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**IX DISPOSITION PROJECT
PROJECT MANAGEMENT PLAN**

**Revision 0
December 2, 1994**

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SUMMARY

This Project Management Plan (PMP) establishes the organizational responsibilities, management control systems, and implementation processes for executing project activities of the Ion Exchange (IX) Disposition Project. The plan also documents the project baselines for schedules, cost, and technical information. An integrated project team from Westinghouse Hanford Company (WHC) and the Pacific Northwest Laboratory¹ (PNL) has been formed to conduct and manage project activities.

The project mission is to provide for elimination of environmental, safety, and health (ES&H) hazards associated with radiolytic hydrogen. Processes and systems are needed to prevent hydrogen production and buildup in the water treatment components temporarily stored in the K-Basins area. Such components include ion exchange modules (IXMs), ion exchange columns (IXCs), and cartridge filters (CFs). These components formerly were used in K-Basin water treatment systems where almost 7500 canisters of highly radioactive spent nuclear fuel are stored.

The project scope will

- provide the technical basis for continued activity involving these components. Such activity will include interim storage, mitigation, packaging, stabilization, staging, and transportation to the 200 Area for disposal of the low level waste (LLW) or long term storage of the transuranic (TRU) spent IXMs, CFs, and IXCs generated from past K-Basin operations.
- support reconfiguration of future IXMs to allow expeditious disposal and the continuance of K-Basin operations
- develop the required technical basis using characterization activities, technical studies, system designs and evaluations, and ES&H reviews.

¹

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ACRONYMS

ALARA	As Low As Reasonably Achievable
CF	Cartridge Filter
DOE	Department of Energy
DOE-RL	Department of Energy, Richland Field Office
ES&H	Environment, Safety, & Health,
FY	Fiscal Year
IXC	Ion Exchange Column
IXM	Ion Exchange Module
KE	K-Area East
KW	K-Area West
LLW	Low Level Waste
NEPA	National Environmental Policy Act
PMP	Project Management Plan
PNL	Pacific Northwest Laboratory
PTS	Performance Tracking System
QA	Quality Assurance
SNFP	Spent Nuclear Fuel Project
TPA	Tri-Party Agreement
TRU	Transuranic
USQ	Unreviewed Safety Question
WBS	Work Breakdown Structure
WHC	Westinghouse Hanford Company

DEFINITIONS

Long-Term Storage - Storage, primarily for TRU wastes, that is expected to be for period of years until the wastes can be disposed.

Mitigation - The temporary conditioning of an IXC, IXM, or CF and their containers to make them safe to handle and move. The most common mitigation method is expected to be a gas purge that will reduce accumulated hydrogen gas to a safe operating level.

Packaging - The use of various barriers to provide containment of the wastes and protection to the environment, allowing safer handling, transportation, and treatment.

Recovery Station - An engineered system that will provide for mitigation of IXCs and, possibly, IXMs. It may include a stabilization system in the future.

Stabilization - The permanent conditioning of an IXC, IXM or CF to make them safe for long-term storage and possibly for disposal. The preferred methods for stabilization have not been selected, but range from simply changing of vents on the container to complete destruction of the ion exchange resins and treatment of the residues.

Staging - The preparation of an IXM, IXC, or CF for a move from one location to another.

1.0 INTRODUCTION

1.1 BACKGROUND

Two spent nuclear fuel storage basins are located in the 100 Area of the Hanford Site, known as the 105-K East (KE) and 105 K-West (KW) Basins. Each basin holds approximately 1.1 million gallons of water used to cool and store almost 7500 canisters containing highly radioactive spent nuclear fuel. Many of these canisters are corroding thereby contaminating the basin water as it comes in contact with the radioactive materials.

In 1986, the filtered water configuration in the K-Basins was changed to include the use of demineralized water through an ion exchange (IX) system. This system originally used cartridge filters (CFs) and ion exchange columns (IXCs), but is now based on ion exchange modules (IXMs). The ion exchange media remove both radionuclide and minerals from the basin water. The original IXCs and CF were regularly disposed on in the 200 Area; however, issues have been raised recently about the safety of handling and transportation as a result of hydrogen generation from radiolysis within the ion exchange media. As a result, 17 IXMs, 60 IXCs, and 15 CFs contain significant radioactive material and remain in temporary storage awaiting disposal. The IXMs are located at the basins and in the 200W disposal area. The IXCs are located in the 183-KW Vault (formerly called the Chlorine Vault) and at the K-Basins. The CFs are in storage near the KE basins.

Several issues and concerns associated with the ion exchange systems wastes have been identified as requiring project activities:

- The need to continue removal of minerals and radionuclides from K-Basin storage water necessitates continued generation of radioactively loaded IXMs. The continued generation of IXMs results in an obligation to move the loaded IX materials from the K-Basins to disposal locations.
- Calculations indicate the loaded IXCs and, possibly, IXMs may have accumulated hydrogen to dangerous (explosive or flammable) levels. Sampling or mitigation methods will be provided to determine the hydrogen level and to remove the hydrogen as necessary. Such procedures will permit further waste management activities and movement of the IX materials to disposal or long-term storage.
- A total of 17 IXMs are awaiting resolution of the hydrogen accumulation concerns are stored at K-Basin and 11 at the 200 Area.
- The rules have changed governing the calculation of transuranic (TRU) concentration of wastes. As a result, many of the IXCs, CFs, and three of the IXMs can no longer be buried as Low-Level Waste (LLW). They will be handled as TRU waste, increasing the complexity of their management and requiring long-term storage until they can be disposed. The project must identify the path and requirements for such long-term storage.
- Grouting has stabilized 11 CFs. Potential hydrogen accumulation prevents moving them to more durable metal pallets and long-term storage locations. Four additional CFs are in as-generated conditions. They need to be packaged for long-term storage and shipped to a TRU storage area. Analysis and characterization activities are planned to resolve the concerns and identify future needs for handling and storage.
- Long-term storage of these ion exchange wastes may require their stabilization to prevent the accumulation of high levels of hydrogen. Identification, evaluation, design, and selection of a stabilization method are needed.

- IXC's have been temporarily stored in the 183-KW Vault. They have caused the area to be designated as a high radiation area, due to high dose rates, and as a safety concern because of unknown levels of hydrogen accumulation. Safety concerns must be resolved and these IXC's moved to the burial ground or to approved long-term storage.
- The certificate for the cask used to transport the IXC's to the burial ground has been placed on hold. Before other IXC's can be moved, a new shipping container must be identified or the issues resolved with the existing container.
- Transportation of the ion exchange materials will require resolution of the hydrogen accumulation issues before the materials can be transported to the disposal or long-term storage site.

In part because of the issues with the current ion exchange system at K-Basins, WHC has (independent of this project) begun additional studies to identify methods to upgrade or modify the IX system. Their goal is to reduce generation of problem wastes and to provide for control of exposures from the higher water contaminations expected during spent fuel and basin sludge handling and removal.

1.2 PROJECT OBJECTIVES

An integrated project team from WHC and PNL has been established, under the IX Disposition Project, to address issues and concerns listed previously.

Project objectives are to

- evaluate the buildup of radiolytic hydrogen in the loaded IXMs, IXC's, and CF's,
- provide methods for near-term mitigation of the IXMs and CF's temporarily placed into storage,
- provide a technical basis and methods for the safe retrieval and purging of loaded IXC's at K-Basins and the 183-KW Vault,
- develop, evaluate, and recommend alternatives for long-term stabilization of the IXC's, and
- develop, design and fabricate a mobile IX Recovery Station for purging of IXC's.

