1c	Complete a draft cost impact assessment of applying RCRA requirements for the storage of fuels identified in Item S-1a.	9/94	Funded
	1-1e	Complete sludge retrieval and packaging system development by 4/96.	Continue	Funded
	1-2d	Implement recommendations of various assessments for fuel and sludge encapsulation (see items 1-1a and 1-2a, b & c).	Continue	$100K

Year	Item No.	Planned Action(s)	Schedule	Funding (from EM-30)
FY '94 (Continued)	HAN 1-2f	Raise basin water level to provide additional shielding. Delayed due to seismic issues. Being compared to other shielding approaches in conjunction with system engineering. Conceptual design review will be held in 11/94 to select dose reduction methodology. Implement dose reduction methodology. Complete by 9/96.	Continue	$300K
	1-4c	Perform technical evaluation for wet storage option. Complete by 9/95.	Continue	$3.0M
	1-4d	Perform evaluation to determine the appropriate location for acceptable long-term interim storage of fuel removed from K-Basins. Complete by 3/96.	Continue	
	1-6b	Identify alternative clean-up systems to minimize the generation of TRU Waste. Deferred pending resource availability for high priority, near term corrective activities.	TBD	$250K
	1-6b	Re-evaluate canister disposal and implement disposal process. Complete by 8/96. (Anticipate initiation of canister removal in 10/94.)	Continue	$500K
FY '95	1-1a	Provide WHC recommendation based on a formal decision process for a path forward to remove fuel and sludge from the 105-K Basins.	10/94	Funded
	1-4a	Implement project control system for Hanford SNF Project Plan.	10/94	$1.8M
	1-4c	Initiate sludge / fuel characterization. (In-situ characterization initiated 7/94.)	10/94	$10M
	1-6a	Perform an analysis to determine whether the degradation of the ion exchange resins results in the generation of explosive or flammable levels of hydrogen. Initial analysis completed 12/93 determined that the levels of hydrogen were below flammable limits. Final report to determine whether the situation involves a USQ will be completed 10/94.	10/94	Funded
	1-6b	Transfer the LLW ion exchange columns to the Burial Ground.	10/94	$100K
	1-7d	Initiate investigation of options for tritium removal.	10/94	$50K
	1-7e	Issue a schedule for the 105-KE Basin water tritium reduction program.	10/94	$10K

Year	Item No.	Planned Action(s)	Schedule	Funding (from EM-30)
FY '95 (Continued)	HAN 1-3	Cofferdam prepared for installation in K-East Basin. Anticipated fabrication completion in 10/94. Anticipate installation in 11/94, contingent on decision for readiness review requirements. Date revised to 11/94.	11/94	Funded
	1-3	Fabricate cofferdam and install in K-West Basin to reduce the possibility of a seismically induced leak at the K-West Basin. Installation schedule contingent on decision for readiness review. Anticipate installation in 11/94. Date revised to 11/94.	11/94	$150K
	S-1c	Complete the final cost impact assessment of applying RCRA requirements for the storage of fuels identified in Item S-1a.	12/94	Funded
	Generic Issue	Complete development of Interim Safety Basis (Generic Issue).	12/94	$250K
	1-7d	Complete investigation of options for tritium removal.	3/95	$50K
	1-1b	Begin pilot run of K-East Basin fuel to support future process for isolation of fuel from basin water, including potential removal from basins.	3/95	$0.8M
	1-1b	Complete pilot run of K-East Basin fuel to support future process for isolation of fuel from basin water, including potential removal from basins.	4/95	$2.7M
	1-6b	Develop a waste form and containers for the TRU Waste from the ion exchange columns.	4/95	$150K
	1-4g	Initiate conceptual design of alternate storage facility.	6/95	TBD by WHC path forward study, Item HAN 1-1a
	1-6b	Transfer the TRU Waste to the appropriate storage facilities.	6/95	$25K
	1-4c	Perform technical evaluation for wet storage option.	9/95	Funded
	1-1e	Complete sludge retrieval and packaging system development by 4/96.	Continue	$2.3M

