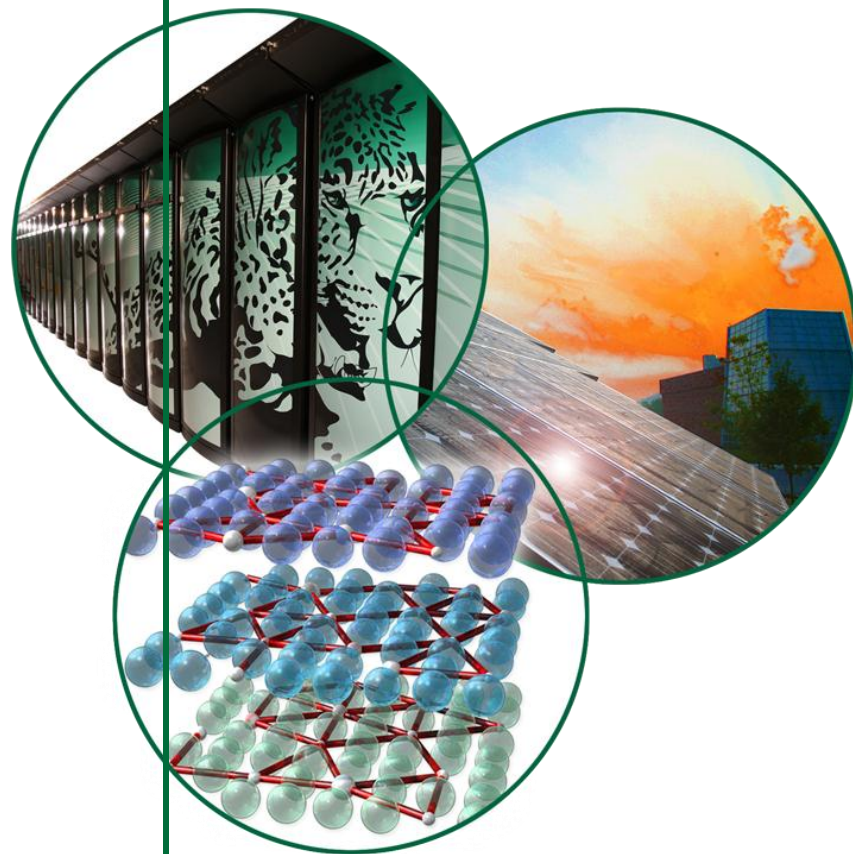


# NSED Monthly Report

## May 2012

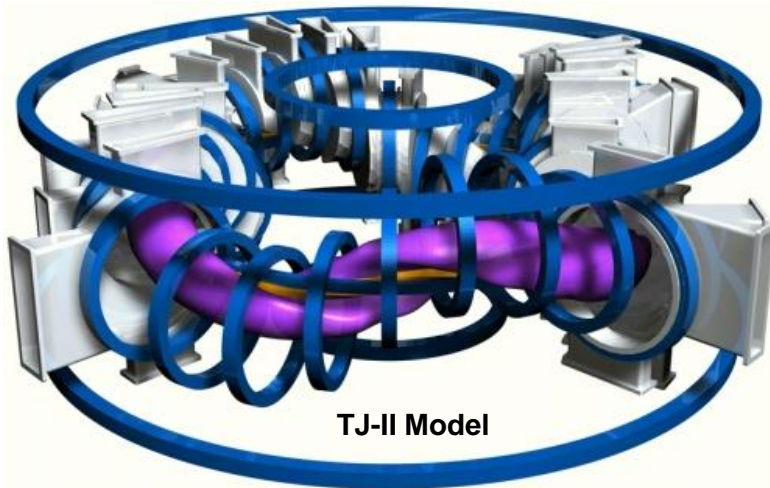
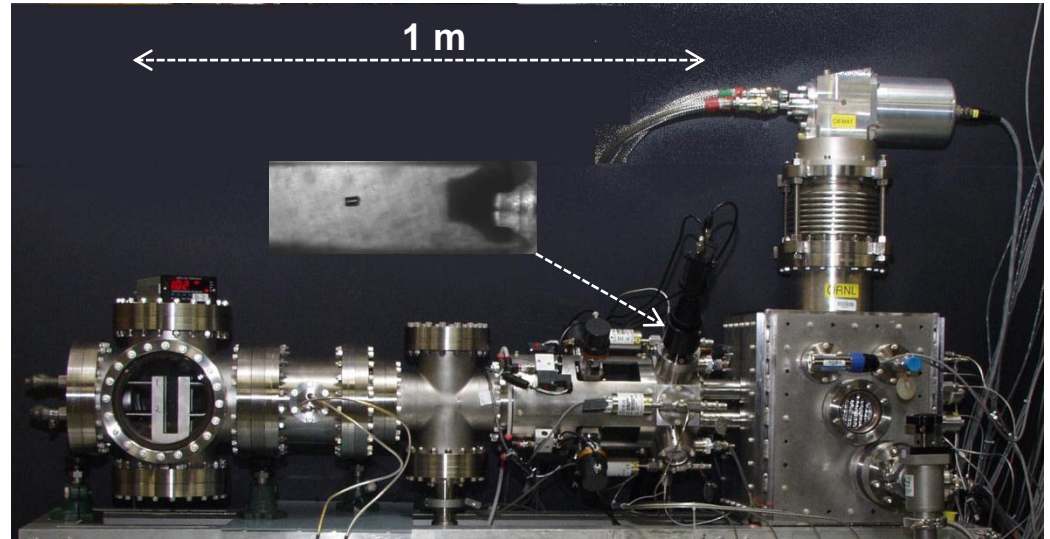
### Nuclear Science & Engineering Directorate



# Fusion Energy Science Outcome

New ORNL pellet injection system has been developed for TJ-II stellarator in a collaboration with CIEMAT (Madrid, Spain)

- Four barrels (bores  $\sim 0.4$  to  $1.0$  mm)
- Hydrogen pellets ( $T \sim 10$  K)
- Speeds  $\sim 1000$  m/s
- Operations with the smallest sizes have previously been problematic; however, new techniques have resulted in highly reliable operations
- After completing final qualification testing, the system will be crated and shipped to CIEMAT for installation on TJ-II this summer



- TJ-II is a four-period, low magnetic shear stellarator device with average minor radius of  $\leq 0.22$  m and a major radius of  $1.5$  m
- Dual purpose for pellets – fueling and diagnostics
  - Small pellets dictated by TJ-II ECRH cut-off limit ( $\leq 1.7 \times 10^{19}$  m<sup>-3</sup>)
  - Large pellets for NBI heating phase ( $< 5 \times 10^{19}$  m<sup>-3</sup>); two neutral beam systems were previously provided by ORNL in this collaboration

# Awards & Recognition



## FY2012 Early Career Research Award

**Nicolas Commaux has been awarded a five-year award under the Office of Science's Early Career Research Program.**



**The Office of Fusion Energy Sciences selected his proposal, "Development and Characterization of Improved Disruption and Runaway Electron Mitigation Systems."**

# High level visits and events in NSED



Jeff Binder and John Wagner briefed Dr. Pete Lyons (NE-1) and Monica Regalbuto (NE-5) on a new activity being led by ORNL related to used nuclear fuel disposition.



