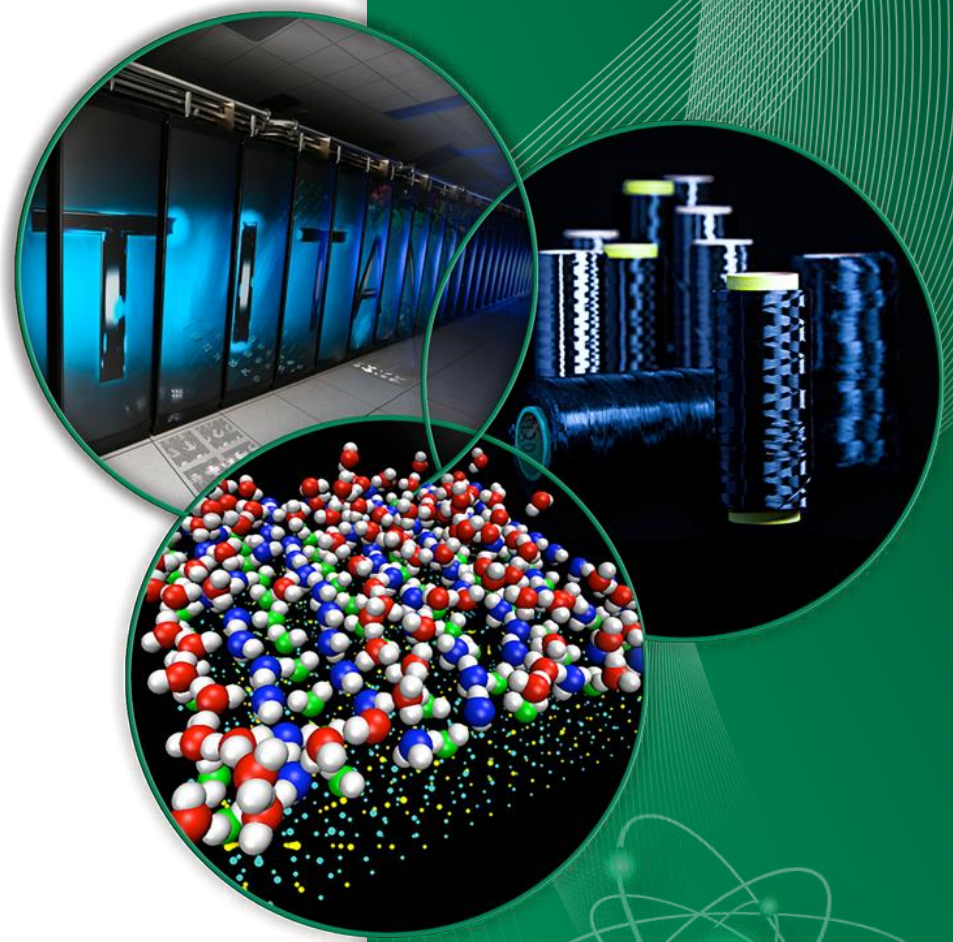
NSED Monthly Report



August 2013

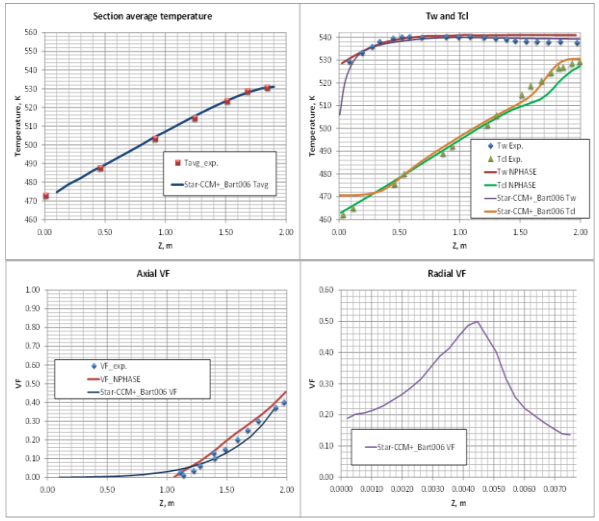
Nuclear Science & Engineering Directorate

Demonstration & assessment of an advanced modeling capability for multiphase flow with subcooled boiling

Science Highlight

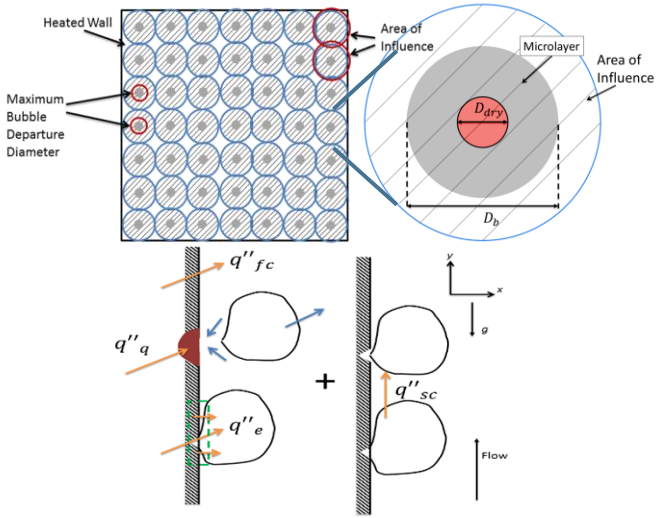
CASL
Consortium for Advanced Simulation of LWRs

Robust Baseline Closure



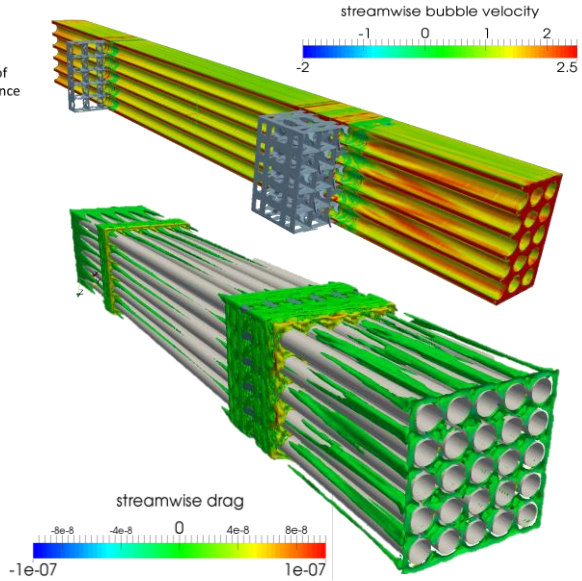
- Mature closure ready for Hydra-TH implementation
- The closure confirms the expected sensitivity from preliminary V&V work
- Validation on Bartolomei experiment confirms expected model accuracy

Innovative GEN-II Closure



- Increased synergy with experimental "micro" measurements
- Extended applicability (lower/ higher vapor generation)
- Include modeling toward limiting behavior (CHF)

New Multiphase-CFD Platform



- Shakedown of Hydra-TH multiphase capabilities show promising enhancement in robustness
- Hydra-TH introduces new capability towards transient simulations (including fast transients)

Contributors:
Jacopo Buongiorno, Yassin Hassan, Masahiro Kawaji ,Gretar Tryggvason, Igor Bolotnov, Annalisa Manera, Michael Z. Podowski, Sreekanth Pannala, Jozsef Bakosi, Lori Pritchett-Sheats, Robert Nourgaliev

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE U.S. DEPARTMENT OF ENERGY

Visiting industrial leaders discuss R&D and technology transfer opportunities

Fred Moore, Mark Haynes, and Finis Southworth of the Next Generation Nuclear Plant (NGNP) Alliance organization were hosted by Sacit Cetiner and Gary Mays on August 26–27.

- During their time at ORNL, laboratory staff provided them with tours and information on ORNL's R&D activities related to advanced reactors. Jeff Binder met with the visitors both days.
- On August 27, Fred Moore presented a laboratory-wide seminar on High Temperature Gas-cooled Reactors (HTGR) and their potential use for high-temperature process heat applications.

TerraPower, LLC, Vice President of Engineering, Pat Schweiger; Deputy Chief Engineer, Jun Ding; and Senior Systems Lead, Owen Nelson visited ORNL on August 27–28 to engage in technical discussions about the development of instrumentation and control (I&C) concepts and technologies for the Traveling Wave Reactor (TWR). David Holcomb and Richard Wood of Reactors and Nuclear Systems Division hosted the visitors.

- Pat Schweiger gave an overview presentation of the TWR concept during an open seminar.

GTRI team, including ORNL's Kimberly Anderson and David Duhamel, recognized by NNSA

- The Global Threat Reduction Initiative (GTRI), Transportation Security Project Team supported the deployment of two radiological transport vehicles to the Philippine Nuclear Research Institute. A dedication ceremony was held August 27, 2013
- ORNL's Kimberly Anderson and David Duhamel are members of this team
- This represents the project team's ongoing efforts around the world in enhancing the security of radiological material while in transport

GTRI Transportation Security Team photo (including ORNL's Kimberly Anderson and David Duhamel) at the Aug. 27 Dedication Ceremony

NNSA NEWS

National Nuclear Security Administration
U.S. Department of Energy
For Immediate Release
August 27, 2013
Contact: NNSA Public Affairs, (202) 586-7371

NNSA, Philippine Nuclear Research Institute to Prevent Radiological Terrorism

MANILA, Philippines – The National Nuclear Security Administration (NNSA) and the Philippine Nuclear Research Institute (PNRI) announced today the commissioning of two secure radiological transportation vehicles as part of a broader cooperative effort to help combat nuclear and radiological terrorism in the Philippines and around the world. The two vehicles are standard cargo vehicles, customized with extra security features specifically designed in coordination with PNRI to provide a more secure means of transporting radiological material within the Philippines.

Photo of radiological transport vehicles

See full press release at: http://nnsa.energy.gov/mediaroom/pressreleases/philippines082713

Summer Internship Program

Guest lecture provided

James Hindered
from
Siemens Molecular Imaging Inc.

This lecture described the technological advances of the field of nuclear medicine over the past few decades – primarily Positron Emission Tomography (PET) and how the cyclotron plays a key role in the delivery of PET.

Siemens Molecular Imaging Inc. develops a variety of medical products, including clinical and pre-clinical imaging systems such as PET/CT, SPECT, and SPECT/CT, as well as cyclotrons and biomarkers for radiopharmaceuticals.

Poster Session for all 57 interns;
33 Nuclear Engineering Science Laboratory Synthesis (NESLS) students' posters were judged for awards.

