Savannah River National Laboratory®

We put science to work.™

SRNL: We Put Science to Work

SRNL and Global Security Directorate Overview

Tim Hasty, NA-21 Portfolio Manager

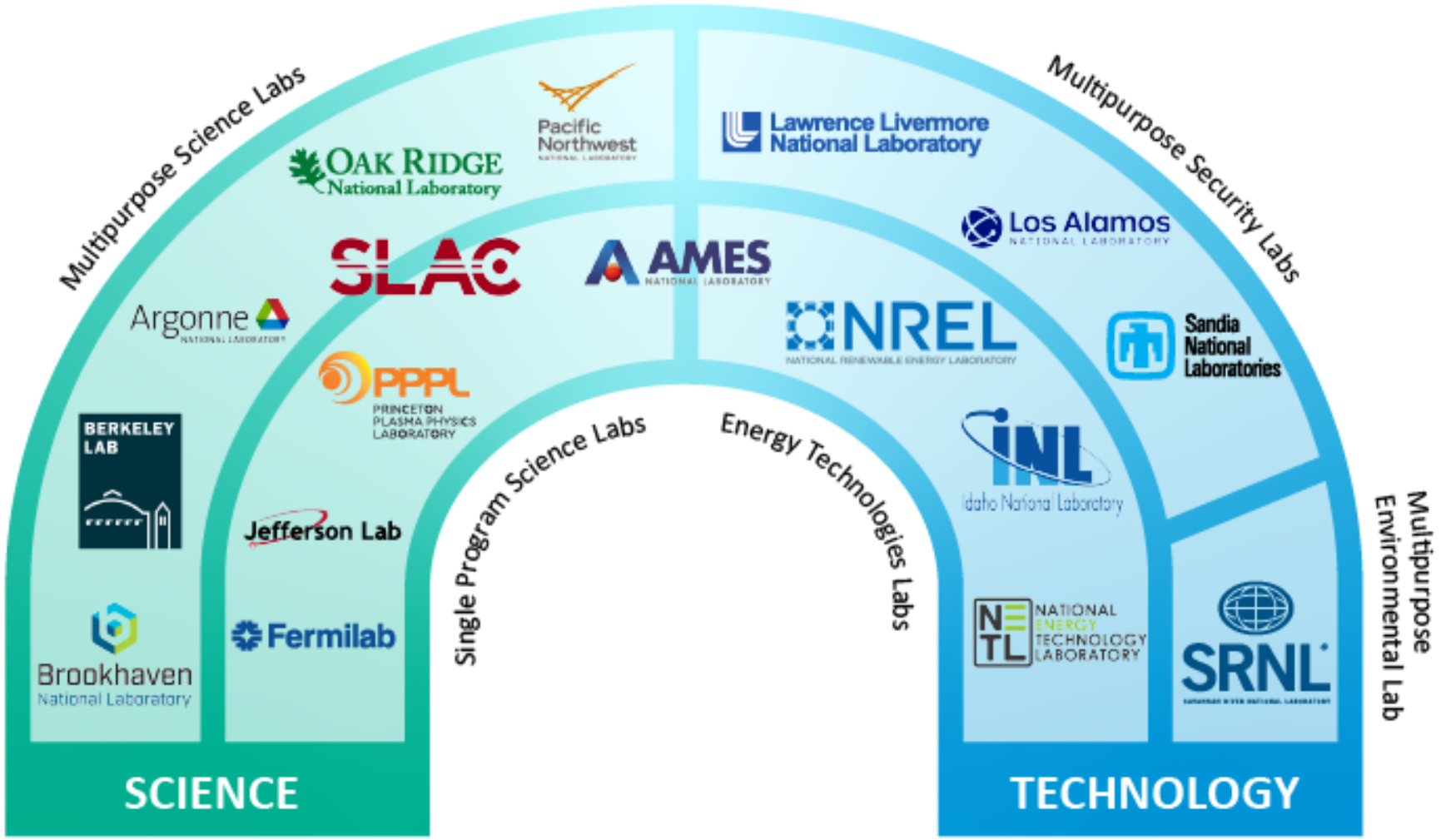
NA-213, Office of Nuclear Smuggling Detection and Deterrence Visit, November 02, 2023

The DOE's Newest National Laboratory

- The Savannah River National Laboratory (SRNL) is one of 17 United States Department of Energy (DOE) National Laboratories.
- SRNL, a multi-program national laboratory, is a leading research and development institution for the Offices of Environmental Management and Legacy Management at the U.S. Department of Energy and the Weapons and Nonproliferation programs for the National Nuclear Security Administration.
- Battelle Savannah River Alliance, LLC (BSRA), a not-for-profit limited liability company, manages and operates SRNL for the DOE. BSRA board leadership includes Battelle Memorial Institute, Clemson University, University of South Carolina, South Carolina State University, University of Georgia, and Georgia Institute of Technology. Battelle Memorial Institute and the five universities are joined in partnership with preferred subcontractors TechSource and Longenecker & Associates with the singular purpose of maintaining SRNL as a best-in-class national laboratory.
- Scientists and Engineers at SRNL use leading edge science and technology to advance the Department of Energy's critical mission outcomes.

BSRA Battelle Savannah River Alliance, LLC
Savannah River Site + Aiken + South Carolina

SRNL is the DOE's only EM laboratory



LOCATION:	Aiken, South Carolina
TYPE:	Multidisciplinary
FOUNDED:	1951
DIRECTOR:	Dr. Vahid Majidi
CONTRACTOR:	Battelle Savannah River Alliance

Savannah River National Laboratory is a multidisciplinary research and development center, where accomplished scientists and engineers solve our nation's most challenging environmental and security problems. Working with partners, we protect our nation by applying science to international security, the environment and the energy economy. We apply our unique scientific and engineering expertise to develop and deploy practical solutions with high returns on investment for our nation.

Savannah River National Laboratory®

We put science to work.™

$249.2 million in FY2022 Program Execution

NNSA	DOE-EM	Strategic Partners	Other DOE
51%	27%	17%	5%

3 Mission Areas

- ENVIRONMENTAL AND LEGACY MANAGEMENT
- NATIONAL SECURITY
- SCIENCE AND ENERGY SECURITY

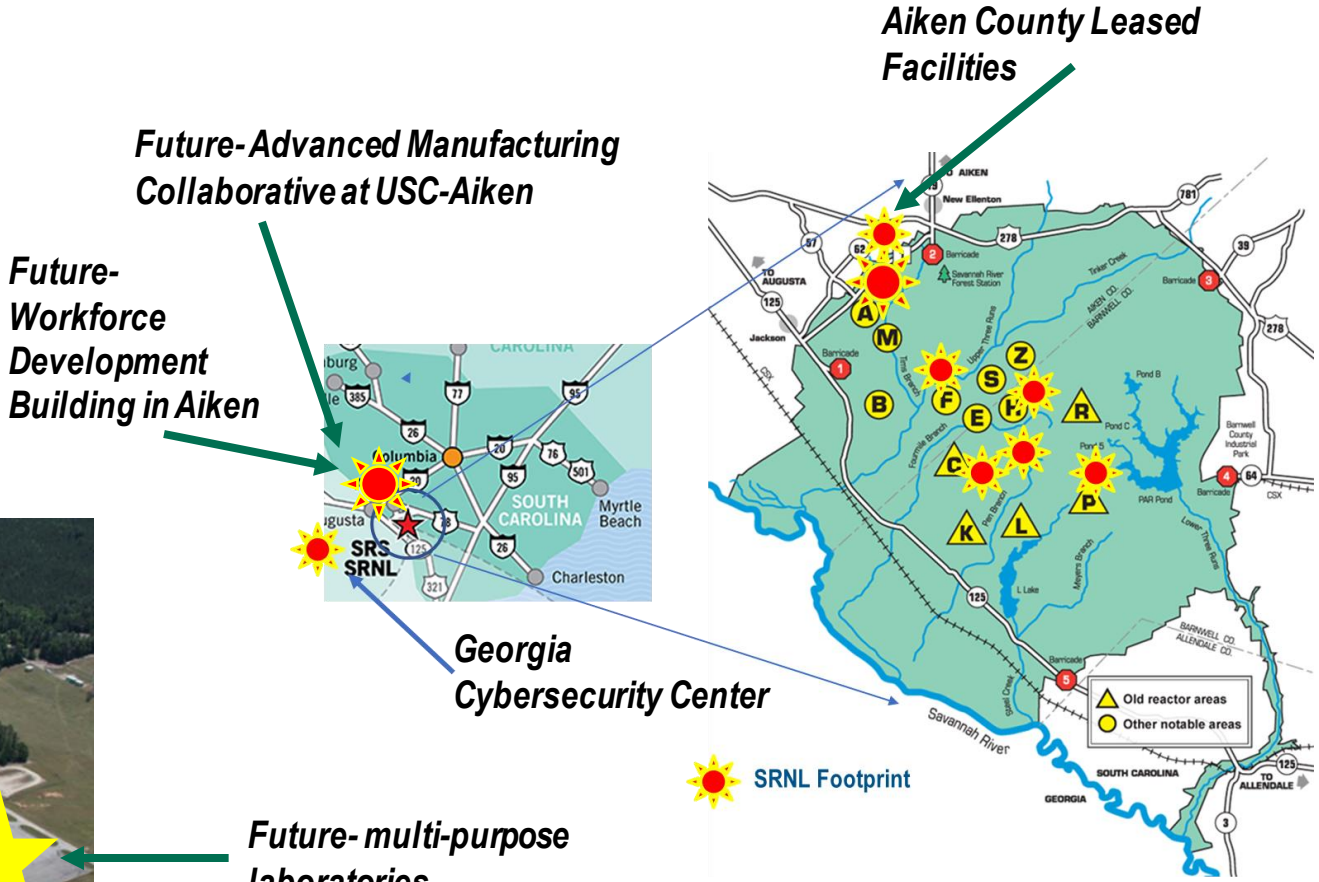
srnl.doe.gov

By the Numbers

More than 1400 people contribute to the mission of SRNL including employees (**>50** postdoctoral researchers), joint appointments, interns, and contract staff.
SRNL is situated on a **39-acre** main campus, valued at **$2B**, home to **~830,000 square feet** of facilities, including **more than 200,000 square feet** of radiologically controlled laboratories and process spaces, and access to an additional **~60,000 square feet** of leased facilities.

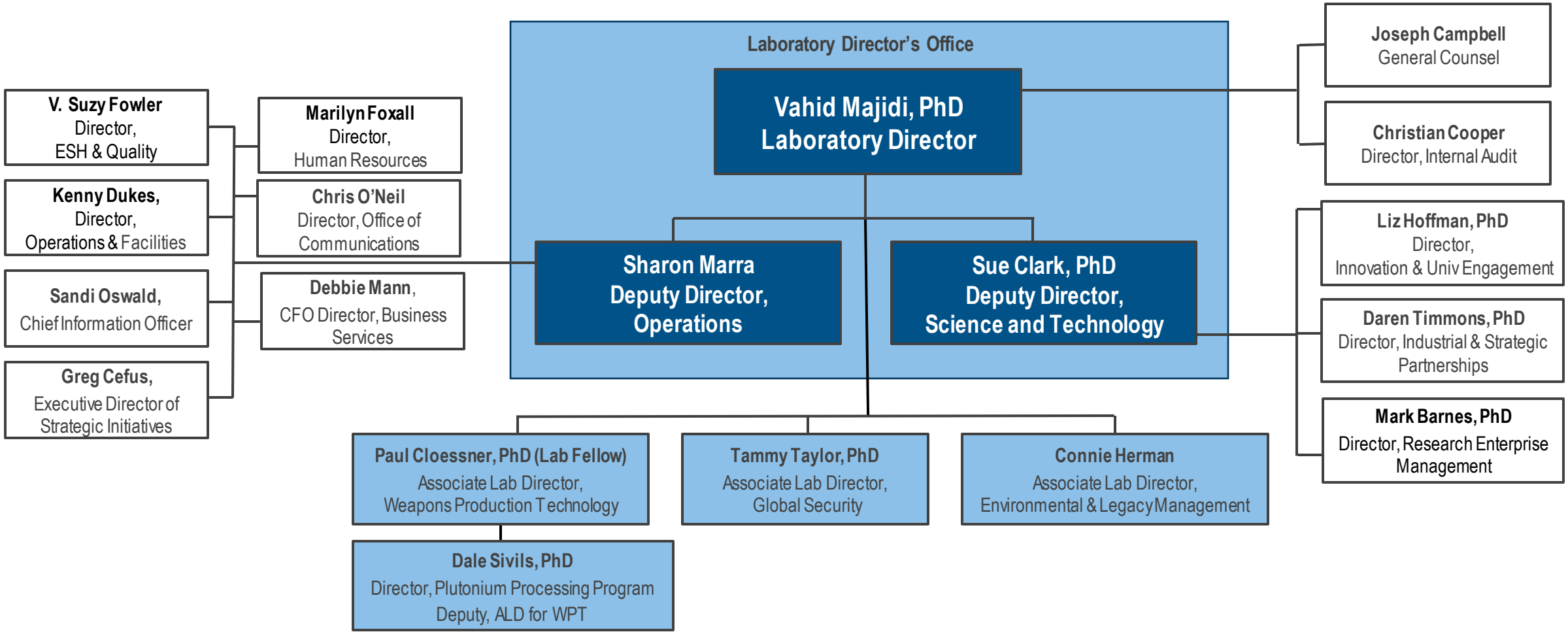
SRNL Campus

- **Core nuclear facilities in main campus**
- **Offsite locations – integral to the future**
- **Utilization of SRS – asset to future programs**
- **Mission driven considering return on investment**
  - Consolidate, Revitalize, Relocate/Expand



