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LETTER REPORT

Reactor and Nuclear Systems Division

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FY 2012 Year-End Status of Standardized Canisters and Feasibility of Direct Disposal of Dual Purpose Canisters

1. INTRODUCTION

The Department of Energy Office of Nuclear Energy (DOE)-NE Fuel Cycle Technology Program Used Fuel Disposition Campaign initiated activities in mid-FY 2012 related to (1) developing a canister/cask system to address storage, transportation and disposition (disposal) issues and (2) developing repository concepts that can directly dispose of existing dual purpose canisters, represent opportunities for better integration of a storage, transportation, and disposal waste management system. These two multi-laboratory activities are consistent with the following Fuel Cycle Technologies Program objectives:*

In the near term:

- *Address Blue Ribbon Commission on America's Nuclear Future recommendations*
- *Partner with industry to develop and demonstrate integrated solutions for storage of used nuclear fuel*

In the medium term:

- *Partner with industry to deploy an integrated solution for the extended storage of used nuclear fuel*
- *Develop the scientific basis for multiple disposal options for used nuclear fuel and high-level waste*

Further, these activities are consistent with the Blue Ribbon Commission (BRC) for America's Nuclear Future, suggestion in its final report to the Secretary of Energy to begin, *"Working with nuclear utilities, the nuclear industry, and other stakeholders to promote the better integration of storage into the waste management system, including standardization of dry cask storage systems,"* as well as a recommendation from the Nuclear Energy Institute to "*strive to dispose of the existing canisters before designing a new standardized canister."*

The R&D necessary to support the development of a standardized canister system and to evaluate the feasibility of direct disposal of existing dual purpose canisters is a multi-year, multi-national laboratory effort. The FY 2012 tasks for this work included the following:

- Writing the *Implementation Plan for the Development and Licensing of Standardized Transportation, Aging, and Disposal Canisters and the Feasibility of Direct Disposal of Dual Purpose Canisters, FCRD-UFD-2012-000106*
- Developing the *Preliminary Used Fuel Management System Concept of Operations Including Options for Standardized Transportation, Aging, and Disposal Canisters, and Direct Disposal of Dual Purpose Canisters FCRD-UFD-2012-000155*
- Developing the *Assumptions for Evaluating Feasibility of Direct Geologic Disposal of Existing Dual-Purpose Canisters*, FCRD-UFD-2012-000352
- Coordination with the CX Systems Architecture and Repository Design Concepts and Thermal Load Management work areas that interface with standardized canisters development and feasibility of direct disposal of dual purpose canisters work.

*Fuel Cycle Technologies Program Mission and Objectives, February 2012.

These tasks are described in more detail below:

2. IMPLEMENTATION PLAN FOR THE DEVELOPMENT AND LICENSING OF STANDARDIZED TRANSPORTATION, AGING, AND DISPOSAL CANISTERS AND THE FEASIBILITY OF DIRECT DISPOSAL OF DUAL PURPOSE CANISTERS, FCRD-UFD-2012-000106

The Implementation Plan describes approaches for developing and licensing standardized transportation, aging, and disposal canisters and for examining the feasibility of direct disposal of existing, loaded canisters. The implementation plan is anticipated to be a living document that will be revised, as needed, to incorporate input from other organizations, such as industry, national laboratories, and the Nuclear Regulatory Commission, as well as changes to national policy positions. The implementation plan ensures that future development and design of standardized canister-based systems be capable of obtaining NRC Certificate(s) of Compliance (CoC) in accordance with 10 CFR Part 71 and 10 CFR Part 72, and also ensures the development of supporting analyses to address aging and disposal at a future repository site. Finally, where applicable, the plan addresses its scope relative to other DOE Used Fuel Disposition Campaign (UFDC) planning activities.

The scope of this plan includes the following:

1. Planning and implementing the development and licensing of a standardized cask system, similar in concept to the Transportation Aging and Disposal (TAD) canister system developed for the Yucca Mountain (YM) Project

2. Feasibility of direct disposal of existing used nuclear fuel (UNF) storage-only and multi-purpose storage and transportation canisters that have been and are being loaded by nuclear utilities, including transportation of existing storage-only casks.

This scope spans the technical and regulatory issues of storage, transportation, and disposal, but is limited to commercial UNF.