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Year	Item No.	Planned Action(s)	Schedule	Funding (from EM-30)
FY '95 (Continued)	HAN 1-2d	Implement recommendations of various assessments for fuel and sludge encapsulation (see Items 1-1a and 1-2a, b & c).	TBD by Item 1-1a	$700K
	1-2f	Implement dose reduction methodology. Complete by 9/96.	Continue	$3.1M
	1-4c	Perform activities to support Title II design. Complete by 3/96.	Continue	$3.5M
	1-4d	Perform evaluation to determine the appropriate location for acceptable long-term interim storage of fuel removed from K-Basins. Complete by 3/96.	Continue	
	1-4e	Complete Hanford site-wide SNF EIS and issue Record of Decision by 6/96	Continue	$600K
	1-6b	Re-evaluate canister disposal and implement disposal process. Complete by 8/96. (Anticipate initiation of canister removal in 10/94.)	Continue	$670K
	S-1b	Perform selected Toxicity Characteristic Leaching Procedure (TCLP) testing for selected fuel from Item S-1a.	FY95	Funded
	S-1d	RL determine cost impact on a case by case basis after identifying applicable fuels that would be dealt with as waste based on Items HAN S-1a, b & c.	TBD	TBD
	S-1e	Based on the results of Items HAN S-1a, b, c & d, which identifies those spent fuel types that may need to fall under the auspices of RCRA regulations and assesses the associated costs, commence a dialogue with interested stakeholders on how best to proceed for the selected fuels.	TBD	TBD
FY '96	1-4c	Perform activities to support Title II design. Complete by 3/96.	3/96	$1.0M
	1-4d	Perform evaluation to determine the appropriate location for acceptable long-term interim storage of fuel removed from K-Basins. Complete by 3/96.	3/96	
	1-1e	Complete sludge retrieval and packaging system development by 4/96.	4/96	$4.1M
	1-4e	Complete Hanford site-wide EIS and issue Record of Decision by 6/96.	6/96	$600K

Year	Item No.	Planned Action(s)	Schedule	Funding (from EM-30)
FY '96 (Continued)	HAN 1-6b	Re-evaluate canister disposal and implement disposal process. Complete by 8/96.	8/96	$120K
	1-2f	Implement dose reduction methodology. Complete by 9/96.	9/96	$2.3M
	1-1f	Complete installation and startup of sludge retrieval and packaging system by 7/98.	Continue	$1.8M
	1-4a	Maintain project control system for Hanford SNF Project Plan. Complete by 12/02.	Continue	$1.8M
	1-4c	Perform sludge / fuel characterization. Complete by 9/00.	Continue	$4.9M
	1-4g	Complete advanced conceptual design of alternate storage facility by 10/96.	Continue	TBD by WHC path forward study, Item HAN 1-1a
FY '97	1-4g	Complete advanced conceptual design of alternate storage facility by 10/96.	10/96	TBD †
	1-4g	Develop Title II design of alternate storage facility.	11/96	$78.9M (Capital) †
	1-1f	Complete installation and startup of sludge retrieval and packaging system by 7/98.	Continue	10.7M
	1-4a	Maintain project control system for Hanford SNF Project Plan. Complete by 12/02.	Continue	$1.8M
	1-4c	Perform sludge / fuel characterization. Complete by 9/00.	Continue	$3.4M
	1-7f	Implement 105-KE Basin water tritium reduction program. Schedule TBD by study.	TBD	†
FY '98	1-4g	Start construction of alternate storage facility.	1/98	$141.4M (Capital) †
	1-1f	Complete installation and startup of sludge retrieval and packaging system by 7/98.	7/98	$1.0M
	1-1l	Complete packaging of sludge by 4/00.	Continue	$2.0M

† Funding subject to future budgetary approval.

Hanford 105-K Basins
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Year	Item No.	Planned Action(s)	Schedule	Funding (from EM-30)
FY '98 (Continued)	HAN 1-4a	Maintain project control system for Hanford SNF Project Plan. Complete by 12/02.	Continue	$1.8M
	1-4c	Perform sludge / fuel characterization. Complete by 9/00.	Continue	TBD
FY '99	1-4g	Complete construction of alternate storage facility.	9/99	$19.8M (Capital) † $5M (Expense) †
	1-1l	Complete packaging of sludge by 4/00.	Continue	$3.9M
	1-4a	Maintain project control system for Hanford SNF Project Plan. Complete by 12/02.	Continue	$1.8M
	1-4c	Perform sludge / fuel characterization. Complete by 9/00.	Continue	TBD †
FY '00	1-1l	Complete packaging of sludge by 4/00.	4/00	TBD †
	1-4c	Perform sludge / fuel characterization. Complete by 9/00.	9/00	TBD †
	1-4a	Maintain project control system for Hanford SNF Project Plan. Complete by 12/02.	Continue	$1.8M
FY '01	1-1j	Initiate removal of all fuel and sludge from 105-KE and 105-KW Basins Complete by 12/02.	12/00	$30M †
	1-4g	Initiate operations of alternate storage facility.	12/00	
	1-4a	Maintain project control system for Hanford SNF Project Plan. Complete by 12/02.	Continue	$1.8M

† Funding subject to future budgetary approval.