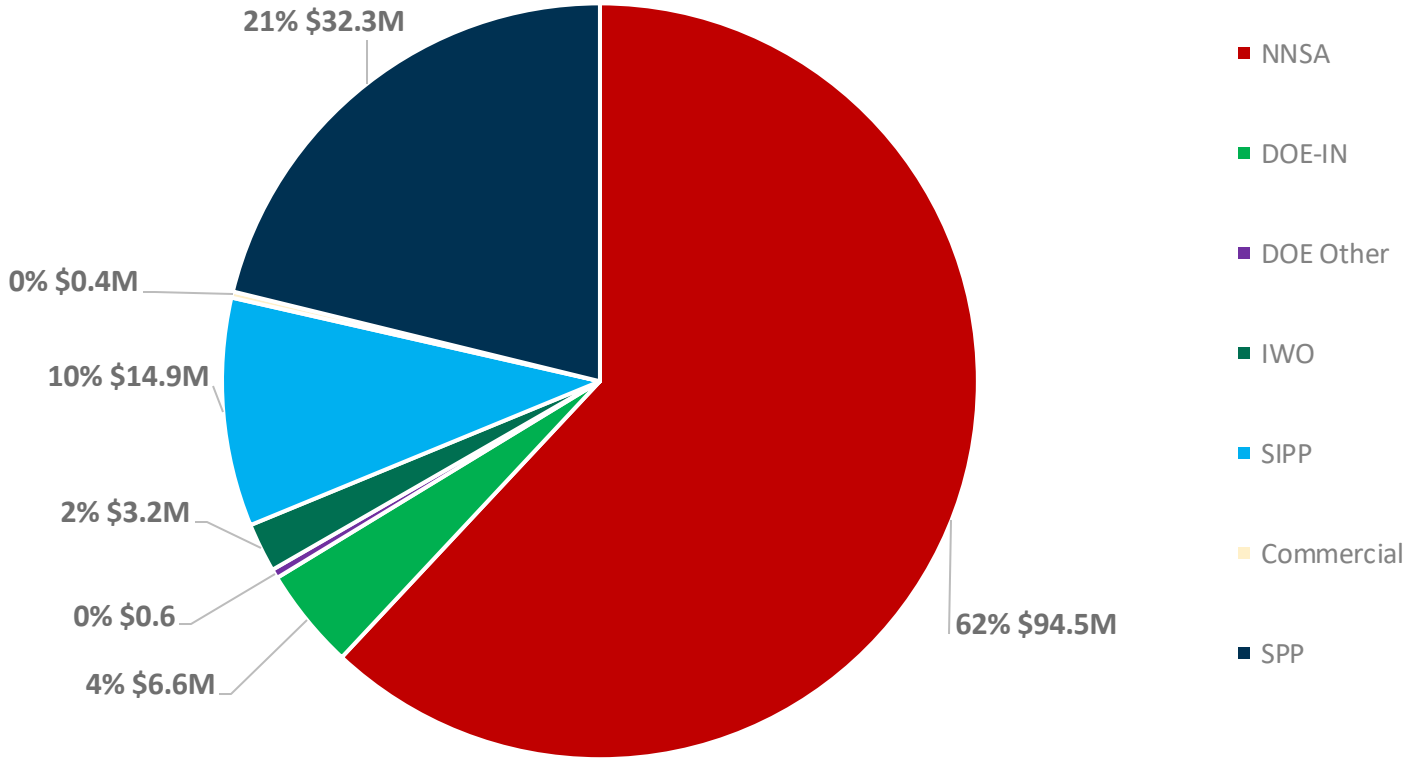
Physical Assets Summary:
830,000 sq. ft., 59 buildings
Replacement plant value: $2B
60,000 sq. ft. in leased facilities

SRNL Organization Chart – October 2023



Global Security Directorate

Global Security Directorate FY23 Execution / Budget



FY23 Global Security Execution $152.5M out of $236.5M FY23 Funding

GSD Core Competencies

Nuclear materials processing

- PUREX processing
- Mobile systems, plutonium lab
- Packaging, logistics, and transportation

Sensing, characterizing, assessing, and deterring nuclear proliferation

- Atmospheric transport modeling
- Particulate analysis
- Gas collection and detection
- Laser spectroscopy

Securing connected systems & associated data

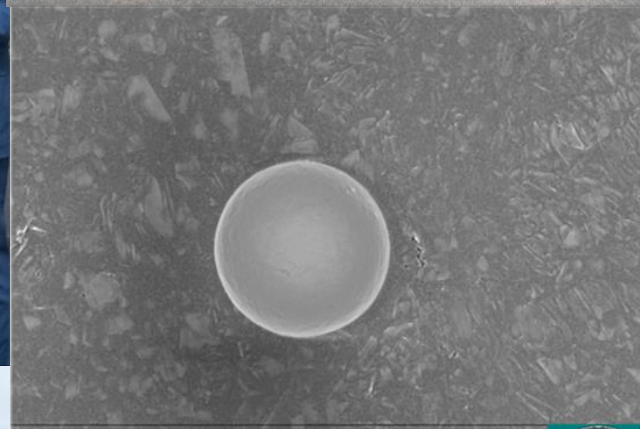
- Cyber-physical
- Electrical energy grid
- Interconnected manufacturing

Advanced Technology and Analysis Division

- Critical Infrastructure, Industrial Control Systems and Cybersecurity Research and Development
- Precision Timing and Satellite Technologies
- Power Systems and Grid Modernization & Resiliency
- Micro-electronics Design, Vulnerability Assessment, Mitigation and Reverse Engineering
- Unmanned Aircraft Systems (UAS) Research and Development
- Training, Test and Evaluation (TT&E) Support
- Virtual Reality Research and Development
- Quick Reaction Engineering and Modeling
- Robotics, Machine Learning and Artificial Intelligence
- Intelligence Community (IC) Analysis and Support
- Nonproliferation Policy Analysis and Support
- Meteorology / Climate, analysis and modeling

Nuclear Nonproliferation Division

- Perform nuclear material characterization and planning to reduce risks associated with material processing and increase confidence in planned material disposition pathways
- Mobile initiatives, like the Mobile Plutonium Facility and the Mobile Melt Consolidate, aid in international denuclearization
- FBI's Radiological Evidence Examination Facility (REEF) which provides the FBI with flexible radiological containment workspaces where they can safely conduct forensic examinations on radiologically contaminated evidence
- Low background environmental radioactive measurements and characterization
- Production and synthesis of uniform reference particles (~1 micron) containing nuclear materials such as plutonium and uranium to aid analytical instrument calibration and method development
- Analytical and engineering support to various missions in ultra-low-level radionuclide collection and analysis
- Expertise in engineered equipment design and fabrication for collection and measurement of ultra-low-level radionuclides
- Support DOE, NNSA, DHS, DoD and NRC in the development, testing, analysis, procurement and sustainment/maintenance of Type B radioactive material packages




SRNL®
SAVANNAH RIVER NATIONAL LABORATORY
773-A
SHELTER AREA
S
INSIDE
SRNL
SRNL
U.S. DEPARTMENT OF ENERGY

Savannah River National Laboratory®

We put science to work.™

Law Enforcement Support Overview

James Davis – Emerging Threats & Assessments, Global Security

NA-213, Office of Nuclear Smuggling Detection and Deterrence Visit, November 2, 2023

Support to Law Enforcement

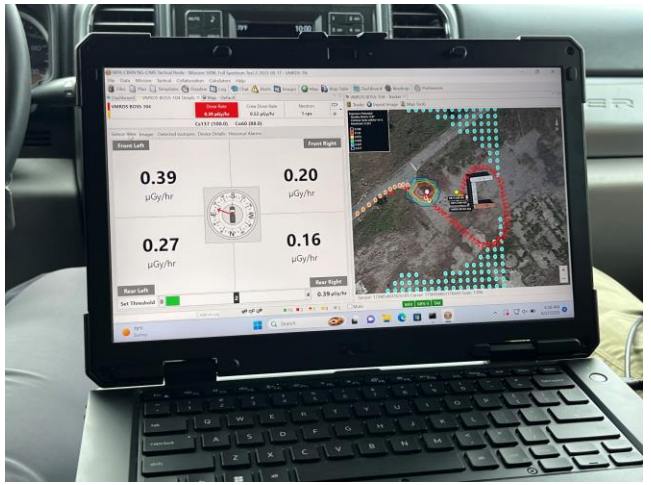
- Training classes for the Federal Bureau of Investigation (FBI)
  - RDD/VBIED Post Blast Investigation
    - Involved contamination with F-18 (alternatives available)
  - Rad Crime Scene

Support to Law Enforcement

- R&D with the FBI
  - Foam Test (2015) – Foam used as absorbent prior to “render-safe” operations

2023 Full Spectrum Test Campaign

- Testing of Integrated Sensor Architecture normalization between the Mobile Field Kit and CBRN Support to Command and Control
- Utilization of over 1000 Radiological Sources
- Three-week event involving multiple agencies including:
  - Defense Threat Reduction Agency (DTRA)
  - Joint Program Executive Office for CBRN Defense
  - 43rd Civil Support Team
  - Naval Information Warfare Center (NIWC) Pacific
  - Members of the Navy, Air Force, Marines, and Army



Support to Law Enforcement

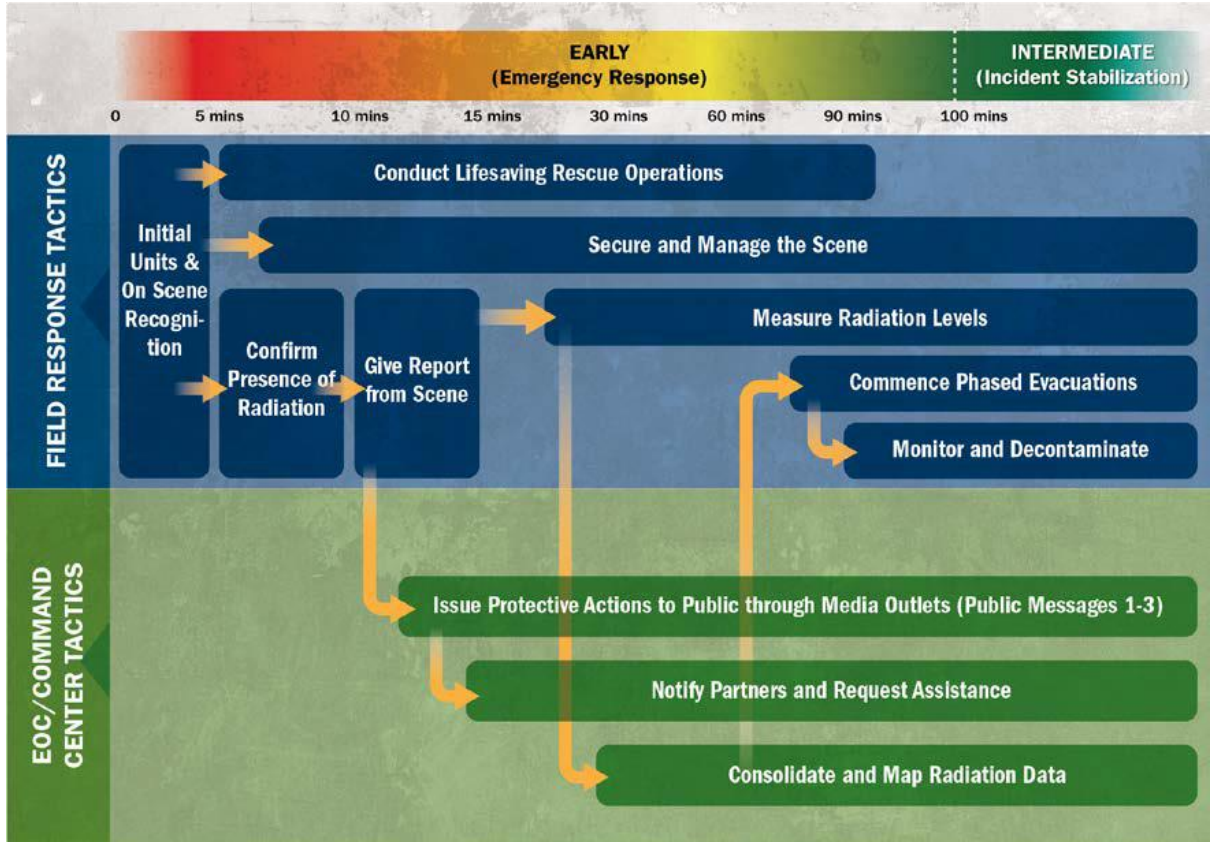
- Radiation Detection, Search and Incident Response Training
  - FBI, SLED, SC Highway Patrol, CSTs (SC/KY), USCBP, Arkansas Highway Patrol, Mississippi County Sheriff, SC Transport Police, Georgia Dept. of Transportation Police, Louisiana Highway Patrol
- Radiation Choke Point Search and Screening Technique Training
  - USCG (Charleston, Wilmington, NC and New England Sectors), Florida Fish and Wildlife
- CBRN Weapons of Mass Destruction Training
  - USCBP

Sealed Radioactive Source Inventory (CWMD-owned)

- Accountable Nuclear Material (ANM) including WGPu, HEU, and DU
- Mobile Material Balance Area (MBA) Global Threat Reduction (GTR) allows for use of ANM at locations both on and off site
- Industrial Sources: various isotopes, low activity up to those which generate a High Radiation Area (>100 mrem/hr.)
- Procurement of radioactive sources and medical isotopes
- Receipt, storage/maintenance, shipment, and disposal of radioactive sources
- Potential access to irradiators containing higher activity sources (neutron and gamma), with ability to generate a Very High Radiation Area

Training in Development for First Responders

- First 100 Minutes Training
  - Follows DHS Guidance Document for Field Operations, Public Messaging, and Response Coordination
    - Protective Actions
    - Life-saving Actions
    - Secure/Manage Crime Scene
    - Measure/Map Radiation Levels
    - Commencement of Evacuations
    - Monitoring/Decontamination
  - Tiered course for multiple disciplines
  - F-18 (or similar isotope) to be used for contamination/decon operations



SRNL Strategic Hiring

- New Organizational Structure - ATPG and Testing & Training Groups
- Strategic hires with below experience to further training/exercise development in this domain:
  - Preventative Radiological/Nuclear Detection (Planning, Training, and Operations)
    - Los Angeles Secure the Cities Program (Primary/Secondary Screening, vehicle, maritime, and aerial radiological surveillance) – Designed for detection of illicit movement of Rad material
  - Hazmat/CBRN – Operations, Tech/Spec, and WMD Operations (and Course Dev.)
  - Prior Law Enforcement Experience
  - Two recent Health Physicists –
    - US Navy Radiological Protection Technician/Emergency Response Training
    - Radiological Response Team for Commercial Nuclear Plant
    - Radiological Response Plan Development for Law/Fire agencies