1.3 PROJECT SCOPE

The five IX project objectives are will be achieved in three specific phases. The first phase will provide methods for near-term mitigation of the loaded IXMs and CF's. Priority will be given to those components in the K-Basin building and to a technical basis for retrieval, purging, and long-term stabilization of the IXC's. Based upon system requirements developed in this initial phase, the second phase will comprise design and fabrication of a recovery station to purge the IXC's. The final phase will entail project support to actual IXC retrieval and purging operations. Until the activities in the first phase are completed, significant uncertainty exists in the scope of the second and third phases of the project. As the project progresses and technical aspects are better defined, a certain amount of replanning is expected to occur.

The IX Project Summary Work Breakdown Structure (WBS) (see Figure 1.1) identifies the project activities that have a detailed plan. The summary-level WBS tasks are listed below.

- 105 KE/KW IXM & CF Mitigation/Analysis
- IXC mitigation and stabilization Technical Basis
- Recovery Station Design, Fabrication, & Operation
- Environment, Safety, & Health
- Project Management

Brief descriptions of each summary-level WBS task are provided in this section. Appendix A provides a

detailed listing of activities by WBS. A more detailed task description is provided Appendix C.

105-KE/KW IXM & CF Mitigation - Working with WHC operations, the IX project will provide methods for the mitigation of loaded IXMs and CFs, temporarily located in the K-Basins, as well as loaded IXMs/CFs to be generated by continued operation of the water treatment system. Methods will be developed to first purge IXMs that potentially contain hydrogen in concentrations greater than 25 % of the lower flammable limits to safely reduce the hydrogen content and second, configure them to prevent further hydrogen accumulation. This task will develop models to predict the levels of hydrogen in IXMs and CFs. An assessment of mitigation needs for CFs will be provided.

IXC Recovery Technical Basis - This task will provide the technical basis for design and operation of a recovery station that will remove radiolytic hydrogen within the IXCs. The major needs are identification and elimination of hydrogen hazards during the retrieval of IXCs from their storage locations, reduction by purging of a suspected hydrogen buildup in the IXCs, and establishment of a method to control the amount of hydrogen in the IXCs. Shielding calculations will be developed to reconcile the measured dose rates from the IXCs with the estimated radionuclide inventory, to provide an upper limit on the hydrogen generation rate, and to help determine requirements for packaging, handling, storage, and disposal of the loaded IXCs. In order to support safety modeling calculations, hydrogen transport and deflagration and explosive characteristics will be determined. Impact resistance and structural evaluations of an IXC will be conducted to address safety issues during the loaded IXC retrieval process. Technical basis information will be consolidated into a system requirements document for use in the recovery station design. Final stabilization approaches will also be identified, and evaluated, and preferred methods selected.

Recovery Station Design, Fabrication, and Operation - The task will provide for the design and fabrication of the recovery station to be used to remove existing hydrogen accumulation in all IXCs. Given the high dose rates and potential hazards inherent in handling the IXCs, risk reduction and ALARA are major factors in developing a recovery approach. The approach envisions sampling and immediate purging, and possible reconfiguration. This may be done at each location with a mobile recovery station. The basis for the design will be finalized with the completion of the Recovery Technical Basis task; therefore, the station configuration at this time is highly conceptual. The station is expected to be an engineered system, consisting of sampling apparatus, an inert gas purge system, systems for measuring the gases and radioactivity levels within the IXCs, a greenhouse to provide radiological confinement, and shielding to limit worker exposure. For baseline purposes, it has been assumed that WHC will have responsibility for design and fabrication of the station, although that may be completed by an additional contractor. Testing, startup, and actual retrieval and purging operations are outside the scope of the project; however, the project will provide some technical support during acceptance and preoperational testing. Decisions regarding transportation and disposal of IX materials are not included in the project.

Environment, Safety, and Health - This task will provide the necessary support for addressing safety, ALARA, and emergency preparedness requirements of the IX Disposition Project. An ALARA assessment will be performed, consistent with K-Basin ALARA Management Plan requirements. NEPA and other environmental documentation will be reviewed for compliance with NEPA regulations. It is assumed no Environmental Assessment is needed. Permits required for mitigation operations are may include air permits from the State of Washington Department of Health. This task will also support efforts by the WHC Spent Nuclear Fuel Regulatory and Public Involvement organization to obtain the required permits.

Figure 1.1 Project Summary Work Breakdown Structure

Project Management - WHC has tasked PNL to manage project activities. Project management activities include overall management and administration of the project, including interfaces with SNFP and K-Basin Management; development of required project management documentation; project control functions (planning, scheduling, work authorization, reporting, and change control); and quality assurance management activities.

1.4 PROJECT SCHEDULE

Preliminary activities leading to the October 1994 project start were completed in Fiscal Year (FY) 1994. Project completion is planned for January 1997. The master schedule for the project is shown as Figure 1.2. Top-level controlled milestones for the project are:

Complete Phase I - (IXM Mitigation, IXC/CF Technical Basis)	August 1995
Complete Phase II - (IXC Recovery Station Fabrication)	August 1996
Complete Phase III - (IXC Retrieval & Purging Operations Support)	January 1997

1.5 COST ESTIMATE

The total estimated cost for the project is \$2.7 million. The cost breakdown for this project is shown in Table 1.1. The overall time-phased cost plan is shown in Figure 1.3. The total estimated cost, includes all required PNL management and technical support costs as well as an allowance for WHC design and fabrication of the recovery station. Costs for all other WHC K-Basin management, safety, quality assurance, compliance, operations and other required WHC staff to support IX Disposition Project activities are assumed to be borne under other K-Basin Project elements. They are not included in the IX Disposition Project cost. Actual IX system components mitigation operations, are outside the scope of the project. However, an allowance has been included for PNL technical support during demonstrations and initial operations.

Table 1.1 Project Cost Estimate

WBS Element	Project Cost (\$1000s)
105-KE/KW IXM & CF Mitigation	206
IXC Recovery Technical Basis	699
IXC Recovery Station Design/Fab/Operation	1121
Environment, Safety & Health	256
Project Management	
• Project Management, QA, Administration	268
• General Support	150
TOTAL	2700

Figure 1.2 Project Master Schedule (1 of 2)

Figure 1.2 Project Master Schedule (2 of 2)

Cumulative Budget in (\$1000s)

Figure 1.3 - Cost Plan for the IX Disposition Project

2.0 MANAGEMENT ORGANIZATION AND RESPONSIBILITIES

2.1 ORGANIZATION

A multidisciplinary integrated project team has been established to meet project objectives. The project team is comprised of staff and management from WHC and PNL. An organizational structure has been established that reflects the needs of the project. The goals are all of the project team members accept their project responsibilities, and are committed to working as a team to meet all project requirements and expectations.

The IX Disposition Project organization chart, shown in Figure 2.1, shows the project organization structure as well as major organizational interfaces. The IX Disposition Project is funded by and reports to the K-Basins Director, WHC. WHC will provide the engineering and operational resources required to support the project. PNL will provide project management, technical, and scientific support resources.

Within the IX project, management responsibilities are delegated to Task Leaders who will provide a focal point for planning, integrating, coordinating, and controlling the work at the level where budgets, schedules, and milestones will be maintained. The IX Project Manager is accountable for all aspects of project planning and performance, and is dependent upon the Task Leaders to coordinate with their respective technical interfaces. Task Leaders are responsible for recommending changes to scope, budgets, schedules, deliverables, and milestones and for initiating/reviewing change requests, as needed.

2.2 RESPONSIBILITIES

The responsibilities of project organizational functions are summarized below.