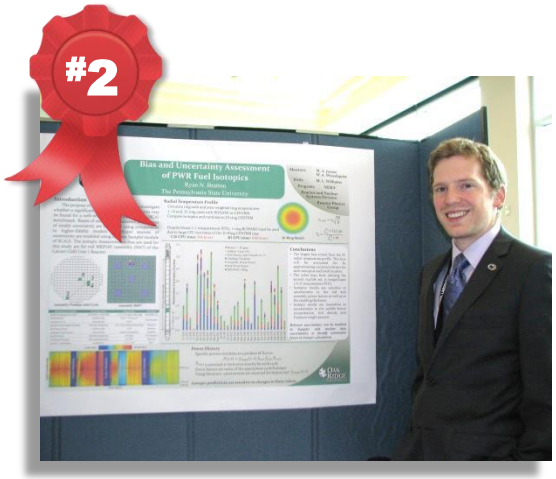
(see following slide for details)

Winners of the NESLS judged poster session

Tucker McClanahan

"Overview of CCR-22"

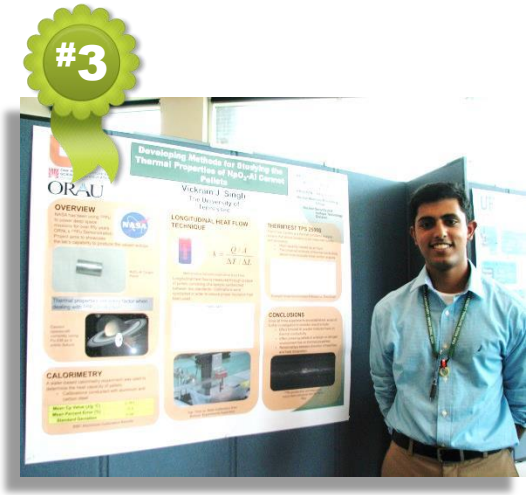
Instrument & Source Division
Mentor: **David Anderson**



Ryan Bratton

"Bias and Uncertainty Assessment of PWR Fuel Isotopics"

Reactor & Nuclear Systems Division
Mentor: **Will Wieselquist**

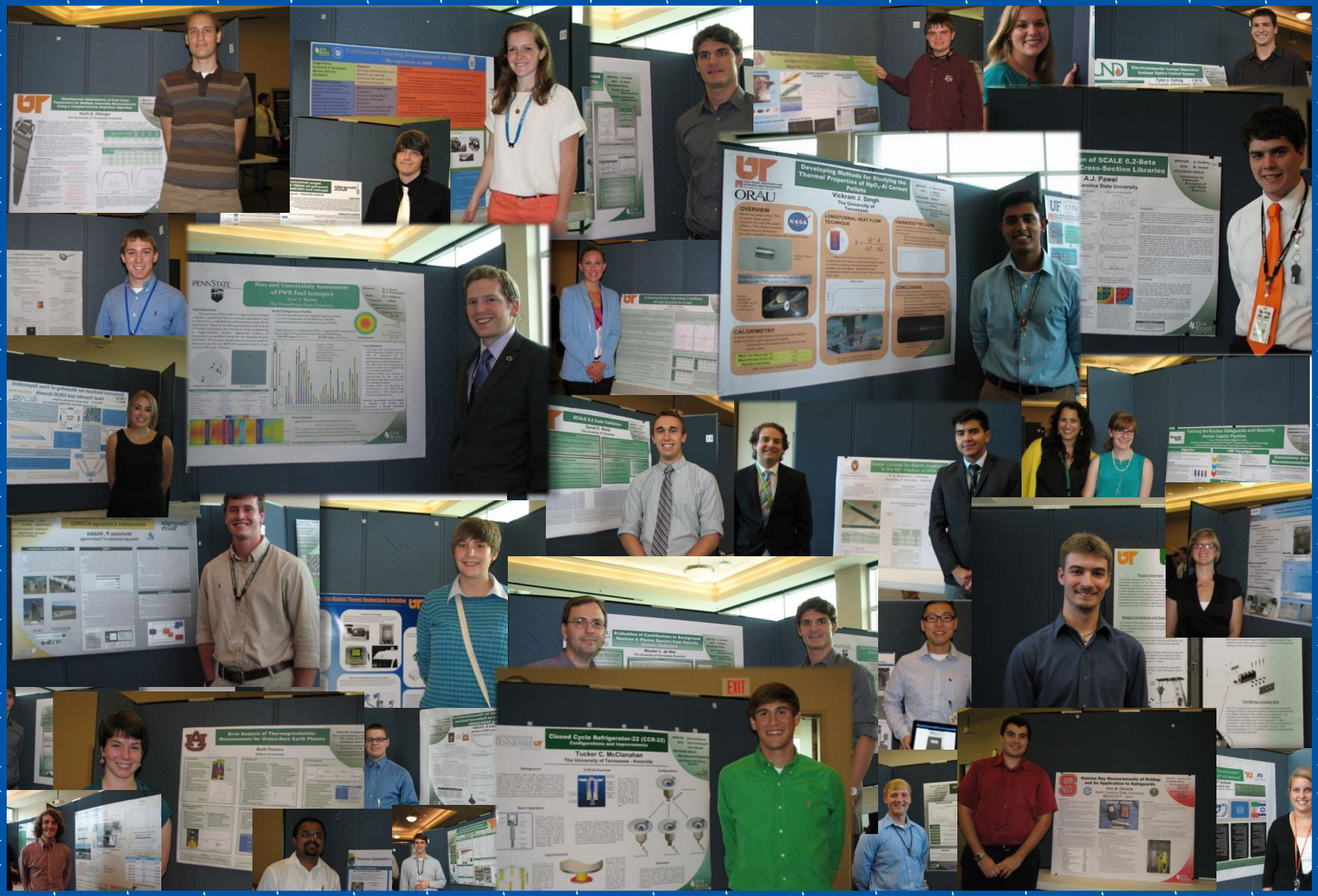


Vickram Singh

"Thermal Conductivity Studies on NpO2-Al Cermet Pellets"

Nuclear Security & Isotope Technology Division
Mentor: **Steve Owens**

Student poster contestants



Next Generation Safeguards Initiative

- ORNL Safeguards interns, fellows and staff attended two webinars offered as part of the Nonproliferation Lecture series coordinated by LLNL
- Strategic planning meetings were conducted on curriculum development at UTK, and the Triangle Institute for Security Studies (North Carolina State University, Duke, and University of North Carolina Chapel Hill) to fill a recognized gap in Safeguards and Verification Policy

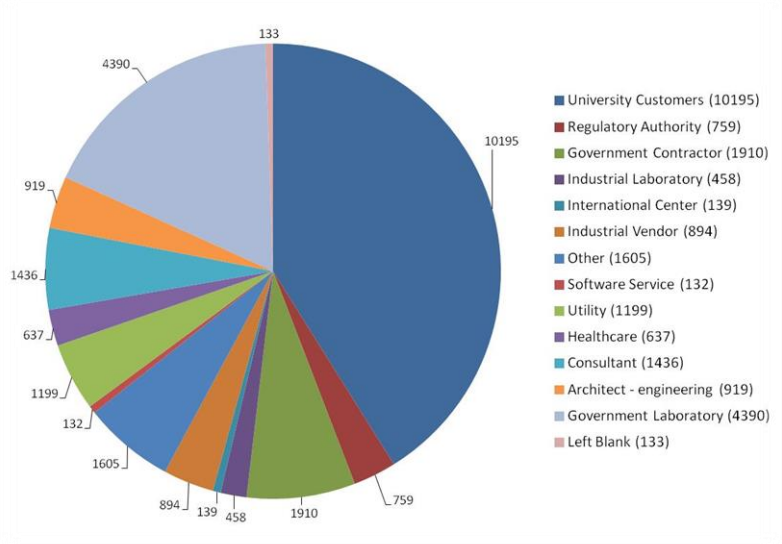
Previous Events:

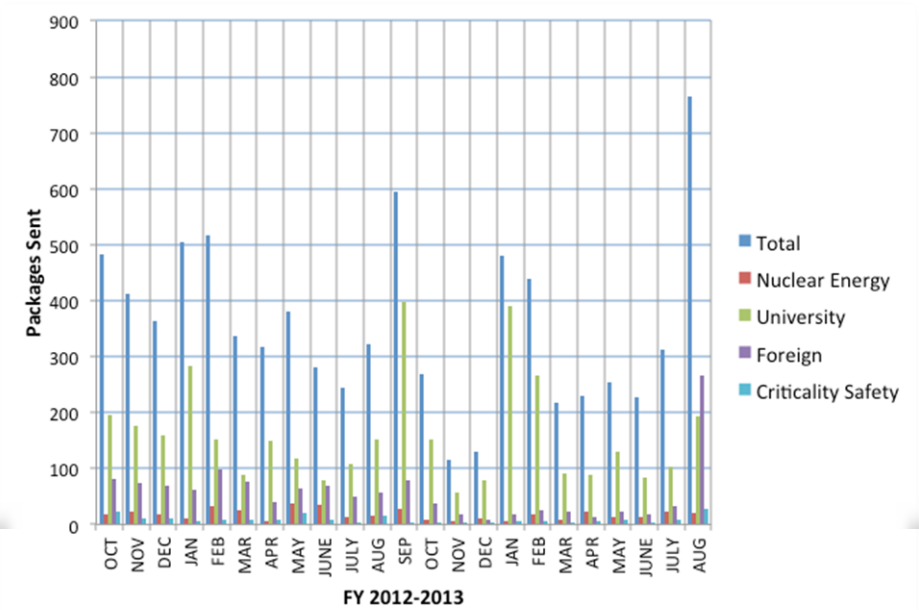
- *Conducted a nonproliferation workshop for 16 students and 2 professors from the University of Florida*
- *Trained the nonproliferation class at ORNL as part of a mock IAEA NDA inspection activities exercise conducted at the University of Florida*
- *ORNL Safeguards interns, fellows and staff attended eight webinars offered as part of the Nonproliferation Lecture series coordinated by LLNL; one of the lectures was provided by ORNL staff*

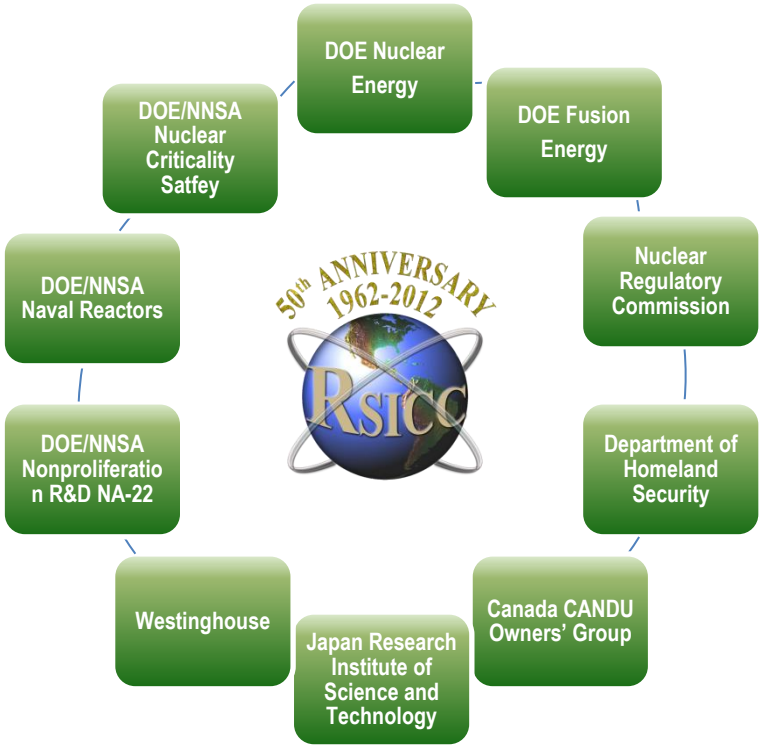
Student performing an active length measurement of a uranium fuel pellet and rods using a FLIR IdentiFINDER2™ handheld spectrometer at mock IAEA NDS inspection at Univ. of Florida

Radiation Safety Information Computational Center (RSICC): Serving the Scientific Community for 50 years

RSICC



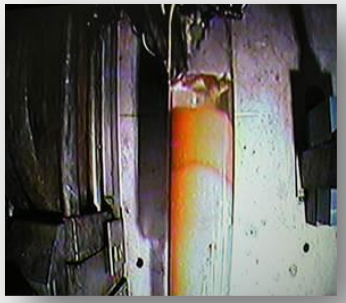




- **Software and data packages distributed FY 2013: 3436**
- **4 package updates and revisions August 2013**

Radioisotope production

Cf-252 Production Program



- Completed conversion of ~63 g C75 curium oxide.
- Oxide will be used for next set of targets
- All orders have been prepared and shipped on-time
- Stripped D-100 loaded ^{252}Cf package for next set of orders

Pu-238 Production Program

- Electron beam weld on ^{238}Pu target housing
- New glove boxes for assembly and radiography of full length targets have been installed
- A fully loaded targets are being assembled for irradiation in the VXF positions in HFIR
- ~400 NpO_2/Al pellets have been prepared
- Pa removal from ^{237}Np solution is done to reduce dose when fabricating pellets

Target Fabrication Refurbishment

- Shop assembly of the cubicle 1 transfer arm is in progress
- Fabrication of welding lathe system is in progress

Ac-225 Program

- Six shipments of ^{225}Ac
- 3 customers
- Activity of 59.6 mCi ^{225}Ac and 0.5 mCi ^{225}Ra

