

Sealion Database: Tracking and Characterization of Legacy Wastes – 10133

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ABSTRACT

The Radioactive Scrap and Waste Facility Liner-by-Liner Characterization Project was initiated to support waste management planning and disposition activities at the Materials and Fuels Complex located at the Idaho National Laboratory. The project scope consisted of a detailed examination of available historical records to consolidate information and eliminate discrepancies between sources. This information was captured in a new comprehensive searchable online database dubbed Sealion ([Searchable Liner Online](#)).

For each storage liner and associated waste container, Sealion tracks the physical configuration, radiological data (e.g., source term, transuranic content, fissile content, and direct gamma radiation reading), Resource Conservation and Recovery Act characterization data, contents descriptions, and a variety of other waste management data. Historical hard-copy records were scanned and are stored in the database for easy access. In addition to storing the consolidated data in a library for easy retrieval or linking, Sealion serves as a tool in the development of batching plans for retrieving, transporting, processing, and, ultimately, dispositioning the waste. An integral search function allows the user to query for a variety of parameters in order to plan custom batches and account for facility or regulatory limitations (e.g., U.S. Department of Transportation limits, hazard category determinations, and fissile gram equivalent limitations). Liners can be combined or batched together and the combined results displayed in real-time graphs and tables showing the cumulative characteristics.

The basic database architecture has proven to be adaptable to a variety of other similar applications. Sealion is capable of tracking segmented inventories (i.e., the liners can be replaced with storage drums, racks in a warehouse, or grids overlaid on a landfill). Additionally, the batching functions allow for the ability to combine inventory sub-locations into real-time graphs that summarize the characteristics of the contents for ease in comparison of characteristics to established thresholds or decision-making modeling needed to support waste-management operations.

INTRODUCTION

The Radioactive Scrap and Waste Facility (RSWF) at the Idaho National Laboratory (INL) Materials and Fuels Complex (MFC) is an interim storage facility for spent fuel and remote-handled (RH), mixed, and radioactive wastes. The wastes stored at the RSWF include transuranic (TRU) waste, mixed-TRU waste, low-level waste (LLW), and mixed low-level waste (MLLW) (including alpha-contaminated LLW and MLLW) subject to provisions of the 1995 Settlement Agreement with the State of Idaho and associated court order [1] and/or the *INL Site Treatment Plan* (STP) and associated consent order [2]. The Settlement Agreement requires the U.S. Department of Energy (DOE) to process and remove all TRU waste from the State of Idaho by a target date of December 31, 2015, and no later than December 31, 2018. The STP includes milestones for the management of mixed TRU-contaminated waste and alpha-MLLW, including

the implementation of the Remote-Handled Waste Disposition Project (RWDP) (formerly the Remote Treatment Project) [2]. The inventory also includes LLW subject to applicable DOE orders.

The RWDP was proposed to provide INL the capability to process RH waste for offsite disposal. At the RSWF, sealed carbon-steel pipe liners, set and buried vertically in the ground, are used to store containers of spent fuel and waste. The RWDP was initially designed to provide the capability to disassemble storage containers and/or entire waste liners; characterize, sort, and segregate the waste as necessary; treat and reduce the amount of waste as appropriate; and repackage the waste to meet the disposal facility's waste acceptance criteria. However, because of funding constraints, the DOE is accelerating retrieval of RH TRU waste from the RSWF, beginning with the retrieval of waste that would not require RWDP capabilities for disposal in an effort to ensure that Settlement Agreement and STP requirements are met. The path forward for the larger RWDP capability is not fully defined at this time.

To support RH waste disposition, a detailed evaluation of the entire RSWF waste stream was necessary. Such an evaluation allowed the waste to be characterized to ensure that the appropriate treatment and disposal requirements are met. This characterization effort included the development of acceptable knowledge documentation and the identification of nuclear material safeguards characteristics. The Sealion (for Searchable Liner Online) database is a comprehensive database designed and developed as a tool to capture and consolidate RSWF liner information. The initial requirements for Sealion included the following:

- Organize available data into one source:
 - Hard-copy records
 - Safeguards custodians records
 - Legacy databases
- Make information easily readable to identify gaps and inconsistencies
- Organize information into functional and searchable groupings
- Provide the capability to batch data for informed decision-making
- Allow remote access using secure Web utilities.

