SRS L-Basin Spent Nuclear Fuel Program Update

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Nuclear Materials Committee requested a 2016 Work Plan topic on L Area:

- Provide an update on L Area Operations
  - Status of L-Basin Capacity
  - Status of Shipments to H-Canyon
- Transportation of SNF
Acronyms

AI – cladding – Aluminum clad
AROD – Amended Record of Decision
CFR – Code of Federal Regulations
CNLL – Canada Nuclear Laboratories Limited
DRR – Domestic Research Reactor
DSA – Documented Safety Analysis
FY – Fiscal Year
FRR – Foreign Research Reactor
HEU – Highly Enriched Uranium
HFIR – High Flux Isotope Reactor
IAEA – International Atomic Energy Agency
ISO – International Standards Organization
lbf/in² – pound foot/square inch (pressure measurement)
LWT – Legal Weight Truck
MTR – Material Test Reactor
NRU – National Research Universal
NRX – National Research Experimental
NNSA – National Nuclear Security Administration
PBS 11C – Performance Baseline Summary for Nuclear Material Stabilization and Disposition
PBS 12 – Performance Baseline Summary for SNF Stabilization and Disposition
SNF – Spent Nuclear Fuel
SRE – Sodium Reactor Experiment
STS – Shielded Transfer System
Savannah River Site
Waste and Material Flow Path

This depiction of SRS activities shows only the general scope of the major facilities and missions. It does not represent all processes or all materials flow.

Tritium Reservoirs

Off-Site Treatment & Disposal Facilities

Area Completion Projects
Soil and Groundwater D&D

Off-Site Disposal
e.g., Clive, Utah, Three Rivers Landfill

LLW, MW & HW

C & D Landfill

E/N-Area

Liquid Waste Filled Equipment

F-Tank Farm (HLW)

H-Tank Farm (HLW)

Saltstone

SDU Future

Legends

- Product Licensed Site
- Waste Licensed Site
- Waste Disposed On Site
- Process Materials Input
- On Site Flow of Materials and Waste
- LLW Tank
- Active Tank Closure
- Closed Tank
- EAL Facilities
- NNSA Facilities

ACRONYMS

AL - Aluminum
ARP - Active Removal Process
C&D - Construction and Demolition
D&D - Decommissioning and Demolition
DEF - Defense Programs
DWF - Defense Waste Processing Facility
ETP - Effluent Treatment Project
GSRS - Glass Storage Repository System
KANS - K-Area Material Storage Facility Project
KRS - K Area REMediation System
LLW - Low Level Waste
MW - Mixed Waste
MWPF - Mixed Waste Processing Facility
NRC - Nuclear Regulatory Commission
SRNL - Savannah River National Laboratory
SWPF - Savannah River Waste Processing Facility
TSR - Transuranic Waste
USF - Used Spent Fuel
SRS Spent Nuclear Fuel Flow Path

Key:
- DWPF – Defense Waste Processing Facility
- EM – Environmental Management
- GWSB – Glass Waste Storage Building
- HFIR – High Flux Isotope Reactor
- LEU – Low Enriched Uranium
- MTR – Material Test Reactor
- NNSA – National Nuclear Security Administration
- Pu – Plutonium
- SNF – Spent Nuclear Fuel
- SRS – Savannah River Site
- SWPF – Salt Waste Processing Facility
- TVA – Tennessee Valley Authority
- LEU (~5%)

SNF authorized under the Domestic and NNSA Material Management and Minimization Programs
Overview of L-Basin

• L-Basin capacity was expanded from the original reactor basin in the 1990s
  • ~3.4 Million gallons of water
  • Pool Depth 17 to 50 feet
  • Receives typical Foreign Research Reactor (FRR) / Domestic Research Reactor (DRR) Material Test Reactor Fuel Assemblies
  • One transfer bay for receipts/shipments

• Spent Nuclear Fuel is Safely and Securely Stored in Reinforced Concrete Facility, Underwater Basin (L-Area)
• Continuous Surveillance and Maintenance is projected to achieve at least 50 additional years of safe storage
L-Basin Stored Fuels and Capacities

- **L-Bundled fuel**
  - Typical FRR/DRR Material Test Reactor Fuel Assemblies
  - Capacity = 3650 bundles
  - Current inventory = ~3020 bundles
  - Amended Record of Decision (AROD) processing decision eliminates need for new racks

- **High Flux Isotope Reactor (HFIR) Fuel Racks**
  - 100% full
  - 120 Cores
  - AROD processing decision eliminates need for new racks; expected to start by 9/30/2017

- **Isolation Cans**
  - Over 400 individual isolation cans stored in 12 oversized cans
Forecast EBS Bundle Positions Filled by FRR/DRR Receipts with H-Canyon Processing