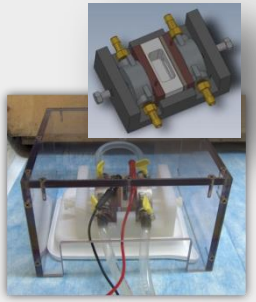
Radioisotope research & development

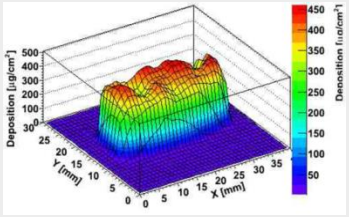
Catalyzed Electrolytic Plutonium Oxide Dissolution (CEPOD)

- CEPOD unit was assembled in the hot cell
- Initial Cm II samples are being dissolved

Electrodeposition Development

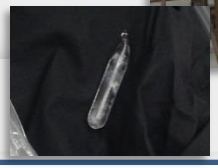
- Two deposition methods are under evaluation for use in super heavy element experiments and in preparation of 1 Ci electroplate for CARIBU
  - Ammonium Acetate
  - Isobutanol





Nuclear Data Th-229 Project

- 181.3 µCi of Ra-228 (0.67 µg) was sealed in a quartz glass ampoule and loaded into a standard finned rabbit.
- The rabbit was welded using gas tungsten arc welding
- Irradiation scheduled for Cycle 450



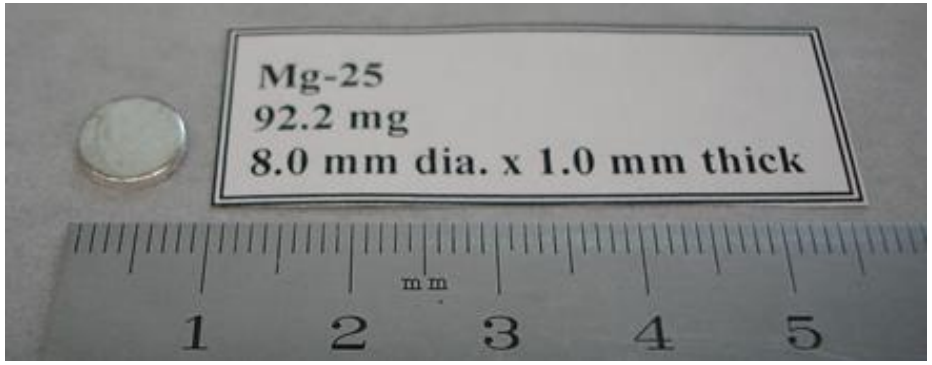
Enriched stable isotope technical services and shipping

Nineteen shipments of 61 enriched stable isotopes were made in August

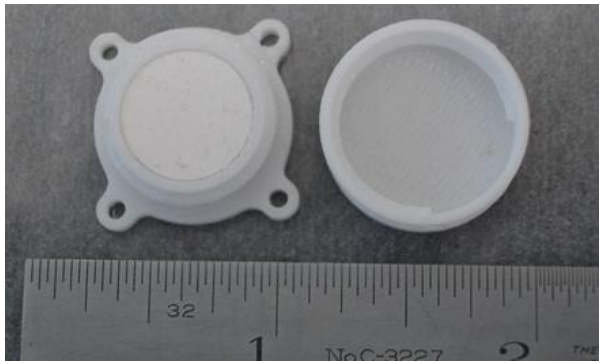
- 132 shipments of 405 enriched stable isotopes have been made in FY13 to date

Fourteen custom technical services were completed in August

- 215 technical services have been completed in FY13 to date
- Included the samples below and conversion of 200 mg of Ag-109 metal to acetate



Mg-25 metal disc for a foreign university to be used for electron paramagnetic resonance spectroscopy investigations.



Lease of Lu-176 oxide as a pressed disc ½" diameter to a national laboratory to investigate the isomer of Lu-176.

Oak Ridge National Laboratory
MANAGED BY UT-BATTELLE FOR THE U.S. DEPARTMENT OF ENERGY

WEBEX remote training for Desktop Analysis Reporting Tool (DART)

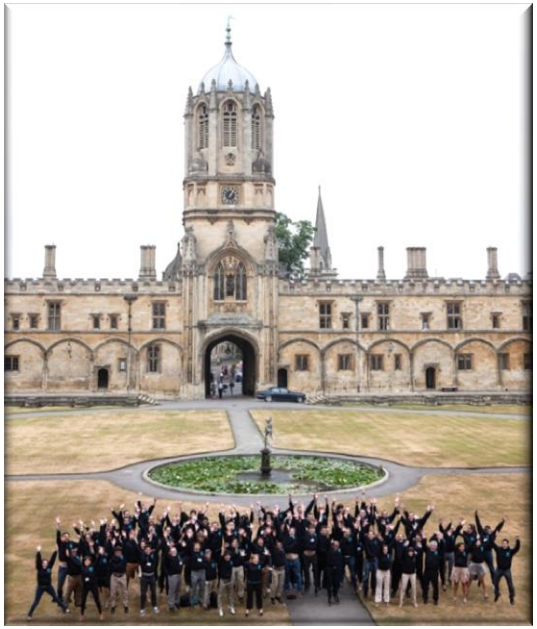
- A series of international WEBEX Remote Training Sessions for the Desktop Analysis Reporting Tool (DART)—an ORNL-developed software package that allows users to easily view and analyze raw data from the radiation portal monitor daily files over a long period of time—were held recently.
- Remote training via WEBEX allows operators, administrators, and maintainers around the world to connect with experts at ORNL to discuss operations and maintenance of the Partner's Country's Radiation Portal Monitors.
- Attendance included participants from the International Cooperation Bureau's Polish Border Guard, Unitrans and the Institute of Radiation Problems of National Academy of Sciences of Azerbaijan, Armenian Customs Inspectors, and Second Line of Defense Program (SLD) Managers from PNNL and Sandia.
- This training has saved the Program (SLD) ~100K in travel costs.

Screen shot of the DART Data Dashboard

World Nuclear Institute 2013

Each year the World Nuclear University (WNU) has a rigorous, six-week leadership development workshop at one of the leading colleges of Oxford University, Christ Church, for nuclear professionals ranging in ages from 27–37.

- NSITD's Jim Garner and Mike Kuhn attended WNU this summer.
- To date, NSITD has had 8 staff members accepted as Fellows in WNU's international networking peer group.
- This workshop is a great opportunity for new staff members to enforce their professional development in nuclear energy and technology.



WNU Class of 2013

Jim Garner (left)

Mike Kuhn (right)

Russian Federation Ministry of Defense upgrades and sustainability

Ministry of Defence of the Russian Federation

- ORNL personnel have been selected to lead multiple Maintenance/Computerized Maintenance Management System (CMMS) workshops for the Sustainability Team under NA-254's Office of National Infrastructure and Sustainability. These workshops will focus on the specific site needs regarding maintenance activities and the utilization of a CMMS to improve performance.

INECP work in Kenya

- Terry Donaldson led a team from other DOE labs and the International Nonproliferation Export Control Program (INECP) headquarters to observe the first-ever national pilot Chemical, Biological, Radiological, Nuclear, and Explosives (CBRNe) Commodity Identification Training (CIT) course in Nairobi, Kenya. Donaldson also conducted an Instructor Training workshop immediately thereafter, from August 5-9, 2013.

- Eighteen new Kenyan instructors, all technical specialists from several Kenyan agencies, attended the pilot course and the IT workshop.

- The Kenyan instructors are expected to begin teaching CBRNe CIT to officers of the Kenya Wildlife Service and other government agencies in the fall of 2013, and also to law enforcement officers from Tanzania and Uganda in the future. Thus INECP's CBRNe CIT will be extended into the East Africa region through regional cooperation.

An NNSA team led by ORNL completes cleanout of HEU from Vietnam's Dalat Nuclear Research Institute

The National Nuclear Security Administration (NNSA) completed a clean-out of Vietnam's highly enriched uranium, removing 11 kilograms of HEU spent fuel from a research reactor in a joint operation with the Russian Federation.

Stan Moses (ORNL) is the DOE/NNSA Vietnam Country Officer for this work, as well as overall Project Manager and Technical Project Officer.

The material, from the Dalat Nuclear Research Institute, was flown from Ho Chi Minh City to Russia, where it will be down blended into commercial nuclear fuel.

TUK-145C being loaded onto the AN-124-100 Cargo Aircraft at Bein Hoa airport (Vietnam).

Information management workshop in Vietnam

Ron Cain traveled to Hanoi, Vietnam, with a US technical team to:

- present an overview of information management concepts and components to the Vietnam Agency for Radiation and Nuclear Safety (VARANS);
- examine the State System of Accounting and Control from a State-level perspective;
- evaluate and prioritize gaps within their current system; and
- introduce the concept of a nuclear materials inventory tracking system.

An established common understanding of information management was achieved and VARANS has requested overall International Nuclear Safeguards and Engagement Program assistance in developing a system to handle specific reporting components.

U.S.-Argentina Joint Standing Committee on Nuclear Energy Cooperation

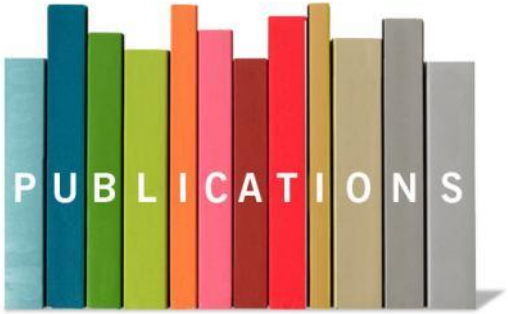
- NSITD hosted delegates from the US Department of State, US Department of Energy, Argentina delegates including Argentina's Ambassador for the 10th Annual U.S.– Argentina Joint Standing Committee on Nuclear Energy Cooperation (JSCNEC) ending in the signing of the joint agreement between the states.

- Argentina is known for its rapidly developing nuclear industry and the JSCNEC bilateral meetings help to establish technical cooperation and coordinate policy; as well as promoting collaboration between states for the advancement of nuclear energy.

US and Argentine delegates at Watts Bar Nuclear Power Plant (Pictured from ORNL: Randy Beatty, Michael Whitaker, Diana Tucker and Katy Snow)

- The group visited several ORNL facilities including High Flux Isotope Reactor, Radiological Engineering Development Center, Spallation Neutron Source and Consortium for Advanced Simulation of Light Water Reactors, and then traveled to Watts Bar Nuclear Power Plant and the Nuclear Regulatory Commission Technical Training Center in Chattanooga.

NSITD publications - August



- Letter Report – 3
- ORNL/TM – 6
- Paper in Conference Proceedings (Books, CD, etc.) – 2

CASL activities

CASL Collocation

- Mamba Discussions
- COBRA Working Group
- Reactivity Insertion Accident (RIA) and Departure from Nucleate Boiling (DNB) Meeting
- Thermal Hydraulics Methods Weekly Meeting

VOCC Tours

3 Tours for August 2013

- DOE Site Office
- Argentine Delegation
- Alacrinet Inc.