**IAEA.org**  
International Atomic Energy Agency

Alexey Anichenko and Bernie Wishard from the IAEA's Containment and Surveillance (C/S) group visited ORNL for a full day to engage in briefings (talks and demos) on ORNL's capabilities in containment and surveillance. The visit was deemed a success as the Safeguards and Security Technology Group's C/S Team was able to convey the breadth and depth of the C/S program in place at ORNL. The IAEA expressed interest in a number of current research projects within the C/S Team.



Scottie Mayfield was provided a tour of the Ultra-Trace Forensic Science Center (UFSC) on May 8, 2012, and briefed on the types of analytical and general forensics-related work being performed at the UFSC and at ORNL in general. He was also briefed on the importance of investing in the Nation's nuclear forensics infrastructure and on ORNL's unique role in providing science solutions to the challenging problems facing the forensics community in the future.

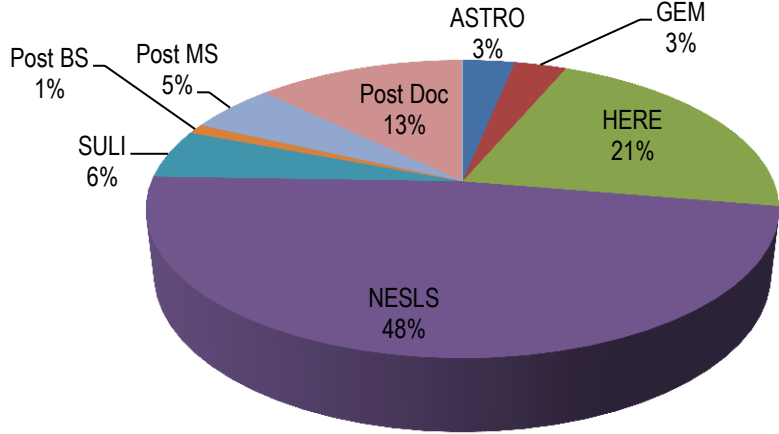


Paul Genoa, Nuclear Energy Institute (NEI) visited ORNL on May 6<sup>th</sup>. While he was here he toured VOCC

# NSED education outreach committee

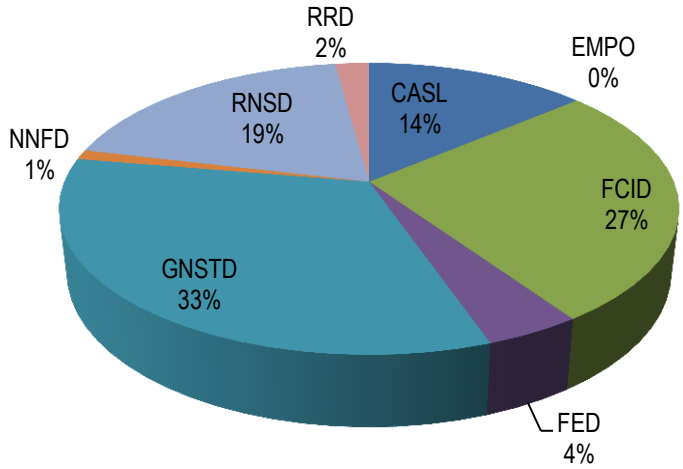
## Summer interns

Offers by Program



Student Program	Applications	Offers as of 5/24/12
ASTRO	69	3
GEM	24	3
HERE (UG+Grad)	524	38
NESLS	269	45
SULI	300	5

Offers by Organization





<p>Collocation: May 14 – 18, 2012</p>	<ul style="list-style-type: none"> <li>• Focus Area Strategic Planning, AMA, MPO, VRI, RTM, THM, VUQ</li> <li>• CASL-VOCC Governance Workshop</li> <li>• Safety</li> <li>• L1 Milestone Review – VERA Release</li> <li>• IC Pilot Project Update (GSI-191)</li> <li>• COBRA Update &amp; Status</li> <li>• Deployment of VERA on INL Fission</li> <li>• VERA Integration &amp; Milestone Policy</li> <li>• CASL Agile Project Management</li> <li>• Status of Reactor Aware Input</li> </ul>
<p>VOCC Tours: 7 Tours for May</p>	<ul style="list-style-type: none"> <li>• Paul Genoa, Nuclear Energy Institute (NEI)</li> <li>• Roberta Kileen, UT Vice Chancellor, National Earth Science Teacher Association</li> <li>• CASL Board of Directors</li> </ul>
<p>Meetings:</p>	<ul style="list-style-type: none"> <li>• CASL Board of Directors Meeting, May 8, 2012</li> <li>• MPO CRUD/MAMBA BOA Integration Meeting, Charlotte, NC May 22-24, 2012</li> </ul>
<p>Announcements:</p>	<ul style="list-style-type: none"> <li>• Organizational Changes:             <ul style="list-style-type: none"> <li>• Rose Montgomery (TVA), Product Applications Coordinator</li> <li>Product Integrators</li> <li>• Robert Montgomery (PNNL), PCI Product Integrator</li> <li>• Nam Din (INL), Validation Data</li> <li>• Zeses Karoutas (WEC), Challenge Problems</li> <li>• Ken Secker (WEC), CRUD Challenge Problems</li> <li>• Scott Palmtag (CP), Core Simulator</li> <li>• Ken Yueh (EPRI), GTRF Challenge Problems</li> </ul> </li> </ul>
<p>Miscellaneous:</p>	<ul style="list-style-type: none"> <li>• 13 students began their internship</li> <li>• Technology Control Plan Training – Continued required training for all CASL funded staff</li> <li>• CASL General Training - Began required training for all CASL funded staff</li> <li>• Chief Strategy Office, Mario Carelli (WEC) retired, May 31, 2012</li> </ul>

# CASL Board of Directors Meeting

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## CASL Board of Directors Meeting, May 8, 2012 (ORNL)


### Attendees:

- **Ernest J. Moniz (Chair), MIT**
- **Ron Gilgenbach, UM**
- **Thomas Zacharia, ORNL**
- **Alan Bishop, LANL**
- **Phillip Finck (substitute for David Hill), INL**
- **Ramesh Shankar, TVA**
- **Kurt Edsinger, EPRI**
- **Dale Klein, UT Austin**
- **James J. Duderstadt, via teleconference, UMI**



## Selected new board Chair – Dale Klein

# Fuel Cycle and Isotopes Division



A full proposal has been submitted after successfully completing the first round of LDRD project selections. The “Advanced Mitigation of Ion Beam Space-Charge” project is a multidivisional project to combine electromagnetic simulations and ORNL’s experimental capabilities to investigate advanced methods of neutralizing the ion beam space-charge in high-current (100 mA) electromagnetic isotope separation devices.