The strategy and approach for developing a standardized canister system has evolved since the plan was issued in May 2012. It is expected that the plan will be updated in FY 2013 to reflect the evolving strategy.

3. PRELIMINARY USED FUEL MANAGEMENT SYSTEM CONCEPT OF OPERATIONS INCLUDING OPTIONS FOR STANDARDIZED TRANSPORTATION, AGING, AND DISPOSAL CANISTERS, AND DIRECT DISPOSAL OF DUAL PURPOSE CANISTERS FCRD-UFD-2012-000155

The Preliminary Used Fuel Management System Concept of Operations describes the key systems, operations, and parameters necessary to evaluate:

(1) a reference used nuclear fuel management system to provide a basis for comparison,

(2) a used nuclear fuel management system concept that includes the implementation of a Standardized Transportable, Aging, and Disposal Canister system, and

(3) a used nuclear fuel management system concept that includes the direct disposal of large, existing dual purpose canisters.

The Concept of Operations provides continuity and consistency in the development and analysis of the various elements of a hypothetical integrated used fuel management system and can serve as a framework around which related systems analyses are developed. These systems analyses, in turn, can provide guidance in developing design concepts for a Standardized Transportation, Aging, and Disposal canister system and its transportation and aging modes, as well as related design considerations for the transfer and handling facilities at a Consolidated Storage Facility, and a geologic repository surface facility and subsurface facility, and possibly an on-site transfer and storage system. The Concept of Operations helps ensure that system evaluation results in a waste management system in which each element is designed and integrated for the benefit of the overall system.

Scenarios and associated sensitivity studies will be developed for the reference system, a waste management system concept that includes the use of a Standardized Transportation, Aging, and Disposal Canister System, and a system concept that includes the direct disposal of large exiting dual purpose canisters as part of the Systems Architecture work being conducted by the Used Fuel Disposition Campaign. This work will provide supporting data for a decision on whether to implement a standardized canister in a future used fuel management system.

The Concept of Operations describes an integrated used fuel management system concept that accounts for the following major system components:

- Used Fuel Management at Utilities
- Used Fuel Acceptance and Transportation
- Used Fuel Management at one or more Consolidated Storage Facilities
- Used Fuel Management at a Repository

The system concepts described for used fuel acceptance and transportation, consolidated storage facilities, and a repository are intended to be part of an overall waste management system that is flexible and can adapt to future changes. It is expected that *The Preliminary Used Fuel Management System Concept of Operations* will be revised in FY 2013 based on input from DOE's industry contractors and ongoing input from systems architecture studies.

4. ASSUMPTIONS FOR EVALUATING FEASIBILITY OF DIRECT GEOLOGIC DISPOSAL OF EXISTING DUAL-PURPOSE CANISTERS, FCRD-UFD-2012-000352

Assumptions for Evaluating Feasibility of Direct Geologic Disposal of Existing Dual-Purpose Canisters, FCRD-UFD-2012-000352 (Miller et. al, 2012) documents the initial Scoping and Assumptions phase, as described in the multi-year plan covering the feasibility study (Howard and Scaglione et al. 2012, Section 3). The report provides background on the current status of dual purpose canisters and single-use canisters and defines the assumptions that will be used throughout the study, describing technical, regulatory, and administrative constraints. These overarching assumptions were developed from input representing various stakeholders. The next phase (to be conducted in FY 2013) will identify specific disposal concepts for evaluation, and establish direction for supporting generic research and development (R&D), and disposal concept development activities. Preliminary planning for the FY 2013 activities associated with the feasibility of the direct disposal of dual purpose canisters is included as Attachment 1.

5. COORDINATION WITH THE CX SYSTEMS ARCHITECTURE AND REPOSITORY DESIGN CONCEPTS AND THERMAL LOAD MANAGEMENT WORK AREAS

Activities associated with the development of standardized canisters and the feasibility of the direct disposal of dual purpose canisters are being coordinated with ongoing tasks in the CX Systems Architecture and Repository Design Concepts and Thermal Load Management work areas. These coordination activities are broadly described in Sections 2.4 and 3 of the *Implementation Plan for the Development and Licensing of Standardized Transportation, Aging, and Disposal Canisters and the Feasibility of Direct Disposal of Dual Purpose Canisters*, FCRD-UFD-2012-000106.