- **IX Disposition Project Manager** The Project Manager at PNL is ultimately responsible to ensure the project meets the stated objectives, scope, budget, and schedule. The Project Manager is supported by quality assurance and project management specialists, as needed. Project Manager responsibilities are to:
 - Establish and obtain from project participants the staff commitments for the project, and ensure that staff and management agree on roles and responsibilities for all participants.
 - Ensure requisite levels of quality, safety, and environmental compliance are applied by project participants.
 - Report baseline performance and ensure that necessary corrective actions are completed.
 - Manage project technical, cost, and schedule changes through systematic utilization of the change control process.
 - Coordinate the management of funding with the client, WHC.
 - Ensure the appropriate project management documentation is developed, approved, distributed, periodically reviewed, and updated, as necessary.

Figure 2.1 Project Organization Chart

- **ES&H** The Task Leader is responsible for the overall determination of project safety, ALARA, environmental, and emergency preparedness needs to ensure that all work is performed safely and within established criteria. Responsibilities include:
 - Ensure applicable safety standards and criteria are identified and evaluated.
 - Coordinate the preparation, review, and approval of environmental compliance documentation, including NEPA reviews and air quality permits.
 - Develop contingency plan and safety procedural input concerning emergency actions for mitigation activities.
 - Preparation of the project's ALARA assessment and to support waste minimization reviews with technical expertise.
- **Technical Support** The Technical Support Task Leader is responsible for the development of the technical basis. Specific responsibilities include:
 - Develop required functions and requirements documents for the technical basis.
 - Ensure technical basis assessments, evaluations, studies, and other laboratory activities are integrated and performed in a timely, high-quality manner.
 - Ensure technical subtask leaders prepare cost account plans, with specific scopes of work, clear responsibilities, resource-loaded schedules, and meaningful milestones.
- **Project Engineering & Integration**
 - Ensure the project's engineering, operation, safety, compliance, quality assurance, and project control work activities are properly integrated with K-Basin/SNFP activities.
 - Develop required design planning and requirements documentation with specific responsibility for the recovery station.
 - Ensure engineered systems/equipment are adequately specified, acquired, fabricated, and tested.
 - Relinquishing systems/equipment and procedures to K-Basins Engineering after successful testing.
 - Ensure detailed work instructions or procedures to perform operations activities at the 100-K area are properly developed and implemented.

3.0 PROJECT MANAGEMENT AND CONTROL

The project will be managed by WHC in accordance with the policies and guidelines defined in the WHC Management Guide, WHC-CM-2-5, *Management Control System*, as supplemented this PMP. The major management tasks are: 1) description of plans for implementing project activities; and 2) internal management control systems to administer the project.

3.1 BASELINE DEFINITION

The project baseline has been structured through the WBS shown in Figure 1.1, and detailed in Appendixes A and C. The project baseline is comprised of the following elements:

Technical: WBS Dictionary as shown in Appendix C.
Schedule: Project Master Schedule as shown in Figure 1.2.
Cost: Cost as summarized in Table 1.1, Figure 1.3 and detailed in Appendix B.

Due to significant uncertainties in the project scope, a number of assumptions were made in baselining the project. These factors present risks in achieving the schedule objectives. The schedule depends upon the successful interaction and integration of the project with other priority K-Basin activities. The schedule has been resource loaded, but not constrained by the availability of resources required to complete the work. The combination of uncertainty in the technical aspects and the limited availability of resources results in a high probability of changes in schedule, scope, and cost. These will be managed through change control, as necessary.

3.2 PROJECT MANAGEMENT DOCUMENTATION

Project management activities consist of organizing, planning, integrating, and coordinating the tasks that are included in the IX Disposition Project. The hierarchy of project management documentation used to manage the project is shown in Figure 3.1. This figure depicts, as well, representative technical plans and documents to be developed by the project. Documents important to the environment, safety, or quality will be given a corresponding approval designator of E, S, or Q (D for documents requiring DOE approval). Approval designator will be assigned to project documentation in accordance with WHC-CM-3-5, *Document Control and Records Management Manual*, Section 12.7, "Approval of Environmental, Safety, and Quality Affecting Documents."

3.3 SCHEDULE CONTROL

The Project Master Schedule is developed by WBS element and comprises an integrated schedule for the project. Detailed work plans and task plans are intended to support this Summary schedule. Supporting schedules have sufficient detail to manage and control activities. Routine meetings will be held to review and update the schedule. The IX project will integrate its schedule into the K Basin Summary Schedule for all 100 K Area activities.

3.4 COST CONTROL

Project cost and schedule control will be maintained as part of the overall SNFP project control system. This system is based on the WHC management control system as described in WHC-CM-2-5, *Management Control System Description*.

The WBS consists of cost accounts divided into work packages and task packages. The initial detailed project cost breakdown is shown in Appendix B. Incurred costs and financial commitments will be summarized

against this structure. Funding required by other project participants, will be provided through work orders in a timely manner. Actual costs will be tracked against original projections permitting identification of problems if they occur.

3.5 REPORTING AND REVIEWS

Weekly highlight reports and monthly progress reports will be prepared by the IX Project Manager. The weekly highlight report will include activities accomplished during the week, planned activities for the current week, future activities for the next 2 weeks, and any outstanding issues or concerns. The monthly progress report needed for the DOE reporting system will include the major accomplishments for the month, status against established milestones and/or deliverables, any major concerns, and the change request status. Cost status information for WHC project tasks will be received from WHC, consolidated with PNL status information, and integrated in a monthly project cost status report.

In addition to periodic written reports, project reviews will be conducted to ensure that work is progressing as planned. Monthly schedule status meetings will be held with all task managers to status all current and past-due activities to determine forecasted dates of completion and remaining durations. Quarterly project reviews will be held with the K-Basin Director.

3.6 CONFIGURATION CONTROL

Configuration control will be maintained for documents of record for the project. WHC controlled documents shall be issued per WHC-CM-4-2, QR 6.0, *Document Control* and WHC-CM-6-1, EP 1.12, *Supporting Documents*.

3.7 WORK CONTROL

Process equipment design, fabrication and installation will be controlled through work plans as specified in WHC-CM-6-1, *Standard Engineering Practices*.

All K Basin facility modifications will be controlled through work packages and the site job control system as specified in WHC-CM-1-8, *Work Management*.

3.8 PROCUREMENT

As needed, a pre-procurement plan will be prepared for any significant procurements.

3.9 PROJECT FILE

Project files will be maintained to store WHC documentation for the project. WHC will identify documents requiring a WHC SNFP indicator and place appropriate copies in the project file.

Figure 3.1 Project Management Documentation Hierarchy

4.0 QUALITY ASSURANCE REQUIREMENTS

The WHC-CM-4-2, *Quality Assurance Manual* identifies the requirements to be implemented for the WHC activities affecting the quality of items or services at the K-Basins. Activities affecting the quality of items or services performed by PNL are established by and shall be conducted in accordance with PNL-MA-70 *Quality Assurance Manual*, and appropriate *Procedures for Quality Assurance Program*.

A graded approach will be used as described in the respective quality assurance (QA) manuals. The PNL QA Plan for the project, prepared consistent with PNL requirements, will be submitted to WHC for review and concurrence. PNL will ensure that applicable QA and other requirements are transmitted to any subcontractor or other Hanford contractor performing work on the project. PNL should also require the subcontractor/contractor to prepare a QA plan applicable to the work activity. PNL will also develop and implement an assessment process to ensure the implementation of QA requirements.