Successfully shipped three orders of  $^{252}\text{Cf}$  to the customers ahead of schedule. This material was recovered from irradiated Cm targets that were processed during processing Campaign 74, as part of the Cf Consortium Agreement with DOE-SC.

A Spring SULI student successfully completed a project to evaluate the isotope inventory workbook for: completeness, verification of the bateman equations for decay, historical references, and ease of use.

A design review signifying the completion of the Preliminary Design of the non-conventional utilities for the Facility for Rare Isotope Beams (FRIB) was held at Michigan State University (MSU). The audience was personnel from MSU and their chosen facility engineering firm, who will be leading the Detailed Design of the non-conventional utilities with ORNL assistance.

A sample of Bk-249 was purified for use in an experiment to be conducted at Argonne National Laboratory. The experiment is a repeat measurement of the branching ratio to be conducted by Irshad Ahmad. Simultaneous measurements of both single spectra and gamma-LEPS coincidences will be performed.



# Radioisotope R&D

- Submitted an LDRD Proposal for  $^{251}\text{Cf}$  Target for Super Heavy Element Research

## Proposals Submitted



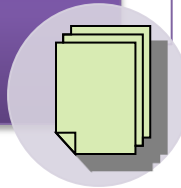
- Clean-up and consolidation of remaining Berkelium (~0.5mg)
- Preparation for column separation studies by summer intern

## Berkelium Purification



- NA-73 agrees to close out the  $^{252}\text{Cf}$  Loan program as described in ORNL's proposal.
- Obtained NA-74 funding to "Study Options for Preserving Rare Isotopes ( $^{244}\text{Pu}$  and heavy Cm) in Mk-18A Targets at SRNS"

## Proposal Initiatives



- Supplemental funding request made to NA-73 to accelerate the recover of Am/Cm in FY2013.

## Americium-Curium Processing



- Approximately 20  $\mu\text{g}$  of Cf-251 within a Cf sample was purified to be utilized in an experiment at Argonne National Laboratory. The Cf-251 will be plated into a target and placed in the GAMMASPHERE

## $^{251}\text{Cf}$



- New design for electrodeposition unit being tested

## Californium-252 Electrodepositions



- 14.4 mCi  $^{225}\text{Ac}$  shipped in six different shipments to three different customers in May.
- 2.1 mCi  $^{225}\text{Ra}$  shipped to ANL
- First Production Campaign was in 1997 - Plans to celebrate campaign #100 (June 2012) are underway.

## Actinium-225 Production



- 11  $\text{NpO}_2$  pellets prepared. Three will be used for metallographic testing, and eight will be irradiated in HFIR during Cycle 442 or 443.
- New equipment for Modified Direct Denitration (MDD) process installed in glovebox. Will be used to make targets.

## Pu-238



# Radioisotope Production

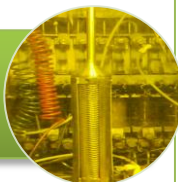
- Recovery of  $^{244}\text{Cm}$  for future HFIR Targets
- Continue with processing of any rework material

Heavy Element Campaign C-75



- Receipt and Storage of LANL  $^{244}\text{Cm}$  Material

Curium Recovery



- A proposal for the restart of C-14 production was updated and submitted to the DOE Office of Science, Isotope Program for consideration.

Proposals Submitted



- Made three shipments to two separate customers ahead of schedule
- Processing two customers orders for scheduled July and August shipments

Californium Wire Production



- Prepared and packaged second capsule for shipment to INL
- Cut, cleaned, and prepared SF Capsule weld segment for delivery to Welding Personnel to support testing (Se75 Isotope)

Selenium Processing



- Operations are ongoing; to celebrate 100<sup>th</sup> Processing Campaign next month

Actinium Production

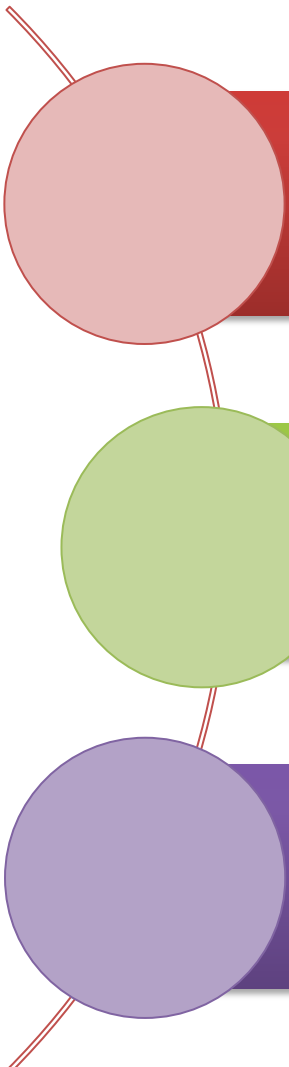


- PEP was updated
- Pellet pressing procedures have been approved
- Target Quals: Completed approvals and SQA's for Neutronics/ depletion calcs.
- Flow calcs –write up in process; to be reviewed

Pu-238



# Enriched stable isotopes chemical processing



A 42 mg sample of enriched Hg-201 was electrochemically converted from oxide to metal to fill a customer order.

Development of an ion exchange process for the separation of natural La contamination from enriched isotopic Sm samples showed excellent results. This will permit the recovery of enriched Sm and many other rare earths from the La that is used to pyrochemically reduce them to metal.

A list of preferred feed materials for the EMIS separation of 50 naturally occurring elements, along with unit cost estimates for each item, was prepared in support of the production-scale EMIS proposal.

# Enriched stable isotope fabrication and shipping

**Eighteen shipments of 39 enriched stable isotopes were made in May**

- 110 shipments of 280 enriched stable isotopes has been made in FY12 to date

**Seven Work Authorizations involving 9 technical services were completed in May**

- 88 technical services have been completed in FY12 to date
- Included among these were a Mg-25 cast and pressed metal disc, a Mo-92 rolled foil, and a Si-28 target – all for international customers



# Global Nuclear Security Technology Division

## Highlights

The Mobile Uranium Facility (MUF) is certified for safe use and ready to deploy immediately for over-seas missions. A mock mission was conducted by GNSTD for the MUF in April and May. During this missions MUF certified the equipment for safe use, completed and approved procedures and obtained medical fitness-for-duty approvals. A tour was given to representatives of all participating laboratories, NNSA, DOD and the State Department to insure their understanding of MUFs capabilities and readiness.