Direct disposal of the large dry storage canisters currently used by the commercial nuclear power industry is beyond current domestic and international capabilities (Hardin et al. 2012). The large capacities of loaded canisters could require significant surface decay storage duration, and still produce relatively high disposal package surface temperatures in the repository. Higher temperatures may limit the choice of geologic disposal media or may require ventilated, open-drift emplacement. Hardin et al. 2012 documents the UFD Campaign's initial investigations into higher temperature repository design concepts that could accommodate larger waste packages. Open modes offer the possibility of emplacing larger waste packages containing more spent nuclear fuel (SNF), while meeting repository temperature limits. Work performed in 2011 showed that small waste packages (e.g., 4 PWR) would be needed for disposal concepts such as the crystalline rock or clay/shale concepts proposed for Sweden and France, respectively. Open emplacement modes could help facilitate direct disposal of dual-purpose canisters (DPCs). The work on open emplacement modes documented in Hardin et. al. 2012 represents the starting point for repository concept that would accommodate the direct disposal of dual purpose canisters.

The principal alternative to direct disposal of DPCs is re-packaging of UNF into smaller canisters for disposal. Re-packaging of UNF from larger DPCs into smaller canisters for disposal would: (1) decrease surface decay storage duration prior to disposal; (2) avoid developing facilities to handle large canisters at a repository; (3) avoid long-distance transport for older UNF and canisters; and (4) avoid the potential need to re-fit DPCs, for example, to add additional criticality control measures. . The Standardized Canister Team is investigating repackaging concepts in conjunction with the Systems Architecture and Repository Design Concepts Teams. An example of a preliminary concept is summarized in Attachment 2. Additional details and updates to this facility concept will be presented in updates to the Preliminary Used Fuel Management SystemConcept of Operations document and system architecture studies.

6. REFERENCES

Hardin, E., J. A. Blink, H. R. Greenberg, M. Sutton, M. Fratoni, J. T. Carter, M. Dupont and R. Howard. 2012. *Disposal Concepts/Thermal Load Management (FY11/12 Summary Report)*. FCRD-UFD-2012-00219 Rev. 0. Idaho Falls, ID: U.S. Department of Energy Fuel Cycle Technology Program, Used Fuel Disposition Campaign.

Howard R., J. M. Scaglione, J. C. Wagner, E. Hardin and W. M. Nutt. 2012. *Implementation Plan for the Development and Licensing of Standardized Transportation, Aging, and Disposal Canisters and the Feasibility of Direct disposal of Dual Purpose Canisters*. FCRD-UFD-2012-000106. Idaho Falls, ID: U.S. Department of Energy Fuel Cycle Technology Program, Used Fuel Disposition Campaign.

Howard, R., and W. M. Nutt. 2012. *Preliminary Used Fuel Management System Concept of Operations Including Options for Standardized Transportation, Aging, and Disposal Canisters, and Direct*

Disposal of Dual Purpose Canisters. FCRD-UFD-2012-000155. Idaho Falls, ID: U.S. Department of Energy Fuel Cycle Technology Program, Used Fuel Disposition Campaign.

Miller, A., R. Rechard, E. Hardin, and R. Howard. 2012. *Assumptions for Evaluating Feasibility of Direct Geologic Disposal of Existing Dual-Purpose Canisters*, FCRD-UFD-2012-000352. Idaho Falls, ID: U.S. Department of Energy Fuel Cycle Technology Program, Used Fuel Disposition Campaign.

Attachment 1
Draft FY13 Work Plan - Dual-Purpose Canister Direct Disposal Feasibility Evaluation
(E. Hardin)

Objectives
Continue assessing the feasibility of direct disposal of existing UNF storage-only and dual-purpose (storage and transportation) canisters that have been and are being loaded by nuclear utilities, including transportation of existing storage-only casks initiated in FY 2012; as described in *Implementation Plan for the Development and Licensing of Standardized Transportation, Aging, and Disposal Canisters and the Feasibility of Direct Disposal of Dual Purpose Canisters*, FCRD-UFD-2012-000106.

Scope
The planned steps for producing the M2 deliverable, "Preliminary Report on DPC Disposal Alternatives," are described in the work plan cited above and summarized below.