This system was built to minimize the amount of hands-on data manipulation and maximize the speed and efficiency of decision-making. To this end, Sealion has proven to be a valuable tool in characterization and batching efforts.

SEALION DATA MANAGEMENT

Because of its flexibility, Sealion may be adapted to a variety of applications. In virtually any situation where inventory is placed in a segmented system, Sealion can be used to track and control data, while allowing the user to make informed decisions about inventory management strategies. The Sealion database is accessible online via a secure Internet site. The system administrator can allow users read-only, container-edit, and or Safeguards-edit access based on job requirements.

Sealion offers four key features:

- Container and materials characterization information
- Extensive search capabilities
- A reference library
- Batching information.

Characterization Information

The liner characterization information is structured according to a hierarchy. All data stored in Sealion are broken down into four basic categories and further broken into sub-categories:

- Liner characteristics:
 - Size
 - Shielding
 - Seal type
- Container characteristics:
 - Gross weight
 - Container type
 - Container shielding
 - Hot link to hard-copy information and technical reports from a document library
 - Radiation monitoring data
- Material Characteristics:
 - Date generated
 - Content weight
 - Material description
 - Radionuclide inventory
 - Sodium or sodium potassium alloy (NaK) quantities
 - RCRA waste codes

- Safeguards:
 - Enrichment percentage
 - Special nuclear material specific weight
 - Attractiveness level
 - Safeguards protection category.

These, along with other descriptors, allow the user to adequately characterize the waste container. Fig. 1 is a screenshot of a typical container listing. (Note: The figure shown represents fictional data for exhibition purposes only.)

Search Functions

Sealion has advanced search functions. These include the ability to identify any combination from a large selection of input parameters. Each search parameter acts as a filter, so users are able to narrow results by selecting more options. This allows the user to create lists unique to their specific situation. Fig. 2 shows the Sealion advanced search screen. Each liner may then be saved or printed. (Note: The figure shown represents fictional data for exhibition purposes only.)

Library

A linkable reference library is included as a central place to store reference material for easy access. Sealion has the ability to link reference files to specific liners and vice versa for easy retrieval from the liner page or library. The user may import files in Excel, Word, PDF, GIF, JPG, and other commonly used file formats. Fig. 3 shows the Sealion liner linked to the library file. (Note: The figure shown represents fictional data for exhibition purposes only.)

Batching

Sealion also includes the capability to develop batching plans for the liners. Use of the batching plan feature begins by conducting a search (basic or advanced) using search parameters. A list of liners that match the search category will result along with the option to select specific liners for inclusion in the batching plan.

The outputs of the batching tool are results that include the nuclear facility hazard category, fissile gram equivalent (FGE), and the safeguard category. See Fig. 4 for examples of the output using three sample liners. (Note: The figure shown represents fictional data for exhibition purposes only.)

A data table is generated that shows the individual liner's sum of ratios and hazard category determination (calculations performed in accordance with DOE-STD-1027-92 [3]), FGE, and safeguards information, for the combined liners being batched. A bar graph that provides a visual representation of the individual and combined liner amounts is also generated. The graphs are designed to show not only the current category of the liners as if they were combined into one facility or package, but they also give the user a visual representation of how much each liner contributes to the overall result. In the cases of the hazard category and safeguards graphs, the results not only show the current category that combined liners fall into, but also how close the combined result is to reaching the next category threshold. This enables users to quickly ascertain which liners should or should not be combined for waste-management activities based on applicable limits. To help with the selection of likely containers that would be processed

together, the batching plans screen contains the same liner search page available in other functions of the system.