SCHEDULE / FUNDING

Year	Item No.	Planned Action(s)	Schedule	Funding (from EM-30)
FY '02	HAN 1-1k	Complete removal of all fuel and sludge from K-Basins by 12/02.	Continue	$30M
	1-4a	Maintain project control system for Hanford SNF Project Plan. Complete by 12/02.	Continue	$1.8M
FY '03	1-1k	Complete removal of all fuel and sludge from K-Basins by 12/02 .	12/02	$20M
	1-4a	Maintain project control system for Hanford SNF Project Plan. Complete by 12/02.	12/02	$1.8M

APPENDIX C
Summaries of Path Forward for Policies

WHAT IS THE PATH FORWARD FOR GEOLOGIC DISPOSAL OF SPENT NUCLEAR FUEL?

BACKGROUND: The Nuclear Waste Policy Act of 1982 (the Act) mandates that the Federal Government pursue the development of deep geologic repositories for the permanent disposal of civilian spent nuclear fuel, high-level waste, and other highly radioactive waste. In 1985, the President accepted the Secretary of Energy's recommendation that defense nuclear waste should be co-located with civilian nuclear waste. General Counsel concluded in a legal opinion dated March 23, 1994, that the Act authorizes the disposal of DOE-owned spent nuclear fuel in a geologic repository, conditioned upon payment by the DOE of a fee adequate to cover the full cost of disposal. The DOE, however, has made no final decision at this time regarding the specific strategy for the ultimate disposition of DOE-owned spent nuclear fuel.

The Act limits the capacity of the first repository to 70,000 metric tons heavy metal, until a second repository is in operation. DOE's Office of Civilian Radioactive Waste Management (OCRWM), however, has allocated as a planning basis 10 per cent of the repository capacity for defense wastes (7,000 metric tons heavy metal, if the capacity of the first repository is at least 70,000 metric tons heavy metal). Projections of waste inventories show that the first repository, with a legislative limit of 70,000 tons, does not have adequate disposal capacity for either all civilian, or the total civilian and defense waste.

The path forward for ultimate disposition of DOE-owned spent nuclear fuel must be addressed in a manner consistent with the three DOE-owned spent nuclear fuel program systems engineering functions: remediation of vulnerabilities in existing storage, achievement of reliable interim storage, and preparation of DOE-owned spent nuclear fuel for disposal. In addition, three assumptions are made when developing options for ultimate disposition of DOE-owned spent nuclear fuel. These assumptions are: (1) The current OCRWM program will be successful in constructing, licensing and operating repositories for the disposal of high-level radioactive waste; (2) Development of long-term interim storage, with active institutional controls in place, will be required to store DOE-owned spent nuclear fuel, pending repository availability; and, (3) There is a distinct possibility that some DOE-owned spent nuclear fuel may not be adequately characterized to support the OCRWM schedule to submit its license application to the Nuclear Regulatory Commission in 2001.

DISCUSSION: The following options are being considered to determine how to proceed with respect to placing DOE-owned spent nuclear fuel in the evaluation process for all materials authorized for disposal in a geologic repository: (1) DOE-owned spent nuclear fuel and vitrified high-level waste will have authority for disposal in the first repository so that the total quantity of DOE material does not exceed 10% of the repository capacity limit. Emplacement priority for DOE material will be based on a systems approach that considers risk, cost, schedule, readiness and other factors to determine the mix of defense high-level waste and DOE-owned spent nuclear fuel. (2) All DOE-owned spent nuclear fuel will have authority for disposal in the first repository, along with the present allocation of defense high-level waste, assuming the 70,000 metric ton heavy metal limitation is removed by congressional action. (3) All DOE-owned spent nuclear fuel is deferred to a second repository.

RECOMMENDED PATH FORWARD: Option 1 provides a path forward for the Office of Environmental Management to emplace material qualified and ready for geologic disposal without significantly impacting the OCRWM schedule for a license application. DOE-owned spent nuclear fuel which can be adequately qualified in time will be included in the initial license application. The mix of DOE-owned spent nuclear fuel and vitrified high-level waste in the first repository may be changed, if necessary, by submitting a license application amendment after the second repository decision is made.