1. Survey of Available Technologies – Consider options in the following areas: hoisting and conveyance, underground access (shaft vs. ramp), DPC packaging (overpacks), excavation and ground support, heat removal, closure, and other technologies. This effort will build on previous catalogs (e.g., Hardin et al. 2011).

2. Media Specific Alternative DPC Disposal Concepts – Convene a working group of project participants and develop a list of disposal concepts for further evaluation. Specify the DPC characteristics, geologic setting, and Concept of Operations for each. Describe the key enabling technologies (see survey above). Use a systematic framework for concept selection that addresses physical limits on natural and engineered materials, and enclosed and open emplacement modes.

3. Logistics Simulation of DPC Aging, Selection, Transport and Disposal – Analyze simple cases to quantify the potential benefits from direct DPC disposal in terms of cost, schedule, worker dose, and other measures. Generate representative cases for further analysis that include a simulated history of DPC deliveries to a repository, and the age, burnup, and heat output of each canister.

4. Scoping Thermal Analysis – Perform simulations of the media-specific disposal concepts using representative and bounding DPC characteristics (dimensions, heat output, etc.). Assess uncertainty in thermal analyses and identify cases or processes where more detailed numerical simulations are needed.

5. Performance Allocation for Engineered and Natural Barriers Including Criticality – Describe the safety strategy for each disposal concept, identifying the natural and engineered barriers and their functions. Perform scoping criticality analyses to evaluate how each DPC disposal concept will disposition postclosure in-package criticality related features, events and processes (FEPs).

6. Develop FEP Crosswalks and PA Scenarios for Disposal Concepts – This activity will plan the performance assessment models for media-specific alternative DPC disposal concepts, including which FEPs are to be included and excluded (with rationale), and identifying the scenarios (e.g., nominal including. seismic, human intrusion, etc.) The plan will specify software and data that will be used, results to be calculated, and the analysis and presentation of those results.

7. Action Plans for Key Performance and Engineering Issues – Obtain consensus among the project participants on a list of key regulatory and engineering issues, for each alternative DPC disposal concept. For each issue develop an action plan that describes the issue, a pragmatic approach to

resolution, resources needed, and how the possible outcomes would impact a decision to proceed with DPC direct disposal.

8. Preliminary Report on DPC Disposal Alternatives – Summarize all of the activities described above in a M2 milestone report, and perform a peer review in accordance with the FCT QA program (QRL 3 for pre-conceptual design-related activities).

The above activities will be conducted in conformance to the assumptions document (Miller et al. 2012, in review). Each of these activities will be documented in a lower-level deliverable that is assigned to the lead organization (see tables below).

Assumptions and Prerequisites
None

Activities

Descriptions	ANL	LLNL	ORNL	SNL	SRNL
1. Survey of Available Technologies		√	Lead 31Jan	√	√
2. Media Specific Alternative DPC Disposal Concepts	√	√	√	Lead 31Jan	√
3. Logistics Simulation of DPC Aging, Selection, Transport and Disposal	Lead 01Mar			√	
4. Scoping Thermal Analysis		Lead 30Jun		√	
5. Performance Allocation for Engineered and Natural Barriers Including Criticality			Lead 28Feb & 30Apr	√	
6. Develop FEP Crosswalks and PA Scenarios for Alternative DPC Disposal Concepts				Lead 28Jun	
7. Action Plans for Key Performance and Engineering Issues	√	√	√	√	Lead 30Jun
8. Preliminary Report on DPC Disposal Alternatives	√	√	√	Lead 30Aug	√

Milestones

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
ANL												
M4: Letter report: Logistics Simulation of DPC Aging, Selection, Transport and Disposal							12 Apr					
LLNL												
M4: Letter report: Scoping Thermal Analysis of Alternative DPC Disposal Concepts									30 Jun			
ORNL												
M4: Letter report: Survey of Available Technologies				31 Jan								
M4: Letter report: Performance Allocation for Engineered and Natural Barriers						15 Mar						
M4: Postclosure Criticality Scoping Analysis for Alternative DPC Disposal Concepts							30 Apr					
SNL												
M4: Letter report: Media-Specific Alternative DPC Disposal Concepts					28 Feb							
M4: FEP Crosswalks and PA Scenarios for Alternative DPC Disposal Concepts									28 Jun			
M2: Preliminary Report on DPC Disposal Alternatives											30 Aug	
SRNL												
M4: Letter report: Action Plans for Key Performance and Engineering Issues for DPC Disposal									28 Jun			