APPENDIX A
WBS ACTIVITIES LISTING

IXBKP

K-BASINS IX DISPOSITION PROJECT
WBS Hierarchy

11-28-1994

SELECTION CRITERIA: All Data Included

WBS ID	LEVEL DESCRIPTION
Project Level ²	1
=> 1	2 K-Basins IX Disposition Project
> 1.1	3 105-KE/KW IXM & CF Mitigation/Analysis
> 1.1.1	4 IXM Mitigation
> 1.1.1.1	5 IXM 94-06 100-KE
> 1.1.1.1.2	6 K Basin Engineering Work Package 94-733
> 1.1.1.1.3	6 Write OPS Procedure
> 1.1.1.1.4	6 Deviation Approval
> 1.1.1.1.6	6 Estimate Inventory
> 1.1.1.1.7	6 HRDWR Installed H2 Estimates
> 1.1.1.1.8	6 Execute Deviated Procedure
> 1.1.1.1.9	6 Execute Work Package
> 1.1.1.1.11	6 Prep WP for Lifting & Storage
> 1.1.1.1.12	6 Cover Procurement
> 1.1.1.1.13	6 Move to Storage
> 1.1.1.2	5 IXM 94-03 100-KE
> 1.1.1.2.1	6 Complete Writing WP IXM
> 1.1.1.2.2	6 Write OPS Procedure
> 1.1.1.2.3	6 Write Deviation for IXM
> 1.1.1.2.4	6 Develop and Approve Purge Procedure
> 1.1.1.2.5	6 Purge & Sample IXM
> 1.1.1.2.6	6 Install Vents & Filter
> 1.1.1.3	5 IXM - 11 at 100-KE
> 1.1.1.3.1	6 Take Sample
> 1.1.1.3.2	6 Purge IXM
> 1.1.1.3.3	6 Take Sample
> 1.1.1.3.4	6 Move IXM KE-11
> 1.1.1.4	5 WMD IXM
> 1.1.1.4.1	6 Sample & Purge IXMs at WMD
> 1.1.1.5	5 IXM 94-02 at 100-KE
> 1.1.1.5.2	6 Purge IXM
> 1.1.1.5.3	6 Take Sample
> 1.1.1.5.4	6 Move IXM 94-02 to Storage
> 1.1.1.6	5 IXM 14 at 100-KE
> 1.1.1.6.2	6 Purge IXM
> 1.1.1.6.3	6 Take Sample
> 1.1.1.6.4	6 Move IXM KE 14 to Storage
> 1.1.1.7	5 H2 Migration Analysis for IXMs
> 1.1.1.7.1	6 Develop IXM Time Dependent Model

²Project level 1 refers to 1.4.1.3.2.2.02 of the site WBS.

IXBKP

K-BASINS IX DISPOSITION PROJECT
WBS Hierarchy

11-28-1994

SELECTION CRITERIA: All Data Included

WBS ID	LEVEL DESCRIPTION
→ 1.1.1.7.2	6 Tech Support of IXMs
→ 1.1.1.8	5 IXM Gas Sampling
→ 1.1.1.8.1	6 Develop IXM Sampling Plan, DQO, QAPP, &
→ 1.1.1.8.2	6 Sampling Equipment Set-up & Acceptance
→ 1.1.1.8.4	6 Sample IXM 94-03 Before & After Purge
→ 1.1.1.8.5	6 Data Review & Report IXM 94-03
→ 1.1.1.8.6	6 Sampling Equipment Set-up & Acceptance
→ 1.1.1.8.8	6 Sample IXM KE-11 Before & After Purge
→ 1.1.1.8.9	6 Data Review & Report IXM KE-11
→ 1.1.1.8.11	6 Sample IXM 94-06 Before & After Purge
→ 1.1.1.8.12	6 Data Review & Report IXM 94-06
→ 1.1.1.8.14	6 Sample IXM 9402 Before & After Purge
→ 1.1.1.8.15	6 Data Review & Report IXM 94-02
→ 1.1.1.8.17	6 Sample IXM KW-14 Before & After Purge
→ 1.1.1.8.18	6 Data Review & Report IXM KW-14
→ 1.1.1.8.19	6 Follow-on Sampling for all IXMs After Mo
→ 1.1.2	4 Cartridge Filter Technical Support
→ 1.1.2.1	5 Non-Grouted Cartridge Filters
→ 1.1.2.1.1	6 Determine Source Terms
→ 1.1.2.1.1.1	7 Determine Source Terms
→ 1.1.2.1.2	6 H2 Transport Analysis for Ungouted CFs
→ 1.1.2.1.2.1	7 Calc of H2 in Ecorock Container
→ 1.1.2.1.2.2	7 Assessment of Vent Ecorock Configuration
→ 1.1.2.2	6 Grouted Cartridge Filters
→ 1.1.2.2.1	6 H2 Transport Analysis for Grouted CFs
→ 1.1.2.2.1.1	7 H2 Transport Calculations
→ 1.1.2.2.2	6 Assessment H2 Accumulation
→ 1.1.2.2.2.1	7 Assessments of H2 Accumulation
→ 1.2	3 IXC Retrieval , Purging & Stabilization
→ 1.2.1	4 IXC Retrieval and Purging Technical Basin
→ 1.2.1.1	5 Technical Integration
→ 1.2.1.1.1	6 Establish Safety limits
→ 1.2.1.1.1.1	7 Establish Acceptable Safety Limits
→ 1.2.1.1.2	6 Retrieval Accident Analysis
→ 1.2.1.1.2.2	7 Retrieval Accident Analysis
→ 1.2.1.1.2.3	7 Retrieval Activities
→ 1.2.1.1.3	6 Outside Reviews
→ 1.2.1.1.3.1	7 Outside Reviews
→ 1.2.1.2	5 Radiation Analysis
→ 1.2.1.2.1	6 Development of Radiation Source Terms
→ 1.2.1.2.2	6 Radiation Doses IXC Burial Box

IXBKP

K-BASINS IX DISPOSITION PROJECT
WBS Hierarchy

11-28-1994

SELECTION CRITERIA: All Data Included

WBS ID	LEVEL DESCRIPTION
→ 1.2.1.2.3	6 H2 Generation Task
→ 1.2.1.3	5 H2 Transport Analysis
→ 1.2.1.3.1	6 Scope H2 Transport Study
→ 1.2.1.3.2	6 Assess H2 Transport Thu Filters & Resin
→ 1.2.1.3.3	6 Assess Bubble Entrapment Pre-Release
→ 1.2.1.3.4	6 Develop H2 time-Dependent IXC H2 Model
→ 1.2.1.4	5 Deflagration Analysis
→ 1.2.1.4.1	6 Realistic Deflagration Analysis
→ 1.2.1.5	5 IXC Structural Analysis
→ 1.2.1.5.1	6 Rupture Analysis
→ 1.2.1.5.1.1	7 Initial Rupture Model
→ 1.2.1.5.1.2	7 Final Rupture Analysis
→ 1.2.1.5.2	6 Assessment of Corrosion
→ 1.2.1.5.2.1	7 Assessment of Corrosion Effects on IXCs
→ 1.2.1.5.2.2	7 Draft Corrosion Evaluation Letter Report
→ 1.2.1.5.3	6 Evaluation of Impacts on IXCs
→ 1.2.1.5.3.1	7 Review of Other Drop Test Results
→ 1.2.1.6	5 Purge Method Development
→ 1.2.1.6.1	6 Develop Purge Method
→ 1.2.1.6.2	6 Draft Letter Report on Purge Method
→ 1.2.1.7	5 System Requirements Document
→ 1.2.1.7.1	6 Draft System Requirements Document
→ 1.2.1.7.2	6 Review of Draft Document
→ 1.2.1.7.3	6 Final Draft of Systems Requirements Doc
→ 1.2.2	4 IXC Stabilization Options Recommendation
→ 1.2.2.1	5 Transportation and Disposal Requirements
→ 1.2.2.1.1	6 Evaluation of Existing Packages
→ 1.2.2.1.2	6 Evaluate Acceptability of Existing Pack
→ 1.2.2.1.3	6 Evaluate Packaging Modification Needs
→ 1.2.2.2	5 Stabilization Options Identification
→ 1.2.2.2.1	6 Stabilization Options Identification
→ 1.2.2.3	5 Screening of Stabilization options
→ 1.2.2.3.1	6 Initial Evaluation of Stabilization Opti
→ 1.2.2.4	5 Detailed Descriptions of Primary Options
→ 1.2.2.4.1	6 Detailed Development & Description of Pr
→ 1.2.2.5	5 Eval & Recommend Stabilization Options
→ 1.2.2.5.2	6 Final Evaluation of Options
→ 1.3	3 Recovery Station Design/Fab & Operation
→ 1.3.1	4 Recovery Station Design/Fabrication
→ 1.3.1.1	5 Design Fab Recovery Station
→ 1.3.1.2	5 Technical Integration

