Savannah River NUCLEAR SOLUTIONS℠

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SRS Used Nuclear Fuel Management

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Governor's Nuclear Advisory Council (GNAC)

Columbia, SC

Acronyms

Al – Aluminum

DOE – Department of Energy

DRR – Domestic Research Reactor

FRR – Foreign Research Reactor

HFIR – High Flux Isotope Reactor

OS – Oversized Can

RBOF – Receiving Basin for Offsite Fuel

S&M – Surveillance and Maintenance

*SNF – Spent Nuclear Fuel

SRNL – Savannah River National Laboratory

SRNS –Savannah River Nuclear Solutions

SRS – Savannah River Site

*UNF – Used Nuclear Fuel

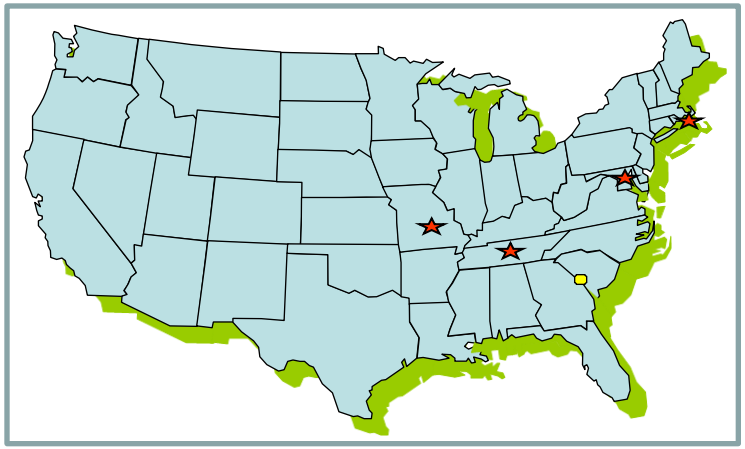
*Because of the significant amount of useable uranium content in Spent Nuclear Fuel (SNF), the term UNF is now being used interchangeably

Agenda

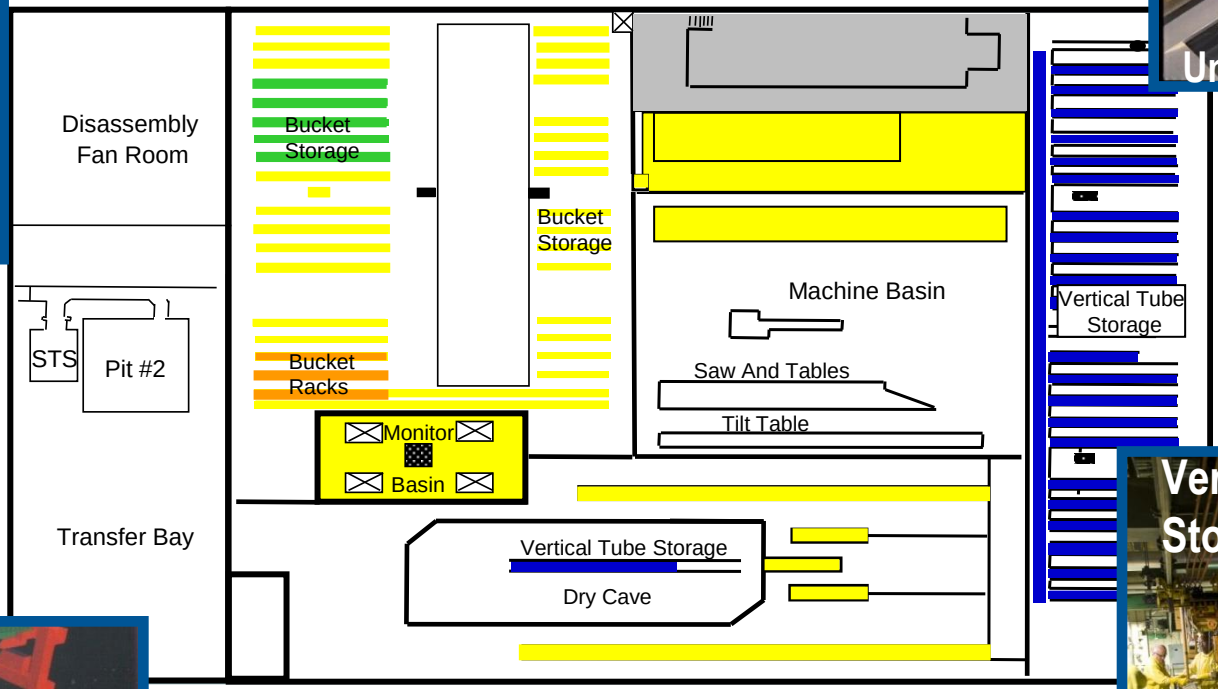
- Mission Overview—Fuel & Fuel Storage Systems
- Water Chemistry Control Program
- Basin Structural Integrity
- Augmented Surveillance & Maintenance Program
- Summary