Savannah River National Laboratory®

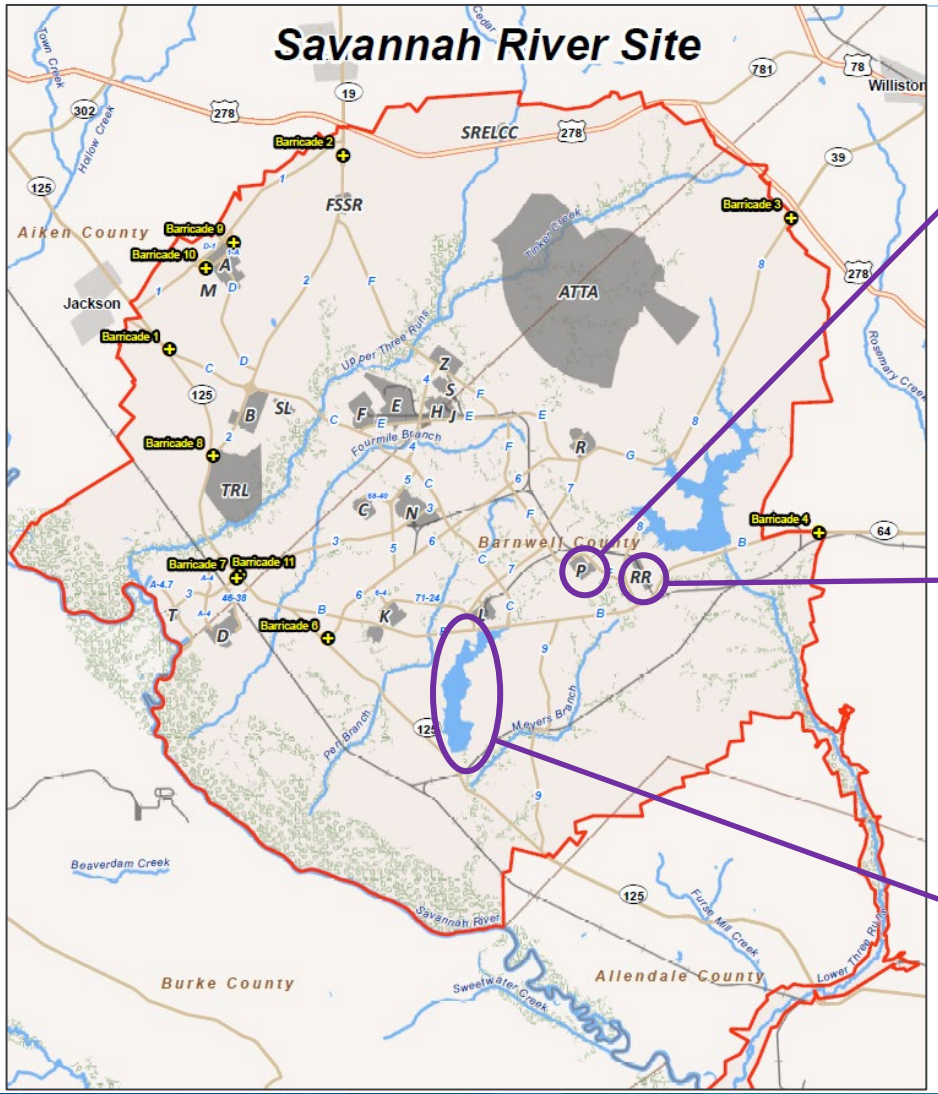
We put science to work.™

Radiation Detector Testing and Evaluation Overview

Troy Lorier – Emerging Threats & Assessments, Global Security

NA-213, Office of Nuclear Smuggling Detection and Deterrence Visit, November 02, 2023

Savannah River Site – Test Location Overview



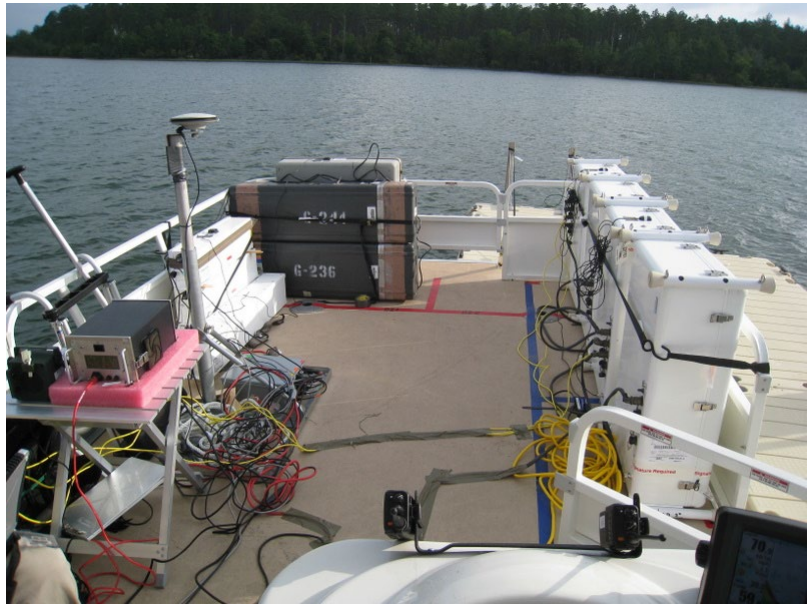
- P-Area

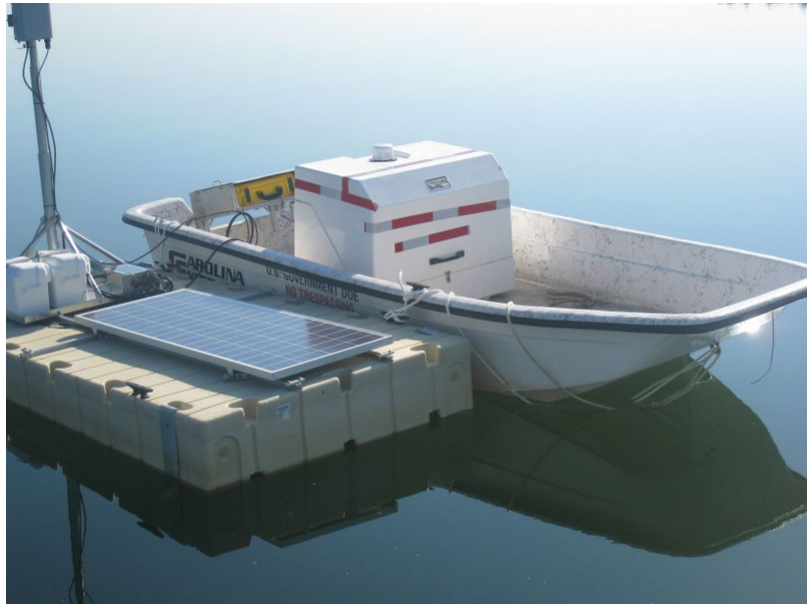
- Railyard

- L Lake

Radiation detection – Maritime capabilities

- Crawdad (2008)
  - Customer – DNDO – Performed on L Lake
  - Mobile radiation detection systems tests in a maritime environment.





Radiation detection – Maritime capabilities (cont'd)

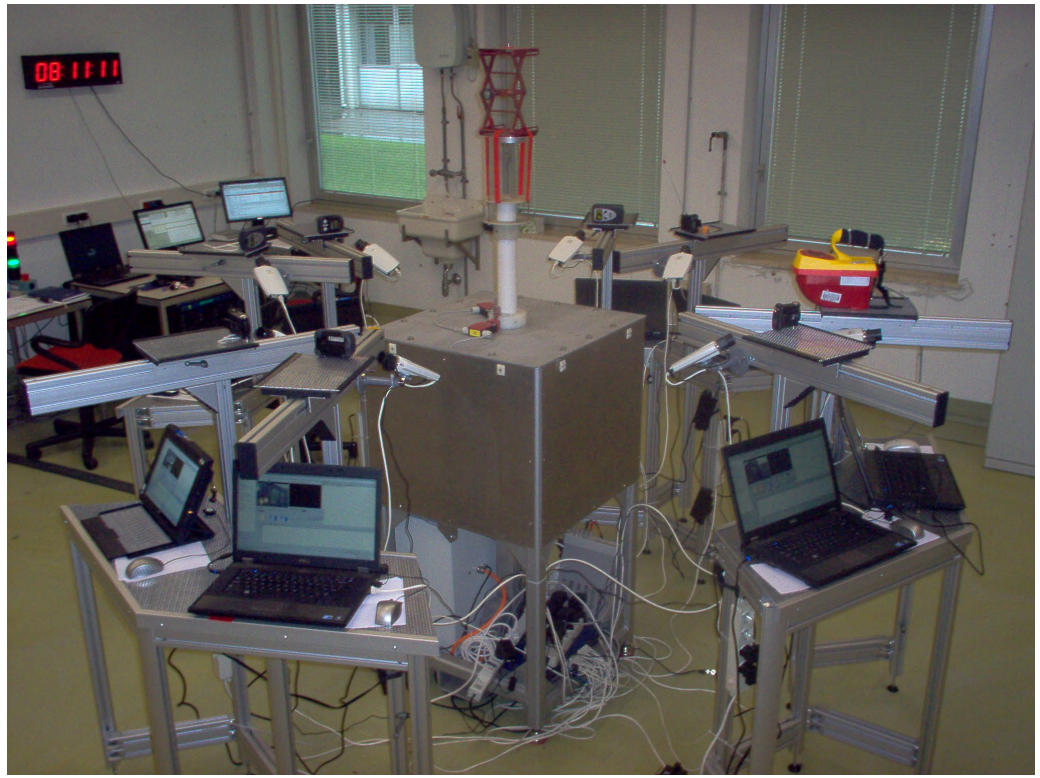
- Dolphin – Small Vessel Boat-to-Boat Standoff Test (2009/2010)
  - Customer – DNDO – Performed at SPAWAR, San Diego, CA
  - Radiation detection systems on a law enforcement vessel to detect/identify illicit radiological or nuclear materials.

Radiation detection projects conducted/supported (cont'd)

- On-Dock Rail (2011, 2016)
  - Testing detection system for ports
  - Customer – DNDO

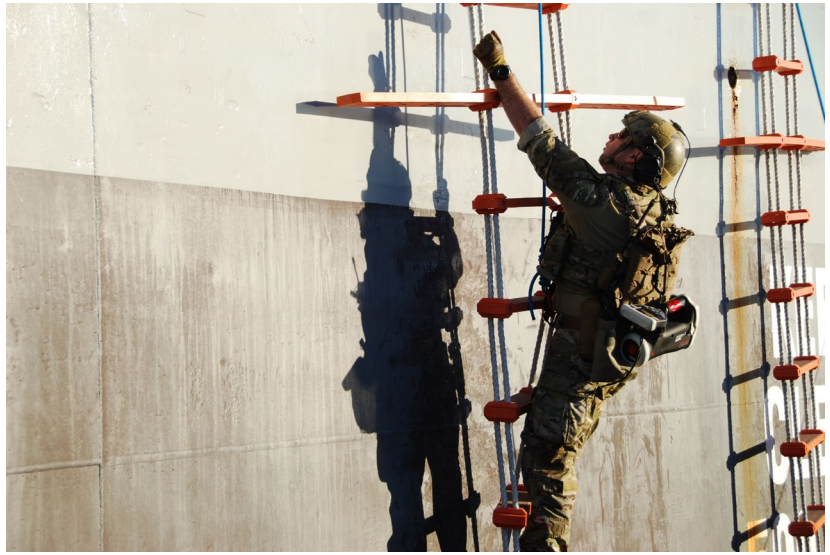
Radiation detection projects conducted/supported (cont'd)

- ITRAP+10 – Illicit Trafficking Radiological Assessment Program (2012)
  - Customer – CWMD
  - Performed at the Cal Lab (B-Area)



Radiation detection projects conducted/supported (cont'd)

- Basic Handheld (BHH) Operational Assessment (2014)
  - Radiation Isotope Identification Device (RIID) testing – detection, localization, and identification
  - Customer – DNDO; performed at FLETC – Charleston
  - Passenger and baggage screening, vehicle checkpoint, bus/mass transit, small vessels, ship-wide area search



Radiation detection projects conducted/supported

- Backpack Radiation Detector (BRD) testing (2014)
  - Tested BRDs against a Technical Capability Standard
  - Customer - DNDO

Radiation detection – Facility training

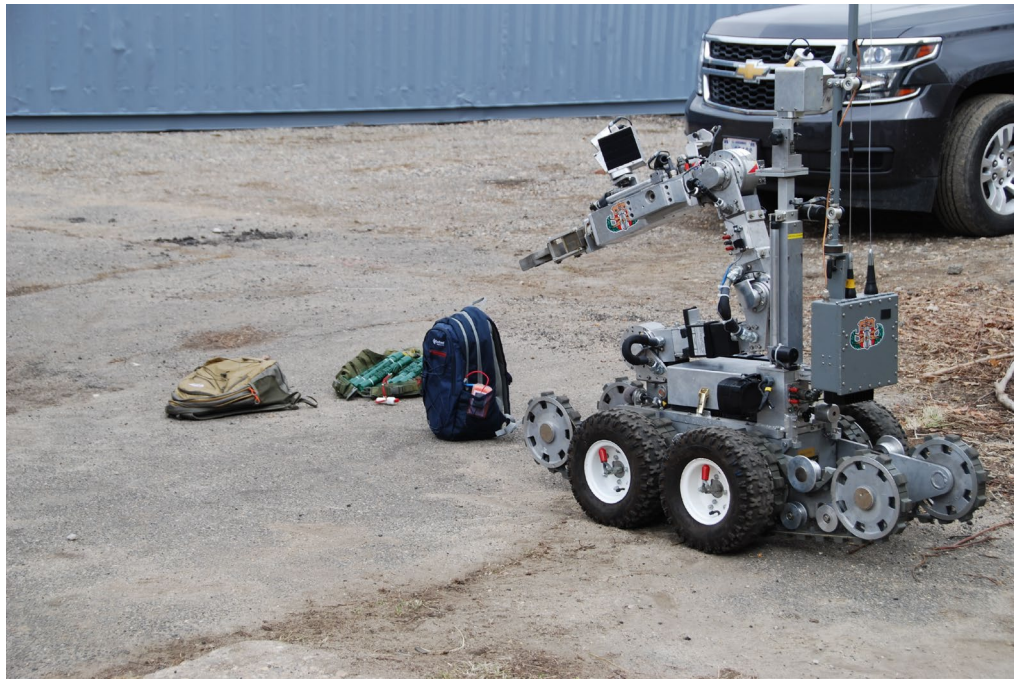
- Exercises with the 20th CBRNE Command and NDTs (2016, 2018)
  - Conducted in C-Reactor and New Special Recovery (NSR) on F-Canyon