IXBKP

K-BASINS IX DISPOSITION PROJECT
WBS Hierarchy

11-28-1994

SELECTION CRITERIA: All Data Included

WBS ID	LEVEL DESCRIPTION
——> 1.3.1.3	5 Outside Review of Recovery Station
——> 1.3.2	4 Radiation & Gas Measurement for Recovery
——> 1.3.2.1	5 Rad Detector Procurement
——> 1.3.2.2	5 Radiation Measurement Method Development
——> 1.3.2.3	5 Gas Sampling Equip Procurement
——> 1.3.2.4	5 Gas Sampling Method Development
——> 1.3.3	4 IXC Purging
——> 1.3.3.1	5 IXC Burial Box Sampling
——> 1.3.3.1.1	6 Sampling Plan and Procedures Development
——> 1.3.3.1.3	6 Set-Up and Sample IXC Vault & Container
——> 1.3.3.2	5 Procedures Development
——> 1.3.3.2.1	6 WHC Devel/Review/Approve Operating Proc
——> 1.3.3.3	5 IXC Purging
——> 1.3.3.3.1	6 Move Station to 105-KW
——> 1.3.3.3.2	6 Purge IXCs in 105-KW
——> 1.3.3.3.3	6 Move Station to 105-KE
——> 1.3.3.3.4	6 Purge IXCs in 105-KE
——> 1.3.3.3.5	6 Move Station to 183-KW
——> 1.3.3.3.6	6 Purge IXCs 183 KW
——> 1.4	3 ES&H
——> 1.4.1	4 Environmental Compliance
——> 1.4.2	4 ALARA Reviews
——> 1.4.3	4 Safety Evaluations
——> 1.4.4	4 Emergency Preparedness Planning
——> 1.5	3 Project Management
——> 1.5.1	4 General Support
——> 1.5.2	4 Management an Administration
——> 1.5.3	4 Quality Assurance
——> 1.5.4	4 Project Control

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APPENDIX B
WBS DICTIONARIES

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition ProjectDate: 11/28/94Project Number: 22696WBS Element Code⁴: 1WBS Element Title: IX Disposition ProjectRevision No: 0

Date: _____

Element Task Description

This description is the summary level WBS element for the elimination of environmental, safety, and health hazards associated with radiolytic hydrogen production and buildup in basin water treatment components used and temporarily stored in the 100 K Area. Ion exchange components include ion exchange modules (IXMs), ion exchange columns (IXCs) and cartridge filters (CFs). These components are used in the water treatment systems at the 100-K Basins, which cool and store almost 7500 canisters containing highly radioactive spent nuclear fuel.

The project scope includes 1) providing to K-Basins the technical basis for continued interim storage, staging, mitigation, packaging, stabilization, and transportation to the 200-W Area for disposal or long-term TRU waste storage, spent IXMs, CFs, and IXCs generated from past K-Basin operations and 2) supporting reconfiguration of future IX systems to allow expedited IXM disposal and uninterrupted K-Basin operations. The technical basis will be developed with characterization activities, technical studies, system designs and evaluations, and ES&H reviews.

*Deliverables:**N/A*

⁴Project level 1 refers to 1.4.1.3.2.2.02 of the site WBS.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.Date: 11/28/94Project Number: 22696WBS Element Code: 1.1WBS Element Title: 105-KE/KW IXM & CF Mitigation/AnalysisRevision No: 0Date:

Element Task Description

This effort includes reducing hydrogen concentrations in 5 IXMs to a safe level so they can be moved to storage/disposal. In addition to IXMs, 13 grouted and 5 ungrouted cartridge filters will be assessed to determine the hydrogen build-up and develop a general concept for mitigating hydrogen. Procedures based on sampled gas data will be developed to mitigate hydrogen in the IXMs. Four phases associated with this task: 1) developing safe procedures for off-lining and moving the IXMs to a staging area, 2) purging the IXMs stored in the staging area if applicable, 3) and developing and installing upgraded ventilation apparatus to stored IXMs if applicable. The ventilation scheme should be applicable to all future IXMs.

Currently, 13 spent CFs are stored at K Basins. These CFs have similar configurations as do IXMs, but do not have any vent holes. Therefore the hydrogen concentration levels for these CFs are expected to be higher than those for IXMs. The mitigation procedures for CFs are expected to be more complex than those for IXMs due to the absence of access port.

Deliverables:

Procedures to remove and vent IXMs, to move the 5 IXMs currently off-line to either storage or burial ground, and an assessment of general methods to reduce hydrogen concentrations to an acceptable limit in the 13 grouted cartridge filters.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.Date: 11/28/94Project Number: 22696WBS Element Code: 1.1.1WBS Element Title: IXM MitigationRevision No: 0Date:

Element Task Description

This effort includes reducing hydrogen concentrations in 5 IXMs to a safe level so they can be moved to storage/disposal. Procedures will be developed to mitigate hydrogen in the IXMs based on sampled gas data. Four phases are associated with this task: 1) developing safe procedures for off-lining and moving the IXMs to a staging area, 2) purging the IXMs stored in the staging area if applicable, 3) developing and installing upgraded ventilation apparatus to stored IXMs if applicable. The ventilation schemes should be applicable to all future IXMs.

Deliverables:

Procedures to remove and vent IXMs, and to move the 5 IXMs currently off-line to either interim storage or burial ground

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: <u>IX Disposition Project</u>	Date: <u>11/28/94</u>
Project Number: <u>22696</u>	WBS Element Code: <u>1.1.2</u>
WBS Element Title: <u>Cartridge Filter Technical Support</u>	
Revision No: <u>0</u>	Date: _____

Element Task Description

The scope of this summary task is to develop models to predict the hydrogen level in grouted and ungrouted CFs, as currently configured and under proposed new configurations for non-grouted CF units. It is anticipated that models will be developed with systems currently being designed and implemented, and that these models will be developed as requested by WHC engineers. Provide an assessment of the potential impacts of the hydrogen levels as determined from the above activity. The assessment will consider both generic alternatives for mitigation of the hydrogen and the actual needs to develop mitigation methods. Identification and selection of a mitigation method will be a potential follow-on activity, if such a need is identified by this activity.

Deliverables:

Letter report on mitigation needs.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.1.2.1

WBS Element Title: Non-Grouted Cartridge Filters

Revision No: 0

Date:

Element Task Description

The scope of this summary task is to develop models to predict the level of hydrogen in ungrouted CFs as under proposed new configurations. It is anticipated that models will be developed with systems currently being designed and implemented, as requested by WHC engineers. Provide an assessment of the potential impacts of the hydrogen levels, as determined from this activity.

Deliverables:

Letter report

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.1.2.1.1

WBS Element Title: Determine Source Terms

Revision No: 0

Date:

Element Task Description

This activity, which is part of another project, is providing the source terms for use in the hydrogen migration analysis activity. It is not managed by the project, but the project is dependent on the source term information to complete its activities. The costs for this activity are also not part of the project. It is being included only because the information is critical to IX project activities.