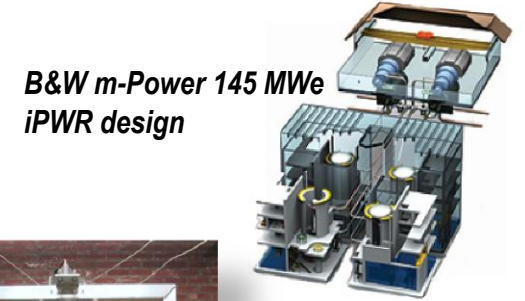
A demonstration of the new INsight application was given to the DOE Office of Intelligence and Counterintelligence. This demo gave stakeholders a first look at their new Dashboard system due to be released later this FY. System Sponsor and Principal Deputy Director Steve Black, as well as several of his direct reports were among those in attendance.

**New project - Nuclear Regulatory Commission:** GNSTD recently was awarded an additional task order for N 4116, a support contract for Nuclear Regulatory Commission (NRC). The task order is valued at approximately \$360,000 and the period of performance runs from April 2012 until August of 2013. The task order involves updating Regulatory Guides for the NRC. Regulatory Guides provide guidance to NRC licensees to aid the licensees in complying with NRC regulations.

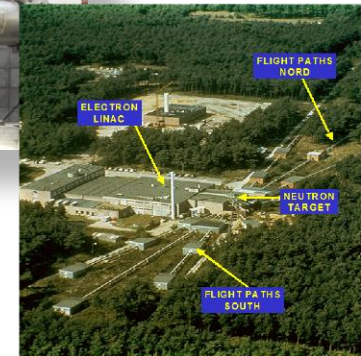
A concerted Fiber Optic Acoustic Sensor data collection effort was undertaken at the Big Explosives Experimental Facility (BEEF) at the Nevada National Security Site. This included operating both the 2nd generation and 3rd generation fiber optic acoustic sensor systems within a blast enclosure at close proximity. A quick analysis of the results shows promise for the further development of this technology for use in these types of applications. A more comprehensive data analysis is underway to compare fiber optic acoustic sensor data to geophone data. Geophones were deployed along the fiber to provide a ground truth comparison during testing.

# S&T Accomplishments

- A Design Specific Review Standard for the m-Power small modular reactor was a major milestone completed for the U.S. Nuclear Regulatory Commission's (NRC's) Office of New Reactors.
- Klaus Guber completed a six-week assignment at the Institute for Reference Materials and Measurements (IRMM) in Geel, Belgium, to perform neutron cross-section measurements on cerium and copper in support of the U.S. Nuclear Criticality Safety Program.
- Using RNSD's unique hybrid deterministic-Monte Carlo radiation transport methods, a new criticality incident detection and alarm system (CIDAS) was designed for the plutonium facility at Los Alamos National Laboratory (LANL).



IRMM





# Key Highlights and Activities



- A SCALE Lattice Physics and Depletion training course was held at the Organisation for Economic Co-operation and Development Nuclear Energy Agency Data Bank, in Paris, France.
- John Wagner organized and led a kick-off meeting for a Department of Energy (DOE)-directed study to assess the value of used nuclear fuel based on current and future needs. Seven labs and DOE officials, including NE-5, participated in this meeting with implications to DOE's response to the Blue Ribbon Commission report.
- Cecil Parks participated in the University of Tennessee-Knoxville Nuclear Engineering Board of Advisors meeting.
- Programmatic reviews of radiation transport projects for NA-42 (Emergency Management) and NA-22 (Nonproliferation R&D) were completed with positive feedback.



# New Projects



- **Over \$500K in new funding received from the NRC.**
- **NRC accepted a new five-year \$19.5M umbrella agreement for ORNL support of new reactor licensing.**
- **DOE-NE has provided \$135K additional funding to examine Fukushima Daiichi Unit 1 Corium-Concrete Interaction and Spreading. This task will be led by ORNL and collaborated with Argonne National Laboratory.**
- **The Defense Threat Reduction Agency announced funding for three collaboration tasks grouped under the title of Rapid Post-Detonation Nuclear Debris Analysis. The collaborations with Pacific Northwest Nuclear Laboratory and LANL utilize RNSD's expertise in nuclear fallout field characterization.**
- **DOE-NE announced approval of \$1.5M in new projects for ORNL to support advanced instrumentation and controls research for small modular reactors.**

# Visits & Tours

- **May 7-8: Chris Nunn, Toby Harris, Pablo Moresco and Michael Thistlewaite of the Atomic Weapon Establishment (United Kingdom) were hosted by Vince Jodoin and met with several ORNL staff members to discuss Nuclear Fallout.**
- **May 10: Frank Helin and Ted Feigenbaum of Generation mPower visited ORNL to discuss small modular reactor technology development and to tour CASL. They were hosted by Jess Gehin.**
- **May 15: Cecil Parks hosted Douglas Weaver, Deputy Director of the NRC, Office of Nuclear Material Safety and Safeguards, Division of Spent Fuel Storage and Transportation. He toured the National Transportation Research Center, the Fuel Irradiation Facility, and saw a demonstration of the fuel clad vibration testing for the NRC.**
- **May 18: Daniel Abriola, Head of the Nuclear Data Development Unit within the Nuclear Data Section of the International Atomic Energy Agency visited with Cecil Parks and several RNSD staff members.**
- **May 31: Cecil Parks and Julie Stringfield met with key Office Directors and senior managers at NRC to discuss ORNL work for the NRC and evolving opportunities.**