Meetings

Pete Lyons Brief – Modeling and Simulation Infrastructure Topics, August 21

DOE Annual Review August 13-14

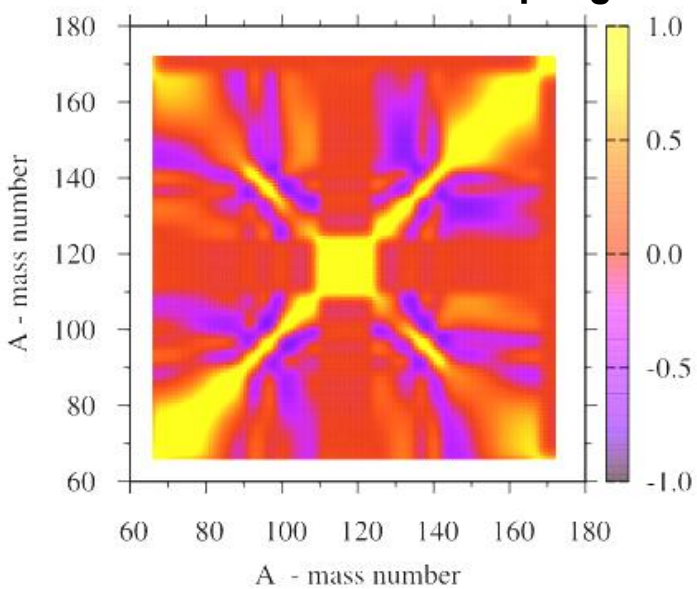
Used fuel S&T activities

- DOE-NE Milestones completed
  - Completed report describing requirements, capabilities, and use of Centralized Used Fuel Resource for Information Exchange (CURIE) website
  - Completed Preliminary Report on Dual-Purpose Canister Disposal Alternatives (FY13) that documents the first phase of a multi-year project to understand the technical feasibility and logistical implications of direct disposal of SNF in existing dual-purpose canisters (DPCs)
  - Completed technical report evaluating the potential implications of low-density, medium-density, and high-density used-fuel pool configurations on the size and operations for wet storage consolidated storage facility (CSF) concepts and repackaging facility (RF) concepts
- Worked with Sandia National Laboratories to organize and develop RADTRAN Workshop held at NRC offices
  - RADTRAN is mainly used for estimating radiation dose to the population and associated risk during radioactive material transportation
- Presentations made
  - Material Protection Accounting and Control Technologies (MPACT) working group meeting held in Germantown, MD
  - PATRAM 2013 held in San Francisco, CA
  - 10th Meeting of the U.S.-Argentina Joint Standing Committee on Nuclear Energy Cooperation held at ORNL

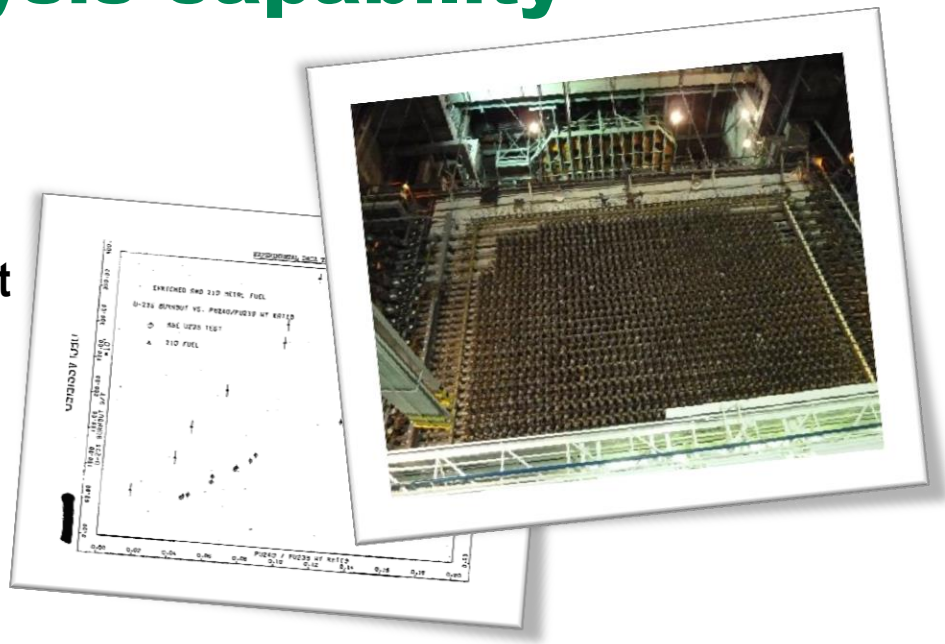
curie.ornl.gov/

Nuclear data for improved reactor analysis capability

- Developed fission product yield covariance data for uncertainty analysis
  - Provides physics-based uncertainties in regimes where limited measurements exist
    - UFD extended storage (*t* > 50 years)
    - Fallout uncertainty modeling
    - Burnup credit
  - Implemented in SCALE 6.2 beta with stochastic data sampling tools



Fission mass chain covariance matrix

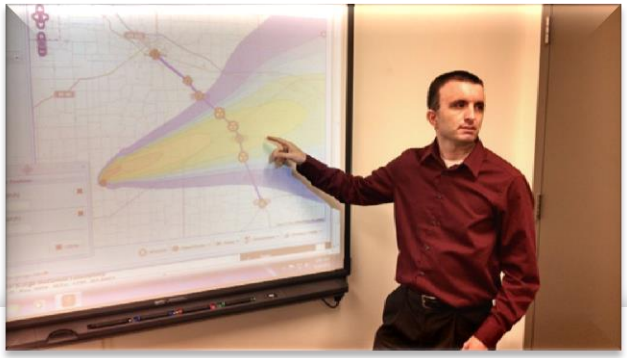


- Analysis of data from declassified Hanford B reactor experiments
  - Production measurements
  - Np-237 targets
  - Evaluation using ENDF/B-VII indicates potential nuclear data deficiencies
  - Coordinating review activities with CSEWG to improve evaluations

Roles in national nuclear forensics continue to expand

- Brandon Grogan of Reactor and Nuclear Systems (RNSD) and Ron Lee of Computational Sciences and Engineering Division (CSED) attended the National Technical Nuclear Forensics Ground Collections Task Force (NTNF GCTF) exercise "Radiant Crane" August 10–15 as controller/ evaluators.
  - This is the first time ORNL personnel have been allowed to serve as controllers for an NTNF exercise.
  - The exercise received many distinguished visitors (DVs), including Ms. Debbie Wilber, NA-40 director, and BG J. B. Burton, commander of the 20th Support Command (CBRNE). In these photos, the DVs are being shown the procedures used for analyzing nuclear fallout samples using gamma spectroscopy.

- Vince Jodoin visited Savannah River National Laboratory (SRNL) on August 13 to collaborate on a DTRA project. ORNL will provide fractionated noble gas inventories to SRNL to determine their value for nuclear forensics analysts.
- Vince Jodoin, David Hooper, and Ron Lee (CSED) provided training on the DELFIC Fallout Planning Tool to members of the NTNF GCTF at the Battelle Facility in Aberdeen, Maryland, on August 28.



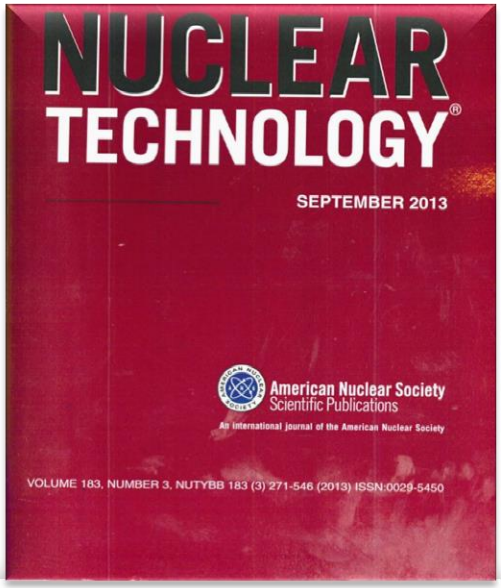
Hooper explains ORNL's capabilities in fallout modeling and analysis

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE U.S. DEPARTMENT OF ENERGY

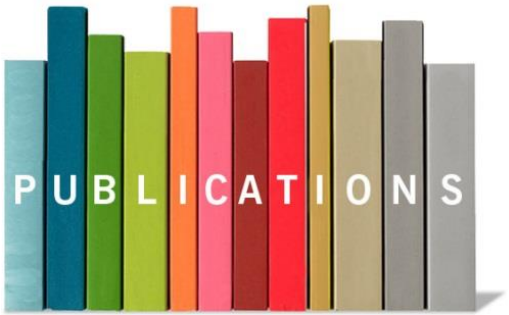
RNSD PHYSOR 2012 papers featured in special issue of *Nuclear Technology*

A special issue of *Nuclear Technology* has been published. This issue features 24 selected papers from the International Topical Meeting on Reactor Physics (PHYSOR 2012), with 6 of them authored or co-authored by RNSD Staff. It also includes a Foreword by Germina Ilas (RNSD), PHYSOR 2012 Publications Chair, who served as guest editor.

- **Germina Ilas** (Guest Editor), "Foreword: Special Issue on the International Topical Meeting on Reactor Physics PHYSOR 2012," *Nucl. Technol.,* **Vol. 183**, No. 3, September 2013, pp. 271.
- Anselmo T. Cisneros and **Dan Ilas**, "Neutronics and Depletion Methods for Multibatch Fluoride Salt-Cooled High-Temperature Reactors with Slab Fuel Geometry," **Vol. 183**, No. 3, September 2013, pp. 331-340.
- **Dan Ilas**, "SCALE Code Validation for Prismatic High-Temperature Gas-Cooled Reactors," **Vol. 183**, No. 3, September 2013, pp. 379-390.
- Ryan Kelly and **Dan Ilas**, "Verification of a Depletion Method in SCALE for the Advanced High-Temperature Reactor," **Vol. 183**, No. 3, September 2013, pp. 391-397.
- Carolyn McGraw and **Germina Ilas**, "Pressurized Water Reactor ENDF/B-VII Cross-Section Libraries for ORIGEN-ARP," **Vol. 183**, No. 3, September 2013, pp. 436-445.
- **M. L. Williams, G. Ilas, M. A. Jessee, B. T. Rearden, D. Wiarda**, W. Zwermann, L. Gallner, M. Klein, B. Krzykacz-Hausmann and A. Pautz, "A Statistical Sampling Method for Uncertainty Analysis with SCALE and XSUSA," **Vol. 183**, No. 3, September 2013, pp. 515-526.
- Ling Zou, Hongbin Zhang, **Jess Gehin**, and Brendan Kochunas, Coupled Thermal-Hydraulic/Neutronics/Crud Framework in Prediction of Crud-Induced Power Shift Phenomenon," **Vol. 183**, No. 3, September 2013, pp.535-544.



Publications



In addition to the seven articles in the Journal of Nuclear Technology, RNSD published :

- **One Letter Report**
- **Two Conference Papers**

Materials irradiation – August 2013

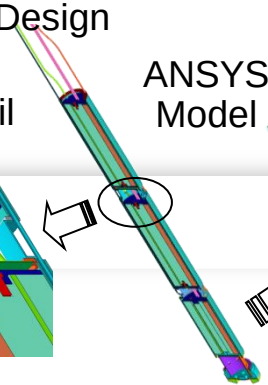
RNSD

Project	Format	Sponsor	Stage					
			Newly proposed	In Design	In Fabrication	In Reactor	Removed	Notes
Steel Screening	Rabbit		5					October 8, Cycle 451
Titan Metal	Rabbit	DOE, FE US-Japan				9	26	Tungsten and steel
Composite Flexure	Rabbit	DOE, FE				8		SiC
Mini-Composite	Rabbit	DOE, FE				4; Cycle 448		SiC
Round-bar Tensile	Rabbit	DOE, FE		4+		TBD 2013		Steel
Hydrided Clad	Target	DOE, NE					4	Zircaloy
Ibiden	Rabbit	WFO, Ibiden				30 (6 waiting)	2	Graphite
Nippon	Rabbit	WFO, Nippon		31		4Q 2013 Cycle 450		Graphite
Titan Tensile	Rabbit	DOE				9	8	V-4Cr4Ti, SiC, Graphite, steel
Toyo Creep	Target	Toyo Tanso			1	2, Cycle 449		Graphite
Inconel springs	Rabbit	AECL		13	8	Cycle 450		McDuffee review package
Graphite Creep	Rabbit	EDF		4		5, Cycle 449		Irr. Graphite
SHINE	Rabbit	DOE		TBD		FY 2014		Mo-99
Exotic Ceramic	Rabbit	DOE, FE				9; Cycle 449		
SiC Joining tests	Rabbit	DOE, FE		21	5	Cycle 452		SiC
HTV Capsule	Target	DOE NE		1		Cycle 451		Graphite
FCR&D Rabbits	Rabbit	DOE NE		1		Cycle 451		DU fuel samples
General Atomics Rabbits	Rabbit	General Atomics				5; Cycle 449		SiC
FeCrAlY	Rabbit	Fusion			5	Cycle 450		FeCrAlY
Pu238		DOE			7	Cycle 450		Flow testing, destructive testing, 6 weeks