Radiation detection projects conducted/supported (cont'd)

- Mobile Urban Radiation Search (MURS) – Honey Badger (2018)
  - MURS Characterization – various vehicle speeds and distances
  - Customer – CWMD; performed at SRS – railyard, Cal Lab

Radiation detection projects conducted/supported (cont'd)

- Impala (2018)
  - Robotics testing – determine best techniques for deploying Radiological/Nuclear Detection Equipment on bomb-squad robots
  - Customer – CWMD and the National Bomb Squad Commanders Advisory Board; performed in Suffolk County NY



Radiation detection projects conducted/supported (cont'd)

- Krieger (2021)
  - Customer – CWMD, Performed at SRNL and Falfurrias, TX

Radiation detection projects conducted/supported (cont'd)

- Integrated Ground-based Agent for Radiological Tracking (iGART) (2022)
  - Customer – NuHorizon Technologies and Georgia Tech

Radiation detection projects conducted/supported (cont'd)

- StormForce (2023)
  - Customer – CWMD, USCG – Performed at Fort Macon, Atlantic Beach, NC

Savannah River National Laboratory®

We put science to work.™

Mobile Melt-Consolidate

Overview

Brian B. Brown, MMC Program Manager

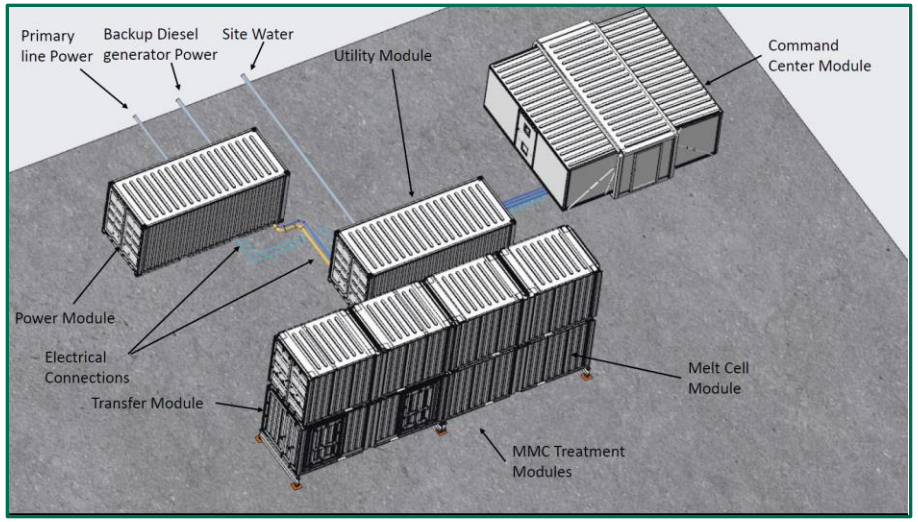
NA-213, Office of Nuclear Detection and Deterrence Visit, November 02, 2023

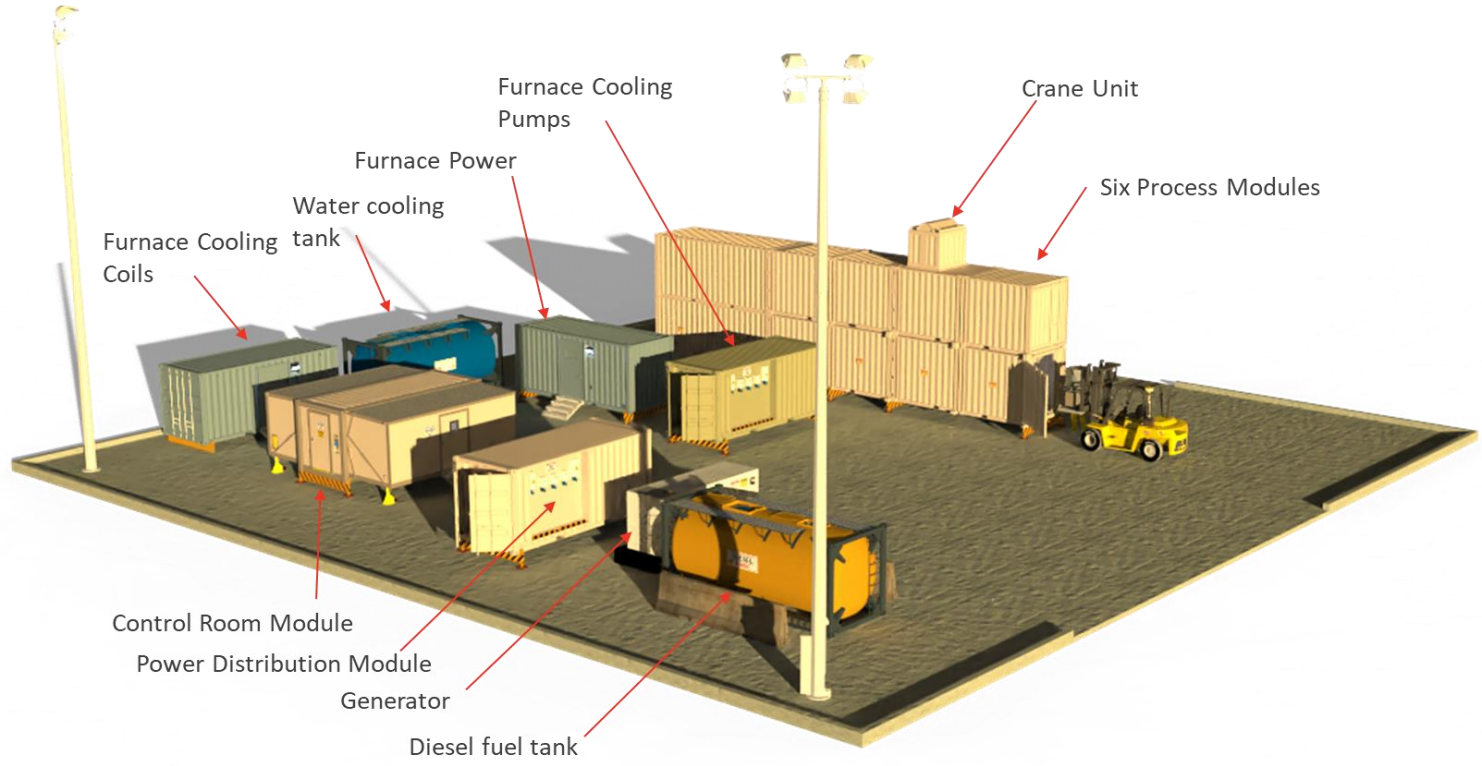
Arc of Presentation

- MMC Safety Overview
- MMC Design and Fabrication
- MMC Operational Readiness

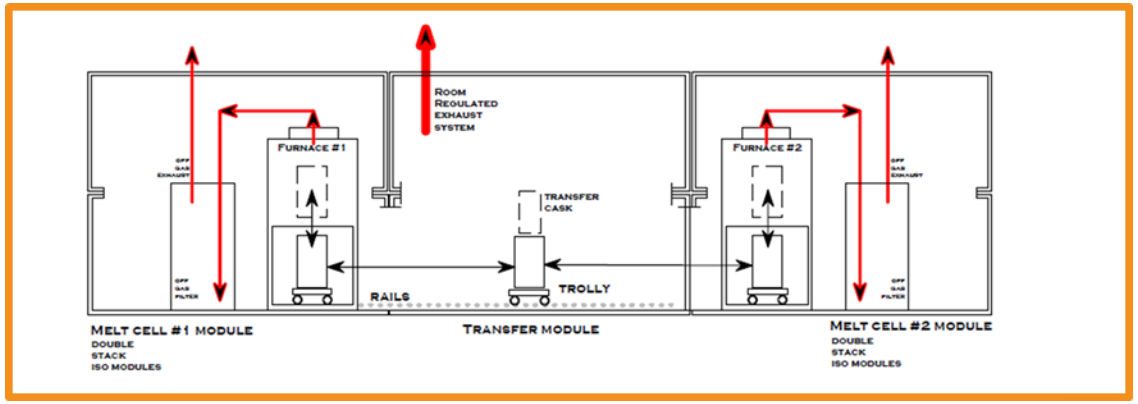
Supporting DOE/NNSA in its mission to mitigate potential risks associated with the production, storage, and disposition of weapons usable nuclear materials through design optimization, material treatment and removal, and final disposition.

MMC Evolution from Concept to Reality





MMC Evolution from Concept to Reality



MMC Safety Overview

Savannah River National Laboratory®

MMC Safety Overview

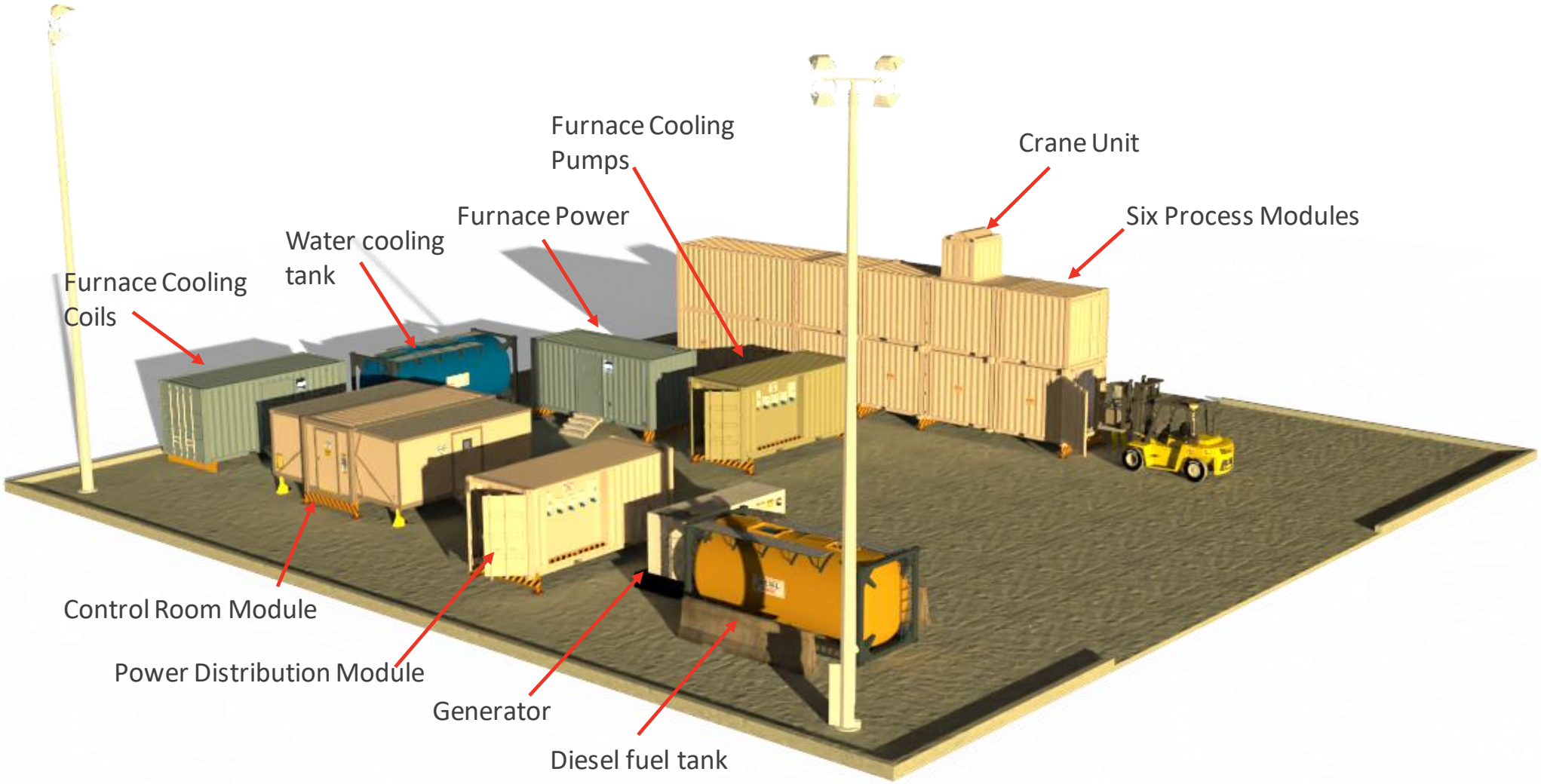
- **Objective**
  - Maintain safe operations of the MMC system by utilizing proven processes, procedures, and practices.
- **How**
  - MMC Statement of Work (SOW)
  - Task Requirements and Criteria Document
  - Consolidated Hazards Assessment Process
  - Safety Basis Strategy
  - Inputs and Assumptions
  - Safety Analysis
  - Technical Safety Requirements (TSRs)
  - Operational Strategy Implementation Plan
  - Procedures/Training
  - Risk Management Plan

MMC Safety Overview

- Project I&A, preliminary FHA, shielding and criticality review, CHAP update
- Schedule logic review, risk mitigation, and cost analysis
- Staffing with emphasis on developing support infrastructure
- Over-communicating with SRNL staff and vendors
- Leveraging existing, relevant documentation; i.e., LEF, MPF

MMC Design, Engineering, and Fabrication Review

Savannah River National Laboratory®


Furnace Cooling Pumps
Crane Unit
Furnace Power
Six Process Modules
Water cooling tank
Furnace Cooling Coils
Control Room Module
Power Distribution Module
Generator
Diesel fuel tank