Deliverables:

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.1.2.1.2

WBS Element Title: H2 Transport Analysis for UngROUTED CFs

Revision No: 0

Date: _____

Element Task Description

The scope of this activity is to develop models to predict the level of hydrogen in ungrouted CFs, as currently configured and under proposed new configurations. It is anticipated that models will be developed with systems that are currently being designed and implemented, as requested by WHC engineers.

Deliverables:

The final product will consist of a draft report describing the models and their application to predict the level of hydrogen in ungrouted CFs. It is anticipated that intermediate reports to support on-going engineering activities will also be generated.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.1.2.2

WBS Element Title: Grouted Cartridge Filters

Revision No: 0

Date: _____

Element Task Description

The scope of this summary task is to utilize models developed to predict the level of hydrogen in grouted CF, as currently configured and under proposed new configurations, and provide an assessment of the potential impacts of the hydrogen levels. The assessment will consider both generic alternatives for mitigation of the hydrogen and the actual needs to develop mitigation methods.

Deliverables:

Draft report on hydrogen levels, and letter report on mitigation needs

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: **IX Disposition Project.**Date: **11/28/94**Project Number: 22696

WBS Element Code: 1.1.2.2.1

WBS Element Title: H2 Transport Analysis for Grouted CFsRevision No: 0Date:

Element Task Description

The scope of this activity is to utilize models developed to predict the level of hydrogen in grouted CF as currently configured and under proposed new configurations for non-grouted CF units. As with other hydrogen migration activities, the radiation source terms and corresponding hydrogen generation rate data will be needed, together with engineering descriptions of the grouted CFs, to allow the most meaning analysis within this activity.

Deliverables:

The final product will consist of a draft report describing the models and their application to predict the level of hydrogen in grouted CFs. The information in this activity will be combined with the information from the preceding activity and reported with the information from the IXC activity (WBS 1.2.1.3). It is anticipated that intermediate reports to support on-going engineering activities will also be generated.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.1.2.2.2

WBS Element Title: Assessment of H2 Accumulation for Grouted CFs

Revision No: 0

Date:

Element Task Description

This activity will provide an assessment of the potential impacts of the hydrogen levels as determined from the previous activity. The assessment will consider generic alternatives for mitigation of the hydrogen and the actual needs to develop mitigation methods. Identification and selection of a mitigation method will be a potential follow-on activity, if such a need is identified by this activity.

Deliverables:

Provide letter report on mitigation needs.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: **IX Disposition Project.**Date: **11/28/94**Project Number: **22696**

WBS Element Code: 1.2

WBS Element Title: **IXC Retrieval, Purging & Stabilization Technical Basis**Revision No: **0**

Date: _____

Element Task Description

This summary level task will provide the technical basis for design and operation of a recovery and stabilization station for IXC's K-Basin. The major needs are for the identification and elimination of hydrogen hazards during the retrieval of IXC from their storage locations to a staging area, the reduction of a hydrogen buildup in the columns by purging, and the establishment of a method to control the amount of hydrogen in the IXC's. The task is divided into three major activities: to develop the technical basis for the retrieval of the IXC's from their current storage locations, develop methods to purge the columns to remove the accumulated hydrogen, and define options to stabilize the columns to prevent future hydrogen accumulations.

Deliverables:***System requirements document***

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.Date: 11/28/94Project Number: 22696WBS Element Code: 1.2.1WBS Element Title: IXC Retrieval and Purging Technical BasisRevision No: 0

Date: _____

Element Task Description

This summary task addresses the identified concerns for the retrieval and hydrogen purging of the stored IXC's at 183-KW. The major concerns are a hydrogen deflagration with an associated release of radioactive plumes and/or particulates, the potential exposure of operating staff, and the subsequent political and public relations problems. The subtask is structured into technical areas of radiation analysis, hydrogen accumulation and transport, deflagration analysis, and IXC structural analysis, all directed to the safety of retrieval actions. After the IXC's are retrieved, they will be purged of hydrogen, then purged and characterized as deemed necessary in the DQO that will be issued. During the retrieval activities, the potential for operational radiation exposures needs evaluation. The activities under this task will be integrated during their performance, the results will be integrated into a systems requirement document for use in the design and operation of the recovery station.

Information from the technical basis will also be used for the design and evaluation of potential stabilization options in the next subtask. Specifically, the allowable operating envelope of concentration and volumes must to be determined. It is anticipated that limits will be established, based on the allowable hydrogen concentration within the columns and the total mass of hydrogen. If a hydrogen mass limit cannot be established, the 1% hydrogen level, based on the 4% lower flammability limit and a safety factor of four, will be the basis for safety evaluation.

*Deliverables:**Systems requirements document*

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WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 226 96

WBS Element Code: 1.2.1.1

WBS Element Title: Technical Integration

Revision No: 0

Date:

Element Task Description

This summary activity provides the technical guidance to the task activities and integrates the results from the activities into two reports. It is composed of two major activities establishing the safe storage and handling conditions for the IXC's and providing for a final safety analysis of the handling and purging activities.

Deliverables:

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: **IX Disposition Project.**Date: **11/28/94**Project Number: 22696

WBS Element Code: 1.2.1.1.1

WBS Element Title: Establish Safety LimitsRevision No: 0

Date: _____

Element Task Description

This activity will identify key safety limits for use in retrieval and the evaluation of options for retrieval and stabilization methods for the IXC's at 183-KW. The hydrogen concentration level has been established as a 1% concentration limit, based on the current lower level combustion concentration of 4% and a safety factor of 4. It is desirable to establish an upper limit for the amount of hydrogen at any concentration that can be contained within an IXC. This value will be determined, based on the IXC structural analysis activities. Additional limits will be identified where possible based on discussions with explosive experts.

The hydrogen concentration level will be used as the primary guide to safe operating limits until additional values can be established. This limit is currently established as noted previously.

Deliverables:

Additional limits will be identified in a draft letter report for review by other activities and program contributors and reviewers.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.2.1.1.2

WBS Element Title: Retrieval Accident Analysis

Revision No: 0

Date: _____

Element Task Description

This evaluation will consider a series of potential accidents including impacts, hydrogen reactions, and potential radiation exposures to the public and workers. It will review current documents such as the "Hydrogen Production in the K-Basin Ion Exchange Columns, Modules, and Cartridge Filters, and the Significance of that Production".

Deliverables:

Information from this activity will be provided in a letter report.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.2.1.2

WBS Element Title: Radiation Analysis

Revision No: 0

Date: _____

Element Task Description

The subtasks of this summary level task are divided into three activities: determination of the source term within the columns, determination of rate of hydrogen generation from radiolysis, and development of dose estimates for the retrieval activities.

Deliverables:

Technical letter reports.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.2.1.2.1

WBS Element Title: Develop Radiation Source Terms

Revision No: 0

Date: _____

Element Task Description

Existing data will be reviewed and used to calculate the range of radiation source terms present in the IXCs, and to characterize the radiation sources according to activity and intensity. The radiation source terms will be used to calculate gas generation rates, and will also be used in the development of source terms for accident analysis.

Deliverables:

A letter report will be provided to project staff.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: **IX Disposition Project.**Date: **11/28/94**Project Number: 22696

WBS Element Code: 1.2.1.2.2

WBS Element Title: Radiation Doses of IXC Burial BoxRevision No: 0

Date: _____

Element Task Description

Dose rates near the IXC burial box will be investigated for both a closed box and an open box. The Monte Carlo Neutron Photon (MCNP) computer code will be used to model dose rates. The dose model will include the contribution from *skyshine* when the burial box containing the loaded columns is opened. During the retrieval operation this calculation will use existing radiation dose measurements around the burial boxes as a starting point for estimating doses. The radiation source terms for the canisters will be based on data from the radiation measurements taken during canister remediation.