Sealion Database

Searchable Liner Online

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Liner Details
Batching Info
Show Help Links

Lock Liner for Editing

A-98
Change History | Edit

Current Location	Liner Size	Liner Shielding	Seal Type	Liner Attr. Level	Safeguards Category	Hard Copy (PDF)	Stage
A-98	16"	Concrete Plug	TBD	B	NA	Not Available	0

PRIMARY CONTAINERS

TR-456
New Container
Change History | Edit

Container No. TR-456	IWTS Container No. NA	Originator No.	Secondary Container HFEF-5 Outer	Secondary Container Shielding Lead Plug (0m ³)	Secondary Container No.
Generation Date 10/12/2004	Original RSWF Placement Date 3/14/2005	Translocation Date N/A	Container Type HFEF-5 Inner	Container Attractiveness Level N/A	
Primary Volume (m³) 0.1	Gross Weight (g) 273170	Content Weight (g) 35036	Content Type(s) TRU Mixed	TRU Amount (nCi/g) 8.8179E+003 <i>Calculated TRU Amount</i>	
Sodium Quantity (g) 0	NaK Quantity (g)	EPA Hazardous Waste No(s). D006 - Cadmium (Cd) D007 - Chromium (Cr) D008 - Lead (Pb)	Percent Combustible 55 %	Percent Metal	
Thermal Decay (W)	Total Curies	Source of Nuclide Information	Reported MAP	Reported MFP 3.9725E+001	

Description of Contents
Misc HFEF MC and AL sample waste, Plastics, cellulose and metallic materials. Waste is CD, CR, and Pb contaminated.

Comments

Record Nuclide Distribution			
Nuclide	Amount (Ci)	Amount (g)	Decay Heat (W)
Cs-134	6.3000E+000	4.8786E-003	
Eu-154	4.1000E+000	1.5177E-002	
H-3	4.0000E-001	4.1354E-005	
Pm-147	1.6100E+001	1.7367E-002	
Pr-144	1.0000E-001	1.3212E-009	
Pu-239	1.0000E+001	1.6118E+002	3.0200E-001
Ru/Rh-106	2.0000E-001		
Sb-125	6.0000E-001	5.7881E-004	
U-235	2.0000E-003	9.2528E+002	
Y-90	1.3360E+002	2.3544E-004	
Calculated MAP:	4.0000E-001		
Calculated MFP:	1.6110E+002		
Calculated TRU:	1.0000E+001		
Calculated Nuclide Total	1.7150E+002		3.0200E-001

Radiological Readings

Date of Reading	Level of Reading (mR/hr)	Location of Reading	Contact Reading?
3/14/2005	0.1	Over Welded Liner	No
3/14/2005	8	Over Open Cover	No

Accountable Materials Present

Yes No Initial Safeguards Determination Made By _____ Date *none*

Last Modified By pwalker **Last Modified Date** 11/10/2009 9:27:08 PM

ACCOUNTABLE MATERIALS

NOTE: Since accountable materials are filtered by the selected primary container, if liner container multiple primary containers you will need to select each primary container to view its corresponding accountable materials.

Accountable materials section for this liner has been reviewed by Safeguards and deemed accurate. Initials:

111-111111-11-111 New Safeguards Data

Batch No. 111-111111-11-111
Change History | Edit

Containers Batch Pertains To A-99 / AB-123	Batch Attractiveness Level D	Description test									
Net Weight (g) 5.0500E+002	Category IV	Form									
Total U (g): 5.0000E+002 % U-235: 60.00 %	U-235 (g): 3.0000E+002 Attr. Level:	Additional Isotopes									
Total Pu (g): 5.0000E+000 Attr Level: D	Pu 239/241 (g):	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Isotope</th> <th>Quantity</th> <th>Attr. Level</th> </tr> </thead> <tbody> <tr> <td>Am-241</td> <td>1.0000E+003 (g)</td> <td>B</td> </tr> <tr> <td>Pu 239/240</td> <td>5.0000E+000 (g)</td> <td></td> </tr> </tbody> </table>	Isotope	Quantity	Attr. Level	Am-241	1.0000E+003 (g)	B	Pu 239/240	5.0000E+000 (g)	
Isotope	Quantity	Attr. Level									
Am-241	1.0000E+003 (g)	B									
Pu 239/240	5.0000E+000 (g)										
DU (kg): % U5:	U5 (g):										
Safeguard Comments:	Last Modified Date										
Last Modified By pwalker	3/13/2009 9:02:00 AM										