Budget

Activity	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	FY
ANL													**50**
Support concept development, action plans, and review of M2 report				5	5	5	5	5					25
Logistics simulation					5	15	5						25
LLNL													**150**
Support concept development, action plans, and review of M2 report		5	5	10	10	10	10	10	10	5	5		80
Thermal analysis						10	15	20	15	10			70
ORNL													**250**
Support concept development, action plans, and review of M2 report		5	5	5	5	5	5	5	10	10	10		65
Survey of available technologies	15	20	15	25									75
Performance allocation for EBS and NBS					10	10							20
Criticality scoping analysis					30	30	30						90
SNL													**250**
Support concept development, action plans, and review of M2 report	5	5	10	15	20	10	10	10					85
FEP Crosswalks and PA Scenarios							25	25	25				75
Prepare and peer review M2 report								10	10	30	40		90
SRNL													**100**
Support concept development, action plans, and review of M2 report		5	5	10		10	10	10	10	10			70
Action plans for key issues								10	20				30
Total													**700**

Deliverable Descriptions

M4: Letter Report: Survey of Available Technologies (31Jan13)
Survey available technologies to ensure that proposed disposal concepts incorporate an appropriate range of potential design solutions (see work plan FCRD-UFD-2012-000106). Consider technologies instead of overall disposal concepts. Focus on critical elements (e.g., hoisting), and use input from diverse international disposal programs and other applications (e.g., mining and tunneling). Provide a letter report (i.e., of limited length, with minimal front matter and formatting) for use in concept development.

Completion Criteria: Submittal of report with FCT Cover Sheet to work package manager responsible for milestones that the deliverable supports, Control Account Manager and Laboratory QA POC. Transmittal of document/records via upload in PICSNE in accordance with the FCT QAPD and records management requirements.

M4: Letter Report: Media-Specific Alternative DPC Disposal Concepts (28Feb13)
Combine information on technologies discussed above, and international experience with deep geologic disposal, to develop a set of alternatives for direct disposal of DPCs. Provide concept description, as this will be the working set of DPC disposal alternatives that supports the remainder of the FY 2013 activities in this area. Note that DPC disposal concepts need not specify a particular geologic medium, but can give a range of suitable media characteristics if the concept is amenable. Specify representative package and

drift spacings, ventilation duration, temperature limits, and other aspects needed for thermal analysis. Provide a letter report (i.e., of limited length, with minimal front matter and formatting) for use in follow-on activities.

Completion Criteria: Submittal of report with FCT Cover Sheet to work package manager responsible for milestones that the deliverable supports, Control Account Manager and Laboratory QA POC. Transmittal of document/records via upload in PICSNE in accordance with the FCT QAPD and records management requirements.

M4: Letter Report: Performance Allocation for Engineered and Natural Barriers (15Mar13)
Describe the major elements of the postclosure safety case for each alternative DPC disposal concept. Address the waste isolation functions, if any, of overpacks, buffer and/or backfill, plugs and seals, host rock and other natural barriers, etc. Identify what elements will be used to disposition postclosure criticality FEPs. Provide a letter report (i.e., of limited length, with minimal front matter and formatting) for use in follow-on activities.

Completion Criteria: Submittal of report with FCT Cover Sheet to work package manager responsible for milestones that the deliverable supports, Control Account Manager and Laboratory QA POC. Transmittal of document/records via upload in PICSNE in accordance with the FCT QAPD and records management requirements.

M4: Letter Report: Logistics Simulation of DPC Aging, Selection, Transport and Disposal (12Apr13)
Describe the simulation of a SNF management system that relies on direct disposal of DPCs. Develop assumptions consistent with Miller et al. (2012, in review) that define the criteria to select DPCs for disposal (e.g., schedule to begin disposal operations). Describe the order in which DPCs are disposed, the heat output, age, and burnup for DPCs selected for disposal, and the progressive ages of all DPCs that remain in storage. Provide a letter report (i.e., of limited length, with minimal front matter and formatting) for use in follow-on activities, particularly thermal analysis.

Completion Criteria: Submittal of report with FCT Cover Sheet to work package manager responsible for milestones that the deliverable supports, Control Account Manager and Laboratory QA POC. Transmittal of document/records via upload in PICSNE in accordance with the FCT QAPD and records management requirements.