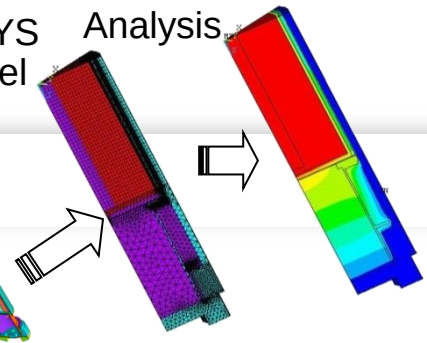
Experiment Design

Design Detail

ANSYS Model

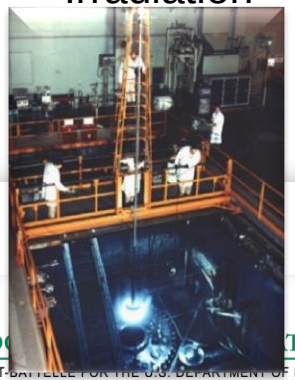


Thermal Analysis



Experiment Fabrication

Irradiation



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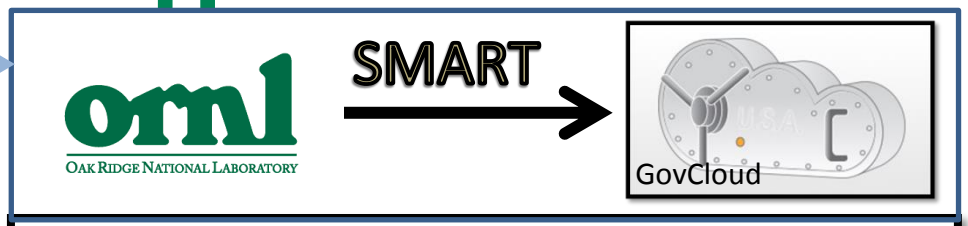
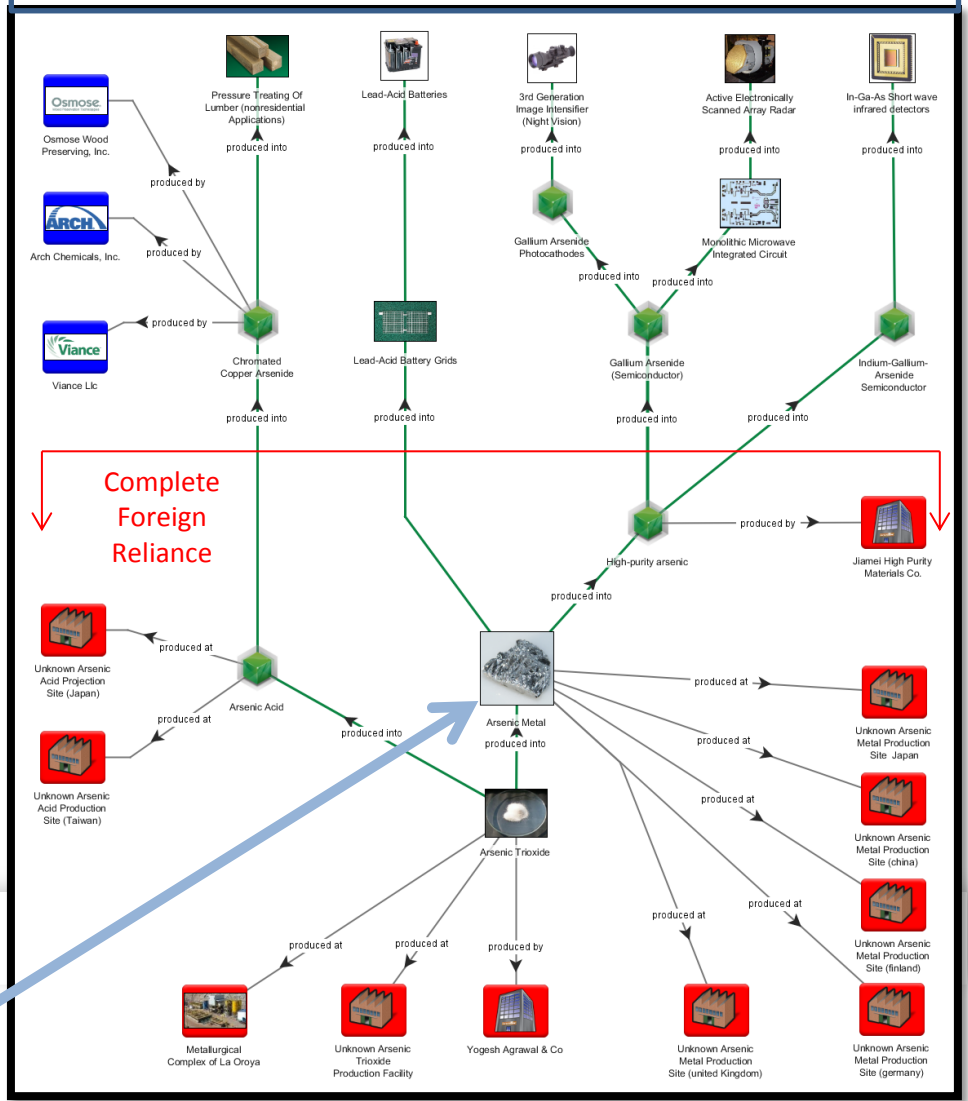
Defense Logistics Agency strategic materials analysis support

FMNSD

- Strategic Material Analysis & Reporting Topography (SMART) system moved from the internal ORNL network to Amazon GovCloud
  - Allows for easier access to SMART from outside ORNL network
  - Equivalent security protocols to ORNL network
  - Removes the need for DLA – Strategic Materials to have ORNL network access
- In discussions with Bloomberg, Deloitte, and Sigma-Aldrich about procuring data for SMART
  - Bloomberg – supply chain / financial detail on companies
  - Deloitte – rates the financial stability of companies within the supply chain
  - Sigma-Aldrich, one of the world largest distributers of specialty metals, provides details on producers (vendors) and customers for all industries including defense
- Contract in place for five part-time support analysts
  - Primarily focus on constructing supply chains within SMART (Arsenic Metal shown)





ORNL supports international mercury policy technical bases

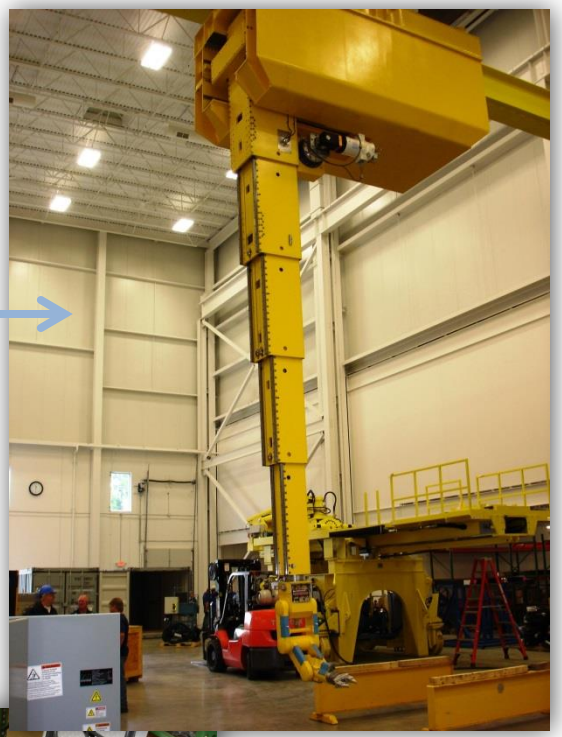
FMNSD

Elemental mercury management and research knowledge gained from a recently completed 5-year research program was presented to the international community at the International Conference on Mercury as a Global Pollutant (ICMGP) 2013

- ORNL chaired a session entitled, "***Elemental mercury stockpile stewardship: selected research results and novel disposal path***"
- R&D knowledge was provided and collected to support elemental mercury processing, storage, handling, health and safety objectives, and disposal for US DOE and other countries
- The overall body of work presented was done transparent to border, and framed to be useful to both industry and the governmental sector as stakeholders work together to improve elemental mercury policy for the benefit of mankind
- Beneficial environmental management and industrial processing knowledge was gained and contacts established to improve mercury related storage and clean-up/disposal processes
- Met with conference delegates including US EPA, Newmont Mining, and DELA GmbH, to discuss the feasibility of organizing a prototype demonstration project to test a specific mercury final stabilization process to US EPA disposal standards

Building 7930 manipulator system replacement progressing

- Remote Systems (RS) personnel are assisting with the design and replacement of the Bldg. 7930 Cell-G failed manipulator system
  - The PaR Systems replacement manipulator fabrication and assembly is nearing completion
  - A fabrication review meeting and preliminary testing was completed by ORNL in August at the PaR Shoreview, Minnesota shop
  - RS personnel are continuing to work on related design documents, including design calculations, and installation drawings



Mobile Uranium Facility (MUF) upgrade in preparation for the next deployment

- Preparing for a mock-mission deployment and demonstration at the Cold Region Test Facility in Alaska next March
- Equipment is being modified in preparation of this mission
- Instead of a soft shell mobile shelter, a hard walled shelter from General Dynamics will be used for housing all the Glove Boxes
- Cameras and audio equipment has been procured and installed in every facility to ensure accountability during an emergency evacuation
- Sealand containers that open on the sides were procured for easy access to equipment needed during the mission

Hard shell Shelter

Open sided Sealand Container

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Y-12 National Security Complex
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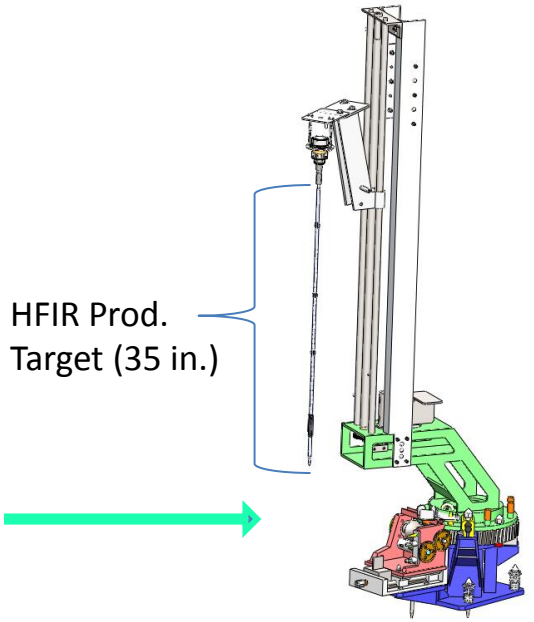
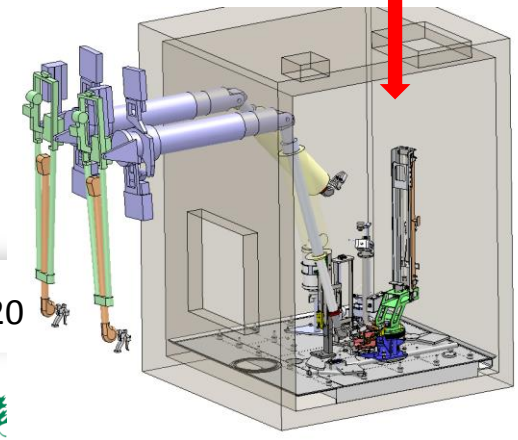
Building 7920 hot cell target transfer arm replacement fabricated and testing in progress

- Remote Systems staff have designed and fabricated a new Target Transfer Arm (TTA) for Cubicle 1
  - Used to precisely handle and position new HFIR targets between multiple manufacturing and inspection stations
  - TTA is a critical device needed in the production of valuable radioisotopes such as Cf and Bk
- Fabrication was completed in late July and testing has commenced
- Installation into 7920 cubicle one hot cell is anticipated to be completed in November