The information needed for this activity will be the dose measurements taken near the burial boxes, detailed information on the construction (radiation shielding) of the burial boxes and the vault in which they are stored, and descriptive information on operations and procedures involving the burial boxes.

Deliverable:

A letter report will be provided to project staff.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.Date: 11/28/94Project Number: 22696WBS Element Code: 1.2.1.2.3WBS Element Title: H2 Generation TaskRevision No: 0Date:

Element Task Description

This activity will provide a range of values for gas generation rates in the canisters, as well as an upper limit, or worst canister. The radionuclides of interest will be the major fission products (Cs-137 and Sr-90) and the major actinides (uranium, plutonium, and americium). The energy deposited to the resin will be estimated as a function of position in the bed. The G values will be taken from the Marusich paper, and will be used to produce a lower limit, upper limit, and best estimate of the gas generation rates.

Deliverable:

A letter report will be provided to project staff.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.Date: 11/28/94Project Number: 22696WBS Element Code: 1.2.1.3WBS Element Title: H2 Transport AnalysisRevision No: 0Date:

Element Task Description

The scope of this activity is to develop and improve models to predict the level of hydrogen in ion exchange materials and to apply those models to the IXC's. Specific issues to be addressed include: modeling transport of hydrogen gas bubbles and other gaseous species such as oxygen, nitrogen, and carbon dioxide through filters, modeling transport and entrapment of hydrogen and other gaseous species in wet resin material, and predicting the degree of wetness of the resin material contained in the IXMs and IXC's.

To complete this work, estimates of the radiation source, estimates of the G values for gases of interest, data describing current hydrogen levels, or levels of other gases, and descriptions of proposed engineering solutions need to be available. For example, the number, area, and geometry of new filters or other engineered features must be specified.

*Deliverables:**Letter Report describing probable bubble trapping and release mechanisms in IXC resin beads.**Letter Report describing steady-state hydrogen level in head space of IXC's in the storage orientation.**Draft report describing time-dependent model for hydrogen level in the head-space of IXC's. A spreadsheet to facilitate application to specific geometries will be made available, as requested.*

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.Date: 11/28/94Project Number: 22696

WBS Element Code: 1.2.1.4

WBS Element Title: Deflagration AnalysisRevision No: 0Date:

Element Task Description

This activity will model hydrogen deflagration in IXC. The input information such as hydrogen concentration level and ignition location need to be provided by other tasks. The modeling runs will be made to provide the pressure changes due to deflagration as a function of time. Both vertical and horizontal IXC configuration will be considered for different ignition locations. The analysis will be performed with BASSIM, a code which has been extensively used for modeling dynamic loads on Light Water Reactor (LWR) containments under severe accident scenario conditions.

*Deliverables:**Letter report*

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: **IX Disposition Project.**

Date: **11/28/94**

Project Number: 22696

WBS Element Code: 1.2.1.5

WBS Element Title: IXC Structural Analysis

Revision No: 0

Date: _____

Element Task Description

This summary level activity will provide structural analysis of the IXC and includes several activities: 1) rupture analysis to determine the rupture strength of IXC following hydrogen deflagration and establish the maximum hydrogen concentration limit allowable to maintain the IXC structure intact; 2) an assessment of corrosion effects on the IXCs; 3) an assessment of potential effects of dropping the IXCs during handling.

Deliverables:

Letter reports

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: **IX Disposition Project.**Date: **11/28/94**Project Number: 22696

WBS Element Code: 1.2.1.5.1

WBS Element Title: Rupture AnalysisRevision No: 0

Date: _____

Element Task Description

This activity will consist of two phases. The initial phase will be a hand calculation used in conjunction with a simplified finite element model of the ion exchange canister to determine failure stresses in the canister. This model can then be compared with pressures calculated from the initial deflagration analysis.

The second phase activity will be a more detailed examination utilizing information from the deflagration analysis activity. It will include a structural analysis to determine the possible level of damage to the IXC resulting from ignition of hydrogen inside the column. The structural analysis will be used to determine stress levels in the wall and joints of the structure subjected to the deflagration event. If the analysis shows that rupture of the vessel is possible, then this information can be used to bound the maximum concentration and hydrogen content allowable inside the canister.

The maximum hydrogen concentration allowable by the structural analysis will point to the need for hydrogen mitigation efforts.

Deliverables:

Initial analysis of IXC structural strength documented in memo to task manager. A letter report that contains a complete Dynamic Structural Evaluation.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.2.1.5.2

WBS Element Title: Assessment of Corrosion

Revision No: 0

Date: _____

Element Task Description

The assessment of corrosion in IXC's will be performed as follows:

1. Characterize the chemical environment inside the containers, by calculations using the known production rates of corrosives by irradiation of the stored resins. Attempt to determine whether the containers were properly stress-relieved after welding, to reduce residual stresses.
2. By consulting the literature, assess whether cracking or pitting mechanisms are likely to be active in the assumed chemical environment.

Deliverables:

A letter report.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.2.1.5.3

WBS Element Title: Evaluation of Impacts on IXC's

Revision No: 0

Date: _____

Element Task Description

This activity will investigate and report all relevant information to be found in previous drop tests of the IXC's and high-level waste HLW canisters. This data and information will be used to develop a handling recommendation. We are assuming at this time that drop tests performed at some previous date are of the same design as those of concern. We also are assuming that drop test data are of sufficient detail to allow accurate conclusions to be developed for the handling recommendation.

Results are needed from the corrosion analysis before this activity can be completed. It also requires an accurate set of canister prints and the drop test reports.

Deliverables:

Complete draft report including special handling requirements.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.2.1.6

WBS Element Title: Purge Method Development

Revision No: 0

Date: _____

Element Task Description

This task is the development of a safe method to purge retrieved IXC's of hydrogen to a safe limit.

Deliverables:

IXC purge method

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.Date: 11/28/94Project Number: 22696WBS Element Code: 1.2.1.7WBS Element Title: System Requirements DocumentRevision No: 0Date:

Element Task Description

This activity will incorporate all of the technical bases and the results of evaluation of stabilization alternatives into a systems requirement document. It will provide a technical perspective to each step in the retrieval, purging, and stabilization operational activities. An initial draft of the report will be prepared with contribution from each of the task activities. It will provide recommendations for the resolution of conflicts between various requirements, such as monitoring to minimize risks due to hydrogen reactions and avoiding radiation exposure by operating staff.

The basic report will be prepared, but, because of time constraints, must limit the number of trade-offs considered and evaluated. The initial draft will be reviewed by project staff and other interested parties and will then be provided to WHC.

*Deliverables:**Information provided as a draft letter report. It will be subsequently published as a PNL topical report.*

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition ProjectDate: 11/28/94Project Number: 22696

WBS Element Code: 1.2.2

WBS Element Title: IXC Stabilization Options RecommendationRevision No: 0

Date: _____

Element Task Description

This summary level task will select a stabilization method for the IXC's to eliminate future concerns about hydrogen buildup. The subtask has been set up with a series of activities that will first identify likely requirements for transportation and disposal of the IXC's; a broad range of options will be identified and screened to select six options for a more detailed analysis and evaluation. The six options must be defined in sufficient detail so that they can be evaluated. The detailed evaluation will be completed using a system approach with consideration of future activities including storage, transportation, and disposal in addition to the conditions for stabilization operations that are being weighted for the initial screening. The establishment of the transportation and disposal requirements for the IXC's will provide one of the bases for the final evaluation of the stabilization options.