Fig.1. Sealion container detail screen.

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ADVANCED SEARCH

<p>Liner Sizes <i>(Hold Ctrl key to select multiple options)</i></p> <p>All 16" 24" 26"</p>	<p>Seal Types <i>(Hold Ctrl key to select multiple options)</i></p> <p>All TBD Welded Flanged</p>	<p>Liner Attractiveness <i>(Hold Ctrl key to select multiple options)</i></p> <p>All A B C</p>	<p>Liner Priorities <i>(Hold Ctrl key to select multiple options)</i></p> <p>All 1 2 3</p>	<p>Stage <i>(Hold Ctrl key to select multiple options)</i></p> <p>All 0 1 2</p>	<p>Secondary Container Types <i>(Hold Ctrl key to select multiple options)</i></p> <p>All ANLE Outer Original 16" Liner HFEF-5 Outer</p>	<p>Secondary Container Shielding Types <i>(Hold Ctrl key to select multiple options)</i></p> <p>All Gravel Lead Plug Concrete Plug</p>	<p>Liner Safeguards Category <i>(Hold Ctrl key to select multiple options)</i></p> <p>All I II III</p>	<p>Container's Waste Generation Date</p> <p>Between <input type="text"/> and <input type="text"/></p>	<p>Description of Waste Contains</p> <p><input type="text"/></p>	<p>Primary Container Types <i>(Hold Ctrl key to select multiple options)</i></p> <p>All ANLE Inner Unknown Paint Can</p>	<p>Primary Container Attractiveness <i>(Hold Ctrl key to select multiple options)</i></p> <p>All A B C</p>	<p>Content Types* <i>(Hold Ctrl key to select multiple options.)</i></p> <p><input type="radio"/> And <input checked="" type="radio"/> Or</p> <p>All TRU HLW Irradiated Hardware</p>	<p>EPA Codes* <i>(Hold Ctrl key to select multiple options. Selecting "None" will negate other options selected.)</i></p> <p><input type="radio"/> And <input checked="" type="radio"/> Or</p> <p>All None D001 - Ignitable D003 - Reactive</p>	<p>Sodium Present</p> <p><input type="radio"/> Yes <input type="radio"/> No</p>	<p>NaK Present</p> <p><input type="radio"/> Yes <input type="radio"/> No</p>	<p>Safeguards Designated</p> <p><input type="radio"/> Scrap <input type="radio"/> Waste</p>	<p>Remote or Contact Handled</p> <p>All Contact Handled Remote Handled No Contact Information</p>	<p>Accountable Materials Present</p> <p><input type="radio"/> Yes <input type="radio"/> No</p>	<p>Originator Number</p> <p><input type="text"/></p>	<p>TRU Amount (range)</p> <p>Between <input type="text"/> and <input type="text"/></p>	<p>TRU Amount Calc Type</p> <p><input type="radio"/> TRU Amount as Reported From 110 Form <input type="radio"/> TRU Amount Calculated <input type="radio"/> Calculated TRU Amount Supersedes Reported Value</p>	<p>Retrieved Containers</p> <p><input type="radio"/> Yes <input type="radio"/> No</p>	<p>Empty Liners</p> <p><input type="radio"/> Yes <input type="radio"/> No</p>
--	--	---	---	--	---	---	---	--	---	---	---	---	--	--	---	--	--	---	---	---	--	--	--

*Note: Selecting "And" will display details for containers whose contents match all selected items. Selecting "Or" will display details for containers whose contents include one or more of the selected items.