SHOULD NEW INTERIM STORAGE AND NEW CONDITIONING FACILITIES BE LICENSED BY THE NUCLEAR REGULATORY COMMISSION?

BACKGROUND: New interim storage facilities will be required for DOE's spent nuclear fuel since additional time is needed to finalize a decision regarding the location and timetable for long-term disposal of this fuel. However, it is very likely that DOE's spent fuel will eventually come under Nuclear Regulatory Commission (NRC) jurisdiction since it will be required to meet waste acceptance criteria for geologic disposal and given the likelihood of new legislation being enacted to address external regulation of new DOE facilities. Further, it appears that the technical standards that would be required for NRC licensability of any facility associated with spent fuel storage or disposal are reasonable. Therefore, it is prudent that DOE pursue an evaluation of the current regulatory framework and technical requirements associated with NRC licensability of spent fuel projects or facilities. This evaluation will provide the data and information required for a future decision regarding licensing of DOE facilities.

DISCUSSION: A number of options exist as to how to best pursue application of NRC requirements to DOE's spent nuclear fuel facilities. Three options under consideration are summarized below.

1. Design new interim storage facilities to comply with NRC technical requirements and proceed to construction without NRC review.

2. Design new interim storage facilities to comply with NRC technical requirements and confirm the compliance through NRC licensability reviews of the proposed facilities. Select a spent nuclear fuel interim storage project as a prototype for the performance of a NRC licensability review.

3. Design new interim storage facilities to comply with NRC technical requirements and delay construction until a NRC license can be obtained.

RECOMMENDED PATH FORWARD: A prototype licensability review as outlined in Option 2 appears to be the most prudent course of action. By using a selected Spent Nuclear Fuel Interim Storage Project(s), DOE can define the cost, schedule, and technical implications of potential future NRC licensing of DOE facilities. This option evaluates licensability in a way that satisfies concerns of DOE's "self-regulation" while at the same time provides the needed experience to DOE for making future technical and licensability decisions. The experience and information gained will be invaluable to DOE as it strives to make future decisions regarding the approach to be taken with regard to NRC licensing of its facilities.

SHOULD HANFORD N-REACTOR BE STORED IN A DRY CONFIGURATION?

BACKGROUND: Facility assessments documented in the Spent Fuel Working Group Report on spent nuclear fuel vulnerabilities issued on December 7, 1993, and Defense Nuclear Facilities Safety Board (DNFSB) reports have identified concerns over continued wet storage of N-Reactor fuel. DNFSB Recommendation 94-1 in part recommends the acceleration of efforts to place N-Reactor fuel into a stable interim storage configuration with a "program to be directed towards storage methods that will minimize further deterioration". Continued wet storage may result in spent fuel degradation and negative impacts on future fuel handling and disposal. Dry storage of spent fuel, in general, is considered superior to wet storage; however, the knowledge base for dry storage of N-Reactor spent fuel is limited. An evaluation is being performed in order to determine whether long-term wet storage or dry storage is most beneficial in minimizing further fuel degradation and potential environmental insult.

DISCUSSION: Placement of the fuel into dry storage has been evaluated by an Independent Technical Assessment team, comprised of industry experts, sponsored by the DOE Richland Operations Office. Within the dry storage option, there are numerous alternatives and methods of packaging to attain confinement. While many dry storage systems exist for commercial spent fuel, N-Reactor fuel has unique properties not found in commercial spent fuel. For example, the characteristics of N-Reactor fuel must be analyzed to determine what conditioning, if any, is required before it can be safely stored in a dry configuration. The Independent Technical Assessment team evaluated this potential concern as well as developing a fuel conditioning process which would stabilize the fuel for long-term interim dry storage. Results of this evaluation indicate that the fuel can be conditioned prior to placement into dry storage, and safely managed during the dry storage period. The Assessment team has defined the steps and related schedule which could be followed for demonstrating that dry storage of N-Reactor fuel is safe and that the fuel degradation can be arrested. Their final report was issued in September 1994.