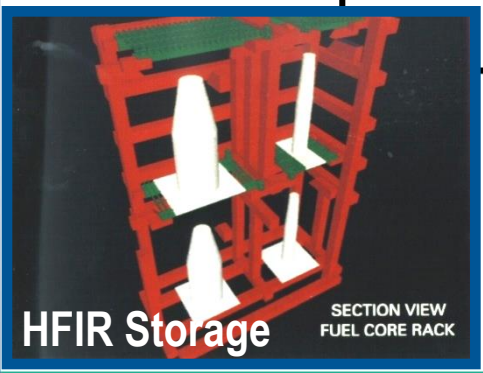
Mission Overview—L Area Complex

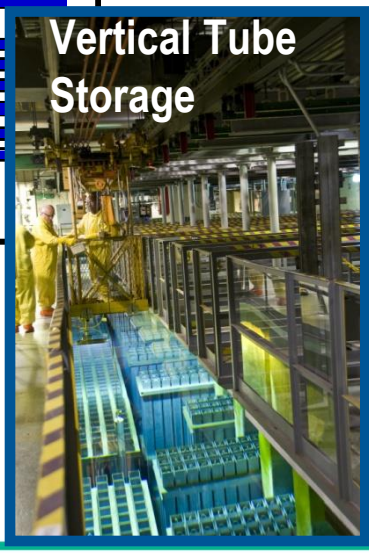
- **Receipt and storage of Used Nuclear Fuel (UNF)**
- **Foreign Research Reactor (FRR) UNF receipts**
  - Part of NNSA Global Threat Reduction Initiative
- **Domestic Research Reactor (DRR) UNF receipts**
  - Support domestic nuclear research



Mission Overview—UNF Storage







- 3.4 million gallons of water
- Pool depths of 17 to 30 feet
- Minimum of 13 feet water shielding above fuel
- Concrete walls minimum 2.5 feet thick
- Concrete floor 6 to 15 feet thick

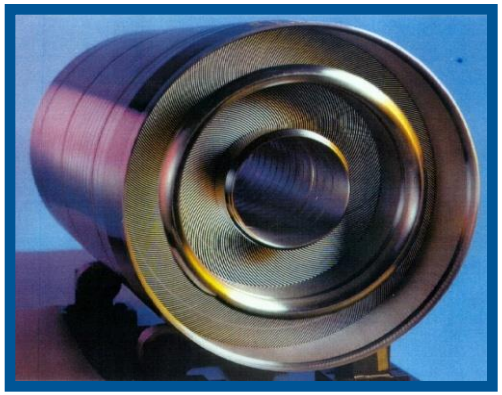
Mission Overview—UNF Inventory

- **Current Inventory**

Aluminum-based UNF	~13,000
Higher Actinide Targets (SRS-origin)	~200
Non-Al-based UNF	~2000
TOTAL	~15,000

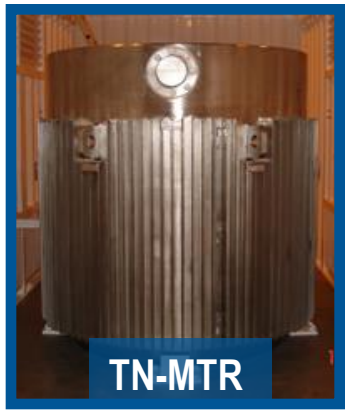
- **Forecast ~8400 additional assemblies by 2019**

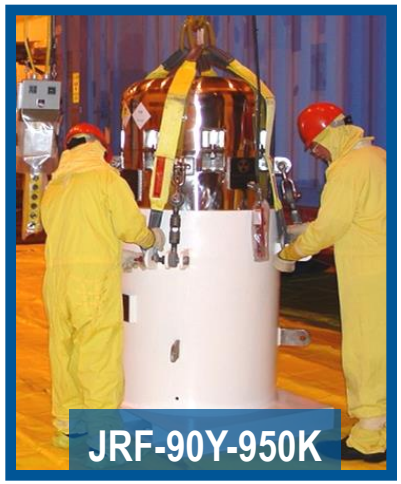
Material Test Reactor Fuels



High Flux Isotope Reactor (HFIR)

