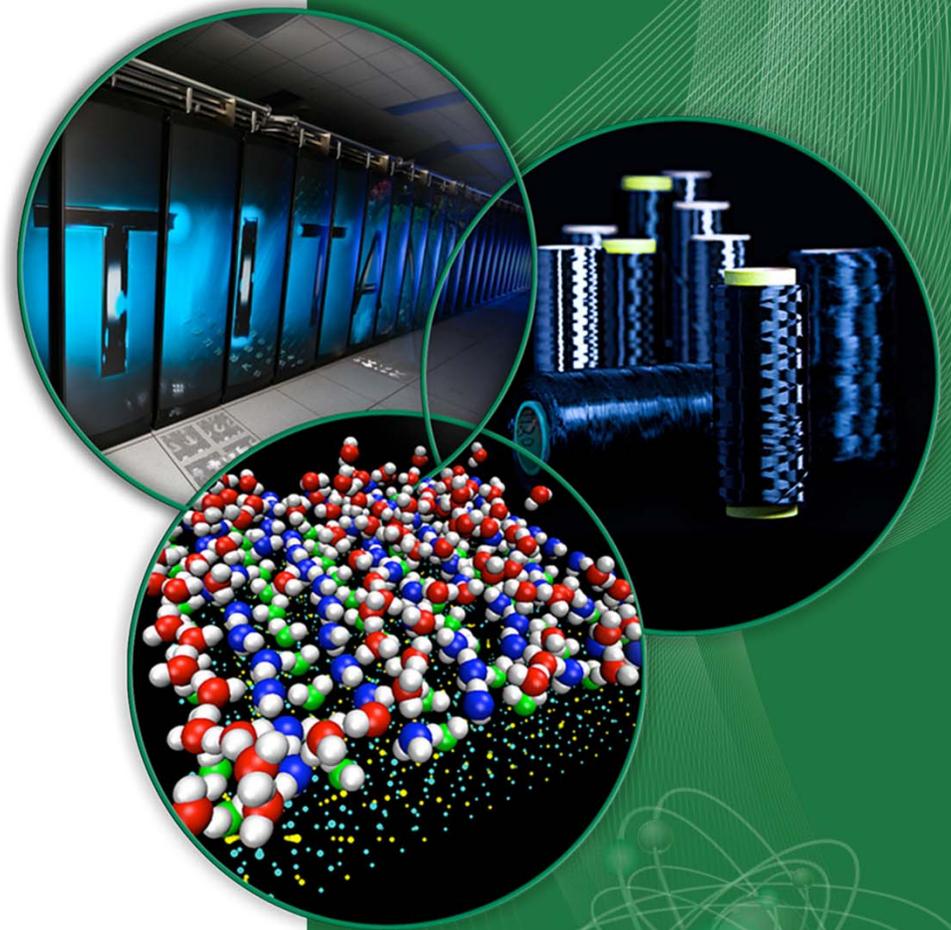


NSED Monthly Report

July 2014

**Nuclear Science &
Engineering Directorate**

ORNL is managed by UT-Battelle
for the US Department of Energy



 **OAK RIDGE**
National Laboratory

ORNL enables continued US contributions to Joint European Torus (JET)

C. C. Klepper (FMNSD) is co-author of a journal paper titled “Ion cyclotron resonance frequency (ICRF) heating in JET during initial operations with the ITER-like wall,” by Ph. Jacquet et al., *Physics of Plasmas* 21, 061510 (2014).

This is a first overview of an ICRF-based auxiliary heating performance in JET, since switching to a fully ITER-like plasma-facing wall.

- Findings included enhanced beryllium (Be) sources from regions where the antennas interact (remotely) with Be wall components and increased radiation in the core, due to tungsten (W) eroded from the divertor; however, the later is balanced by an apparent W screening from the central core by the ICRF.
- ORNL’s current contributions are through optical spectroscopy measurements of such sources from the walls and their interpretation.

This paper reflects ORNL’s role in maintaining US involvement in the JET fusion energy program located at the Culham Science Centre in Great Britain

2 NSED Monthly Report – July 2014



Chris Klepper



ICRF Antenna Structures inside JET's vacuum vessel

High Flux Isotope Reactor American Nuclear Society Nuclear Historic Landmark

X-15
1959–1970



CDC 6600
(1 megaFLOPS)
1962–1966



Apollo
1966–1975



Other 1960s breakthroughs

HFIR: 1965–present (and still going strong)



“The field of new transuranium elements is entering an era where the participating scientists in this country cannot go much further without some unified national effort.... The future progress in this area depends on substantial weighable quantities (say milligrams) of berkelium, californium, and einsteinium...”

G. T. Seaborg
Berkeley, October 24, 1957

North Carolina State University (NCSU) visit

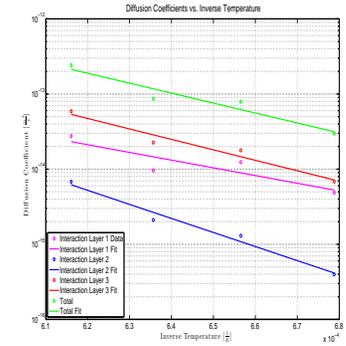
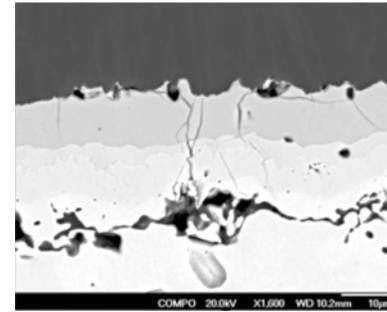
- Dr. Louis Martin-Vega, Dean, NCSU College of Engineering and Dr. Yousry Azmy Professor and Head, Department of Nuclear Engineering visited ORNL
 - Meetings were held with the various NSED divisions to give overviews on Nuclear program at ORNL
 - Tours were conducted of the Fusion R&D labs, REDC and Pu-238 Program
 - Dr. Yousry Azmy gave presentation on NA-22 Consortium and JFA Opportunities to NSED Group Leaders
 - Dean Martin-Vega presented overview of the NCSU Engineering Program



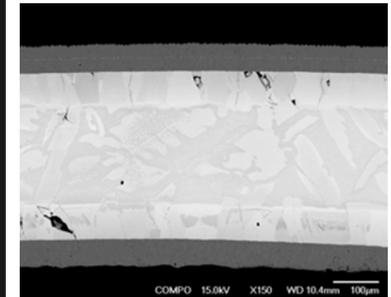
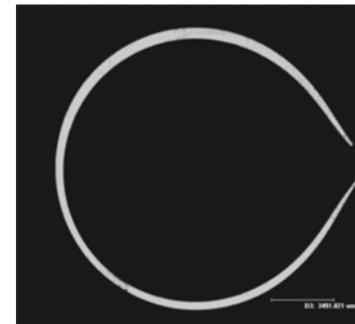
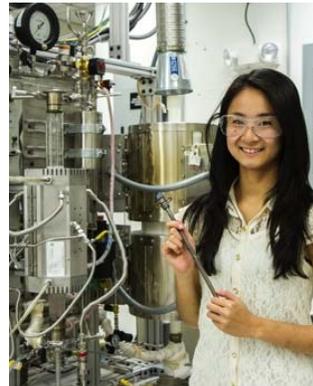
**NC State College of Engineering Toured 7625
L to R: Phil Ferguson, Alan Icenhour, Juergen Rapp,
Yousry Azmy, Dean Martin-Vega and John Caughman**

Nuclear Fuels Materials Group Summer Students

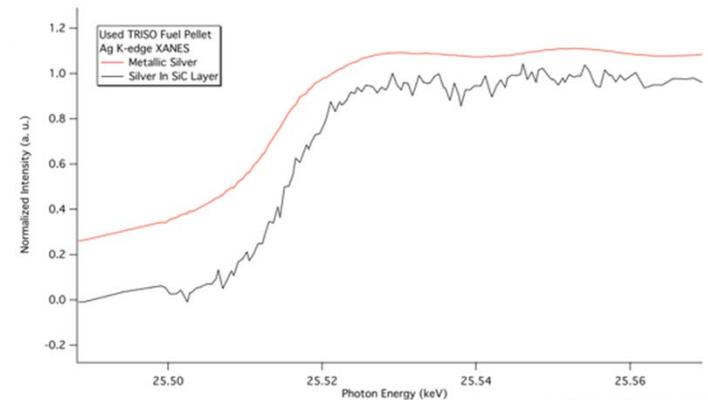
Caleb Massey
Nuclear Engineering
Virginia Commonwealth University
Kinetics of Cr-SiC reaction at 1000-1350°C



Yuri Kato
Biomedical Engineering
George Washington University
Characterization of cladding post-burst



Rachel Seibert
Condensed Matter Physics -
Illinois Institute of Technology
X-ray Absorption Fine Structure
on Irradiated TRISO Particles at
Advanced Photon Source