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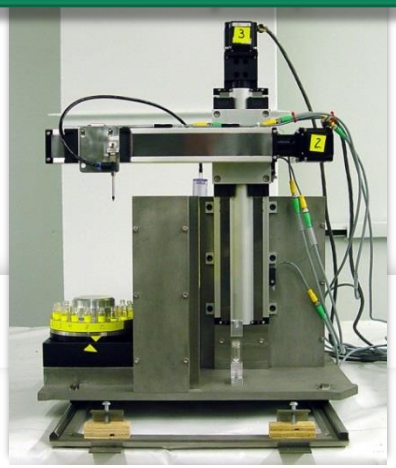
Post-Irradiation Examination (PIE) of world record setting AGR-1 coated particle fuel continued

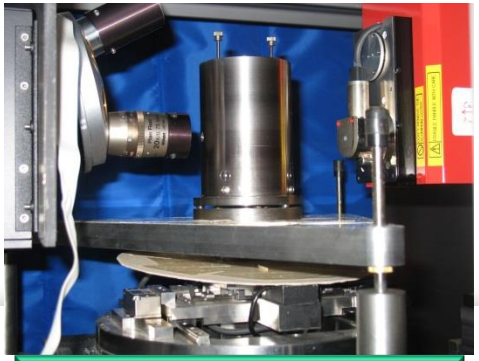
- Completed 9th RNL safety test
  - Compact 5-3-3 held at 1600°C for 300 hours with no particle failure
- Submitted DOE Level 2 Milestone Report on ORNL completion of three other safety tests in FY13
- Completed post-safety test PIE on three compacts
  - Compacts 6-2-1, 3-3-1, and 4-4-1 analyzed by DLBL, IMGA, X-ray, and Materialography

Deconsolidation Leach-Burn-Leach (DLBL)

Irradiated Microsphere Gamma Analysis (IMGA)



Materialography

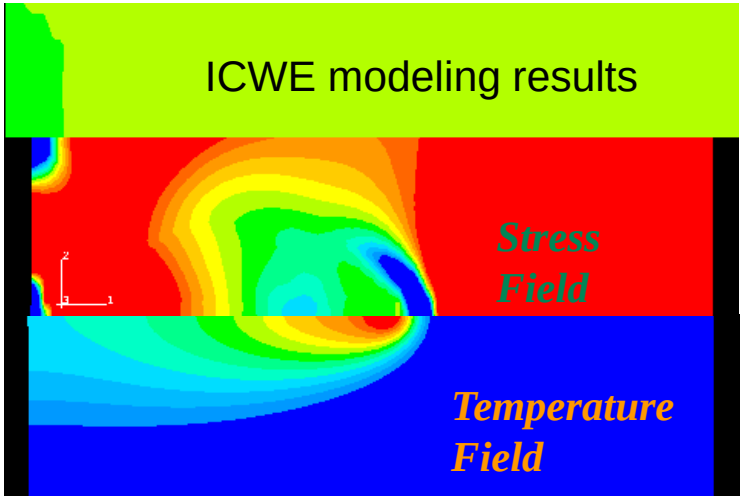


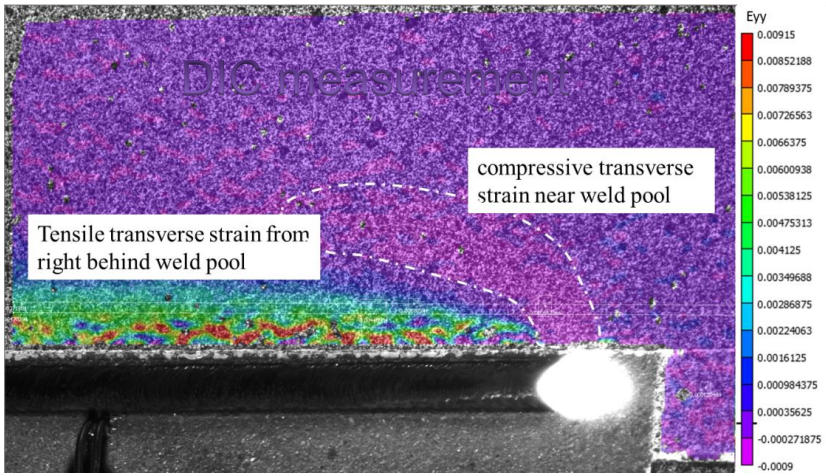
X-ray Tomography

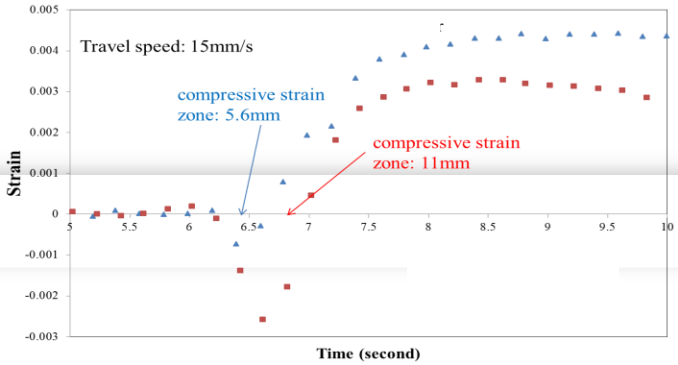
Weld stress management hybrid welding process demonstrated

Highlights courtesy of Z. Feng in MSTD

- In collaboration with Electric Power Research Institute (EPRI) researchers, a new hybrid welding process has been demonstrated that can proactively manage stresses during welding of irradiated materials to eliminated helium induced cracking
- The development of welding technology was guided by Integrated Computational Welding Engineering (ICWE) tools
- In-situ strain field measurement technique based on digital image correlation (DIC) was developed to experimentally capture and confirm the compressive strain fields near the weld region
- A joint ORNL/EPRI patent application is being prepared







Research is part of Advanced Welding Processes for Highly Irradiated Materials Project jointly sponsored by DOE NE LWRS program and EPRI LTO program

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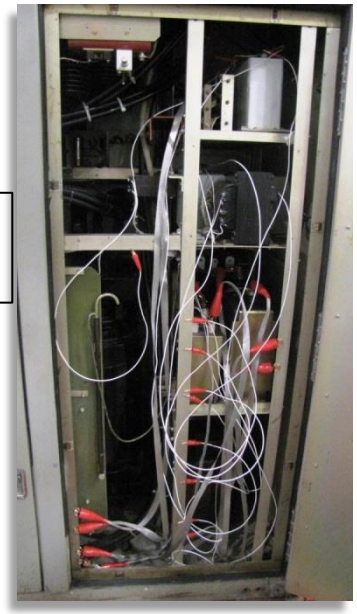
Multi-Program High Bay Facility (7625/7627)

FMNSD

- Research Safety Summary (RSS) 8797 for the Proto-MPEX (Material Plasma Exposure eXperiment) was fully released by the Resumption of Work Group (ROWG)
- FRT-86 Radio Frequency (RF) Transmitter damage inspection completed; repairs to be completed in September
- Several equipment-specific Lock-Out/Tag-Out procedures were reviewed, revised, and approved
- Power upgrades are underway in Building 7627; new power lines from separate substation to be completed by mid-September
- Expanded operational approvals for the Microwave Assisted Plasma (MAP) Line
- Performed energized tests for new control circuits in HFPS rectifier test cabinet

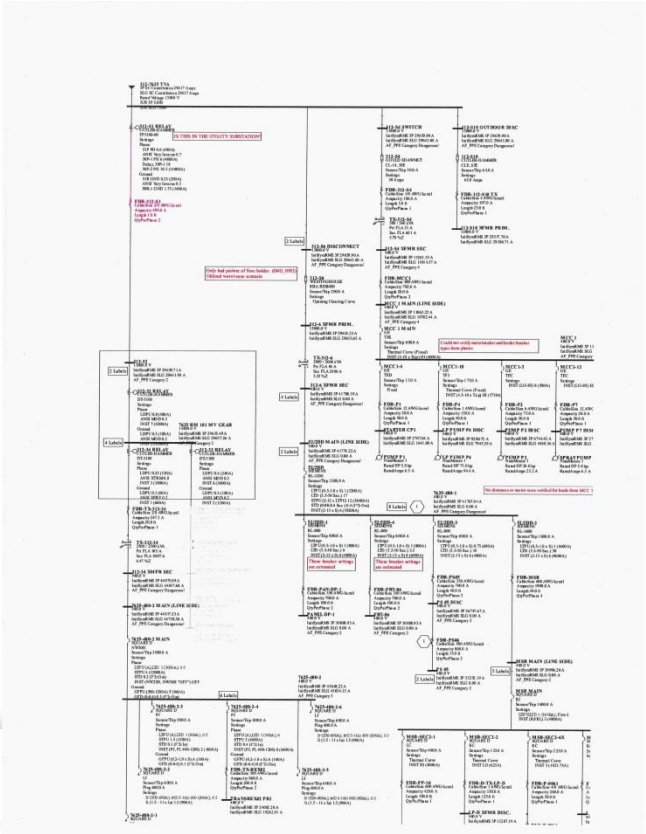


View into a FRT-86 cabinet with capacitors grounded

7627: Inside HFPS Test Cabinet

Multi-Program High Bay Facility (7625/7627) (cont.)

- Received arc flash labels and system plot. Results under review prior to attaching stickers
- Contract in place for NEC Compliance Assessments in the buildings. A series of Lock-Out/Tag-Outs have started with the goal of assessment completion by September 30th. A graded approach will be developed in response to the assessment results in FY 2014

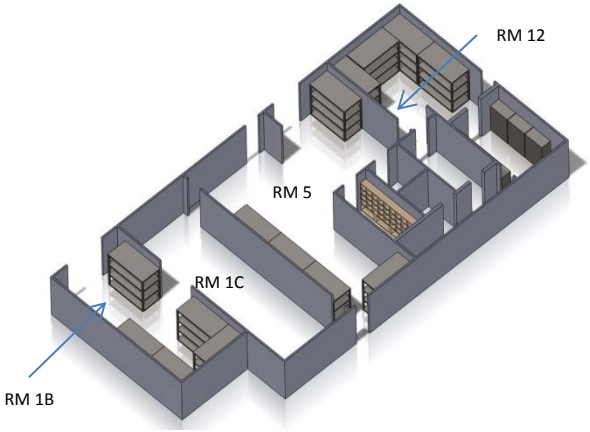


Portion of Arc Flash Plot

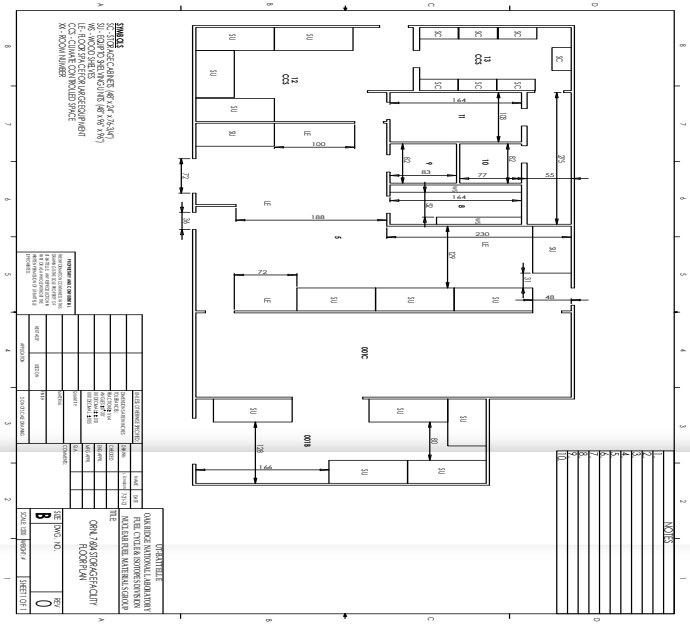
7604 cleanout update – significant progress continues

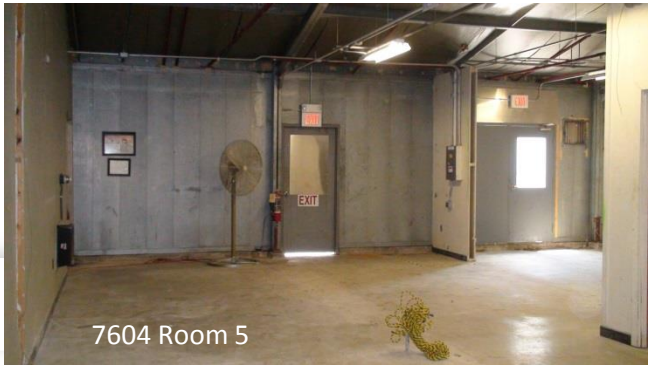
FMNSD

- Storage cabinets in place in air conditioned space
- Racks to be located in other areas by mid-September
- Equipment located in 9201-2 for move to 7604 scheduled for 2nd week of September
- Other equipment from 7625/7627 to be moved in after Y-12 items in place



Storage Shelves in 7604 Room 1B



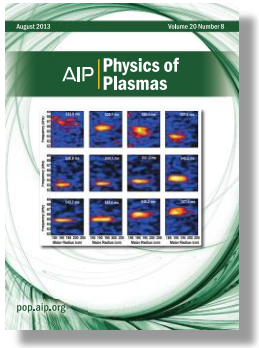


Fusion Science & Physics of Plasmas publications

Journal articles (3)

S. J. Zinkle, "Challenges in Developing Materials for Fusion Technology – Past, Present and Future," *Fusion Science and Technology*, Vol. 64(2), pp. 65-75, August 2013.