# Publications



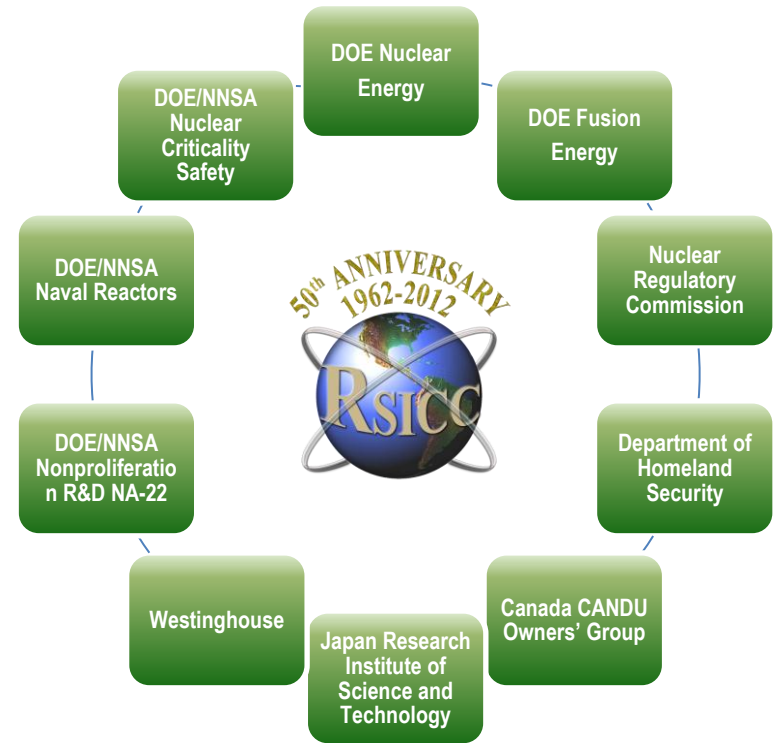
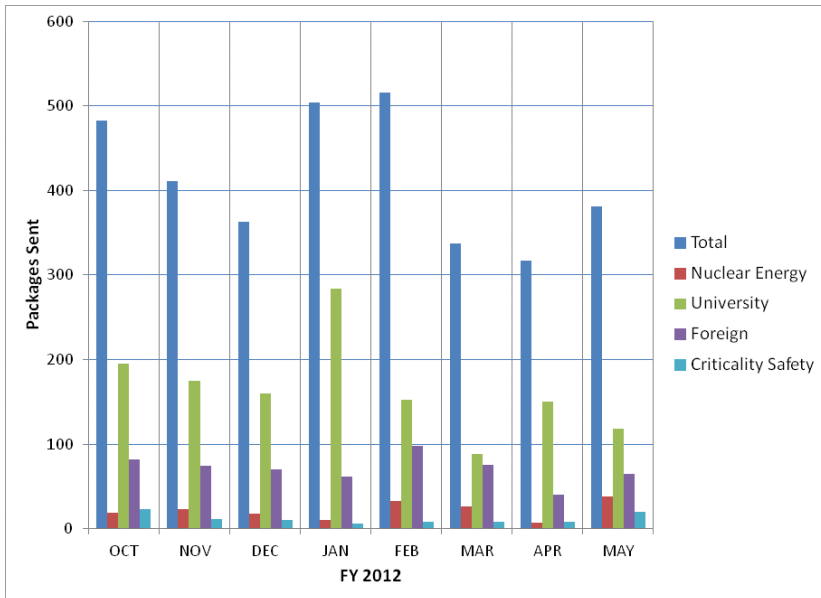
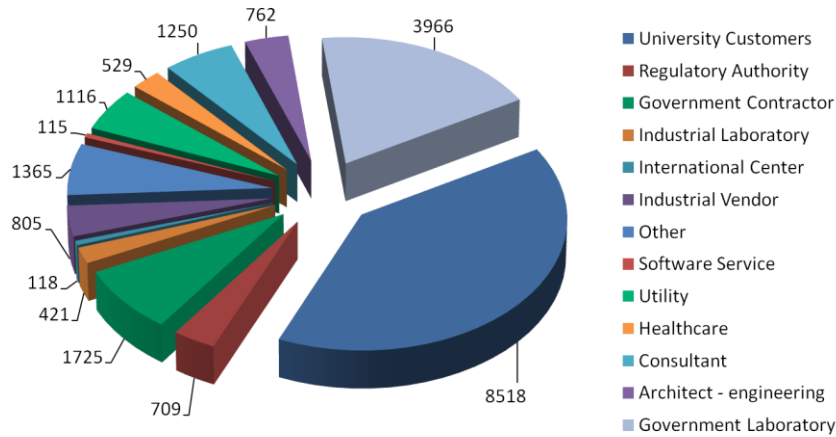
- Conference papers – 0
- NUREG – 0
- ORNL/TM - 1
- Letter reports – 2
- Progress Reports - 38
  
- A journal article titled, “FW-CADIS Method for Global and Semi-Global Variance Reduction of Monte Carlo Radiation Transport Calculations,” Wagner, Peplow, Mosher was submitted to *Nuclear Science and Engineering* for publication.
- The following PHYSOR 2012 paper was invited for publication in a special issue of *Nuclear Science and Engineering* :
  - J. J. Jarrell, A. T. Godfrey, T. M. Evans, and G. G. Davidson, “Full Core Reactor Analysis: Running Denovo on Jaguar”
- The following PHYSOR 2012 paper was invited for publication in a special issue of *Nuclear Technology* :
  - D. Ilas, “SCALE Code Validation for Prismatic High-Temperature Gas-Cooled Reactors”
  - A. T. Cisneros and D. Ilas, “Neutronics and Depletion Methods for Parametric Studies of Fluoride Salt Cooled High Temperature Reactors with Slab Fuel Geometry and Multi-Batch Fuel Management Schemes”
  - R. P. Kelly and D. Ilas, “Verification of a Depletion Method in SCALE for the Advanced High Temperature Reactor”

# Materials Irradiation - May

Project	Format	Sponsor	Stage					Notes
			Newly proposed	In Design	In Fabrication	In Reactor	PIE	
Fuel Cycle R&D	Rabbit	DOE, NE						
Titan Metal	Rabbit	DOE, FE US-Japan		20		Cycle 443		Tungsten and steel
Titan Metal Perforated	Rabbit				9	Cycle 442		Tungsten SiC,, steel
Composite Flexure	Rabbit	DOE, FE		8		Cycle 443 or 444		SiC
Hydrided Clad	Target	DOE, NE		1-3		TBD		Zircaloy
Ibiden	Rabbit	WFO, Ibiden			38	Cycle 444		Graphite
Nippon	Rabbit	WFO, Nippon	34			Sometime in 2013		Graphite
UO2 TEM disks	Rabbit	Texas A&M	1			Cycle 444		UO2
Titan Tensile	Rabbit	DOE			16	Cycle 444		V-4Cr4Ti, SiC, Graphite, steel
Selenium				unlimited		varies		Selenium
EPRI	Large VXF	EPRI			3	Cycle 444		Steel, Inconel
Toyo Creep	Target	WFO, Toyo		3		Cycle 444		Graphite