Remote Systems Group Summer Students

- Remote Systems hosted a total of 10 summer interns and guests this summer working on the following projects:
 - Isiah Bell (NESLS) – Next generation remote manipulator
 - Elliott Cooper (NESLS) – ESIPF Mechanical Design
 - Jessica Shewmaker (HERE) – Application of Raspberry Pi to International Nuclear Non-proliferation Training
 - R. Scott Vance (NESLS) – Q-Ball Cask Target Lifter Design and Fabrication
 - Andrew Wolfe (HERE) – Radium Chloride Extractor Concepts
- Defense Logistics Agency Strategic Materials:
 - Sonny Bittle
 - Gloria Bowen
 - Cale Caldwell
 - Meredith Manning
 - Paul Nogrady



Appalachian Regional Commission (ARC) 2014 Summer Math-Science-Technology Institute students hosted at ORNL

- The ARC program brings in high school juniors and seniors from the Appalachian Region and gives them the opportunity to spend two weeks at ORNL learning about a topic of their choice; Students focused on robotics and fusion energy
- Adam Carroll, Adam Aaron, Venu Varma, Ted Biewer, and Robert Duckworth mentored 17 ARC summer students



Fusion Students & Mentors

Robotics Student & Mentors



Map by Appalachian Regional Commission, November 2008

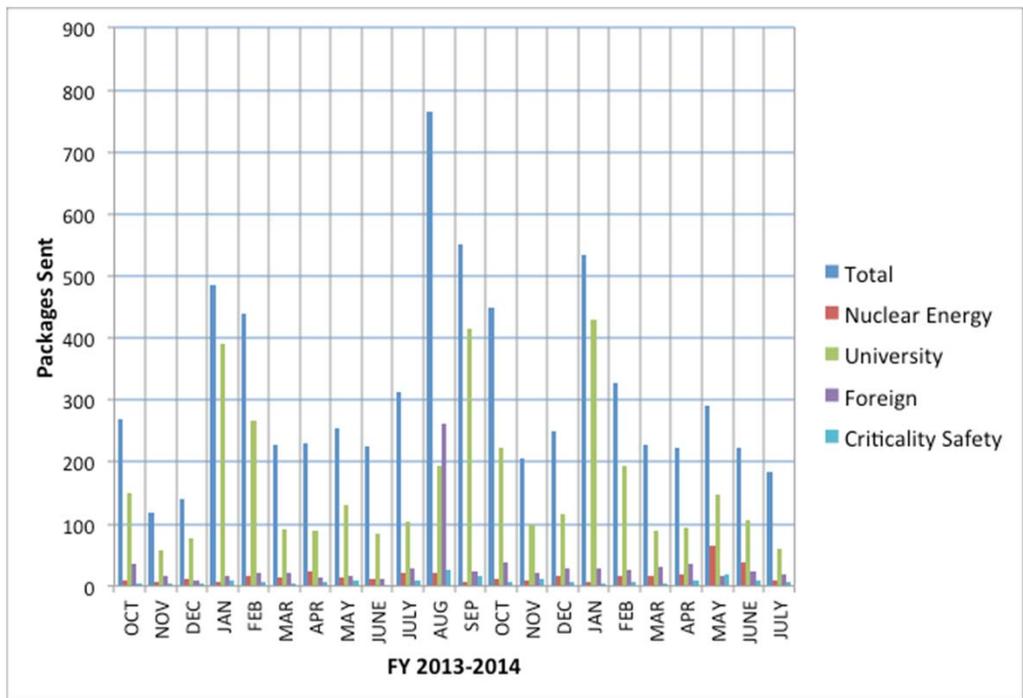
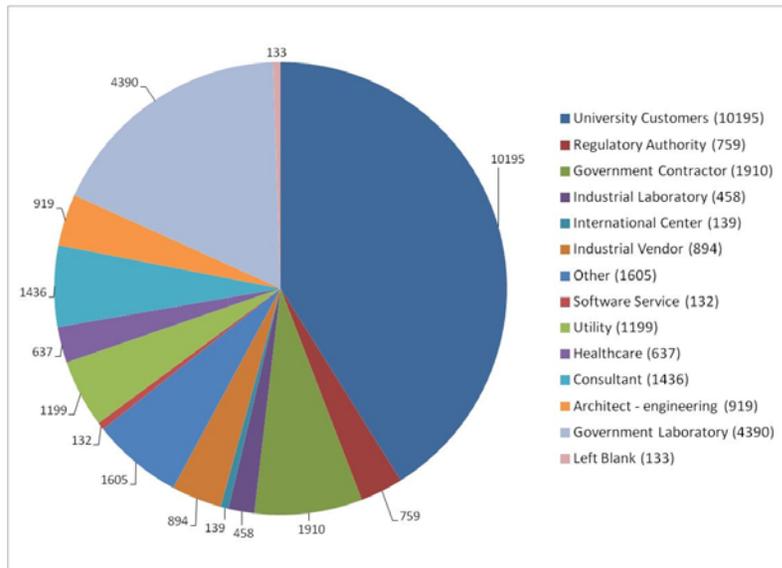
Appalachian Regional Commission Area

NSED provides hands-on robotics exhibits at ORNL's "Take Your Child to Work Day" on July 18

- A Remotec Andros Robotic Platform and CRL Ball Manipulator were set up for children to hands-on operate under direct supervision while being educated on Remote Systems
- ORNL student Interns also supported the event



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



- Software and data packages distributed FY2014: 2915
- 3 package updates and revisions July 2014

Radioisotope Production

Pu-238 Production Program

Cf Production Program

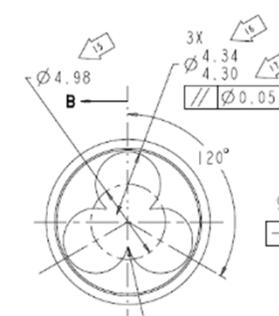
- Two heavy Cm targets were transferred to HFIR for irradiation during cycles 455-456; for a total of 5 targets in the reactor
- Efforts to qualify the light curium target holder for use in the large VXF positions in HFIR continue



Cf-252 sources

Ni-63 Production

- A new target design for irradiating Ni-62 was placed in HFIR for 13 cycles of irradiation starting with cycle 455
- New design utilizes a Se-type rabbit
 - Increases flexibility for irradiation positioning
 - Lowers costs of irradiation and processing
- ^{62}Ni targets are irradiated for two years in HFIR to produce high specific-activity ^{63}Ni for use in explosive detectors
 - The enriched ^{62}Ni target material is obtained from the ORNL Isotope Program enriched stable isotope inventory



New Ni target design



Ac-225 purification glove box line at the Radiochemical Engineering Development Center



Np-237 Targets in target holder

- 15 Np-237 pellets were fabricated
- 14 targets were transferred to HFIR
- 1st dissolution test of 6 pellets from a two-cycle irradiated target was initiated
- Hosted DOE/HQ Program Manager & NASA Project Manager
- Continued nitrite analysis of Pu/Np solutions

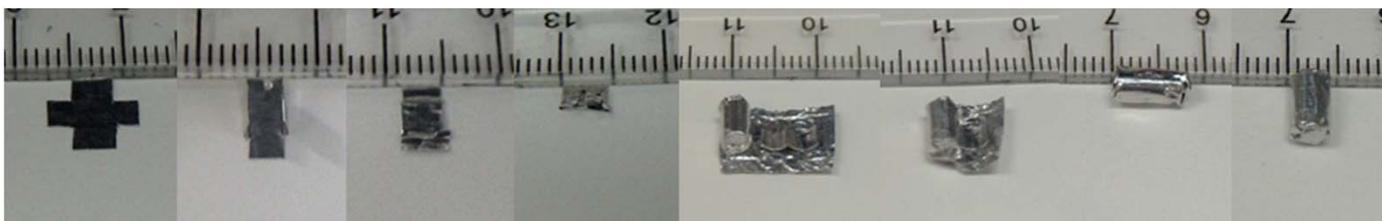
Ac-225 Program

- In July, 11 shipments were made to 7 customers with a total activity of 44.1 mCi
- To date, Campaign 112 has already set a single-campaign record of 129.8 mCi Ac-225 shipped to customers – this campaign will continue into August

Radioisotope Research & Development

Transcurium Optimization Study

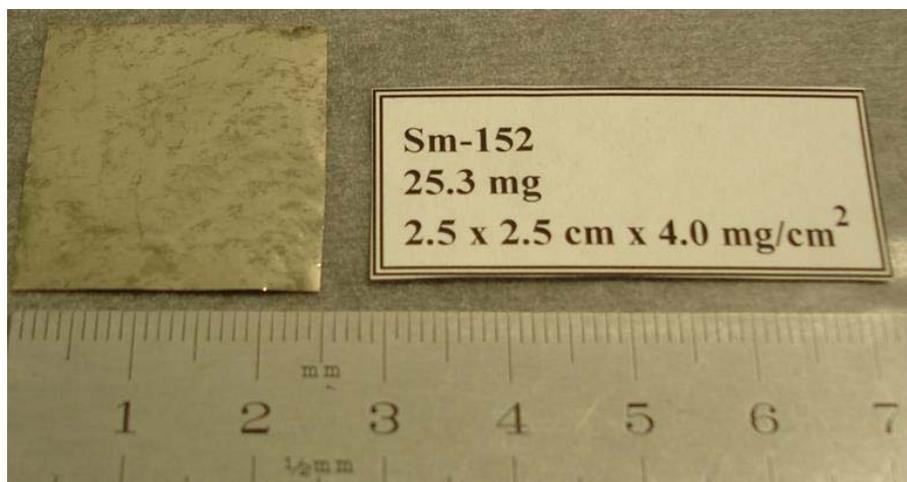
- All five rabbit targets have been irradiated and are awaiting transfer to REDC after decay
- Transfer basket has been modified to accommodate use of Loop Cask with rabbit targets
- Expect to transfer rabbits in early August