M4: Letter Report: Scoping Thermal Analysis of Alternative DPC Disposal Concepts (30Jun13)
Analyze peak temperatures (waste package, host rock, and/or other locations as appropriate) for each DPC disposal concept, using representative fuel burnup, age, and other characteristics from the concept descriptions deliverable. Perform parameter studies to estimate the minimum fuel age and maximum heat output at closure, or at emplacement for concepts that use preclosure ventilation, so that thermal limits can be met subject to documented assumptions (Miller et al. 2012, in review). Provide a letter report (i.e., of limited length, with minimal front matter and formatting) for use in the M2 deliverable. Submit working files for thermal analysis to the DPC Disposal SharePoint site at SNL for archival.

Completion Criteria: Submittal of report with FCT Cover Sheet to work package manager responsible for milestones that the deliverable supports, Control Account Manager and Laboratory QA POC. Transmittal of document/records via upload in PICSNE in accordance with the FCT QAPD and records management requirements.

M4: Postclosure Criticality Scoping Analysis for Alternative DPC Disposal Concepts (30Apr13)
Perform neutronics calculations sufficient to assess whether postclosure DPC criticality is likely for representative disposal concepts (particularly those offering water exclusion as a defensible boundary condition). Evaluate initial and crushed configurations. These are scoping calculations intended to address one of the most important potential barriers to direct disposal (BSC 2003). Submit a deliverable report for incorporation in the FY 2013 M2 project deliverable.

Completion Criteria: Submittal of report with FCT Cover Sheet to work package manager responsible for milestones that the deliverable supports, Control Account Manager and Laboratory QA POC. Transmittal of document/records via upload in PICSNE in accordance with the FCT QAPD and records management requirements.

M4: FEP Crosswalks and PA Scenarios for Alternative DPC Disposal Concepts (28Jun13)
Develop a technical plan for follow-on performance assessments for each alternative DPC disposal concept, or group of similar concepts. Identify which PA scenarios are important, and describe which FEPs would be included and excluded. Describe the calculation procedure and which software and data will be used. Submit a deliverable report for incorporation in the FY 2013 M2 project deliverable.

Completion Criteria: Submittal of report with FCT Cover Sheet to work package manager responsible for milestones that the deliverable supports, Control Account Manager and Laboratory QA POC. Transmittal of document/records via upload in PICSNE in accordance with the FCT QAPD and records management requirements.

M4: Letter report: Action Plans for Key Performance and Engineering Issues for DPC Disposal (28Jun13)
Identify primary regulatory and engineering issues associated with disposal of DPCs that will need to be resolved or specifically accommodated in the disposal concept. Include in the evaluation of potential issues, those concepts that rely heavily on engineered barriers, or that rely on developmental technologies or materials that are difficult or expensive to obtain. Include risks associated with failure of engineered components such as excavations, ventilation systems, and conveyances. Estimate the scope of activities to address or resolve the issues, and the resources needed to accomplish that scope. Provide a letter report (i.e., of limited length, with minimal front matter and formatting) for use in the M2 deliverable.

Completion Criteria: Submittal of report with FCT Cover Sheet to work package manager responsible for milestones that the deliverable supports, Control Account Manager and Laboratory QA POC. Transmittal of document/records via upload in PICSNE in accordance with the FCT QAPD and records management requirements.

M2: Preliminary Report on DPC Disposal Alternatives (30Aug13)
Prepare a summary report documenting FY 2013 project activities. Describe the available technologies and the alternative DPC disposal concepts selected. Summarize the logistical and technical information supporting the feasibility or lack thereof, for the selected concepts. Summarize the specific activities and resources needed to complete the identified follow-on activities for feasibility evaluations supporting final recommendations.

Completion Criteria: Submittal of report with FCT Cover Sheet to DOE NE-53 Technical Lead responsible for work package oversight, DOE NE-53 Federal Program Manager, UFD NTD, UFD Deputy NTD, Control Account Manager and Laboratory QA POC. Transmittal of document/records via upload in PICSNE in accordance with the FCT QAPD and records management requirements.

References

BSC (Bechtel-SAIC Company). 2003. *The potential of using commercial dual purpose canisters for direct disposal*. TDR-CRW-SE-000030, Rev 0. Las Vegas, NV: Bechtel SAIC Company.