In the Department's letter of April 28, 1994, to the DNFSB, a detailed description was provided of the engineering alternatives and the criteria utilized in arriving at the presently planned fuel/sludge encapsulation approach. In summary, alternatives considered to the proposed fuel/sludge encapsulation included overpacking of the existing fuel canisters (placing the existing canisters into larger canisters without having to empty them), placement of the fuel directly into dry storage, or delaying the effort until better guidance could be established. Direct overpacking minimizes handling and thus the actual total radiation exposure to operations personnel might be less than that for encapsulation. However, the present basin storage racks cannot accommodate an overpack, thus a storage system redesign and installation would be required. Thus the potential radiation exposure savings in process operations may be offset by the removal of the old racks and installation of the new design.

The Westinghouse Hanford Company is further evaluating the feasibility of maintaining N-Reactor fuel in wet storage. This evaluation includes alternatives to the currently proposed process of reencapsulating the fuel and placing it directly back into wet storage. Alternatives include containerization techniques with the fuel being stored either wet or dry within new containers that are stored underwater, fuel passivation - wet (shear/leach/calcine) or dry (shear/fluidized bed) oxidation - performed at different site locations, as well as alternate site locations for fuel passivation and wet storage. The Independent Technical Assessment team report and recommendations concerning dry storage will be included in the overall Westinghouse Hanford Company evaluation, and a proposed course of action on whether to proceed towards dry storage or maintain the fuel in wet storage will be developed. This consolidated report / recommendation is due to be completed in late October 1994. A Departmental decision regarding the path forward for N-Reactor fuel storage is expected to be made in early November 1994.

RECOMMENDED TECHNICAL APPROACH: Based on the combined set of recommendations and the proposed course of action, the Department will decide which course of action for storage of N-Reactor spent fuel is prudent. This proposed course of action would include confirmation of the conditioning process for dry fuel storage and the development of the hardware necessary to carry out the fuel conditioning.

WHAT SHOULD THE APPROACH BE IF SOME DOE-OWNED SPENT FUEL IS DEEMED UNSUITABLE FOR EXTENDED INTERIM, DRY STORAGE OR DIRECT GEOLOGIC DISPOSAL?

BACKGROUND: During April 1992, the Secretary of Energy directed the "phaseout of reprocessing at both the Savannah River Site and the Idaho National Engineering Laboratory." Pursuant to this policy, further DOE spent nuclear fuel processing would be limited to DOE-owned fuel deemed "at risk" for interim storage. "At risk" fuels are defined as those not expected to retain the necessary integrity during underwater or extended dry storage.

The processing of some "at risk" spent nuclear fuel in the F and H Canyons at the Savannah River Site is under evaluation within the context of the National Environmental Policy Act process. Also, the DOE is developing an alternative technology that could prove to be useful in conditioning certain "at risk" spent nuclear fuel types. This technology currently under evaluation is known as "pyroprocessing" and employs pyrochemical methods to separate fissile materials from fission products in such a way that there is no production of separated plutonium; therefore, this process has an attendant non-proliferation advantage.

Spent nuclear fuel at various DOE facilities has been inventoried, with data being assembled on [illegible]ately 150 fuel types. A Fuel Data Base has been assembled on the condition of each fuel type and [illegible]al for, or existence of, serious deterioration. For some fuel types, the existing storage facilities [illegible]eriorating fuel condition may place the fuel "at risk" during the period prior to transfer to dry storage, or during the period of up to 40 years of extended dry storage.

DISCUSSION: Various options are available to DOE with respect to dealing with the fuel deemed to be at risk:

1. Transfer to extended interim, dry storage facilities; conditioning will be limited to packaging.

2. Process fuel considered to be "at risk."

3. Modify storage environment to prevent further fuel degradation.

RECOMMENDED TECHNICAL APPROACH: Evaluate on a case-by-case basis at risk fuel and select the best option to ensure safety and environmental protection during the period prior to implementation of extended interim, dry storage. Select "at risk" fuels for treatment utilizing the National Environmental Policy Act process and technical documentation such as technical risk evaluation studies; process studies; cost studies; waste form, volume, and stability studies; and systems engineering studies. An example of this process is the current Interim Management of Nuclear Materials Environmental Impact Statement at the Savannah River Site which will determine which of the spent fuel and targets (reactor irradiated nuclear materials) at the site are at risk and which option should be utilized for near-term stabilization.