Layout of integrated filters and filter monitors for each rabbit target

Enriched Stable Isotopes

- Eleven shipments of 121 isotopes were completed in July
 - 110 shipments of 443 isotopes have been made in FY2014 to date
- Eight technical services were completed for a FY2014 total of 92 technical services
 - These included targets of Sm-152 at 2.5 cm x 2.5 cm x 4 mg/cm², Ca-44 @ 1 cm x 1 cm x 5 mg/cm² and Ca-48 at 1 cm x 1 cm x 5 mg/cm²



Sm-152 target for measuring internal conversion coefficients and electric monopole transitions strengths in the Sm-152 nucleus



40 bottles of Hg-202 metal (5 mg each) and 10 bottles of Hg-199 oxide (5 mg each) for commercial resale

Patents awarded

NSITD researchers Emory Collins, Bill Del Cul, Rodney Hunt, Jared Johnson, and Barry Spencer were granted a US Patent for Advanced Dry Head-End Reprocessing of Light Water Reactor Spent Nuclear Fuel

(12) United States Patent Collins et al.	(10) Patent No.: US 8,747,790 B2 (45) Date of Patent: *Jun. 10, 2014
(54) ADVANCED DRY HEAD-END REPROCESSING OF LIGHT WATER REACTOR SPENT NUCLEAR FUEL	(58) Field of Classification Search USPC 423/249, 253; 210/758 See application file for complete search history.
(71) Applicant: UT-Battelle, LLC, Oak Ridge, TN (US)	(56) References Cited
(72) Inventors: Emory D. Collins, Knoxville, TN (US); Guillermo D. Delcul, Powell, TN (US); Rodney D. Hunt, Harriman, TN (US); Jared A. Johnson, Knoxville, TN (US); Barry B. Spencer, Knoxville, TN (US)	U.S. PATENT DOCUMENTS 4,279,875 A 7/1981 Bray et al. 6,033,636 A 3/2000 Todokoro et al. 6,156,183 A 12/2000 Kondo et al.

NSITD researcher Jack Collins was granted a US Patent for Formulation and Method for Preparing Gels Comprising Hydrous Aluminum Oxide

(12) United States Patent Collins	(10) Patent No.: US 8,753,534 B2 (45) Date of Patent: Jun. 17, 2014
(54) FORMULATION AND METHOD FOR PREPARING GELS COMPRISING HYDROUS ALUMINUM OXIDE	OTHER PUBLICATIONS
(76) Inventor: Jack L. Collins, Knoxville, TN (US)	Collins et al., "Determination of Ideal Broth Formulations Needed to Prepare Hydrous Aluminum Oxide Microspheres via the Internal Gelation Process," ORNL/TM-2009/006, Feb. 1, 2009. Collins et al., "Determination of Ideal Broth Formulations Needed to

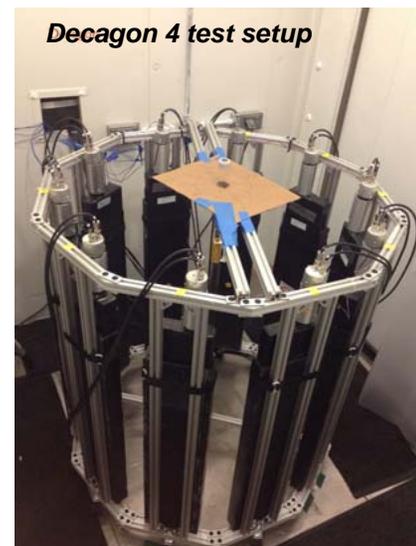


Performance testing for NNSA Second Line of Defense (SLD)

- The SLD Program requested performance testing of Polimaster radiation portal monitors (RPM)
 - Four RPMs arrived from Belarus and assembled and energized.
 - Testing has been completed using highly enriched uranium (HEU), depleted uranium, and plutonium
- The SLD Program selected ORNL to perform a series of tests on gamma detectors used in over 1,000 RPMs deployed worldwide
 - Sixteen gamma detectors, made of poly-vinyl-toluene (PVT), were harvested from four locations around the world along with new PVT procured specifically for testing
 - A series of cold temperature tests are being performed to determine if any long-term effects have degraded detector performance



Polimaster testing with HEU in Building 7603



WMD commodity identification and interdiction training

- Terry Donaldson was the technical lead for a WMD Commodity Identification and Interdiction Training demonstration course in Voi, Kenya, July 14-17, 2014.
 - Thirty-five Kenya Customs officers and technical specialists participated
 - The instructor team included subject matter experts from South Africa and Kenya and a representative from the U.S. Department of Homeland Security/Customs and Border Protection/National Targeting Center-Cargo
- Plans for national instructor training and course development, plus a national pilot course sometime in FY 2015, were also made



Program management support to DOE-IN – Development of IT tools

- INsight version 3.0 was deployed to production in July
- This release includes a new procurement module, allowing IN to manage contracts and interagency agreements in INsight

INSight

Welcome Matt [Switch User]

Dashboard | Data Import | General Ledger | AFP | Human Resources | COOP | Procurement | Reports | Administration

Home > Manage Procurements

Procurement Manager – 411

FY 20

Details | Tasks | Labor Costs | ODC | Attachments

Task Name: X

Task	Contractor	Employee	Labor Category	Labor Rate	Daily Rate (x8)	Monthly Rate (x160)	Annual Rate (x1920)	Annual Rate (x1860)	Total Costs	October Cost	November Cost	December Cost
Task Name: Operations												
Operations		Hr Director (95%)		\$200.00	\$1,520.00	\$30,400.00	\$364,800.00	\$353,400.00	\$43,000.00			
Operations	International, Aaron	Information Technology Specialist		\$200.00	\$1,600.00	\$32,000.00	\$384,000.00	\$372,000.00	\$25,000.00			
				\$400.00	\$3,120.00	\$62,400.00	\$748,800.00	\$725,400.00	\$68,000.00			
Task Name: R&D												
R&D		Behr, James T.	Ci Analyst	\$100.00	\$800.00	\$16,000.00	\$192,000.00	\$186,000.00	\$18,000.00			
R&D		Reo, Sam	Research Developer (Sme)	\$200.00	\$1,600.00	\$32,000.00	\$384,000.00	\$372,000.00	\$32,000.00			
				\$300.00	\$2,400.00	\$48,000.00	\$576,000.00	\$558,000.00	\$50,000.00			

INSight

Welcome Matt [Switch User]

Dashboard | Data Import | General Ledger | AFP | Human Resources | COOP | Procurement | Reports | Administration

Home > Manage Procurements

Procurement Manager – 411

FY 20

Details | Tasks | Labor Costs | ODC | Attachments

+ Add New Task

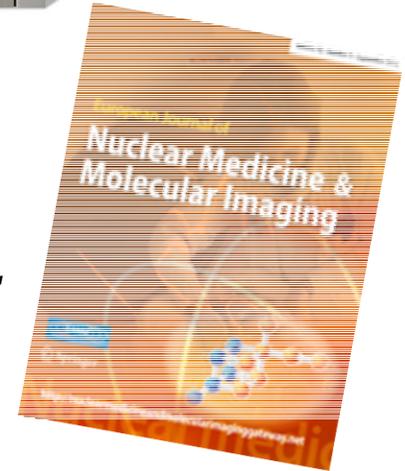
Task	Funding	Labor Costs	ODC Costs	Remaining Funding	Organization	Task Monitor
Operations		\$0.00	\$68,000.00	\$0.00	GD25 - GD25 - Name	Anthony, Allison Andrew (AnthonyAllison@doe.gov)
Funding Sources						
REQ 222		\$0.00	\$68,000.00	\$0.00		
OB 222		\$0.00	\$0.00	\$0.00		
+ Add Position						
Labor Category	Employee	Current Rate	Percent on Task	Total Labor Costs	Onsite	
Hr Director	Behr, James T. (Acting)	\$200.00	95%	\$43,000.00	True	
Information Technology Specialist	International, Aaron	\$200.00	100%	\$25,000.00	True	
+ Add Position						
R&D		\$9,000.00	\$50,000.00	\$3,000.00	GD25 - GD25 - Name	Allbright, Allison Jennifer (AllbrightAllison@doe.gov)
Funding Sources						
REQ 549		\$9,000.00	\$50,000.00	\$3,000.00		
OB 727		\$0.00	\$0.00	\$0.00		
Grant 707		\$0.00	\$0.00	\$0.00		
+ Add Position						
Labor Category	Employee	Current Rate	Percent on Task	Total Labor Costs	Onsite	
Ci Analyst	Behr, James T.	\$100.00	100%	\$18,000.00	True	
Research Developer (Sme)	Reo, Sam	\$200.00	100%	\$32,000.00	True	

Publications



- **Journal Article – 2**

- Kratochwil C, Giesel FL, Bruchertseifer F, Mier W, Apostolidis C, Boll R, Murphy K, Haberkorn U, and Morgenstern A, "*²¹³Bi-DOTATOC receptor targeted alpha-radionuclide therapy induces remission in neuroendocrine 3 tumors refractory to beta-radiation – a first in human experience,*" Eur J Nucl Med Mol Imaging, DOI 10.1007/s00259-014-2857-9, July 2014
- Fleenor, Matthew C., Blackston, Matthew A., and Ziock, Klaus-Peter, "*Correlated Statistical Uncertainties in Coded-Aperture Imaging,*" Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment.