Hardin, E., J. Blink, H. Greenberg, M. Sutton, M. Fratoni, J. Carter, M. Dupont and R. Howard. 2011. *Generic Repository Design Concepts and Thermal Analysis (FY11)*. FCRD-USED-2011-000143 Rev. 2. Idaho Falls, ID: U.S. Department of Energy Fuel Cycle Technology Program, Used Fuel Disposition Campaign.

Miller, A., R. Rechard and E. Hardin. 2012 (in review). *Assumptions for Evaluating Feasibility of Direct Geologic Disposal of Existing Dual-Purpose Canisters*. FCRD-UFD-2012-00***. Idaho Falls, ID: U.S. Department of Energy Fuel Cycle Technology Program, Used Fuel Disposition Campaign.

Attachment 2

Preliminary Repackaging Facility Concept:

The repackaging facility conceptual module is sized for 1500 MTU/yr throughput. The main structures within the module include a Carrier Receipt Bay, a Waste Handling Building, (WHB) and a Carrier Release Bay. Two air locks are included—one between the Receipt Bay and the Waste Handling Building and one between the Waste Handling Building and the Release Bay (Figure 1). The configurations of the Receipt Bay and the Release Bay may vary considerably depending on whether the Repackaging Facility is co-located with a Consolidated Storage Facility (CSF), a Mined Geologic Repository, or is a stand alone facility. For example, if the repackaging facility is co-located with a Mined Geologic Repository, then the Release Bay would not be needed and could be replaced with a transfer corridor to a facility for placing waste package overpacks on the canisters as described in *Disposal Concepts/Thermal Load Management (FY11/12 Summary Report)* (Hardin et.al., 2012).

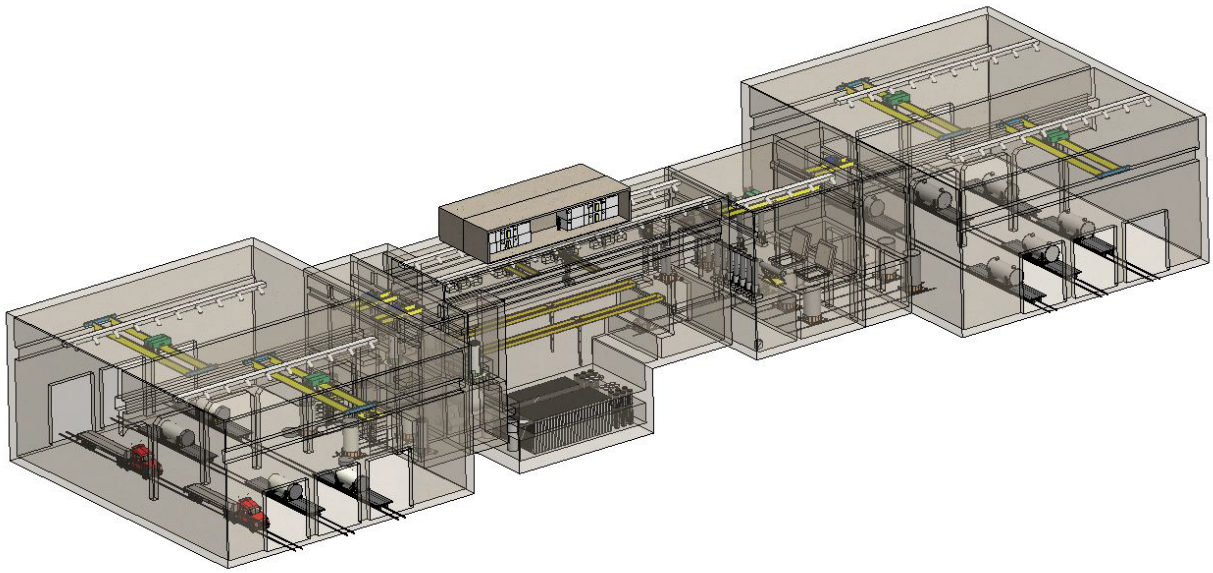

Figure 1-Isometric view of the overall Repackaging Facility Module Concept, including Carrier Receiving Bay, Airlocks, Waste Handling Building and Carrier Release Bay