Process Modules

Lower Transfer Module

Upper Transfer Module

Crane Hood

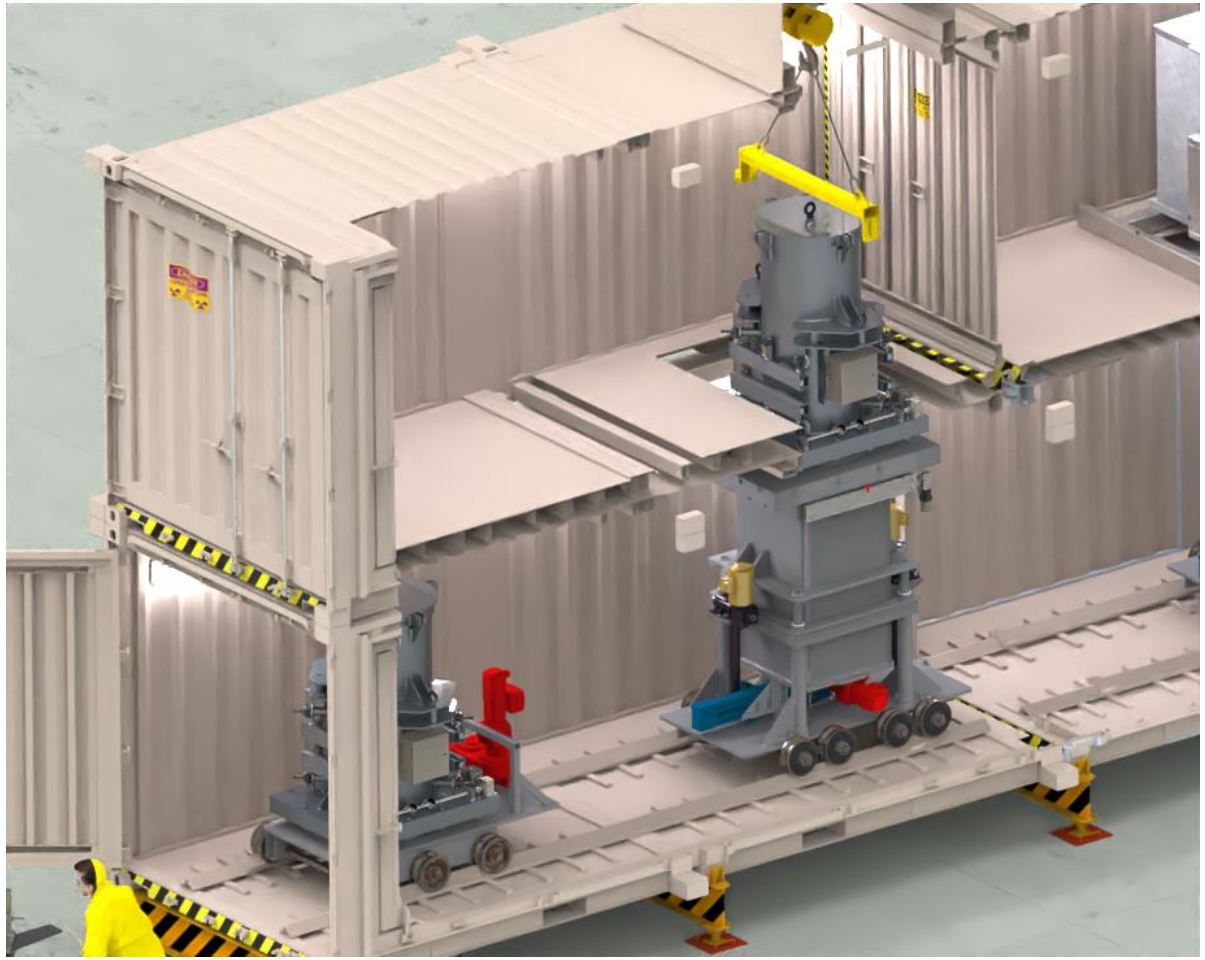
Lower Melt Module

Upper Melt Module

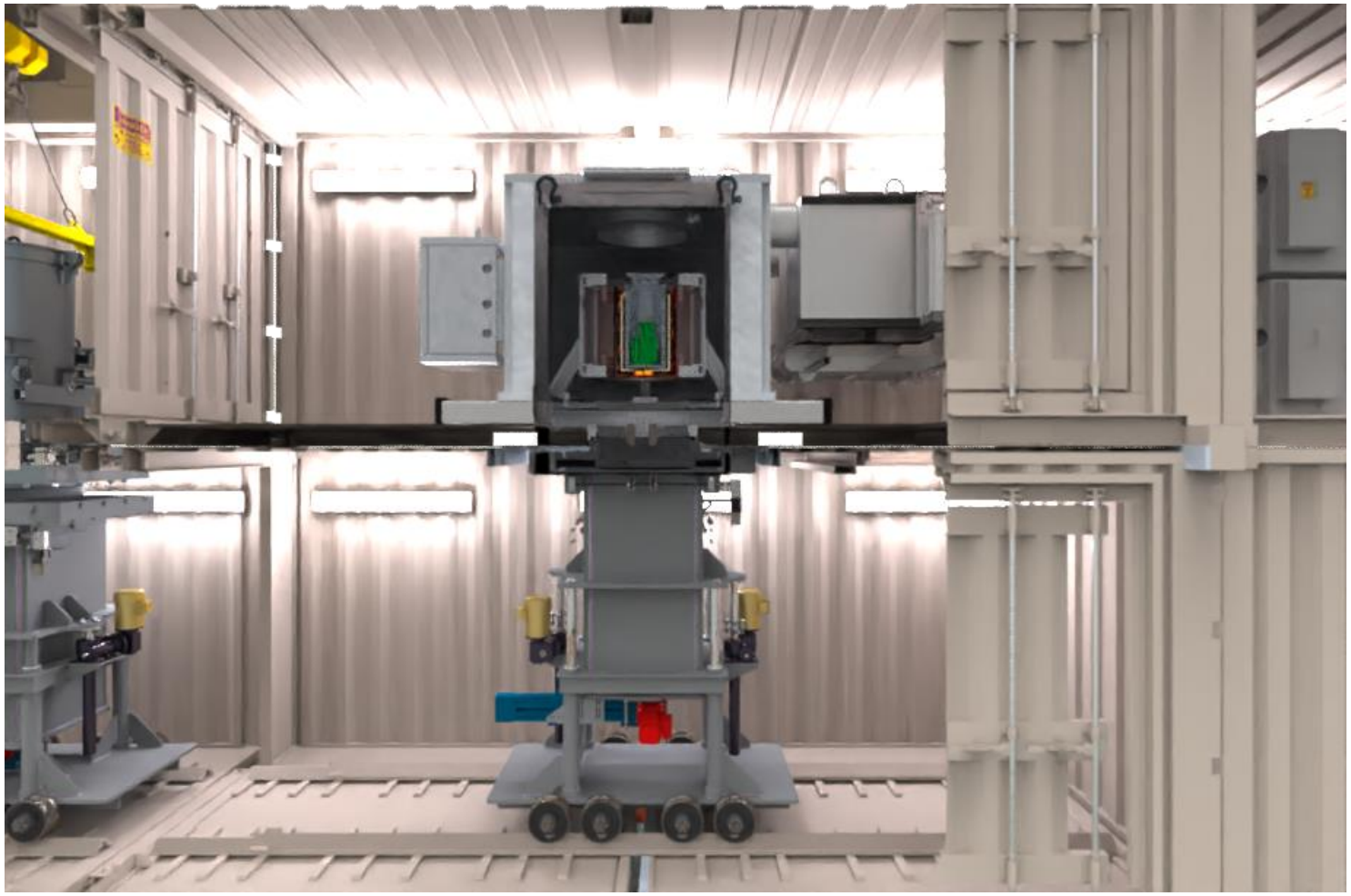
Lower HEPA Module

Upper HEPA Module

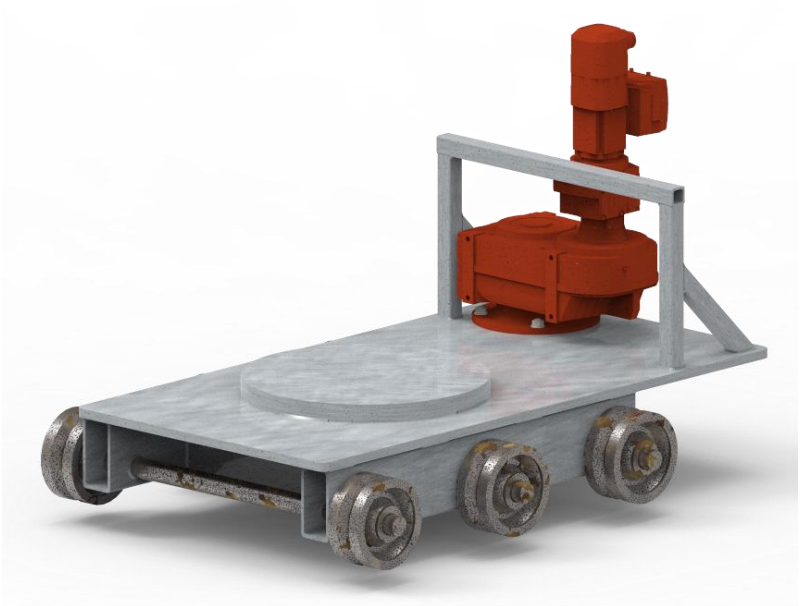
Process – Transfer Operations



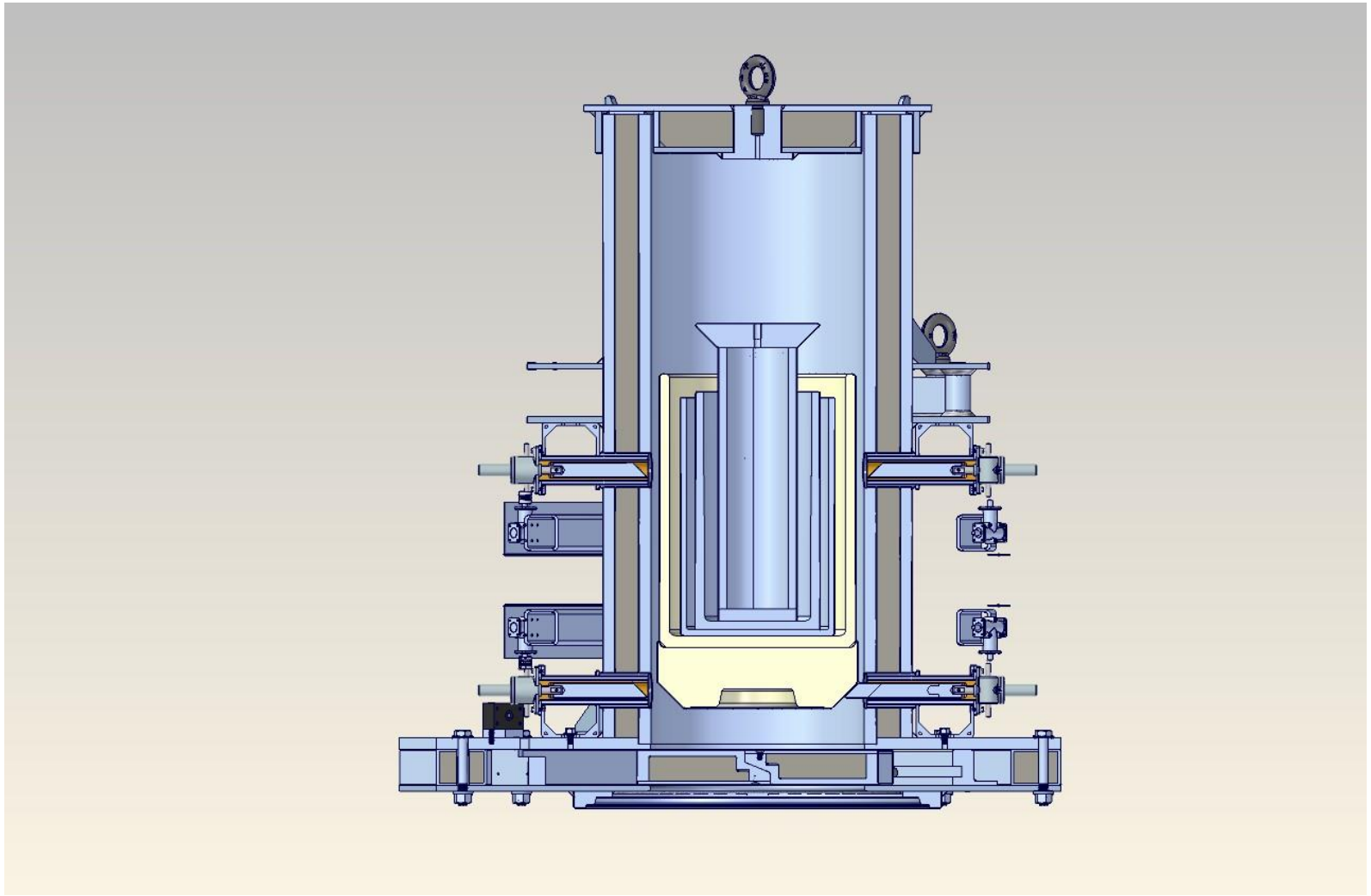
Process – Furnace Operations



Process Equipment

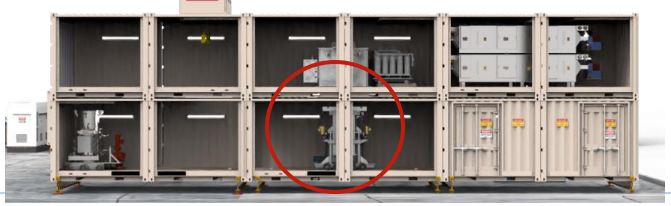


Loaded Transfer Container



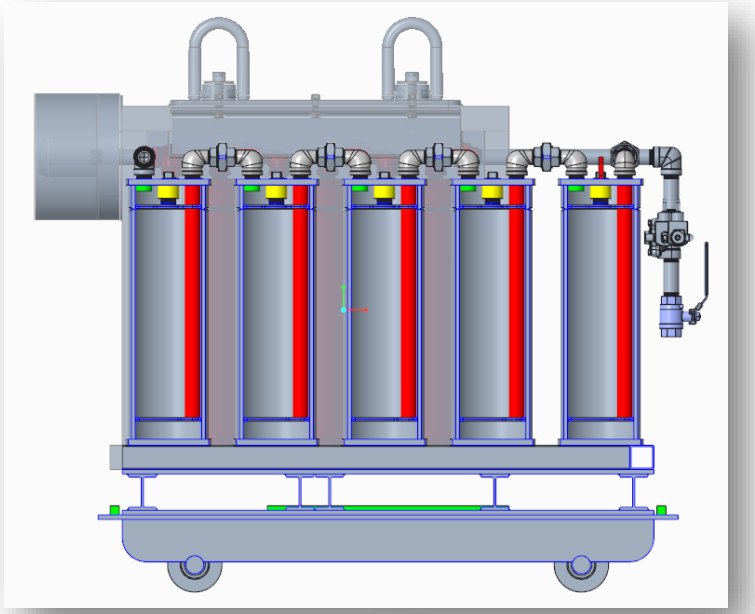
Dolley and Transfer Container

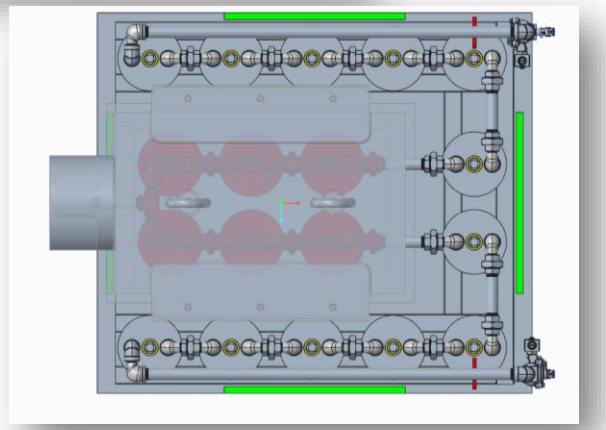
Process Equipment



Crucible Arrangement and Material Receipt

Offgas Layout





MMC Process Module Operation

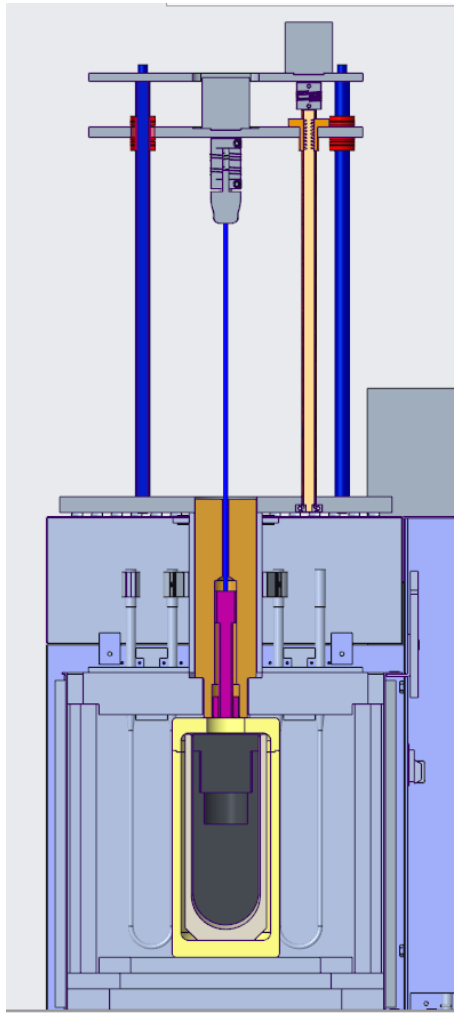
MMC Research and Development Review

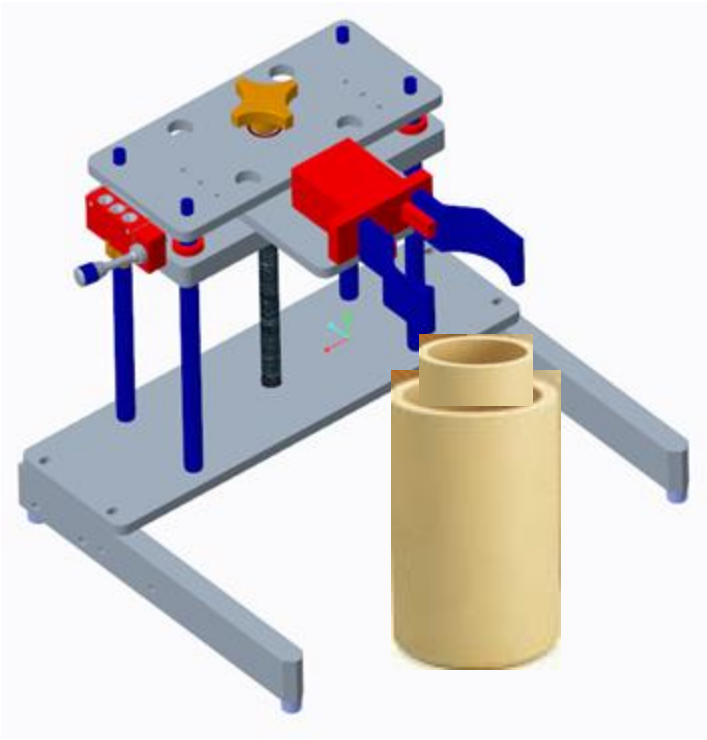
Savannah River National Laboratory®

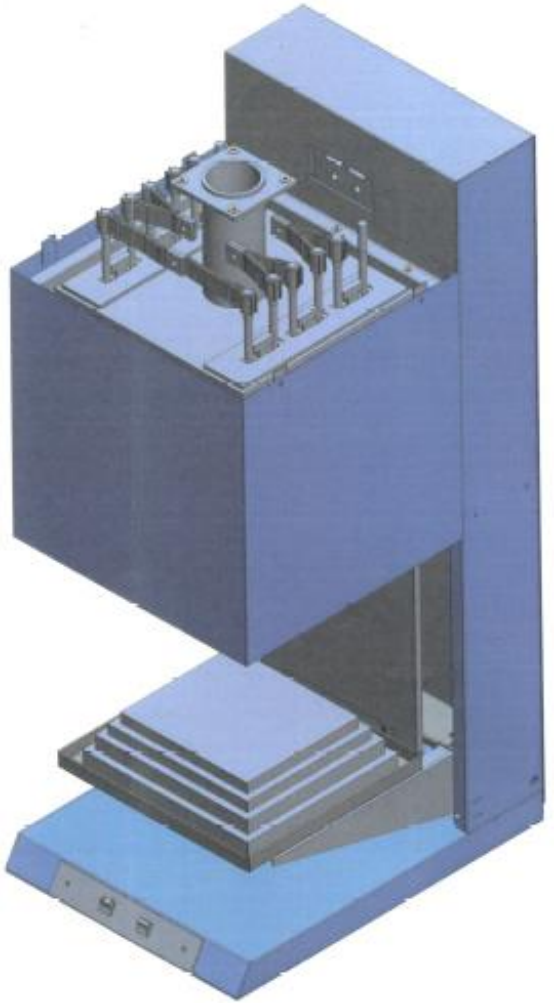
Small Scale Melt Matrix:

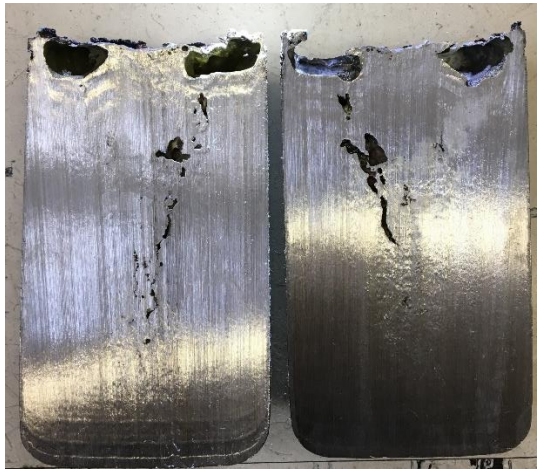
Run #	Label	Master Alloy	Crucible Liner	Can Material	Total Melt Weight (grams)	Master Alloy Melting Temp. deg. C	Process Hold Temp. deg. C	Process Hold Time (Minutes)	Melt Medium	Stirring (Y/N)	Furnace	Visual Results	Chemical Characterization	Status	What is the purpose of this test	Did the test meet its intended objective. (Notes and %)
1	AlY-1000-60	Al-Y	alumina	steel	45	960	1000	60	Flowing Argon	N	Tube	can lid un-dissolved but melted dissolved bottom	visual	9/13/2019	to measure the extent of reduction in Al as a result of Y additions	No
2	AlY-1000-240	Al-Y	alumina	steel	45	960	1000	240	Flowing Argon	N	Tube	can lid un-dissolved but melted dissolved bottom	Opt mtlgrphy/SEM/EDS/XRF	complete	to measure the extent of reduction in Al as a result of Y additions	Yes
3	AlY-1100-60	Al-Y	alumina	steel	45	960	1100	60	Flowing Argon	N	Tube	can lid un-dissolved but melted dissolved bottom	visual	complete	to measure the extent of reduction in Al as a result of Y additions	Yes
4	AlY-1100-240	Al-Y	alumina	steel	45	960	1100	240	Flowing Argon	N	Tube	can lid un-dissolved but melted dissolved bottom	Opt mtlgrphy/SEM/EDS/XRF	complete	to measure the extent of reduction in Al as a result of Y additions	Yes
5	AlY-1000-60	Al-Y	MgO	aluminum	230	960	1000	60	Flowing Argon	N	Muffle	little or no reaction oxides on bottom		complete	to measure the extent of reduction in Al as a result of Y additions	No
6	AlY-1100-60-1	Al-Y	ZrO2	aluminum	170	960	1100	60	Flowing Argon	N	Muffle	could not stir sample oxidize. Oxide bridged over crucible on top of melt and prevented stirring	visual	complete	to incorporate stirring into melt process schedule from melt#3	no
7	AlCa-800-60	Al-Ca	alumina	aluminum	230	700	800	60	Flowing Argon	N	Muffle	little or no reaction oxides on bottom	visual	complete	to measure the extent of reduction in Al as a result of Ca additions	No
8	AlCa-800-240	Al-Ca	alumina	aluminum	230	700	800	60	Flowing Argon	Y	Muffle	melted on 5/14/20 + slag oxides appear consolidated with metals dark vapors appeared on stirring	Opt mtlgrphy/SEM/EDS/XRF	complete	to incorporate stirring into melt process schedule from melt#7	
9	AlCa-900-60	Al-Ca	alumina	aluminum	230	700	900	60	Flowing Argon	N	Muffle	appeared to have little or no reaction oxides on bottom	visual	complete	to measure the extent of reduction in Al as a result of Ca additions	No