Assumptions:
- FY16-FY33: Total 1212 bundles in
- Includes ATR, S. Korea, Extended Japan
- FY20: Second Dissolver on line for HFIR
- FY23: Complete 1000 bundles out

PRE-DECISIONAL DRAFT
L-Basin HFIR Storage Capacity, Receipts, Canyon Processing

PRE-DECISIONAL DRAFT
Receive Cask/
Removed Impact Limiters

Cask Placed Under Water

Lid Removed

Cask with fuel ready for verification

Fuel Removal & placed in bucket for transfer to Basin from Transfer Bay

Decon, Reassembly & Ship Empty Cask

Receipt Cask Handling in L-Basin
L-Area Accomplishments in Fiscal Year 2016

• Received 6 FRR casks and 4 DRR casks in Fiscal Year 2016 as of July 30, 2016

• In FY15, pre-shipped SNF to H-Canyon for processing in FY16. Anticipating at least one shipment of SNF to H-Canyon before the end of FY16

• Continued safe storage of SNF and Heavy Water

International Standards Organization (ISO) Container containing a Legal Weight Truck (LWT) Cask

Shielded Transfer System (STS)
Transportation of Spent Nuclear Fuel

- Governed by Department of Transportation (DOT) and Nuclear Regulatory Commission (NRC)
- SNF requires a Type B Cask certified to meet 10CFR71 requirements
- Regulations are put in place to ensure material remains contained even during hypothetical accident conditions.
- Type B Cask must pass the following test conditions for
  - Normal conditions of transport (10 CFR 71.71):
    - Heat (100 °F plus insolation) Cold (-40 °F)
    - Increased External Pressure (20 lbf/in²) Decreased External Pressure (3.5 lbf/in²)
    - Vibration
    - Free Drop
    - Penetration
  - Hypothetical accident conditions (10 CFR 71.73):
    - Free drop (a 30 foot drop onto a flat, unyielding surface so that the package's weakest point is struck)
    - Crush (a 1100 lb mass dropped from 30 ft onto package placed on unyeilding horizontal surface)
    - Puncture (a 40 inch free drop onto a 6 inch diameter steel rod at least 8 inches long, striking the package at its most vulnerable spot)
    - Thermal (exposure of the entire package to a 1,475 °F fire for 30 minutes)
    - All tests are done to the same package in the above order
    - Immersion (Immersion of the package under 50 feet of water for at least 8 hours - allowed to use an new/untested package for this test.)
Cask Testing Video

TRUPACT III testing

https://www.youtube.com/watch?v=YCk_UZEjpnY

Train crash tests

https://www.youtube.com/watch?v=U1nvRBk4W3o
Casks Handled in L-Basin

- **F-257**
  - 7,000 lbs
  - MAX CAPACITY = 1 SLOWPOKE Core

- **JRF-90Y-950K**
  - 2,100 lbs
  - MAX CAPACITY = 10 MTR

- **18.5T**
  - 41,000 lbs
  - MAX CAPACITY = 30 MTR

- **20T**
  - 52,000 lbs
  - MAX CAPACITY = 40 MTR

- **TN-MTR**
  - 52,000 lbs
  - MAX CAPACITY = 52 MTR

- **GNS-16**
  - 34,000 lbs
  - MAX CAPACITY = 33 MTR

- **GE-2000**
  - 33,550 lbs
  - MAX CAPACITY = HFR, 1 inner, 1 outer

- **BRR**
  - 32,000 lbs
  - MAX CAPACITY = 8 MTR

- **TN-7/2**
  - 54,400 lbs
  - MAX CAPACITY = 64 MTR

- **LWT**
  - 52,000 lbs
  - MAX CAPACITY = 42 MTR
Disposition Options for SNF

Processing in H-Canyon

- Provides a method to recover the uranium for reuse and eliminates potential issues with stability of the fuel form after long term storage
- Amended Record of Decision (AROD) allows:
  - Processing up to 1000 bundles and 200 High Flux Isotope Cores
  - 120 bundles shipped to H-Canyon through July 2016
  - Amount shipped and processed is dependent on funding amounts received
- H-Canyon continued processing of the L-Basin Aluminum Cladded Fuel past the AROD amounts is possible but no decision has been made to pursue this at this time
- H-Canyon currently cannot process the Stainless and Zircaloy cladded fuels stored in L-Basin (~ 10% of the inventory by volume)

Dry Storage

- Removes fuel from wet storage and places into a dried container awaiting a final repository
- Technical questions exist on how long to dry and how dry is dry for aluminum clad fuel need to be addressed
Summary

• Fuel is Safely Stored in L-Basin

• Transportation of SNF is being safely conducted around the US and is governed by DOT and NRC. Regulations are put in place to ensure material remains contained even during hypothetical accident conditions.

• Some processing of SNF is occurring in H-Canyon

• Departmental Decision needed on future direction of fuel storage versus processing