[Basic Search](#)

Fig. 2. Sealion advanced search screen.

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Liner Details		Batching Info		Show Help Links			
				<input checked="" type="checkbox"/> Lock Liner for Editing			
A-28				Change History Edit			
Current Location	Liner Size	Liner Shielding	Seal Type	Liner Attr. Level	Safeguards Category	Hard Copy (PDF)	Stage
A-28	24"	Concrete Plug	Flanged	N/A	N/A	Not Available	0
Library Files Linked to This Liner: test - Copy.txt							

Fig. 3. Sealion liner linked to library file.

Sealion Database

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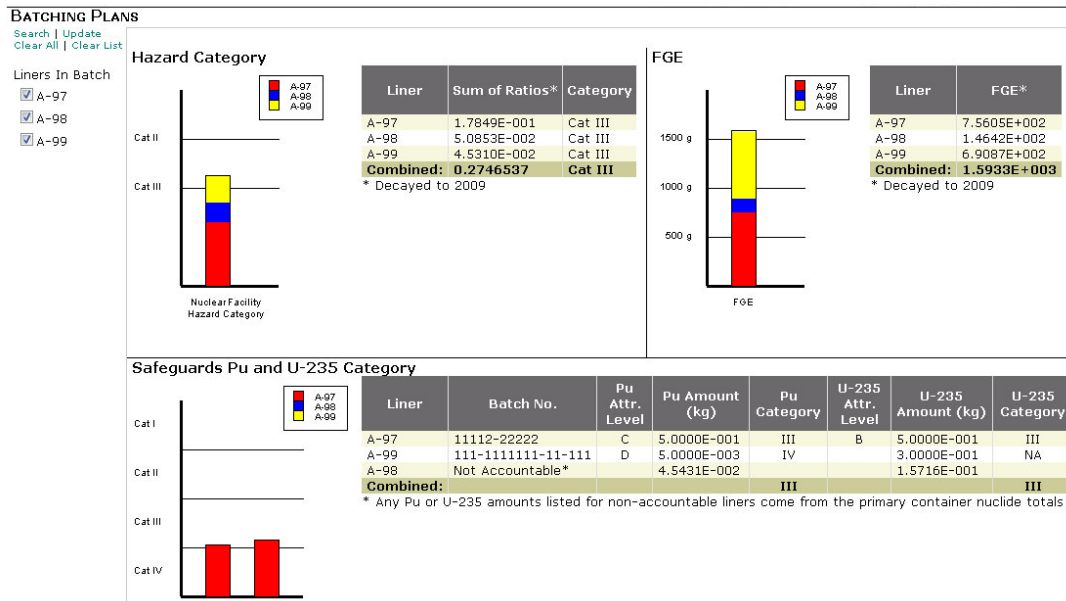


Fig. 4. Sealion batching plan output screen.

CHANGE HISTORY

Because of the importance of the information that has been entered into the database, tracking any changes that may have occurred is of the utmost importance. To this end, the system was developed to save a snapshot of the information that was on the edit screen and log the active user's identity every time the "Save" button is clicked. This ensures the integrity of the data and provides a way of reviewing who has made the changes as well as quickly viewing the fields that were changed.

CONCLUSION

Sealion may be configured to handle a wide range of situations and to display and track many different aspects of data. With its segmented container tracking capability, user-friendly data entry, and batching utility, Sealion is an ideal tool for waste-management applications.

REFERENCES

1. STATE OF IDAHO, U.S. DEPARTMENT OF ENERGY, AND U.S. DEPARTMENT OF THE NAVY, *Settlement Agreement*, October 16, 1995.
2. IDAHO NATIONAL LABORATORY, *INL Site Treatment Plan*, October 31, 2008.
3. U.S. DEPARTMENT OF ENERGY, "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports," DOE-STD-1027-92, December 1992.