- **Letter Report – 1**

- **ORNL/TM – 4**

- **Paper in Conference Proceedings (Books, CD, etc.) – 1**



ORNL staff participates in nuclear energy-renewable energy systems workshop

Integration of nuclear energy with renewable energy is seen as a new operational paradigm that can help decarbonize the spectrum of energy services and stabilize the grid due to the intermittency of the renewable energy sources

- INL workshop co-sponsored by DOE-NE and NREL
- Objectives of workshop were
 - Identify priority opportunities for integrated nuclear-renewable energy systems in US
 - Select Figures of Merit (FOM) to rank and prioritize candidate systems
 - Discuss development needs for enabling technologies
 - Identify analysis capabilities and gaps to estimate FOM for integrated system options
 - Identify experimental capabilities available to develop and demonstrate nuclear-renewable energy systems
- Workshop results will yield roadmap to identify R&D needed for developing these integrated systems
 - RNSD to support INL for the nuclear portion of the roadmap

INTEGRATED NUCLEAR-RENEWABLE ENERGY SYSTEMS

Invitation is for Designated Recipients Only, Non-transferable Without Approval of Organizers
July 8-10, 2014 — Idaho Falls, Idaho

Foundational Workshop
 You are invited to actively engage in selective, evaluation, and future development of integrated nuclear-renewable energy systems at a workshop sponsored by the Idaho National Laboratory, the National Renewable Energy Laboratory, and the Massachusetts Institute of Technology.

Input collected at the workshop will be used to guide technical, environmental, and economic assessments of options for region-specific nuclear-renewable energy systems. These assessments will provide the information necessary for the development of a multi-year technology development roadmap.

Workshop objectives:

1. Define priority opportunities for integrated nuclear-renewable energy systems in the U.S.
2. Select Figures of Merit (FOM) to rank and prioritize candidate systems.
3. Discuss development needs for enabling technologies.
4. Identify analysis capabilities and gaps to estimate FOM for integrated system options.
5. Identify experimental capabilities available to develop and demonstrate nuclear-renewable energy systems.

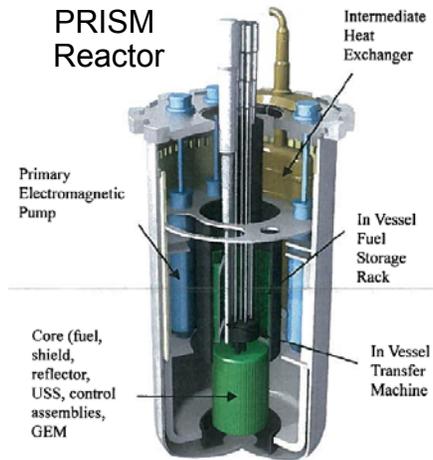
A Powerful Challenge
 The U.S. is undergoing an unprecedented transformation of energy systems — a renaissance in the way we produce, deliver, and consume energy. One new paradigm involves tighter integration of thermal energy sources — particularly nuclear reactors — with variable renewable electricity generation. Coupling nuclear and renewable energy into an integrated energy system could supply electricity to the grid while providing substantial grid flexibility and utilizing capital equipment for a large fraction of each year. Depending upon regional resources and markets, integrated nuclear-renewable energy systems could provide clean heat and electricity for hydrogen, industrial or regional production, or support another industrial process such as desalination.

Integrated Energy Systems Interactions
 How complex is your "grid integration?"

For additional details and to register for the workshop, please contact NRE.Systems@inl.gov or call (208) 526-1291.

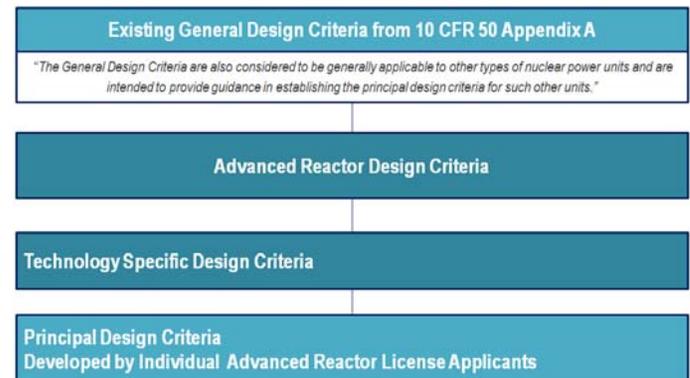
U.S. DEPARTMENT OF ENERGY | INL Idaho National Laboratory | NREL

Public workshop on licensing framework for advanced reactors



- Joint DOE/NRC program initiated in August 2013
- Purpose is to develop a set of Advanced Reactor Design Criteria (ARDC) based on the General Design Criteria in Appendix A of 10CFR50 for use as guidance to advanced reactor designers to assist in the development of the Principal Design Criteria (PDC) required under regulations
 - Three sets of design criteria were produced: (1) ARDC as general guidance (to be used for all types of non LWR designs); (2) SFR DC focused on sodium fast reactors; and (3) mHTGR-DC focused on modular high temperature gas reactors

- Two workshops were held (April and July) to review the products and receive stakeholder comments (about 70 attendees)
- Phase 1 Product deliverable to NRC in the form of an INL report in November 2014



Engagement in US bilateral meetings on reactor technology

Andrew Worrall and Jess Gehin represented NA-26 and NE at the bilateral Pu Management Expert Group between the US and Japan

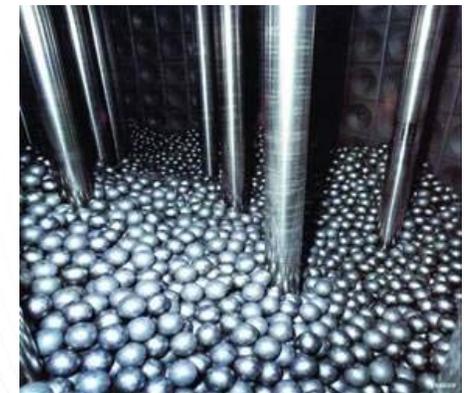
- This meeting was held in Tokyo, with representation from a range of government bodies and support organizations from both countries
- Topics discussed included reactor and fuel cycle issues associated with Pu management, as well as safeguards technologies

Ian Gauld attended a two-day workshop on nuclear material accounting control technology and safeguards approaches applicable to the China HTR-PM demonstration reactors

- The workshop was held in Beijing July 9-10
- Workshop topics focused on developing collaborations in the areas of pebble bed reactor analysis, spent fuel depletion, and spent fuel NDA measurements



 JAPAN NUCLEAR FUEL LIMITED



Laboratory Directed R&D (LDRD) RNSD proposals accepted for FY15

New Projects for FY15

- Title:** “Transformational Integrated Fusion Neutronics Modeling and Simulation”
Project Team: Scott Mosher (PI), Ahmad Ibrahim, Douglas Peplow, Tom Evans, Will Wieselquist, Juergen Rapp (Advisor, FMNSD)
Budget: FY15 - \$400K (proposed); FY16 - \$400K (proposed)
- Title:** “Optimizing HFIR Isotope Production through the Development of a Sensitivity-Informed Target Design Process using High-Fidelity Modeling and Simulation Capabilities”
Project Team: Bradley Rearden (PI), Tom Evans, Susan Hogle (NSITD), Christopher Perfetti
Budget: FY15 - \$419K; FY16 - \$483K

Current Projects Renewed for FY15

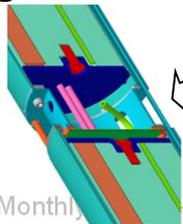
- Title:** “Transformational Capability for the Integrated Analysis of HFIR Irradiation Experiments and Isotope Production Using High-Fidelity Modeling and Simulation”
Project Team: Joel Risner (PI), Charles Daily, Seth Johnson, Will Wieselquist, David Chandler (RRD)
Budget: FY15 - \$450K (proposed)
- Title:** “An Advanced Materials Irradiation Facility to Promote Innovative Materials Research at the High-Flux Isotope Reactor”
Project Team: Nesrin Cetiner (PI), Graydon Yoder, Joel McDuffee, Lance Snead (MSTD), Chris Bryan (RRD), Young Soo Kwon (RRD)
Budget: FY15 - \$500K (proposed)