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

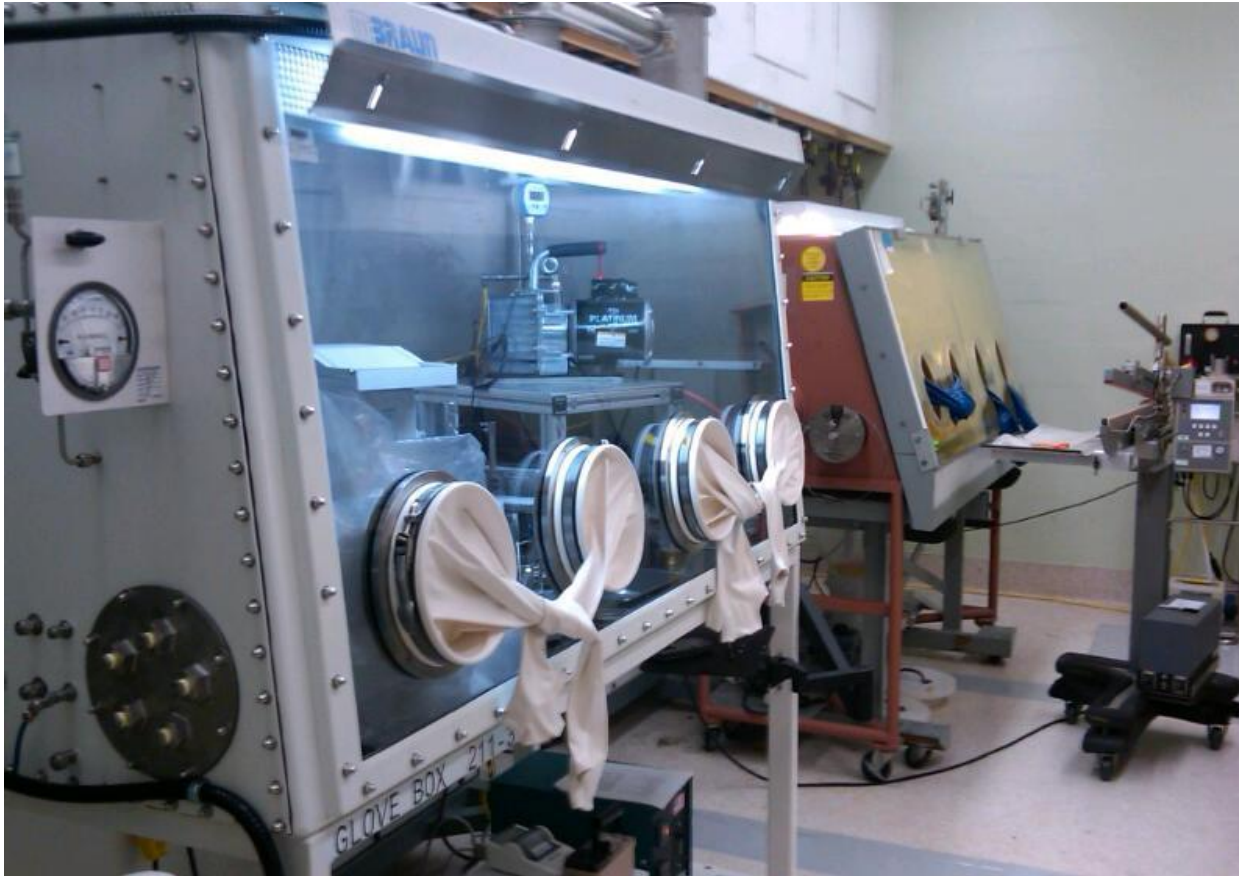
RSICC Customer Base



- **Software and data packages distributed FY2012: 3,312**
- **4 package updates and revisions May 2012**



# Non-Reactor Nuclear Facilities Division



Installed new glovebox into 7920 Lab 211 and began pressing NpO pellets in support of Pu-238 program.

**Np237 Pellet Pressing glovebox in service**

# NNFD FY2012 Cumulative Facility Metrics

## Hot Cell Availability

97.20% REDC (7920)

95.00% REDC (7930)

92.00% Irradiated Fuels Examination Laboratory (3525)

90.00% Irradiated Material Examination and Testing Laboratory (3025E)

## Facility Upgrades and Maintenance Activities

7920

- Completed Installation of NP237 Pellet Pressing Glove-Box in Lab 211



- Replacement of lights, off-gas hose, and filter for the Transfer and Decontamination Facility (TDF)



7930

- Completed SR 4.1.1.4 Instrument Calibrations
- Completed SR 4.1.1.5 Low Differential Pressure Alarm System Functions Tests