*Deliverables:**Letter report on stabilization options*

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.2.2.1

WBS Element Title: Transportation and Disposal Requirements

Revision No: 0

Date: _____

Element Task Description

This activity addresses the issues and potential resolutions associated with packaging and transportation of ion exchange columns generated at the 105-KE/KW. The activity will address packaging and transportation of both TRU and LLW IXC's. The activity will involve evacuation of existing packages, acceptability of existing packages, and identification of gaps with respect to waste acceptance criteria.

Deliverables:

A letter report.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.Date: 11/28/94Project Number: 22696WBS Element Code: 1.2.2.2WBS Element Title: Stabilization Option IdentificationRevision No: 0Date:

Element Task Description

This activity identified 28 general options for the stabilization of the IXC's. These activities focused on four general approaches: 1) temporary stabilization until permanent facilities are constructed on the Hanford site, 2) permanent stabilization as part of the current processing activities, 3) development of sufficient data that show the columns do not require stabilization, and 4) the treatment of the resins so that the bulk of the material could be treated as LLW and any residual concentrated activity sent to the HLW tanks or stored for future treatment.

Deliverables:

This activity was completed in FY-94 with the completion of a draft report.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.2.2.3

WBS Element Title: Screening of Stabilization Options

Revision No: 0

Date: _____

Element Task Description

The options identified will be screened to reduce the number from 28 to about 6, selecting the better options for each of the general approaches. Individual rating from two different evaluators will be used in the screening. The selected options from this activity will be further described and developed in WBS 1.2.2.4.

Deliverables:

A letter report.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.2.2.4

WBS Element Title: Detailed Descriptions of Primary Options

Revision No: 0

Date: _____

Element Task Description

This activity will take the selected activities from WBS 1.2.2.3 and further describe them. It will provide an early engineering description of the anticipated processes, flow rates, and characteristics of the processes and final stabilized waste forms. This information will be used by the WBS 1.2.2.5 activity to evaluate the options.

Deliverables:

A letter report.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.2.2.5

WBS Element Title: Eval & Recommend Stabilization Options

Revision No: 0

Date: _____

Element Task Description

The options described in 1.2.2.4 will be evaluated based on criteria established by this activity and the selected option recommended for stabilization of the K-basin IXCs. The criteria are expected to represent total system concerns and behavior. A series of reviews will be held, first to select the criteria, then to develop individual evaluations and resolve major differences. With the final resolution of differences, the selection will be made.

Deliverables:

A letter report

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: **IX Disposition Project.**Date: **11/28/94**Project Number: 22696

WBS Element Code: 1.3

WBS Element Title: Recovery Station Design/Fab & OperationRevision No: 0

Date: _____

Element Task Description

This summary level task includes the design, fabrication, and operation of the recovery station for the IXC's with potential application to the IXMs. This is a WHC task and PNL is providing technical support to the design activities. Specifically PNL is providing recommendations, procurement, and calibration of equipment for radiation and gas measurements of the IXC's.

The station will consist of sampling apparatus, inert gas purge system, and shielding to limit worker exposure, all within a radiological confinement. Each component of the IX recovery station will be designed in a modular fashion so that it can be operated and repaired independent of other components. However, all of components will be assembled in the context of an integrated system that functions as a single hydrogen mitigation and stabilization unit.

*Deliverables:**Recovery Station, purged IXC's*

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.Date: 11/28/94Project Number: 22696WBS Element Code: 1.3.1WBS Element Title: Recovery Station Design/FabricationRevision No: 0Date:

Element Task Description

This task is to design and fabricate of the recovery station, which will consist of sampling apparatus, inert gas purge system, and shielding to limit worker exposure, all within a radiological confinement. Each component of the IX recovery station will be designed in a modular fashion, so it can be operated and repaired independently of other components. However, all of the components will be assembled in the context of an integrated system that functions as a single hydrogen mitigation and stabilization unit.

*Deliverables:**Recovery station*

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: **IX Disposition Project.**Date: **11/28/94**Project Number: 22696

WBS Element Code: 1.3.2

WBS Element Title: Radiation & Gas Measurement for Recovery StationRevision No: 0

Date: _____

Element Task Description

The recovery station will provide the mechanical system to purge the hydrogen from the column. The determination of when the hydrogen has been removed and the measurement of the actual radioactivity level within a canister are needed for future handling and disposal activities. The characterization of the IXC's while they are in a controlled condition provides the ideal time for these measurements. This activity will provide both the radiation and gas measurement systems to allow characterization of the columns.

Hydrogen concentrations will be measured at several different steps in the operation of the IXC recovery station. The applications of the measurements fall into two general categories: operational safety and in-line monitoring. The operational safety measurements are intended to determine the possibility of encountering a potentially explosive concentration during a specific task, and thus determine the need for additional precautions before performing the task.

*Deliverables:**Radiation and gas detector for IX Disposition station.*

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.3.3

WBS Element Title: IXC Purging

Revision No: 0

Date: _____

Element Task Description

This summary level task includes the work necessary to purge IXC's of hydrogen to a safe level.

Deliverables:

Purged IXC's

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.3.3.1

WBS Element Title: IXC Burial Box Sampling

Revision No: 0

Date: _____

Element Task Description

This task includes the work necessary to sample the hydrogen concentrations in the IXC burial box. Included in this task are all the necessary procedures and reports needed to sample.

Deliverables:

A letter report.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.3.3.2

WBS Element Title: Procedures Development

Revision No: 0

Date:

Element Task Description

This task is for the development of purge procedures to purge IXC's in the recovery station.

Deliverables:

Recovery station purging procedures

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.3.3.3

WBS Element Title: IXC Purging

Revision No: 0

Date: _____

Element Task Description

This task includes the purging of the IXC's in the recovery station.

Deliverables:

Purged IXC's.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.

Date: 11/28/94

Project Number: 22696

WBS Element Code: 1.4

WBS Element Title: Environmental Health and Safety

Revision No: 0

Date: _____

Task Description:

Provide environmental compliance support and evaluations, as necessary to initiate activities for each phase of the IX Program, including sampling, purging, retrieval, stabilization, and disposal. .

It is assumed that WHC will develop the environmental documentation (that may include air permits, NEA, and RCRA compliance documentation) for input to Department of Energy (DOE) and Washington Department of Health (WDOH) with input and support from PNL. The PNL environmental compliance support typically will be based on activities and tasks provided in the scope of work designated in the IX Project Management Plan. The support will entail written reports, memos, and recommendations to WHC, as needed, to ensure adequate environmental compliance is met for the project. Note that the ultimate decision authority regarding implementation of PNL recommendations is WHC management. Overall environmental compliance of WHC K-Basins operations is the responsibility of WHC line management with support from the WHC environmental services organizations.

Deliverables:

The deliverables include reports and input to support and inform the WHC environmental staff of activities and status of the K-Basin IX Projects that may require environmental compliance documentation.

WORK BREAKDOWN STRUCTURE DICTIONARY

Project Title: IX Disposition Project.Date: 11/28/94Project Number: 22696

WBS Element Code: 1.5

WBS Element Title: Project ManagementRevision No: 0

Date: _____

Element Task Description

This task includes planning, coordination, and control of the activities associated with the IX Disposition Project. The task includes preparing and issuing documents such as Project Management Plan, Functions and Requirements and Quality Assurance Plan. The task also includes managing activities, costs and schedules and maintaining liaison with WHC. Project progress reports will be prepared that contain descriptions of technical progress, the schedule status, and expenditure information for WHC.

*Deliverables:**Project Management Plan, Quality Assurance Plan, Functions and Requirements, Project Status Reports*