J. Rapp, et al., "The Development of Plasma Material Interaction Facilities for the Future of Fusion Technology," *Fusion Science and Technology*, Vol. 64(2), pp. 237-244, August 2013.



L. R. Baylor, et al., "Reduction of edge localized mode intensity on DIII-D by on-demand triggering with high frequency pellet injection and implications for ITER," *Physics of Plasmas* 20, August 2013.

DOE level 2 milestone report

J.D. Hunn, R.N. Morris, C.A. Baldwin, and F.C. Montgomery, *Safety Tests on Irradiated AGR-1 Compacts 4-1-2, 4-4-3, and 4-4-1*, ORNL/LTR-2013/290, Oak Ridge National Laboratory, August 2013.

NNFD FY 2013 cumulative facility metrics

Hot Cell Availability

Bldg 7920 August	**99.6%**
Cumulative	97.66%
Bldg 7930 August	**99.43%**
Cumulative	92.98%
Bldg 3525 August	**100%**
Cumulative	98.91%
Bldg 3025E August	**100%**
Cumulative	100%

Facility Upgrades and Maintenance Activities

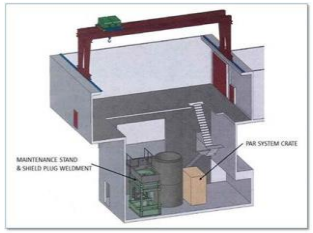
7920

- Programmed maintenance operations
- Replacement of transfer case hoist cable

- Glove box installa-tions on-going
- TSR Surveillances, functional testing of the HCSA/LA Motor Control System
- Target Fabrication refurbishment support – removal of Q-ball Carrier top shield plug in preparation for maintenance on shield plug

7930

- Programmed maintenance operations
- New PaR fabrication/ assembly; FAT has been delayed, waiting on a few issues to be resolved
- Cell G Waste Pull Operations complete; waste casks have been moved off-site



- North Valve Pit Grouting operations. Evaluating maximum expansion pressure of grout components during curing process and assessing further the physical condition of E-1 off-gas header prior to moving forward with project.

3525

- Programmed maintenance operations
- Steam Station Upgrades (on-going)

3025E

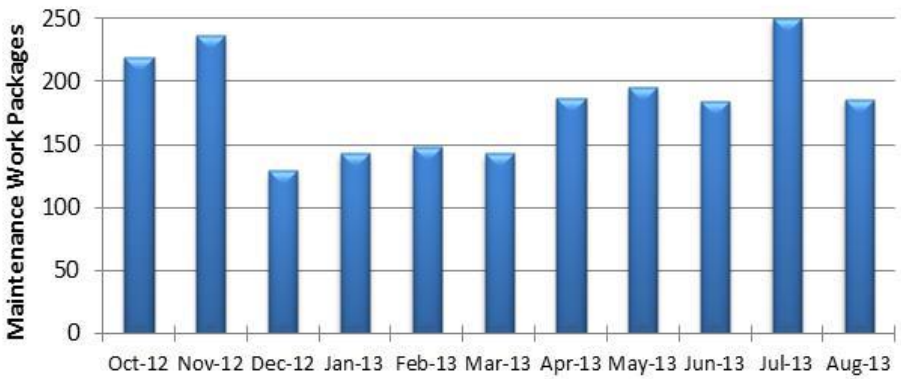
- Programmed maintenance operations
- Completed repairs to remote operating functions of 5 ton building crane

- Completed replacement of Cell Access Area HEPA filters
- CAA HEPA Change out, sampled HEPA filters for waste characterization

NNFD Maintenance Program* performance for FY 2013 to date

NNFD

186 work orders open >90 days
Nuclear Maintenance backlog increased**

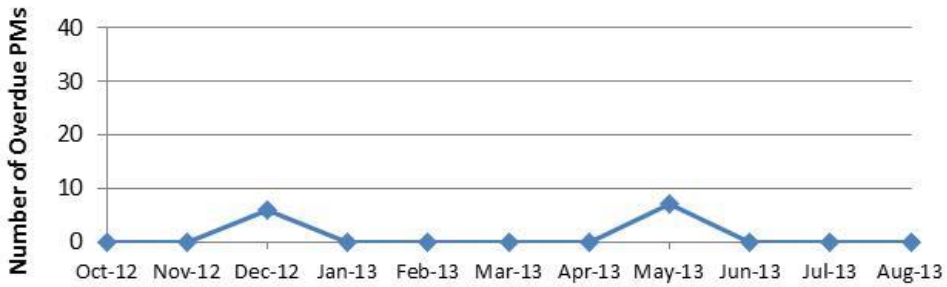


Goal: <175

*Work scope that could affect the operation of a CAT 1, 2, or 3 Nuclear Facility (safety and non-safety; corrective, preventive, experiment, and modification)

**Majority of backlog increase due to completed but not closed work on hot cell manipulators and planned HEPA filter changes

No safety-related overdue NNFD repetitive maintenance actions



Goal: Zero overdue

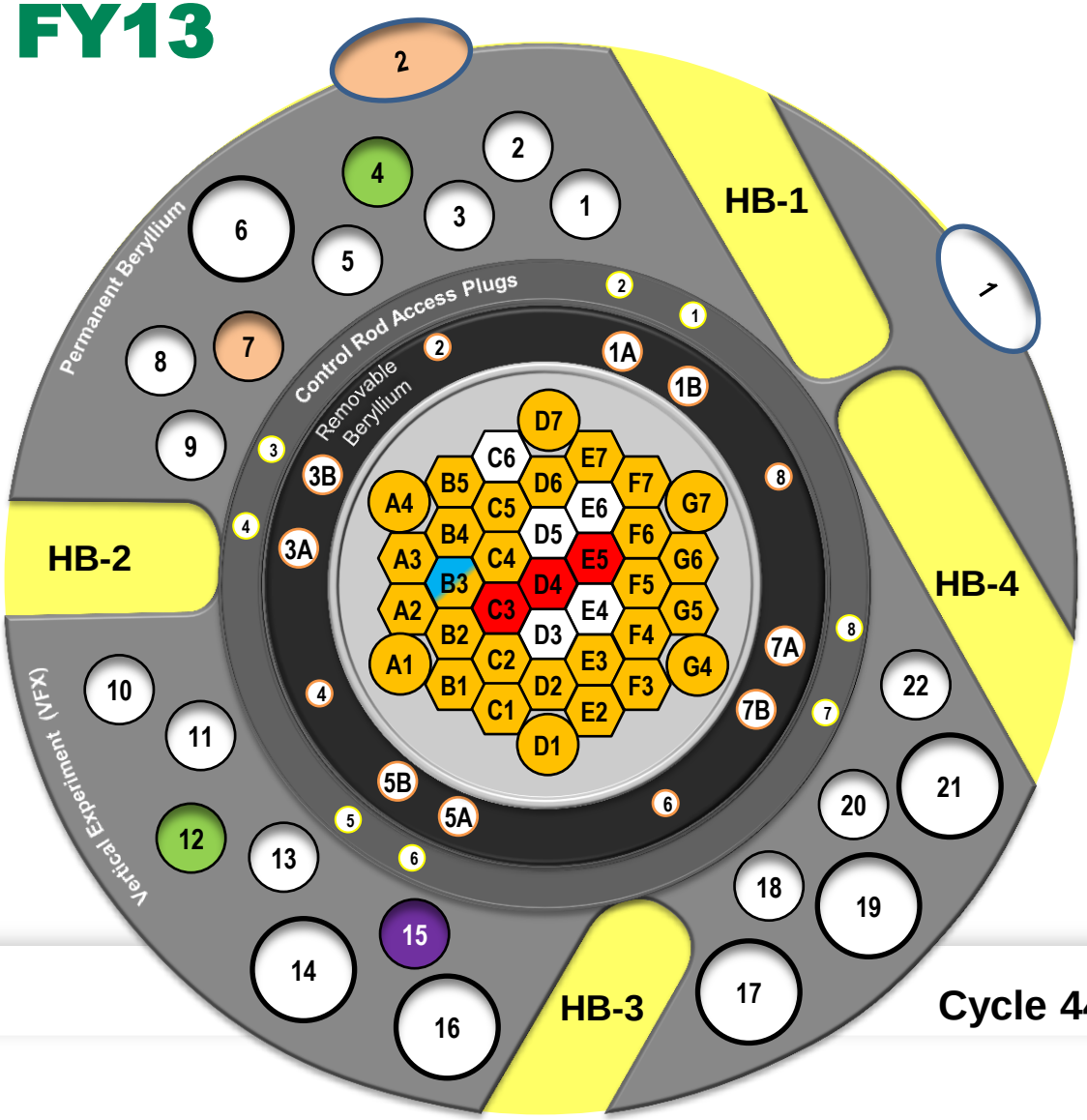
Cycle 449 at HFIR ends in August with high flux trap utilization – Leads to record high number of irradiations for the FY13

HFIR

August 2013						
SU	M	T	W	TH	F	SA
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	28	30	31

Reactor OFF

Reactor ON



- Isotope Production
- Isotopes for Research
- Materials Experiment
- Fuels Experiment
- Pneumatic Facility NAA
- Hydraulic Facility
- Neutron Scattering
- Available Positions

Cycle 449 graphical summary

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Number of irradiations in HFIR Cycle 449 remain high, driven by materials irradiations supporting fusion materials programs