- E-9 alarm and control system upgrade in progress

- North Valve Pit grouting proposal in progress

*E-1 Annulus Inspection for Scoping Purposes*



3525

- Installation of new glove-box exhaust system



- Removal of obsolete chiller and chill water system



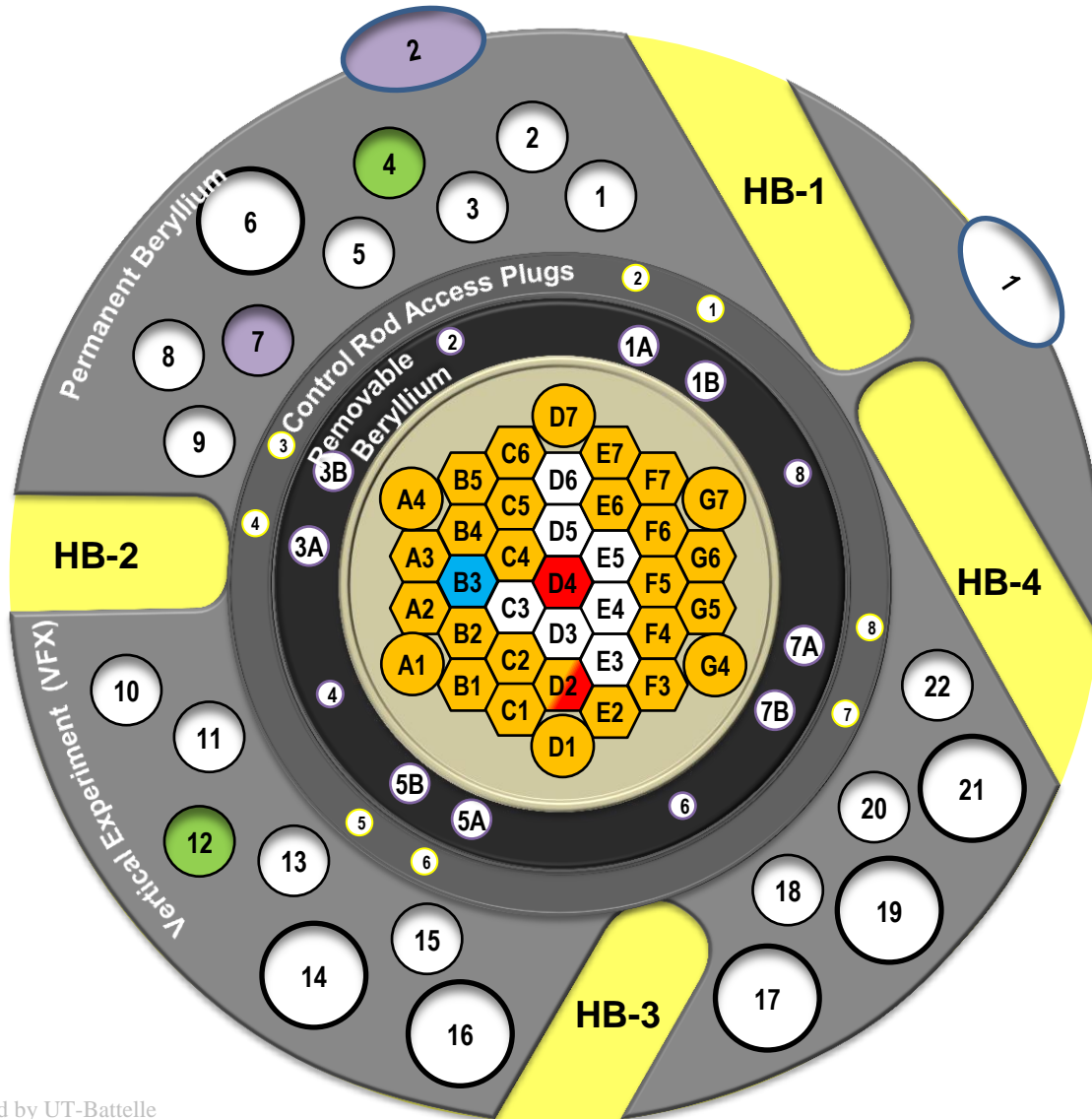
3025E

- Routine ongoing maintenance activities

# Cycle 441 continues strong demand for materials irradiation

May 2012						
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	29	30	31		

Reactor On



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

# HFIR sets another decade record in cycle 441 for the number of irradiation capsules

## 117 Materials and Fuels Experiments

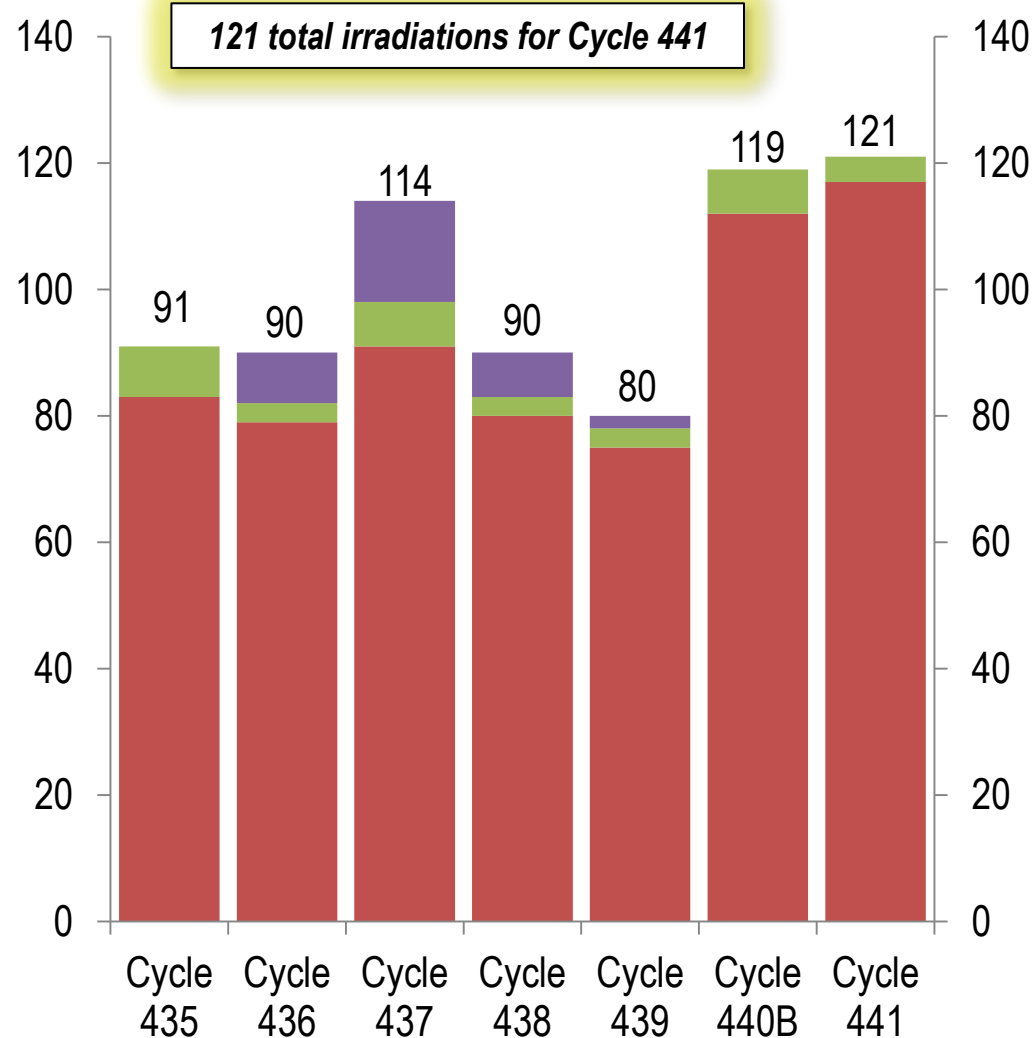
- Silicon Carbide
- V, Mo, & Cu alloys
- Zircaloy
- UO<sub>2</sub> Fuels
- Graphite
- Uranium
- Steels
- UCN Fuels
- Flux Monitors for Pu-238 program