Materials Irradiation – July 2014

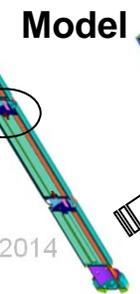
Project	Format	Sponsor	Stage					Notes
			Newly proposed	In Design	In Fabrication	In Reactor	Removed	
Steel Screening	Rabbit					5		Cycle 451
Titan Metal	Rabbit	DOE, FE US-Japan				1	29	Tungsten and steel
Composite Flexure	Rabbit	DOE, FE				8		SiC
Mini-Composite	Rabbit	DOE, FE				3	1	SiC
Round-bar Tensile	Rabbit	DOE, FE		4+		TBD 2013		Steel
Hydrided Clad	Target	DOE, NE					4	Zircaloy
Ibiden	Rabbit	WFO, Ibiden				15	23	Graphite
Nippon	Rabbit	WFO, Nippon				17, Cycle 452	13	Graphite
Toyo Creep	Target	Toyo Tanso				2, Cycle 449	1	Graphite
Inconel springs	Rabbit	AECL		11		Cycle 454	10	
Graphite Creep	Rabbit	EDF			4		9	Irr. Graphite
Exotic Ceramic	Rabbit	DOE, FE				2	7	
SiC Joining tests	Rabbit	DOE, FE		21		6	2	SiC
HTV Capsule	Target	DOE NE			1	2014		Graphite
FCR&D Rabbits	Rabbit	DOE NE		1		1	4	DU fuel samples
FeCrAlY	Rabbit	Fusion				2, Cycle 450	3	FeCrAlY
EPRI Rabbits	Rabbit	EPRI					7	
TOYO Rabbits	Rabbit	TOYO TANSO				3 Cycle 454, 11	28	Graphite
Superconducting Tapes	Rabbit	Fusion		2		Cycle 456		
Bulk Metallic Glass	Rabbit	Fusion		4				
PXW Rabbits	Rabbit	Fusion		6				Tungsten
IMR Rabbits	Rabbit	Fusion		11				Ceramic composites
SCF	Rabbit	Fusion		12				SiC
Nickel	Rabbit	Isotopes				2		
Cobalt-60	Target	Isotopes			15+	ATR		
ATF-1 Fe CrAl	Target	DOE FCRD			6	ATR		
ATF-1 Molybdenum	Target	DOE FCRD		6+		ATR		
Concrete rabbits	Rabbit				4	Cycle 455		Quartz, calcite, dolomite, HCP

Experiment Design

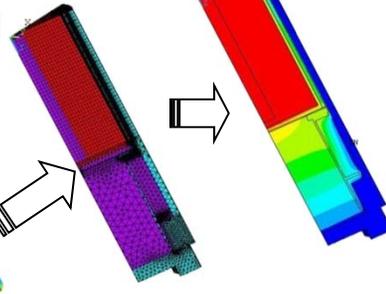
Design Detail



ANSYS Model



Thermal Analysis



Experiment Fabrication



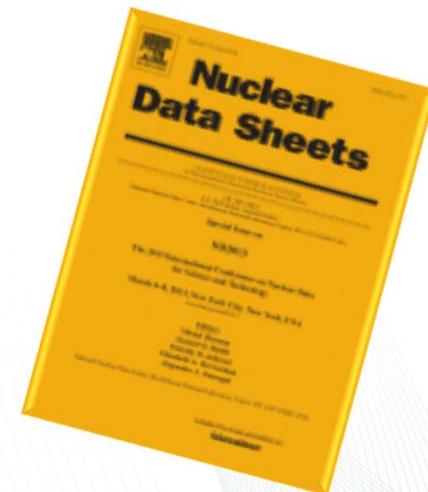
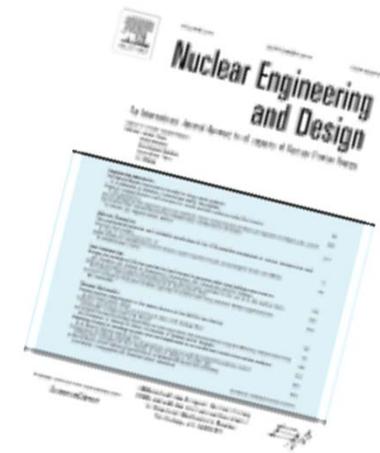
Irradiation



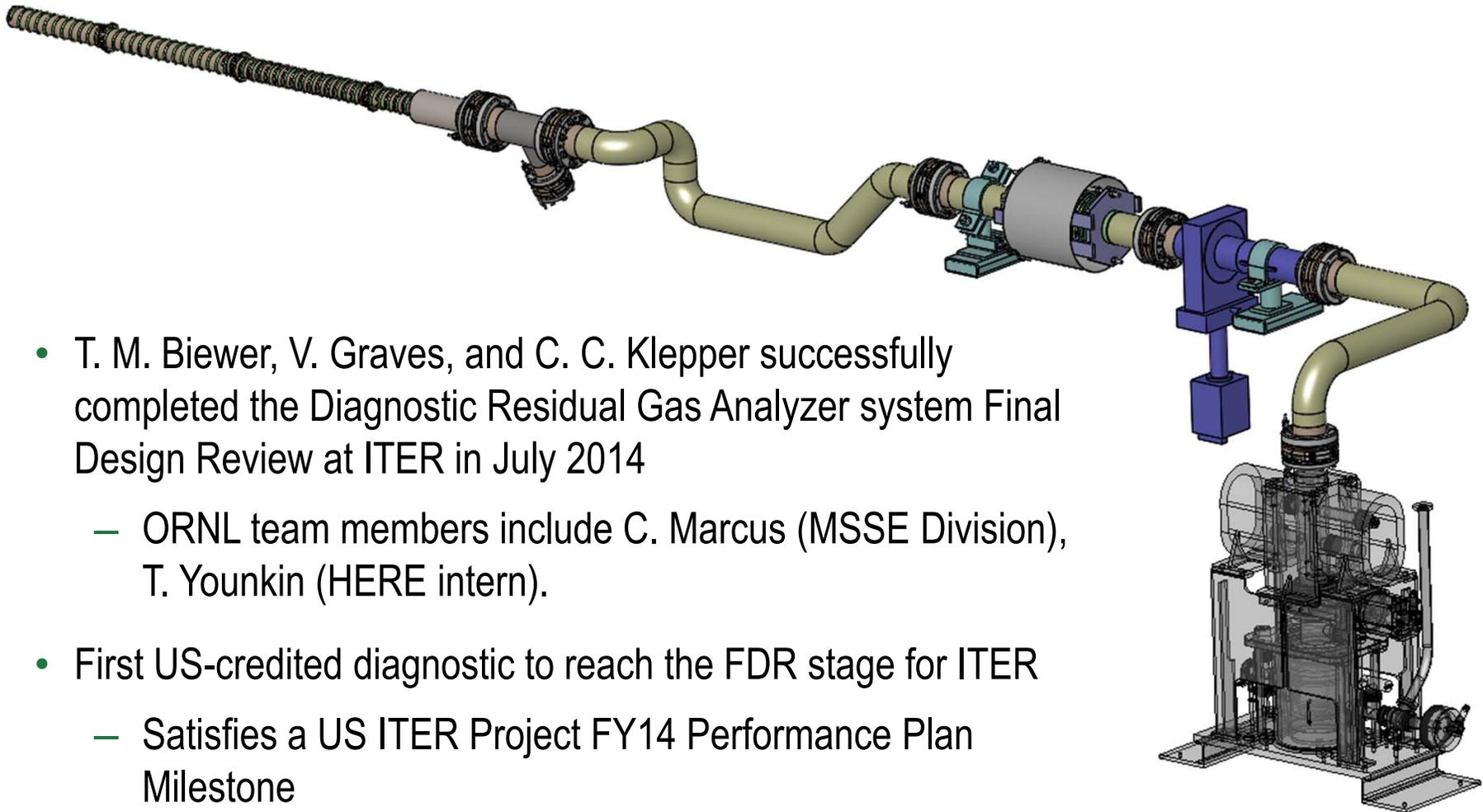
Publications



- **Conference Papers – 14**
- **Journal Articles – 2**
 - G. Ilas and I. Gauld, "Validation of ORIGEN for LWR used fuel decay heat analysis with SCALE," *Nuclear Engineering and Design*, 273, 58-67 (July 2014).
 - I. C. Gauld, M. T. Pigni, and G. Ilas, "Validation and Testing of ENDF/B-VII Decay Data," *Nuclear Data Sheets*, 120, 33-36 (2014).
- **Letter Reports – 9**