10	AlCa-900-240	Al-Ca	alumina	aluminum	230	700	900	60	Flowing Argon	N	Muffle	little or no reaction oxides on bottom 12/26	visual	complete	to measure the extent of reduction in Al as a result of Ca additions	No
11	SSY-1400-60	SS-Y	alumina	stainless	750	1350	1400	60	Flowing Argon	N	Muffle	12/27/2019 made with Fe-Y master alloy in can and 310 SS resting on top of lid, fully melted with reacted material on top	visual	complete	to measure the extent of reduction in SS as a result of Y additions	yes
12	SSY-1400-240	SS-Y	alumina	stainless	750	1350	1400	240	Flowing Argon	N	Muffle	12/31/2019 made with Fe-Y master alloy in can and 310 SS resting on top of lid	visual	complete	to measure the extent of reduction in SS as a result of Y additions	No
13	SSY-1450-60	SS-Y	alumina	stainless	750	1350	1450	60	Flowing Argon	N	Muffle	12/30/2019 made with Fe-Y master alloy partially in can (1 chunk on top of can) and 310 SS on bottom. Not fully melted.	visual	complete	to measure the extent of reduction in SS as a result of Y additions	No
14	SSY-1500-75	SS-Y	alumina/MgO	stainless	350	1350	1500	75	Flowing Argon	Y	Muffle	10/14/2020 made with Ni master alloy and 304L SS on top	visual/Opt mtlgrphy/SEM	complete	to measure the extent of reduction in SS as a result of Y additions	No
15	SSCa-1400-60	SS-Ca	alumina/MgO	stainless	750	1280	1400	60	Flowing Argon	N	Muffle	1/02/20 made with Ni master alloy in can and 304L SS on top. Not fully melted.	visual	complete	to measure the extent of reduction in SS as a result of Ca additions	No
16	SSCa-1500-60	SS-Y	alumina/MgO	stainless	350	1280	1500	60	Flowing Argon	Y	Muffle	10/15/20 made with Ni master alloy in can and 304L SS. Melted but not homogenius	visual	complete	to measure the extent of reduction in SS as a result of Ca additions	No
17	SSY-1475-60	SS-Y	alumina/MgO	stainless	350	1280	1450	60	Flowing Argon	Y	Muffle	10/16/2020 made with 304+Y master alloy. Fully Melted but not homogeneous	visual/Opt mtlgrphy/SEM	complete	to measure the extent of reduction in SS as a result of Ca additions	No
18	FeY-1450-60	SS-Y	alumina/MgO	master alloy	300	1280	1450	240	Flowing Argon	Y	Muffle	10/19/2020 made with Fe master alloy. Fully Melted but not homogeneous	visual/Opt mtlgrphy/SEM	complete	to measure the extent of reduction in SS as a result of Ca additions	No
19	SSCa-1470-120	SS-Ca	MgO	stainless	750	1280	1500	60	Flowing Argon	Y	Muffle	05/07/20 Melt 16 + slag layer Ingot was very easy to stir produced nice ingot	visual/Opt mtlgrphy/XRF/SEM/EDS/	complete	float slag on top of melt #16	Yes, stirring was possible
20	SSY-1500-60	SS-Y	alumina	stainless	750	1350	1500	60	Flowing Argon	Y	Muffle	5/12/20 #13 + slag layer and stirring + added 7g of Zr to see where it would be distributed	visual/Opt mtlgrphy/XRF/SEM/EDS/	complete	float slag on top of melt #18	Yes, stirring was possible
21	AlY-1050-60-1	Al-Y	alumina	aluminum	180	960	1050	60	Flowing Argon	Y	Muffle	4/3/20 Melt 6 + slag layer and stirring, slightly lower temperature than #6 stirring was possible	visual/Opt mtlgrphy/XRF/SEM/EDS/	complete	float slag on top of melt #6	Yes, stirring was possible
22	AlCa-900-240	Al-Ca	alumina	aluminum	230	700	900	240	Flowing Argon	Y	Muffle	5/5/20 Melt 9 + slag layer and stirring.	visual/Opt mtlgrphy/XRF/SEM/EDS/	complete	float slag on top of melt #8	Yes, stirring was possible