APPENDIX D
Vulnerability Listing With Action Plan Development Status

VULNERABILITY LISTING WITH ACTION PLAN DEVELOPMENT STATUS

	PRIORITY			STATUS	
Site/Facility **Vulnerability Number** **Brief Description**	Eight Major Facilities With Vulnerabilities	Less than One Year	Greater than One Year	Complete	Partial
Brookhaven/HFBR BNL-1 Unevaluated seismic resistance of spent fuel and racks.			✓	✓	
Hanford/K-East Basin HAN-1-1 Corrosion of Fuel in Unsealed Canisters, and Its Release, with Fission Products into KE-Basin Environment.	✓			✓	
Hanford/K-East Basin HAN-1-2 Worker Exposures and Releases to the Environment During Re-Encapsulation of Corroding Fuel in KE-Basin.	✓			✓	
Hanford/KE & KW Basins HAN-1-3 Basin Leakage Due to Deterioration and Seismic Inadequacy of KE and KW Basin Discharge Chute Construction Joint.	✓			✓	
Hanford/KE/KW Basins HAN-1-4 The Institutional Control of Stored RINM is a Concern at K-Basins.	✓			✓	
Hanford 100 Area/105 K-East Basin HAN-1-5 Plutonium-239 Accumulation in the Sand Filter Backwash Pit of 105 K-East Basin Resulted in a USQ.	✓			✓	
Hanford/KE-Basin HAN-1-6 Creation of TRU Waste Associated with the KE-Basin Operations.	✓			✓	
Hanford/KE-Basin HAN-1-7 Tritium is Evident in Monitoring Wells Near the K-Basins.	✓			✓	
Hanford/KW and KE Basins HAN-1-8 Uncharacterized Fuel Stored in Sealed and Unsealed Canisters in KW and KE-Basins.	✓			✓	
Hanford/PNL 327 HAN-2-1 Uncharacterized Mixed Fission Product Accumulation in the Hot Cell Ducts in the PNL 327 Building (Hot Cells D, F, SERF).		✓		✓	
Hanford/PNL 327 HAN-2-2 Isolation of Radioactive Liquid Waste (RLW) System in Building PNL-327 Due to Inability to Send RLW to the 300 Area RLW Collection Building (Bldg. 340)		✓		✓	

VULNERABILITY LISTING WITH ACTION PLAN DEVELOPMENT STATUS

	PRIORITY			STATUS	
Site/Facility **Vulnerability Number** **Brief Description**	Eight Major Facilities With Vulnerabilities	Less than One Year	Greater than One Year	Complete	Partial
Hanford/PNL 324 HAN-2-3 Significant Quantities Materials (HAZMAT)/Special Case Wastes Temporarily Stored (Co-Located with RINM) in Hot Cells in Building PNL-324.			✓	✓	
Hanford/PNL 324 HAN-2-4 Unresolved USQ from 1986 Radioactive Spill which Occurred in Building PNL-324, B Cell.		✓		✓	
Hanford/PNL 324/325/327 HAN-2-5 Lack of Approved Disposal Pathway for RINM Causing a Backlog of RINM at all 3 Hot Cell Facilities at PNL (Building 324/325/327).		✓		✓	
Hanford/PNL 324 HAN-2-6 Lack of an Approved Integrated Facility SAR for Building 324 Radiochemical Engineering Cells (REC) and Shielded Material Facilities (SMF).		✓		✓	
Hanford/PNL Building 325 HAN-2-7 Lack of an Approved Integrated Facility SAR for Building 325 High-Level Radiochemistry Facility (HLRF) and Shielded Analytical Laboratory (SAL).		✓		✓	
Hanford/Building 327 HAN-2-8 Lack of an Updated Integrated Facility SAR for the PNL Building 327 Postirradiation Testing Laboratory.		✓		✓	
Hanford/Building 327 HAN-2-9 Lack of a Current Seismic Analysis Building 327.		✓		✓	
Hanford/FFTF HAN-3-1 Potential for Inadequate Funding for Removal and Interim Storage of FFTF Spent Fuel.			✓	✓	
Hanford/308 Bldg Annex HAN-3-2 Inadequate Technical Safety Requirements for Storage of TRIGA Fuel in the 308 Building Annex.		✓		✓	
Hanford/308 Bldg Annex HAN-3-3 Transport/Storage Casks for Removing the Irradiated Fuel from the NRF TRIGA Storage Basin in the 308 Building Annex Have Not Been Designed or Procured.			✓	✓	