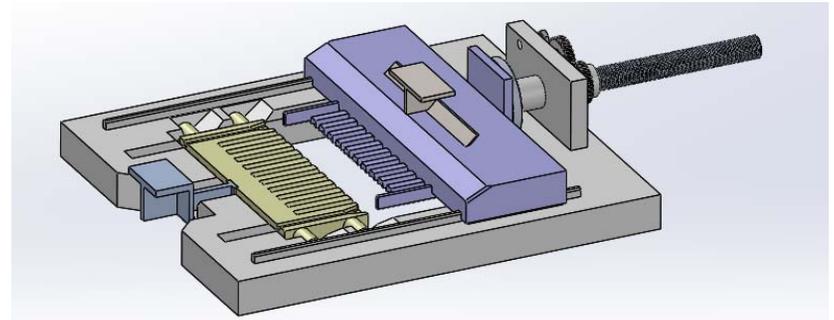
ORNL led diagnostic is the first to reach Final Design Review milestone for ITER



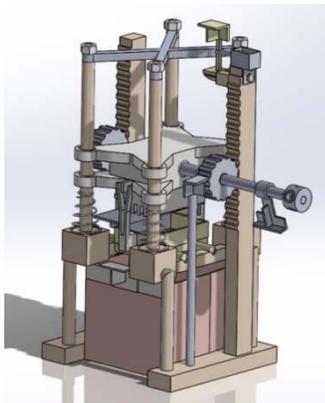
- T. M. Biewer, V. Graves, and C. C. Klepper successfully completed the Diagnostic Residual Gas Analyzer system Final Design Review at ITER in July 2014
 - ORNL team members include C. Marcus (MSSE Division), T. Younkin (HERE intern).
- First US-credited diagnostic to reach the FDR stage for ITER
 - Satisfies a US ITER Project FY14 Performance Plan Milestone

Conceptual Designs for Radium Chloride Extractor Have Been Produced

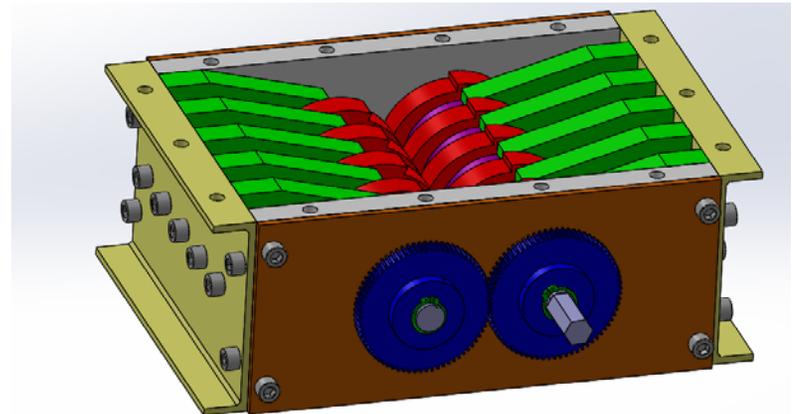
- Remote Systems personnel have designed tools in support of the Radium Chloride Extractor, the target material for production of Ac-227 in the Medical Isotope Program
- Concepts designed include a Shear, Planer, and Shredder
 - A prototype shredder is to be fabricated in the near future



Planer Concept



Shear Concept



Shredder Concept

Successful completion of qualification for Southwire Project

- Witness testing of 3- Φ 3-m-long superconducting cable segments from 250-m-long production cable that is slated for installation in ConEd grid in FY2015
- The cable passed all high voltage and current performance tests
 - DC Current > 6 kA
 - AC Withstand at 60 kV_{rms} for four hours
 - Partial Discharge inception greater than 30 kV_{rms}
 - Passed BIL Testing to IEEE 82-2002 criteria



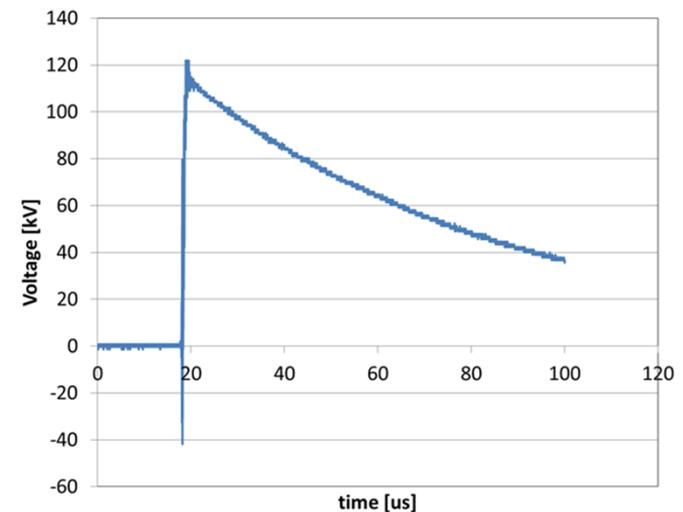
HV Cable Preparation



DC Current Test at 7625



Terminated HV cable sample



Example of BIL discharge in HV cable

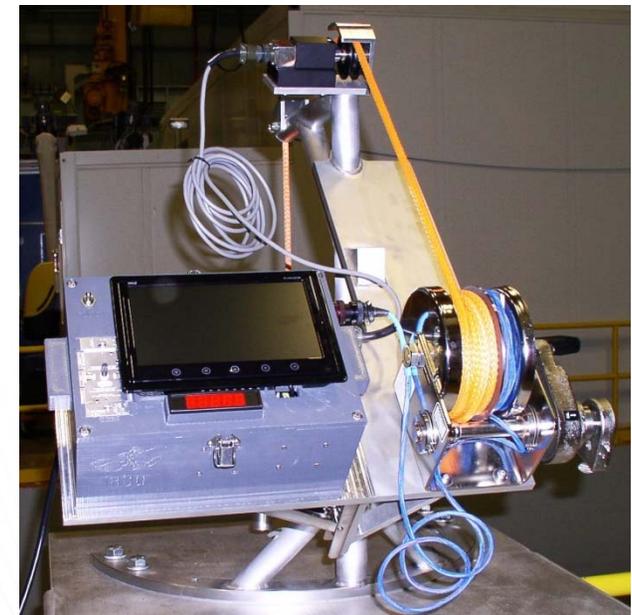
Q-Ball Cask Target Lifter design & fabrication completed

The LRL Model 25T Cask (Q-Ball cask) is used to transfer heavy actinide isotope targets between REDC building 7920 and High Flux Isotope Reactor (HFIR)

- Remote Systems personnel have designed and fabricated a new lifter tool for targets in the Q-Ball cask
- New REDC target basket lifter design includes:
 - Electrical-solenoid actuated target basket gripper
 - Remote manual-backup, basket grip & release actuator
 - Weight sensor verification of gripper attachment
 - Two closed circuit television cameras, with lights, for visual verification
- Detail design, fabrication and assembly of the electrical version are complete, including the actuator, lights, cameras and weight sensor.
- Final testing is currently in progress



7920 Q-ball Target Lifter



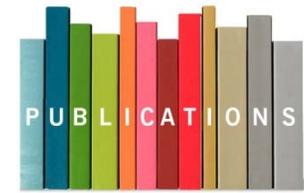
Electrical Version of Target Lifter

Support of fusion programs in the Multi-Program High Bay Facility (7625/ 7627)

- Structural engineer inspected and load-rated Thales transmitter hoist for transmitter tube handling and installation
- Relocated 53-GHz gyrotron from electrical equipment room to ECH Test Stand (Room 105)
- Continued fused disconnect installation to reduce arc flash hazards in 120/208V breaker panels in Building 7625
 - 11 completed to-date
- Began inspection of cable trays for NEC compliance scoping
- Released two new equipment-specific LOTO procedures
- F&O installed and evaluated two different LED fixtures in Building 7627 Bay 1 to upgrade area illumination
- Conducted annual review of Facility Protection Agreement
- Removed an exhaust duct from a cable tray
- Initiated beryllium sampling of equipment stored in Sealand container “E”
- Hosted ORNL material handling “Extent of Condition” team observations and interviews of facility and F&O personnel



Publications



Paper in Conference Proceedings

C. E. Thomas, Jr., E. M. Granstedt, T. M. Biewer, L. R. Baylor, S. K. Combs, S. J. Meitner, D. L. Hillis, R. Majeski, R. Kaita, “Digital Holography for in Situ Real-Time Measurement of Plasma-Facing-Component Erosion,” *Review of Scientific Instruments* 85(11).

T. M. Biewer, G. C. Shaw, “Initial implementation of a Thomson scattering diagnostic for Proto-MPEX,” *Review of Scientific Instruments* 85(11).

ORNL/TM

J. D. Hunn, C. A. Baldwin, T. J. Gerczak, F. C. Montgomery, R. N. Morris, C. M. Silva, “AGR-1 Irradiated Compacts 5-2-3 and 5-2-1 PIE Report,” ORNL/TM-2014/171.