SRNL Support for IFE Shielded Cells: Furnace Design and Assembly









MMC Offgas Development Testing Review

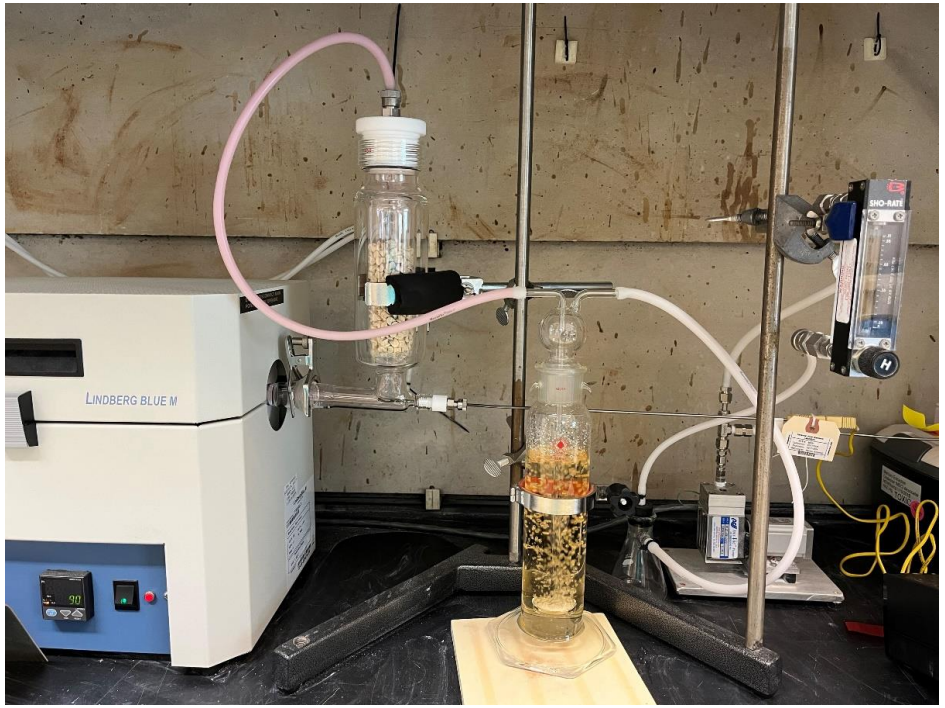
Savannah River National Laboratory®

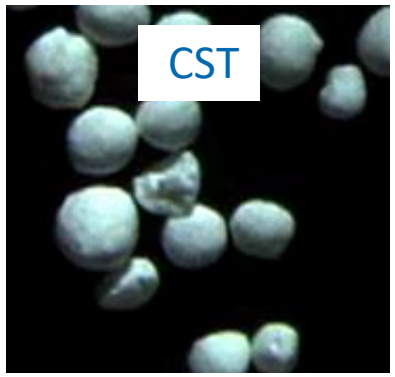
Small-Scale Testing – Ambient Temperature Sorbent Cartridges

CST and/or Zeolite for cesium

Sintered Flyash for technetium (rhenium)

Silver-coated zeolite for iodine





Sorbent	Diameter (mm)
Zeolite 4A	1.6
Zeolite 3A	3.8
CST	0.45

MMC Operational Readiness

Savannah River National Laboratory®

MMC Operational Readiness

- **Operational Readiness Review (ORR):** A disciplined, systematic, documented, performance-based examination of the MMC system, equipment, personnel, procedures and management control systems for ensuring MMC can be operated safely within its approved safety envelope as defined by the system safety basis plan.
    - Are our staff ready? …
    - Is our environment ready? …
    - Are our end users ready? …
    - Have we considered and planned for our risks? …
    - Do we have a maintenance plan?

MMC Validation Testing Status

- PLC Installation and System FAT
- Startup & Test
- Testing of Non-process Components and Movements Ongoing
- Validation Testing of Process Components (HEPA/Furnace)
  - Bump test
  - Melt testing
  - Air balance testing
  - Multiple stainless melts with additives/surrogates

Validation Testing

- Furnace Operability
  - Temperature profile within enclosure
  - Furnace safety system functions
  - Furnace melting and mixing (with characterization)
  - Remote operation and monitoring
- Contamination Controls
  - Air balance
  - (Airlock) Door operations
  - Material handoffs
- Transport Systems
  - Movement and location
  - Proper handoff and loading/unloading
- Power
  - Total power needs
  - Power source transitions (UPS/ATS)
- Offgas Efficiency and Utilization
- Volatile Materials Retention
- Integrated PLC Operation
  - Cameras, alarms, switches, and sensors

Questions

Brian B. Brown – brian02.brown@srnl.doe.gov

Savannah River National Laboratory®

We put science to work.™

Mobile Plutonium Facility

Doug Lowry, Executive Advisor

NA-213, Office of Nuclear Smuggling and Deterrence Visit, November 02, 2023

MPF Mission

Maintain a capability to enable denuclearization of nuclear programs while supporting verification efforts by providing;

- In-country stabilization, packaging and removal of at-risk nuclear materials
- Experienced teams
- 30-day readiness
- Sampling for forensics
- Characterization of actinides and chemicals
- Stabilization
- Safety to workers and the environment during operations
- Producing stable, packaged product ready for shipment and subsequent safe storage pending disposition

Additional Mission Capabilities

Early Operations

- Rapid deployment to assist other organizations with basic safety characterization and criticality safe storage while the rest of the MPF complex is being readied for deployment or other early nuclear material dispositioning needs.
  - Deployment in 7-14 days
  - Small team size 7-12 SME(s)
  - Small equipment footprint (3-7 modules)
    - *Full X-Ray DR & CT capability*
    - *Radiation and contamination monitoring*
    - *HPGe, RadEye, Gemini, XRF, and Identifinder*
    - *Classified satellite communications*
    - *Criticality Safe Storage Array*
    - *Calorimetry, Neutron and Gamma assay*
    - *Power grid*
    - *Control Room for Command-and-Control*
  - Exercises
    - *Sputnik I, 2015, LANL*
    - *Peregrine Falcon, 2021, Sellafield UK*
    - *Sputnik II, 2023, LANL*
    - *Red Kite, 2023, Sellafield UK*

Red Kite (Sellafield UK)

Additional Mission Capabilities

Remote Recovery Operations

- Rapid recovery, packaging and removal of nuclear materials from a foreign country
  - Deployment in 3-7 days
  - Small team size 4-8 SME(s)
  - Small equipment footprint, one trailer that can be pulled by a standard duty truck
    - *Generator*
    - *Respiratory equipment & Rad PPE*
    - *HPGe, RadEye, Gemini, XRF, and Identifinder*
    - *Portable X-Ray Digital Radiography (DR)*
    - *Radiation and contamination monitoring*
    - *Classified Satellite Comms*
    - *Packaging quick hit equipment*
    - *Portable HEPA filtered glovebags*
    - *Remote controlled robotic equipment*

Skills House - Dark Sleeper, UK

Safety Documentation

• **Functional Design Requirements**	2005 (SRNL, PNNL, LANL
• **Hazards Analysis**	2006, 2009, 2011, 2016, 2019
• **Dose Rates Calc, 077**	2012
• **Safety Basis Strategy**	2013,2014
• **NCSE 024: Operations**	2011,2012,2016,2018,2019
• **NCSE 032: NIMS**	2013 (deactivated
• **NCSE 051: CAAS**	2022 Drafted but not approved to replace 2013
• **Safety Analysis**	2016, 2018, 2020, 2020 (DRAFTS)
• **Technical Specifications**	2016, 2017, 2019, 2020, 2020 (DRAFTS)
• **Developed a USQ-Like process** - Form MPF-FRM-002 - MPF-2012, FOSC Charter - MPT-2008, Nuclear Safety Evaluations	2016

MPF Exercises

2005 - 2007	Design/Construction/Startup Testing
2008 - 2011	Team Selection/ Training/ Program Development
2012	Cutthroat Trout: Nevada Nuclear Security Site, NV
2013	Firebird: Savannah River National Laboratory, 645N, SRS, SC
2014	Arctic Char: Cold Regions Test Center, Ft. Greeley, AK
2015	Thunderbird: Savannah River National Laboratory, 645N, SRS, SC
2015	Sputnik I: Los Alamos National Laboratory, Los Alamos, NM
2017	Corvina Loco: Navel Air Station Key West, Key West, FL
2019	Southern Osprey: 100 miles offshore from Norfolk, VA
2021	Relentless Rook: Savannah River National Laboratory, P-Reactor, SRS, SC
2021	Peregrine Falcon: Sellafield Nuclear Site, Seascale, UK
2022	Dark Sleeper: Weeton Barracks, Preston, UK
2022	Puffin Peeper: Dounreay Nuclear Site, Thurso, Scotland
2023	Sputnik II: Los Alamos National Laboratory, Los Alamos, NM
2023	Red Kite: Sellafield Nuclear Site, UK
2024	Blackfin Ghost: Australia
2025	Black Swift: TBD
2026	Magpie Challenge: South Korea (ROK)

Mission Logistics

PROVIDED BY SUPPORT ORGANIZATIONS:

- Classified Satellite Communications (RSL)
- Transportation of facility equipment and team to and from host country and within the country (DTRA & STS)
- Transportation of nuclear materials from the host country facilities to MPF (TBD)
- Transportation of nuclear materials from MPF to final destination (MPF will escort) (DTRA)
- Non-operations support for the team while in-country (DTRA or HC)
  - Food/Water
  - Lodging
  - Restrooms
- Security at the MPF site and billeting area as applicable (DTRA or HC)
- Emergency evacuation for illness or otherwise required by in country situations (DoS, DoD)
- Diesel Fuel for generators (DTRA or HC)
- ISO Container moving equipment (20-ton fork truck, or crane) (DTRA or HC)

Notional Timeline

Mission Identified

Large Missions:
Smaller Missions: Sets may vary

Mission Readiness Phase
1-4 Weeks
Assemble Team
Readiness Eval
Packing Equip
Logistics Planning

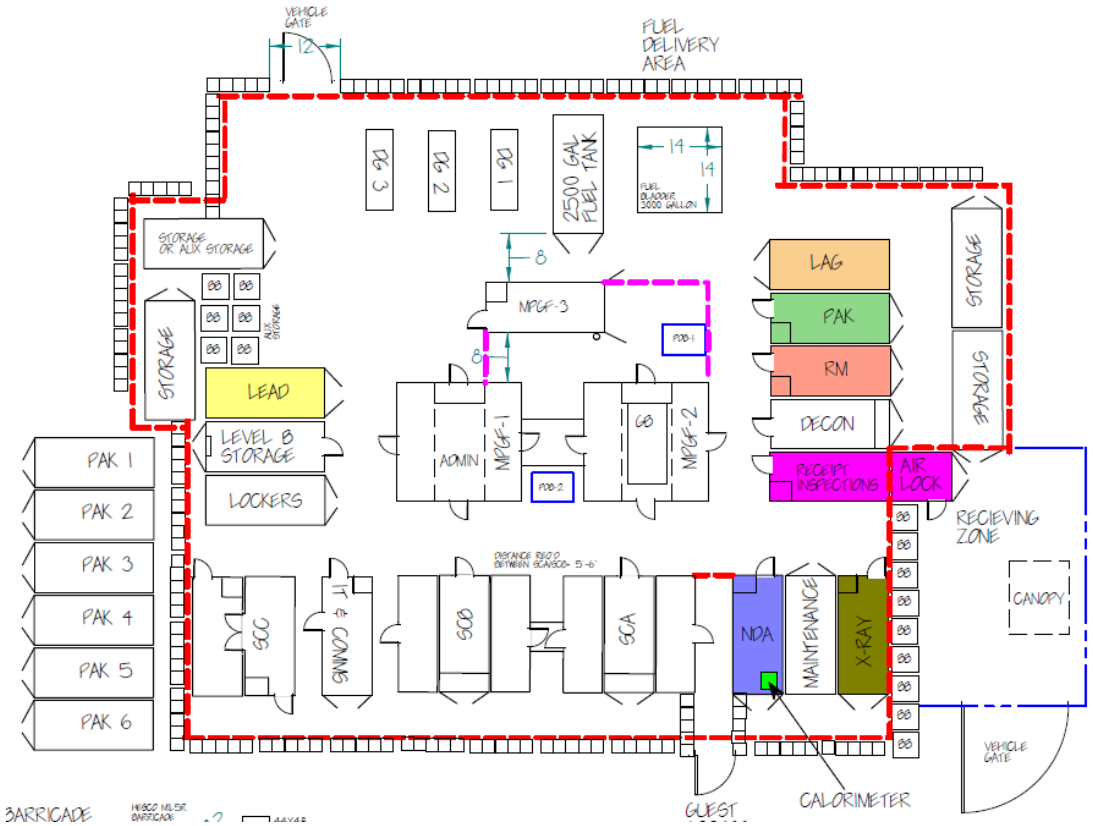
Transport
1-4 Weeks
DoD or Commercial Air/Sea/Land