VULNERABILITY LISTING WITH ACTION PLAN DEVELOPMENT STATUS

	PRIORITY			STATUS	
Site/Facility Vulnerability Number Brief Description	Eight Major Facilities With Vulnerabilities	Less than One Year	Greater than One Year	Complete	Partial
Hanford/200 West Burial Grounds HAN-4-01 EBR-II Waste Containers May Exceed Expected 25 Year Life Analyzed in the SAR of the 200 W Burial Ground.	✓			✓	
Hanford/200 West Burial Grounds HAN-4-02 Containers, Other Than EBR-II Casks, Are Not Analyzed in the SARs for Fuel Storage Containers in the 200W Burial Grounds.	✓			✓	
Hanford/Burial Grounds HAN-4-03 The Inventory of RINM Cannot Be Determined or Verified at the Hanford Burial Grounds or in Basins at F- and H-Reactors.	✓			✓	
Hanford/200 West Burial Grounds HAN-4-04 Fuel Stored on Interim Basis in Burial Ground May Exceed Expected Storage Period in the 200 Area Burial Grounds.	✓			✓	
Hanford/T-Plant HAN-4-05 Susceptibility of the T-Plant Fuel Pool to Seismic Damage.		✓		✓	
Hanford/T-Plant HAN-4-06 Lack of Forward Path for Removal and Ultimate Disposition of the Fuel Currently Stored in the T-Plant Spent Fuel Pool.		✓		✓	
Hanford/T-Plant HAN-4-07 Poor Housekeeping in the T-Plant Canyon.		✓		✓	
Hanford/T-Plant Canyon HAN-4-08 T-Plant Fuel Pool Cooling System Pump not Qualified for Current Environmental Service Conditions.		✓		✓	
Hanford/PUREX HAN-4-09 Frequency of Fuel Pool Level Monitoring at PUREX.	✓			✓	
Hanford/PUREX HAN-4-10 Inaccessibility of Fuel for Inspection at PUREX.	✓			✓	
Hanford/PUREX HAN-4-11 The Four Fuel Baskets are Only Supported from One Rail at the PUREX Fuel Pool.	✓			✓	
Hanford/PUREX HAN-4-12 Fuel, Fuel Baskets, and Yoke Assemblies are Corroded at PUREX Fuel Pool.	✓			✓	

VULNERABILITY LISTING WITH ACTION PLAN DEVELOPMENT STATUS

	PRIORITY			STATUS	
Site/Facility **Vulnerability Number** **Brief Description**	Eight Major Facilities With Vulnerabilities	Less than One Year	Greater than One Year	Complete	Partial
Hanford/PUREX HAN-4-13 N-Reactor Fuel Elements, Both Intact and Broken, Located on Dissolver Cell Floors at PUREX.	✓			✓	
Hanford/PUREX HAN-4-14 No Path Forward for Ultimate Disposal of Fuel Stored at PUREX.	✓			✓	
Hanford/Site-wide HAN-S-1 Sitewide Classification of DOE Spent Nuclear Fuel (SNF) and Spent Nuclear Material (SNM) Materials as Hazardous Waste.	✓			✓	
Hanford/200 West Burial Grounds HAN-S-2 Classification of RINM is undetermined in the 200 Area Burial Grounds.	✓			✓	
INEL/Hot Fuels Exam. Facility at ANL-West ID.A.1.1 Lack of an approved SAR for Hot Fuels Examination Facility (HFEF).		✓		✓	
INEL/RSWF ID.A.2.1 Corrosion of in-ground carbon steel fuel storage containers at RSWF - ANL West.			✓	✓	
INEL/Zero Power Physics Reactor ID.A.5.1 Potential localized radioactive releases from cladding separation from fuels stored in ZPPR storage vault.			✓	✓	
INEL/Zero Power Physics Reactor ID.A.5.2 Lack of approved path forward for ultimate disposal of ZPPR fuel stored in ZPPR storage vault.			✓	✓	
INEL/Test Area North ID.E.1.1 Corrosion monitoring inadequate at TAN.		✓		✓	
INEL/Test Area North Pool ID.E.1.2 Lack of Leak Detection and Leak Trending of Test Area North (TAN) Storage Pool Water Inventory.			✓	✓	
INEL/Test Area North Pool ID.E.1.3 Long Term Ownership of TAN Pool and Disposition of Residual RINM Inventory.			✓	✓	
INEL/Test Area North/TAN 607-Basin ID.E.1.4 Potential Deficiency in Seismic Design of TAN 607 Basin.			✓	✓	