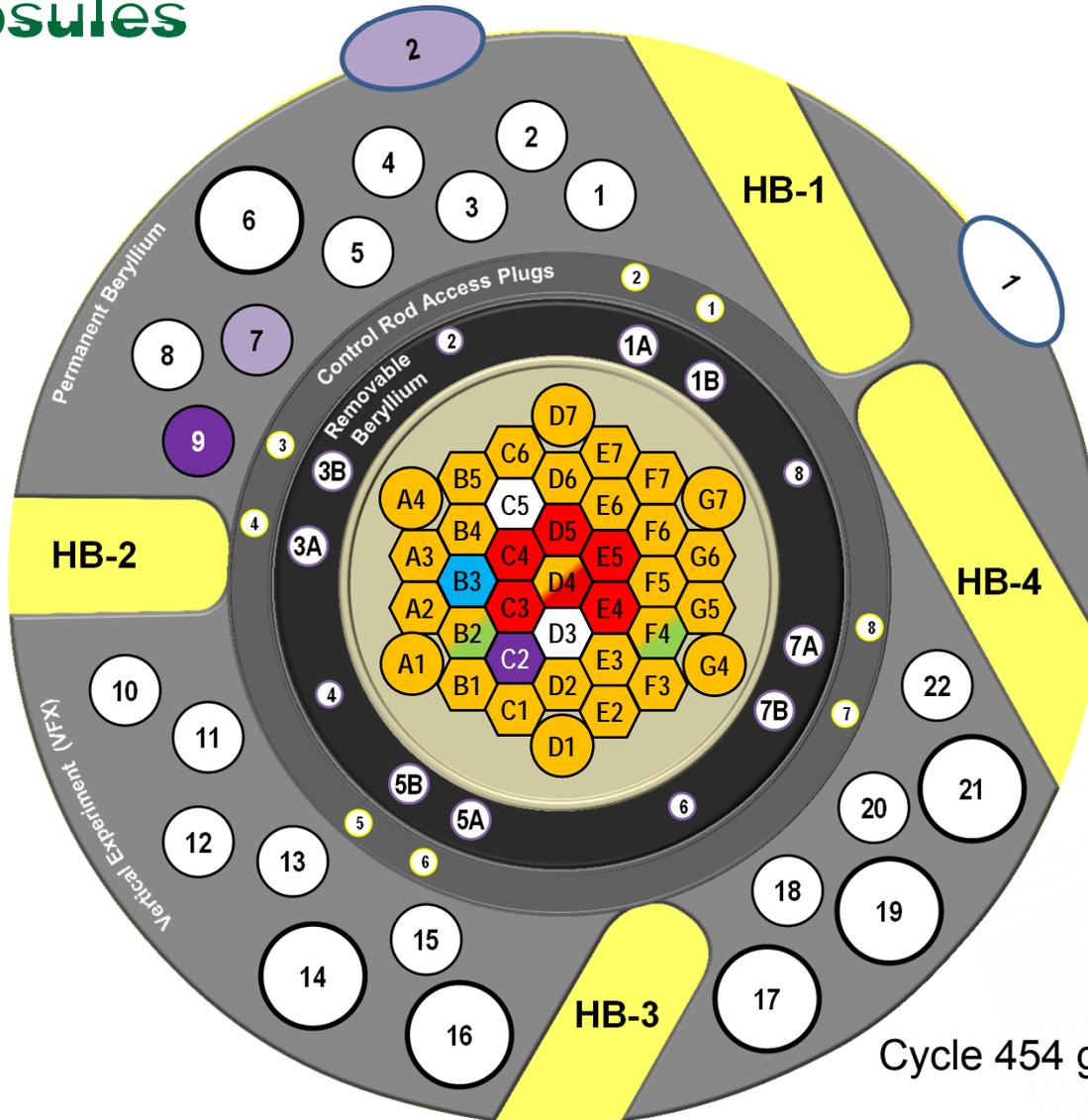
Cycle 454 begins with continued high flux trap utilization including californium-252 production targets and plutonium-236 capsules

HFIR

July 2014						
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 OFF

Reactor ON

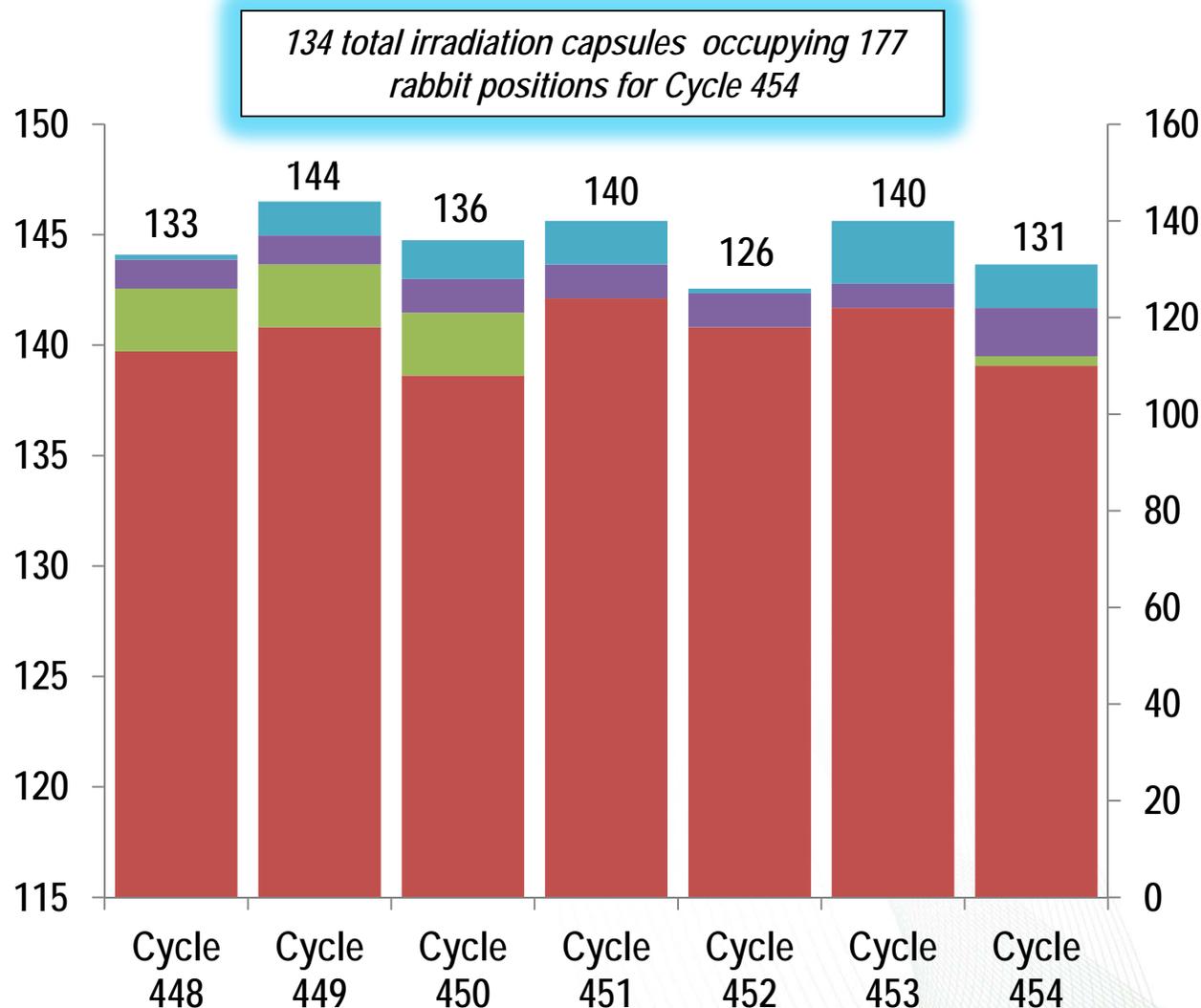


- Isotope Production
- Isotopes for Research
- Materials Experiment
- Fuels Experiment
- Pneumatic Facility NAA
- Hydraulic Facility
- Neutron Scattering
- Available Positions