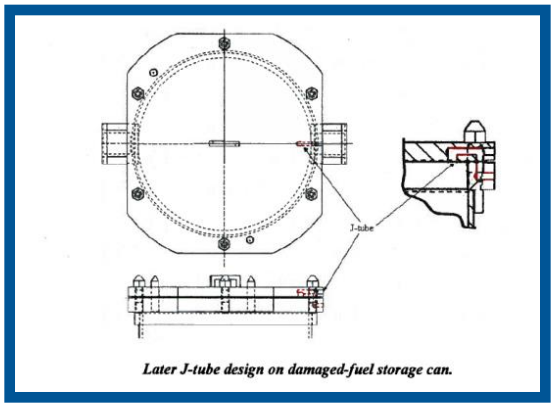
Mission Overview—Cask Management





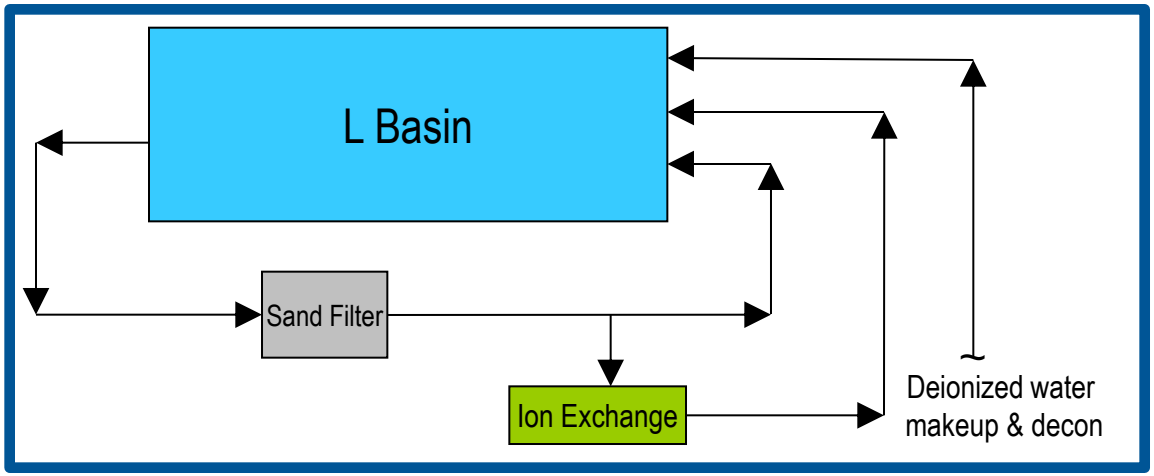
Mission Overview—Fuel Handling Challenges

- **Subset of stored fuels vulnerable to oxidation**
  - Declad / Damaged
  - Intentionally cut
- **~500 Sealed & Vented Cans**
  - ~20 oversize cans (OS)
  - ~200 bundles
- **Challenges include:**
  - Handling & packaging for disposition
  - Risk of basin contamination & cleanup
- **Bounded by Safety Analysis**
- **Experience handling this fuel type from RBOF deinventory**



Later J-tube design on damaged-fuel storage can.

Water Chemistry Control Program



Parameter		Limits	Indicates	Frequency
Conductivity		10 µS/cm	Level of impurities	weekly
pH (limits)		5.5-8.5	Hydrogen ion concentration	weekly
Chlorine		0.1 ppm	Pitting corrosion	biannual
Copper		0.1 ppm		biannual
Mercury		0.014 ppm		biannual
Aluminum		1.0 ppm	Corrosion	biannual
Iron		1.0 ppm		biannual
Activity	Cesium 137	500 dpm/ml	Fuel cladding failure	weekly
	Alpha	3 dpm/ml	Fuel cladding failure	monthly
	Tritium	0.4 µCi/ml	Residual contamination	biannual
Coupon Analysis			Cladding corrosion potential	annual

Basin Structural Integrity

- **Structural Integrity Program**
  - Full video inspection every 6 years
    - Concrete structure
    - 70-ton Cask lid lifting hardware
  - Make-up water trending
  - Basin level monitoring

Augmented Surveillance & Maintenance Program

- **SRNL Study on Fuel & Basin Life Extension (4/27/11)**
  - Recommended Augmented Surveillance & Maintenance Program
- **DOE-SR Direction to SRNS (6/30/11)**
  - Develop Augmented Surveillance & Maintenance Plan (12/30/11)
- **FY12 Deliverable—Develop 3 Program Plans**
  1. Inspection of bundled fuel for storage
  2. Assessment of fuel condition in isolation containers
  3. Condition assessment of basin concrete
- **Continued Water Chemistry & Structural Integrity Programs**

Summary

- UNF receipt mission continues through 2019
- UNF storage mission likely to extend beyond 2019
- Augmented S&M recommended for extended storage