Start Up & Test
1-2 Weeks
Test systems
Set up comm's

Mission Phase
3-6 Months
Operations, Stabilization, Packaging

Post Mission Phase
2 Weeks
Ship Materials
Disassembly
Ship Equipment

MPF Complex



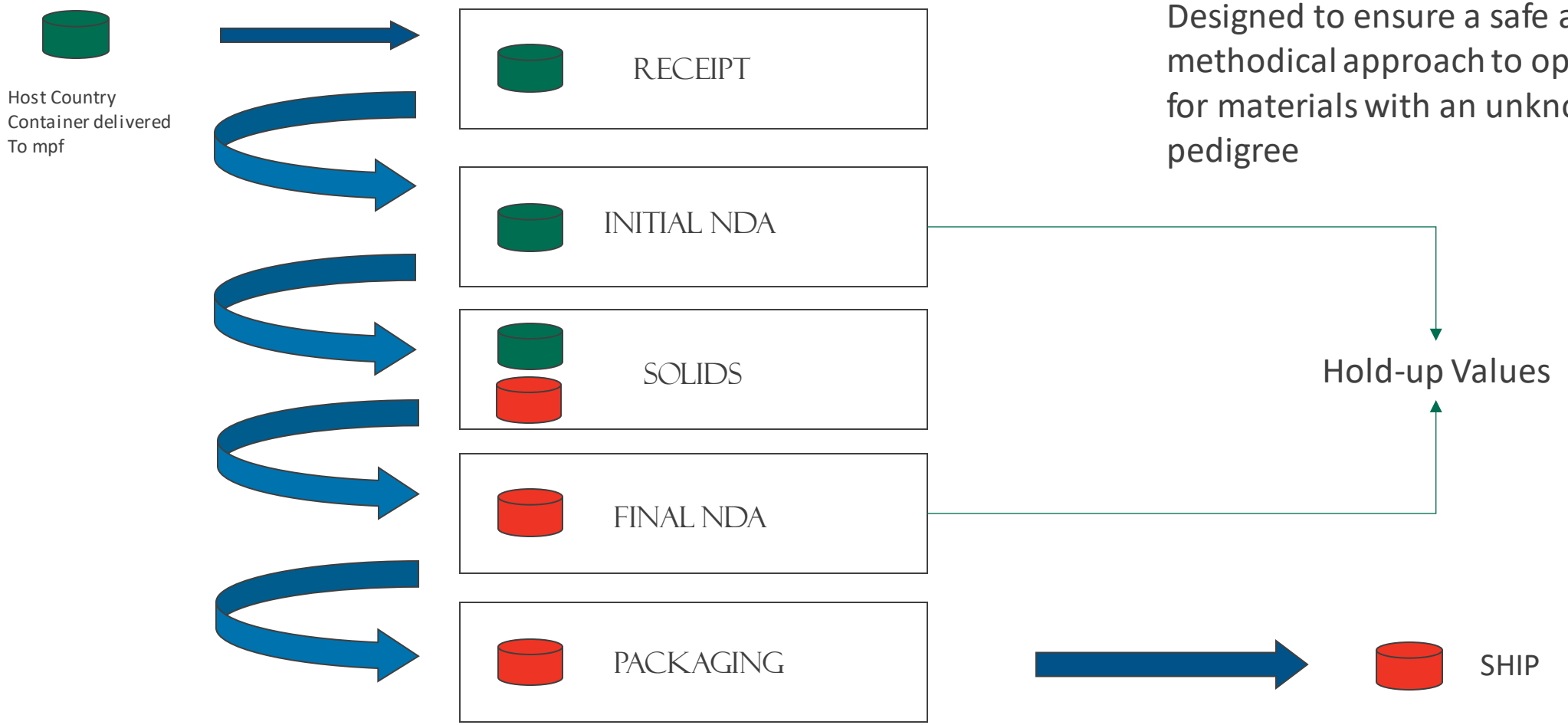
- Criticality Controls
  - Mass Balance Area shown in red
  - Nine individual Mass Control Zones
- Footprint is changeable to accommodate the needs of the mission plan
- Perimeter walls can be made from MPF containers or other materials provided in country
- Lighting and camera surveillance provided for security in addition to G^3 (guards, gates & guns) provided by others

MPF Personnel

Subject Matter Experts (SME) from SRNL, SRNS, LANL, and PNNL

- Primary Team ~ 30 SME(s)
  - Pu Process SME(s)
  - Pu Glovebox SME(s)
  - Engineering & Maintenance
  - Radiation Protection
  - Administrative
  - IT & Communications
  - Packaging & Shipping
  - NDA / Criticality
  - Operations / Maintenance / Engineering
- ~ 20 trained alternates
- Home Team for consultation (call back)
- Subset of 12 team members for assembly, startup testing, disassembly and shipping

MPF Five Step Process

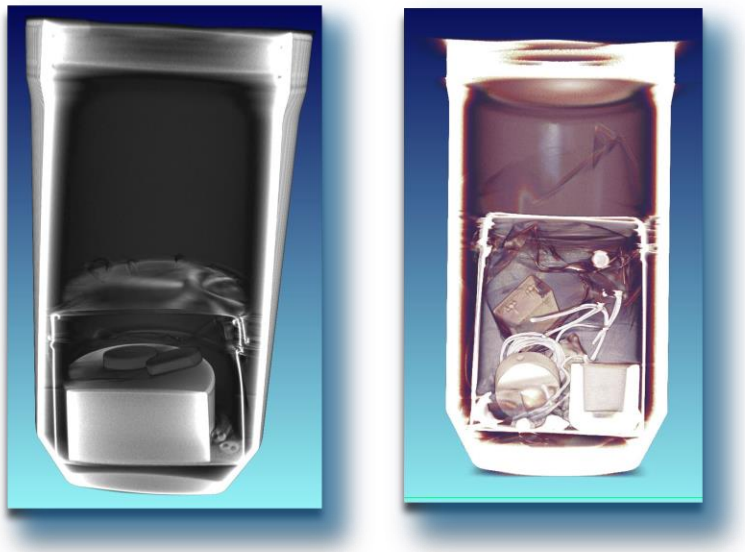


1A-Receipt

HC Declaration/ Manifest
Turnover from HC or DoD to MPF
Chain of Custody
Radiological survey
TID application
Container Weight
Photographs
HPGe (spectra analysis)

Mobile X-Ray
-Pre receipt
-Remote locations

1B-X-Ray



- Digital Radiography (DR)
- Computed Tomography (CR)
- Densities
- Content identification
- Mobile X-Ray Digital Radiography (DR)

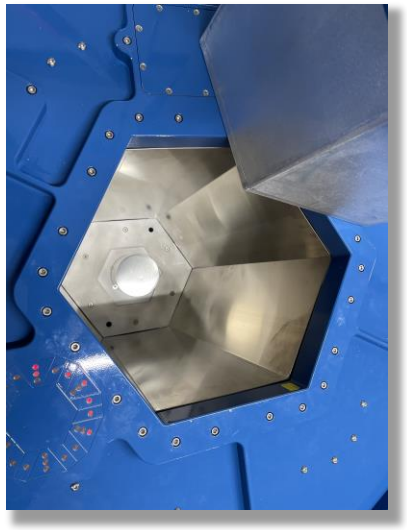
2-NDA Initial

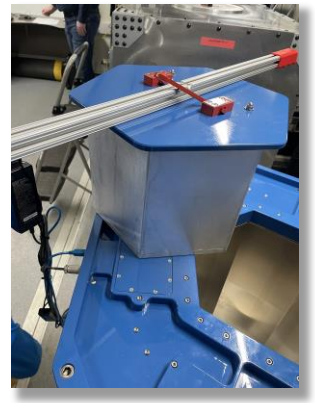
HEXAGONAL Neutron Multiplicity Counter (HNMC)

Neutron detector for passive neutron coincidence and multiplicity counting of dirty scrap and bulk samples of plutonium.

High precision measurements of bulk plutonium samples in a variety of containers.

The plutonium mass can be computed from the resultant data coupled with the isotopic distribution measured by the HPGe.

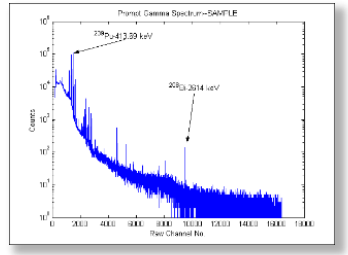




Two Calorimetry Systems

Measures heat output resulting from radiological decay of plutonium. The plutonium mass can be computed from the resultant data coupled with the isotopic distribution measured by the HPGe.

GAMMA ISOTOPIC SYSTEM AND Prompt Gamma Analysis



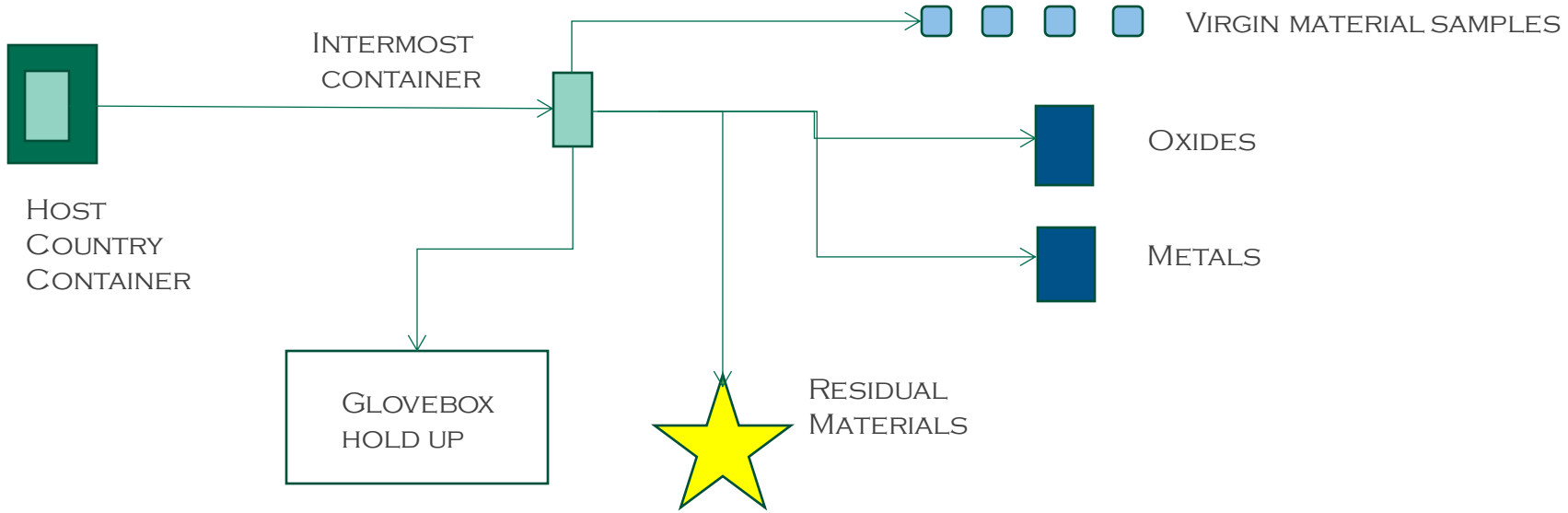
HPGE: High Purity Germanium Detector to determine plutonium isotopic distribution and identification of elemental contaminants by gamma pulse height analysis

3-Solids (Glovebox Operations)

Initial characterization of nuclear materials in an inert atmosphere
Separation of material types and sampling of virgin materials
Chemical Analysis
Oxidation of small Pu metals
Stabilization of Pu Oxides
Primary packaging of Pu oxides and metals for final shipping

4-NDA Final

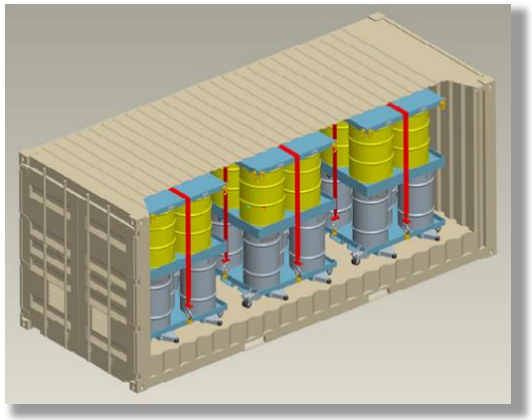
New NDA Module

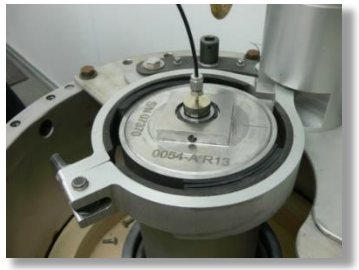


Accountability
Tracking

5-Packaging

Approved compliant packages for nuclear materials and residual materials

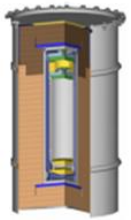




9975

Container Specs:
- 19" dia
- 36" tall
- 404 lb max wt.

Inner Cavity Specs:
- 5"/6" dia
- 17"/22" tall
- 19 W , 44.4 lb payload



International Certification for Pu
Authorized for Pu and U content

7A Certified TRU 55 Gal.

Container Specs:
- 24" dia
- 35" tall
- 1008 lb max gross wt

- Will contain 15 – 20 cuts of TRU
- WIPP Certified
- Non-lined, ring closure

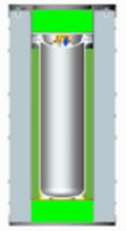
FL Package

Top 3 Items to Address:
- Content Envelope
  - Specific to US Inventory
- Packaging Specifics
  - New to fleet
- Handling Specifics and Tooling
  - Size: 24" dia/50" tall
  - Weight: 370 lbs

BTSP

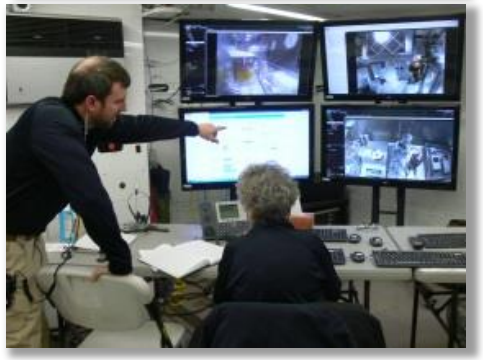
Container Specs:
- 25" dia.
- 50" tall
- 515 lb

Inner Cavity Specs:
- 14" dia
- 38" tall
- 50 W , 120 lb payload



Limited Content authorizations

Command and Control



Process Command & Control

- Criticality Safety
- Prioritization
- Scheduling
- Work Authorization
- Analysis
- Material Tracking
- Information Gathering

FM

Facility Command & Control

- Technical Specification. LCO
- Equip rounds
- 24/7 Monitoring
- Maintenance
- Engineering
- Configuration Mgmt
- Surveillance
- Emergency Response

Mission Objectives
Outside Coord.
*Safety Basis Oversight

TL

Supporting Team Structures

Communications	In Country: Radios, VOIP Satellite comms to USG Home team support
Information Technology	Material Information Tracking System Facilities equipment tracking, alarm status
Radcon	Radiological monitoring (dose and contamination) Decontamination module for personnel and equipment
Admin	Procedures Personnel accountability Nuclear materials movement & accountability
Medical	Emergency medical support Radiological medical support

Questions?

Please contact Doug Lowry
Douglas.Lowry@srnl.doe.gov
803-507-8537