HFIR

Pu-238 irradiations resume after 1-cycle rest

Materials Experiments

- Silicon Carbide
- V, Mo, & Cu alloys
- Zircaloy
- Graphite
- Steels

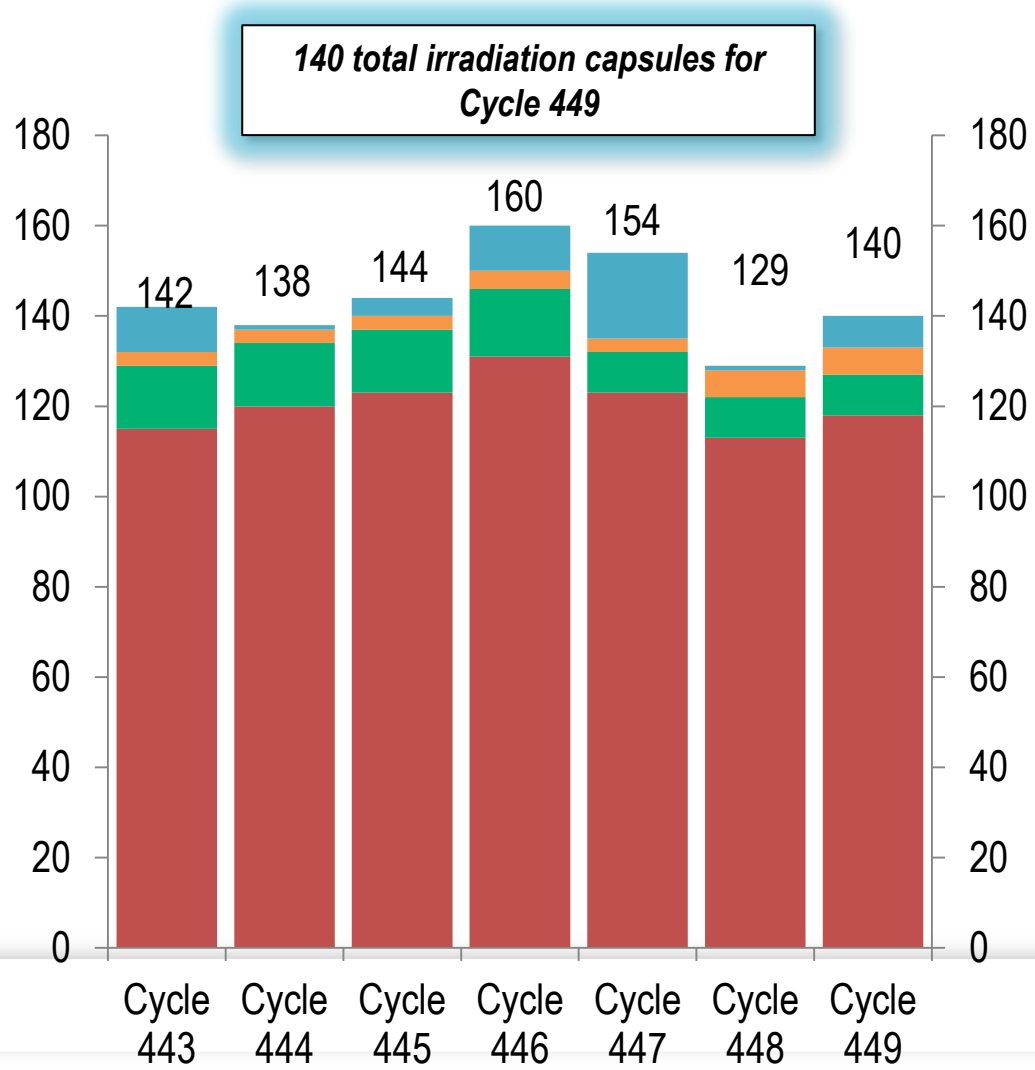
- **Fuels Experiments**
- UO_2 Fuels
- UCN Fuels

Commercial Isotope Production

- Selenium (Se-75) – production
- Ni-63 production

Research Isotopes

- Pu-238 for NASA



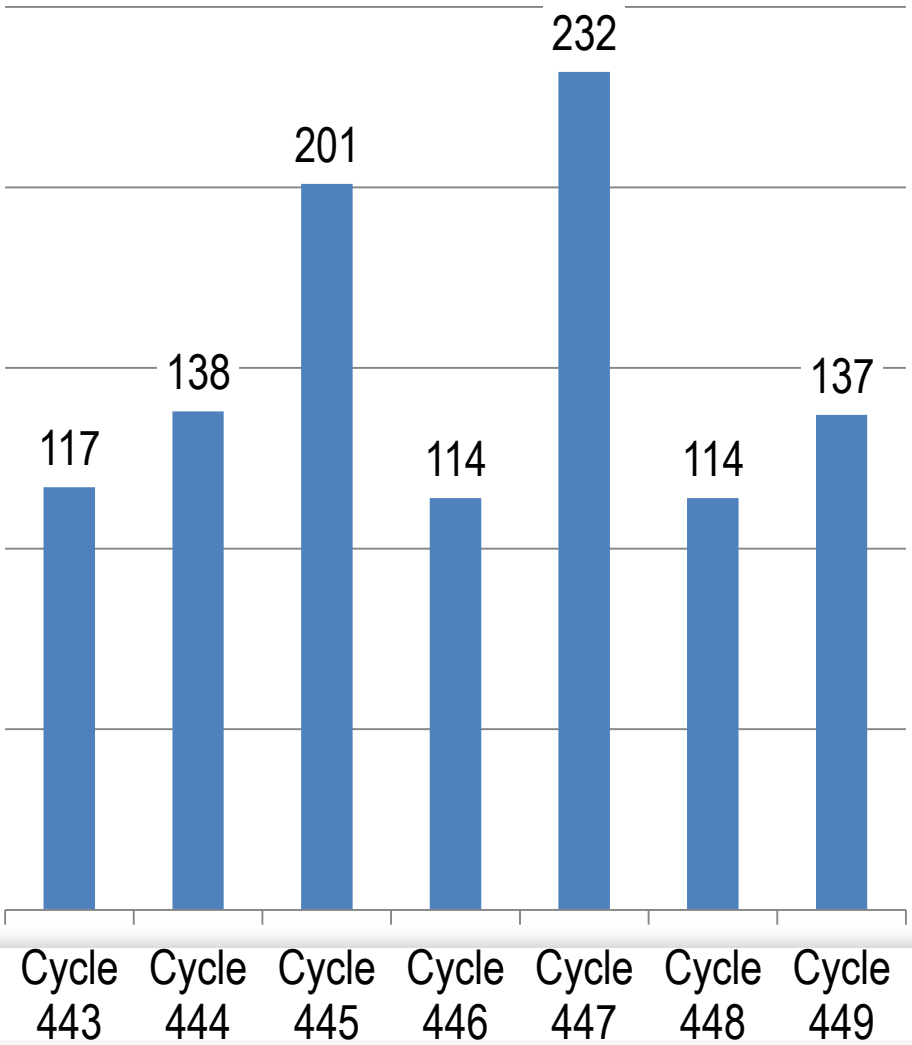
Significant pneumatic tube irradiations and NAA work during Cycle 449

HFIR

FY totals reach 937 irradiations

Pneumatic Tube Summary

75	Rabbits for IAEA
27	Rabbits for iodine determination in zeolites
8	Flux Monitors
3	Botanical reference materials for k_0 calibrations of PT-1
6	Rabbits for ^{129}I determination as AgI from spent fuel
2	Rabbits for environmental U determination in walnut
1	^{153}Sm production for tracer research at REDC
1	^{160}Tb production for separations research in CSD
4	Rabbits for impurity determinations in Cf stripper solutions for REDC process development
3	Rabbits for W determination in diamond for CSD
4	Rabbits for radiation effects on germination of Sphagnum spores for ESD
1	Rabbit for multiple isotope production for CSD Separations Group
2	Rabbits for impurity determination in ^{228}Ra
137	**TOTAL**



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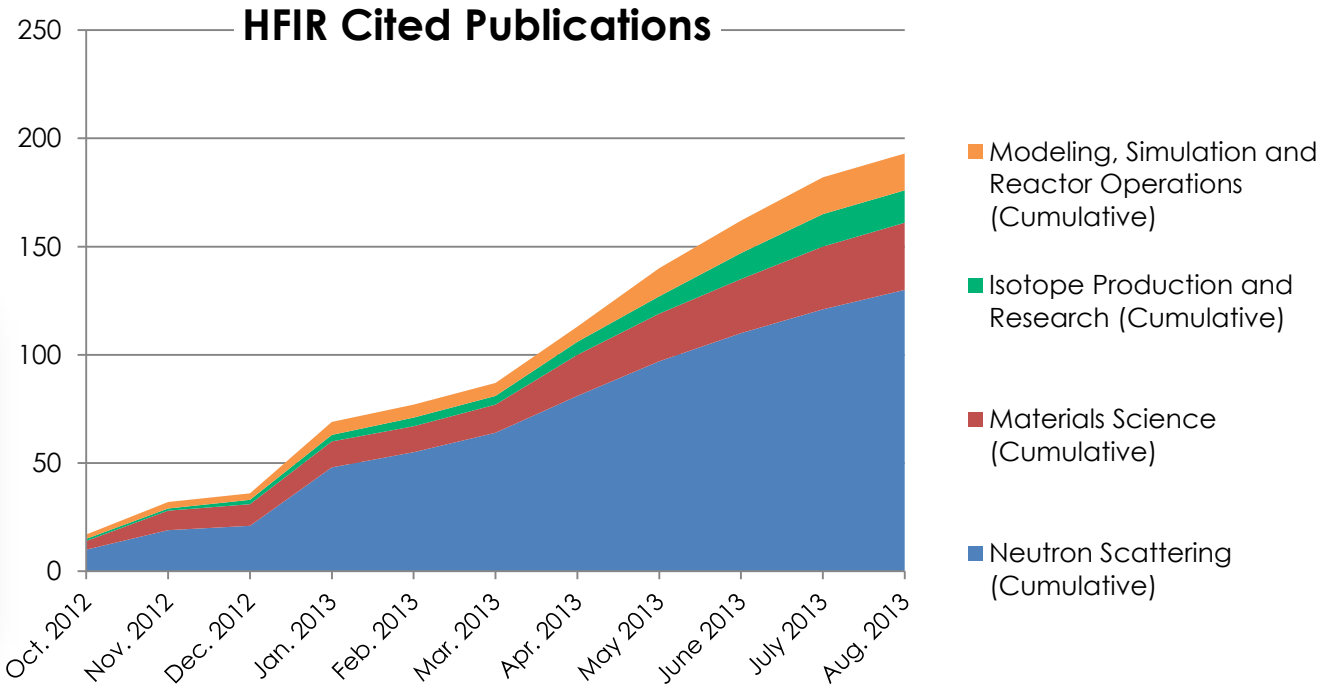
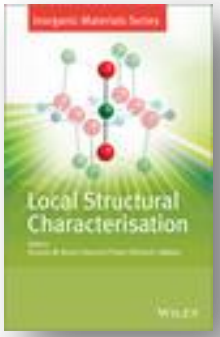
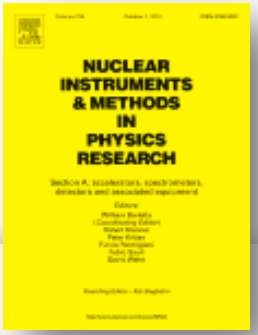
Eleven new publications in August that cite HFIR in neutron scattering and material science

- 9 Neutron Scattering
- 2 Materials Science







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Trace

Central campus legacy material removal project

2026 Activities

- Completed clean-out of the decon cell area
- Completed disposal of fissile equivalent material (FEM)
- Initiated clean-out of Room 125 and associated glovebox
- Performed waste load-out from the decon cell area and Room 125
- Continued chemical removal
- **Continued remote waste removal from Hot Cells 1 & 2**
- Negotiated with DOE EM to fund Phase III cleanout activities ($630K) in FY 2014

Glovebox from Lab 101 Loaded into Intermodal

Chemical Removal

Waste Load-out from Decon Cell

Soil and slab characterization and removal in the southeast quadrant

- Completed and submitted D0 of the Phased Construction Completion Report (PCCR) to DOE
- Received DOE response (no comments) on PCCR D0 and prepared D1 for submission to regulators
- Area is ready for future development

Completed 3550 Area

4500 area gaseous waste reconfiguration and stabilization project

- Completed filling ventilation duct and 4556 Filter Pit with flowable fill, and demobilized the grouting subcontractor
- Began close-out of grouting subcontract
- Completed removal and packaging of HEPA filters, wedges, and metallic filters from 3106 Filter Pit
- Began site restoration and demobilization from 3106 Filter Pit

Filling 4556 Filter Pit with Flowable Fill

Removing HEPA Filters from 3106 Filter Pit

Placing 3106 HEPA Filters into Waste Container

DOE-EM project integration support

- Consummated MOU with UCOR for Material Development & Exam Complex to perform characterization on a drum of unknown materials from Building 3525
- Coordinated with UCOR on the Building 3038 Roof Replacement Project

Building 3038 Roof Replacement

- Coordinated with UCOR on the D&D of the 3005 Annex

D&D of Building 3005 Annex