## 4 Commercial Isotope Production Capsules

- 6 Selenium (Se-75) - production

## Isotopes for Research

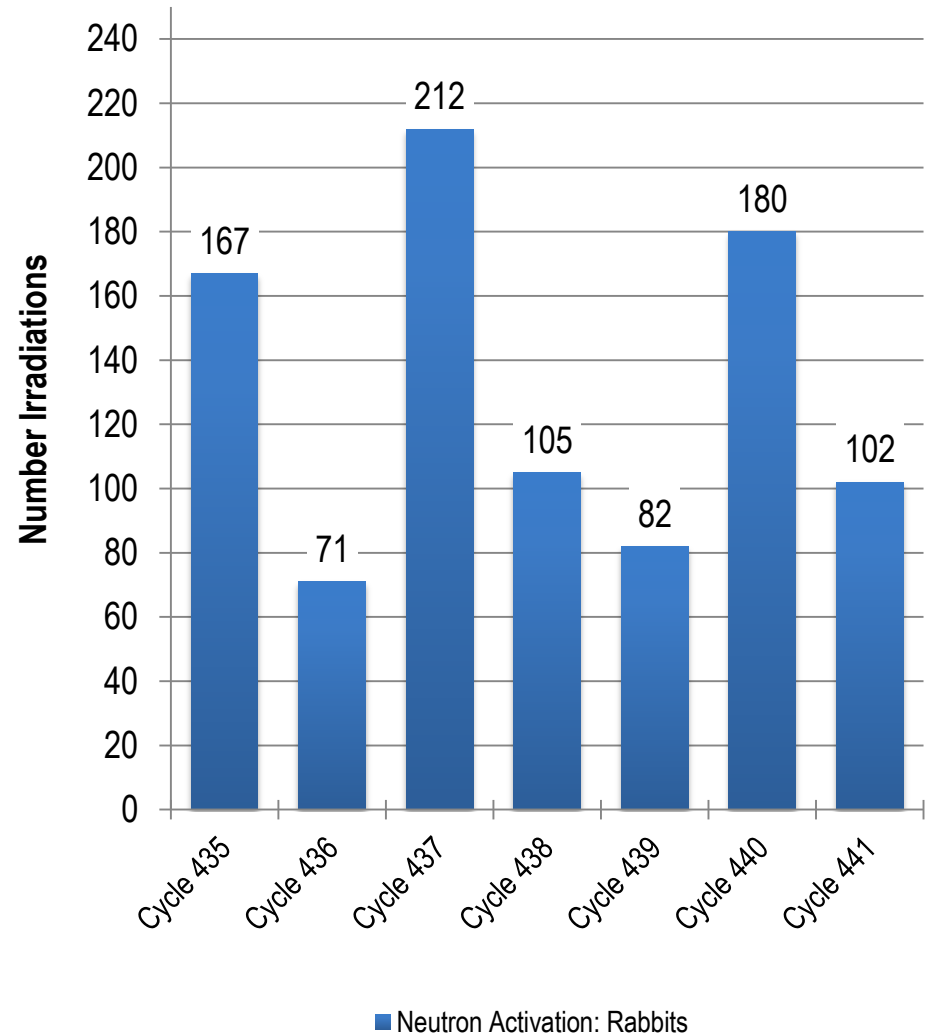
- None this cycle



# Significant number of NAA irradiations during cycle 441

## NAA irradiations during Cycle 441 include

- 8 rabbits for VT researchers in conjunction with CNMS – 4 graphene and 4 nanotubes
- 2 rabbits for NIH looking at impurities in diamond powder
- 3 rabbits containing sodalite for stoichiometry verification for ESD
- 33 rabbits for Roger Kapsimalis (DNAA data deconvolution to simultaneously determine U, Pu)
- 56 rabbits for IAEA



# Fusion Energy Division Highlights

Stan Milora attended the 12<sup>th</sup> meeting of the ITER Science and Technology Advisory Committee (STAC) in Cadarache, France. He participated in a working group that was formed to address the ITER Council charges associated with ITER's magnetic field system: central solenoid coil conductor performance and production, cold testing of magnets especially the 19 toroidal field coils assigned to Europe and Japan and the central solenoid (US and Japan responsibility). STAC completed its business by issuing a draft report and conducting a briefing for ITER Organization senior management

FED provided operational support removing hardness equipment from cell to SPL for troubleshooting to support testing

R. Maingi presented an invited talk at the 20th International Conference on Plasma Surface Interactions in Aachen, Germany: "Physics of the H-mode pedestal and its possible role in setting the power flux channel." In addition, R. Maingi presented a second invited talk at the same conference on behalf of Vlad Soukhanovskii, "Advanced diverter configurations with large flux expansion."

FED Completed shipments of specimens (pellets and disks) to LAMBDA



# Environmental Management Program Office

- ORNL North-West Quad Soils and Slabs D&D and Remediation
  - Completed site restoration at 2016
  - Grouted segment of process waste drain line between MH-97 and MH-95
  - Completed removing concrete-encased process waste drain piping in 2000 Area
  - Began site restoration on 2000 footprint
  - Waste shipments to date (through May 2012) total 398 loads to EMWMF and 91 loads to the Y12 landfill



**Excavating for PW Drain Pipe Removal**



**Site Restoration Complete at 2016**

**Making Confined Space Entry into Manhole Prior to Grouting**

# Environmental Management Program Office

- **Isotopes Area Legacy Material Removal**
  - Received EPA and TDEC comments to D0 PCCR
  - Finalized waste disposition documentation packages



Preparing to Load Lead Shielding into Intermodal Container



Building 3030 Hot Cell with Lead Shielding Removed

- **Beta 3 (9204-3) Project at Y12**
  - Received formal DOE approval of the Hazard Assessment Document (Building below HC 3 by analysis)
  - Formally transmitted to the regulators the D1 Project Completion Report
  - Shipped for offsite disposal 1 B25 of waste with only one drum remaining for disposal



# Environmental Management Program Office

- 4500 Area Gaseous Waste Reconfiguration and Stabilization Project
  - Began hot operation of new cell ventilation system in 4507
  - Shipped two containers with approximately 4.9 yards of SLLW from 4507 stabilization work for disposal
  - Received lab results for samples from 4556 filter housings
  - 4556 Filter Pit clean out subcontractor began the submittal process
  - Initiated removal of HEPA filters from 4556 filter housings
  - Accepted delivery of 7 HEPA filter housings for 4501, 4505 and 4500N
  - Reconfiguration contractor began assembly/installation of the electrical panels



**Preparing for 4556 Filter Pit Entry**



**4501, 4505, and 4500N Filter Housings**



**4507 Hot Cell Ventilation System**

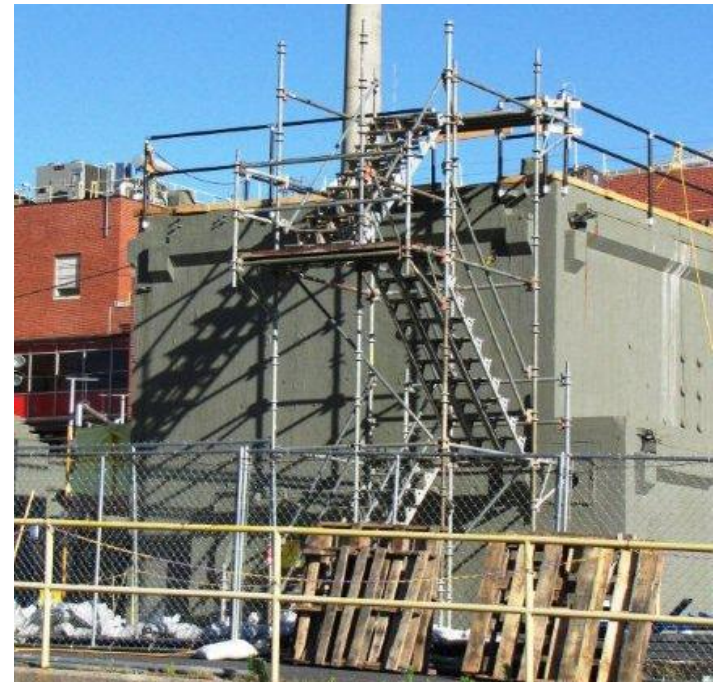
# Environmental Management Program Office

- Integration Support

- EM Contractor Perma-Fix continued demobilization from Campus on Miscellaneous Facilities Project
- UT-B performed fit test of RCA/ Schaich Cask RTG for Miscellaneous Facilities Project
- EM Contractor Perma-Fix continued performing evolution mock-ups preparing for 3026D Management Assessment
- UT-B completed the installation of specialty scaffolding at 3026D for Hot Cells Project
- UT-B performed gamma imaging on unknown capsules and perchlorate sampling in 5 hot cells at 3038 for Hot Cells Project
- EM Contractor UCOR completed site restoration of Tank W1A Site



**RCA Source Fit up**



**Specialty Scaffolding installed by UTB at 3026D**