> ***"The overall conclusion is that the fuel can be stored in L-Basin, meeting general safety functions for fuel storage, for an additional 50 years and possibly beyond contingent upon continuation of existing management activities and several augmented program activities."***
>
> Savannah River National Laboratory Long-Term Storage Capability Study
> SRNL-STI-2011-00190

UNF Receipt Forecast (Backup)

Type	Reactor	Location	2012	2013	2014	2015	2016	2017	2018	2019	Grand Total
DRR	HFIR	Tennessee			12	12	12	12	12	12	72
	MIT	Massachusetts	16	8	8	8	8	8	8	8	72
	MURR	Missouri	24	24	24	24	40	40	40	16	232
	NIST	Maryland	91		42		42		42		217
DRR Total			**131**	**32**	**86**	**44**	**102**	**60**	**102**	**36**	**593**
FRR	BER-2	Germany	33			66		33			132
	DCA	Japan				4					4
	FRG-1	Germany	25								25
	IRR-1	Israel						51			51
	JMTR	Japan			240	120	120	120	120	90	810
	JMTRC	Japan			32						32
	JRR	Japan					80	80	80	40	280
	KUR	Japan							60		60
	OPAL	Australia				140		140			280
	RP-10	Peru			29						29
	RPI	Portugal						14			14
	SLOWPOKE	Jamaica		1							1
FRR Total			**58**	**1**	**301**	**330**	**200**	**438**	**260**	**130**	**1718**
New Scope	NRU / NRX	Canada		120	180	180	180	180	170		1010
	Osiris	France	102			237		211			550
	SAFARI	S. Africa Gap	408	362							770
	SLOWPOKE	Canada	8								8
New Scope Total			**518**	**482**	**180**	**417**	**180**	**391**	**170**		**2338**
Grand Total			**707**	**515**	**567**	**791**	**482**	**889**	**532**	**166**	**4649**

Number of Fuel Assemblies

UNF Storage (Backup)

Storage Type	Total Approved Positions	Positions Filled	Percent Filled (Rounded)
HFIR	120	120	100
VTS	3500	3135	90
Dry Cave	150	0	0
Bucket Row Storage	19	7	37
Bucket Racks	32	4	12
Dry Fuel Storage Area 1	27	23	85
Oversized Can Racks	42	23	55
Dry Fuel Storage Area 2	16	16	100

Current NEPA Candidates for Processing* (Backup)

*SRS SNF EIS-0279

Fuel	Description	Details	HLC Total	KgHM
SRE (declad)	Sodium Reactor Experiment	Bare metal slugs packaged dry in tubes. Stored in VTS	36	2126
Failed or sectioned Tower Shielding Reactor	Identified as Oak Ridge Reactor Special	2 Canisters X-22, X-23	2	0.576
Failed or sectioned High Flux Isotope Reactor	Identified as Oak Ridge Reactor Special	1 Canister, X-20	1	0.126
Failed or sectioned Oak Ridge Reactor	Identified as Oak Ridge Reactor Special	8 Canisters, X-12, X-13, X-14, X-15, X-16, X-18, X-19, X-21	1	17.776
Failed or sectioned Heavy Water Components Test Reactor	A5 Can	$U0_2$ debris from 2 cans (Z2 and Z10)	1	13.8
Failed or sectioned Heavy Water Components Test Reactor	Tubular Fuel Element Natural	3 P-cans of Sectioned (TFEN-74) : PE-7, PE-8, PB-23	1	21.75
Failed or sectioned Heavy Water Components Test Reactor	Tubular Fuel Element Natural	3 K-cans of Sectioned (TFEN-74) : PS-2, PS-3, PSB-4	1	45.25

Highest Level of Containment (HLC)
Kilograms Heavy Metal (KgHM)

L Basin (Backup)

L Basin provides safe & secure storage of Spent Nuclear Fuel (SNF) pending disposition

- In addition to DOE assemblies, ~9500 SNF assemblies received from offsite since 1996
- Additional ~8400 assemblies forecast to be received by 2019, includes:
  - ~ 1700 FRR (Baseline)
  - ~ 700 DRR (Baseline)
  - ~ 4000 INL Exchange (Baseline but not funded)
  - ~ 1000 Gap nuclear material Removal Program assemblies (Baseline)
  - ~ 1000 Canada NRU/NRX assemblies (Baseline but not funded)

L Basin Deinventory

- Preparations underway to support shipments of SNF from L Area to H Area for disposition (L to H Project, crane, etc.)
- SNF exchange with Idaho National Laboratory targeted to begin FY13
  - SRS's stainless steel and zirconium clad fuel to be exchanged for INL's aluminum-based fuel (likely unfunded)