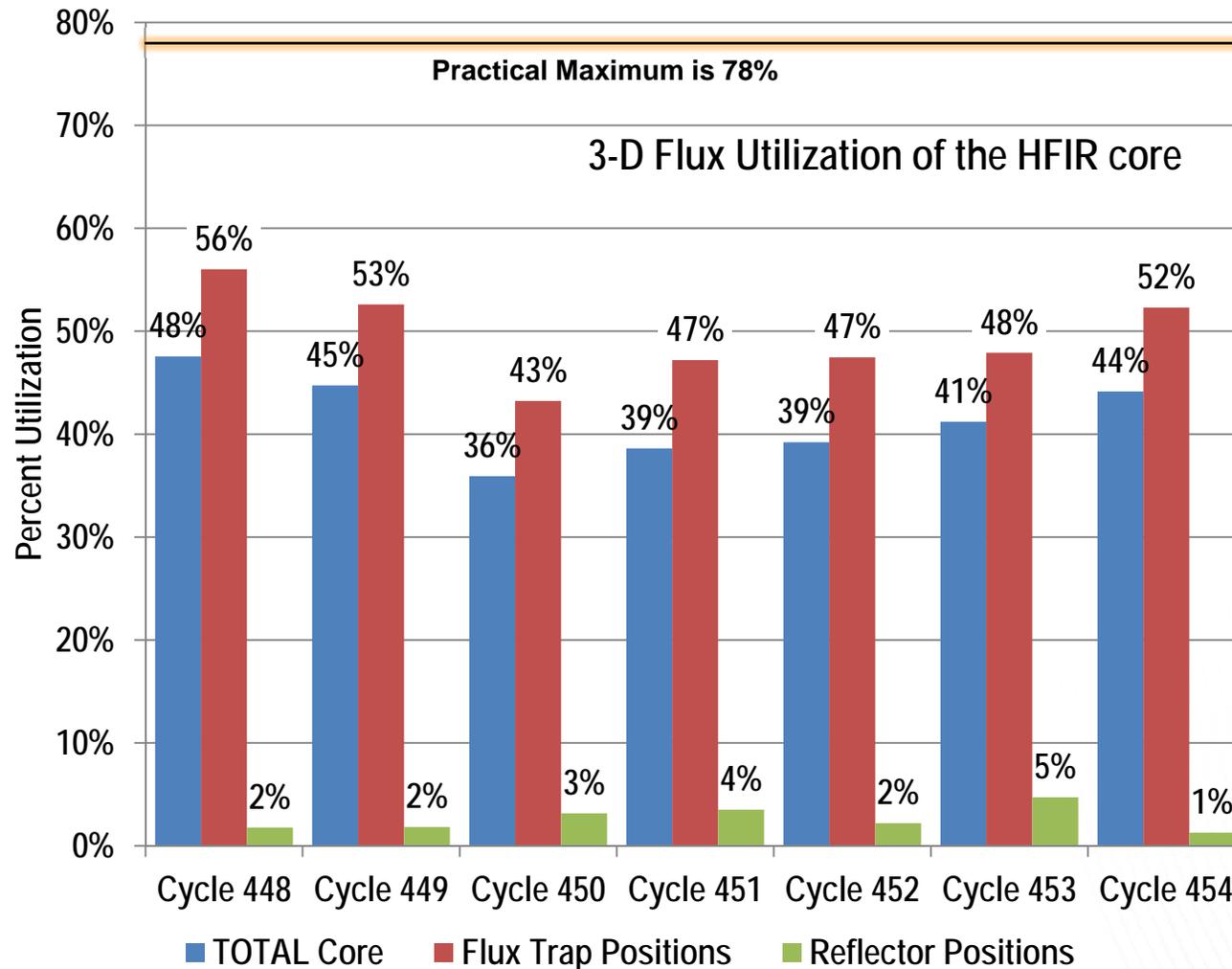
Cycle 454 graphical summary

Cycle 454 contains fewer capsules but more positions are used in the core

Materials Experiments	
•	Silicon Carbide
•	V, Mo, & Cu alloys
•	Zircaloy
•	Graphite
•	Steels
Commercial Isotope Production	
•	Selenium (Se-75) – production
•	Ni-63 production
Research Isotopes	
•	Silver-107 irradiation for research
•	Pu-238 full length targets (second cycle irradiation)



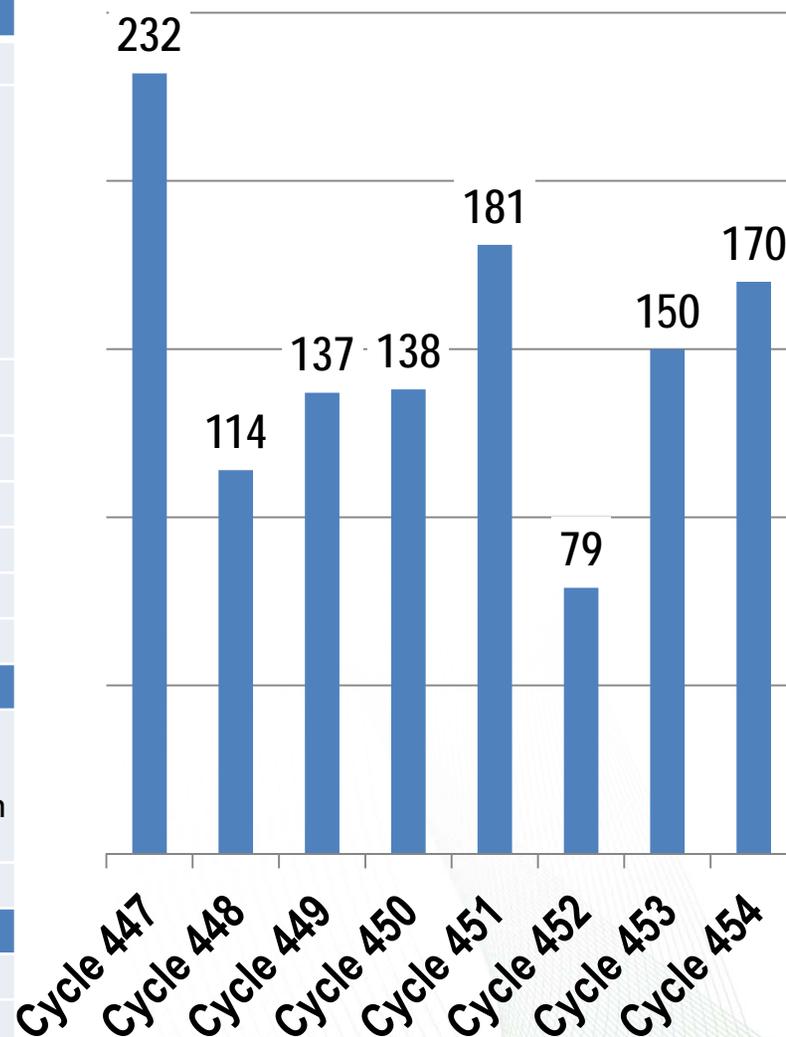
3-D Flux utilization increased due to Cf-252, Ni-63 and Se-75 production while continuing with large numbers of materials irradiation capsules



- Flux utilization will rise further with Pu-238 targets
- The *practical maximum* 3D utilization is less than 100% due to heat-load and flow limitations in the flux trap. The practical maximum is approximately 78%.

Pneumatic tube irradiations and NAA work continue during cycle 454 with low and zero power testing

Full Power Tests	
68	IAEA Pre-Inspection Check program
35	Flux monitor rabbits- These were different this time since we are trying to get a first detailed look at the k_0 NAA standardization method developed by Franz DeCorte. No k_0 (kayzero) factors have ever been published for HFIR and work is progressing towards a paper to describe them for both PT-1 and PT-2. The flux monitors this cycle also contained zirconium oxide which exploits the ratio of Zr-95 production (thermal) to Zr-97 production (epithermal), required for the DeCorte method.
25	Carbon engineered materials - verification and statistical reproducibility tests
24	Silver Zeolites for fission product iodine sorption research
5	Cd smears of the HFIR HOG systems both before and after the HEPA filters
5	Multi-element comparators - known samples for k_0 verification
2	Steel samples for cobalt determination for shipping dose rate calculation
10% Reactor Power Tests	
5	10% reactor power flux monitoring suite focused on epithermal and fast neutron reactions - dilute Co, Au and pure Ni, Fe, Ti, Zr metals - (these should have been irradiated a second time for long-lived species but we ran out of time.
Zero Power - Pre-startup Tests	
1	Europium oxide flux monitor for refueled reactor prior to startup
170	TOTAL Irradiations



NNFD FY 2014 cumulative facility metrics

Hot Cell Availability

Bldg. 7920 July **98.7%**
Cumulative **94.8%**

Bldg. 7930 July **99.4%**
Cumulative **97.8%**

Bldg. 3525 July **100%**
Cumulative **98.8%**

Bldg. 3025E July **100%**
Cumulative **97.0%**

Facility Upgrades and Maintenance Activities

7920

- Programmed maintenance operations
- Repaired / Replaced Solvent Storage Room Exhaust Fan
- Inspected / Adjusted Hot Cell Conveyor System Drive chain
- Performed HKED high voltage cable prog. maintenance
- Instrumentation upgrade on tanks T-501 & T-502
- Cell Off-Gas Fan AJ-104 maintenance operations
- Lab 108 renovation for installation of ICP Mass Spec Walk-in Hood
- TSR Surveillances / Functional Testing of several systems

7930

- Programmed maintenance operations
- Continued Par Phase 1 facility electrical modifications
- Relocated Fire Protection Sprinkler Drain Valve
- Began preparations for installation of Cell C 5-Ton Hoist in support of test fit of the Cell C Friction Stirrer Welding Cubicle
- Completed 10-year inspection of Cell F packages

3525

- Programmed maintenance operations
- Office Area roof replacement began



- K-8 Transmitter replacement



- Glove box post modification leak test



3025E

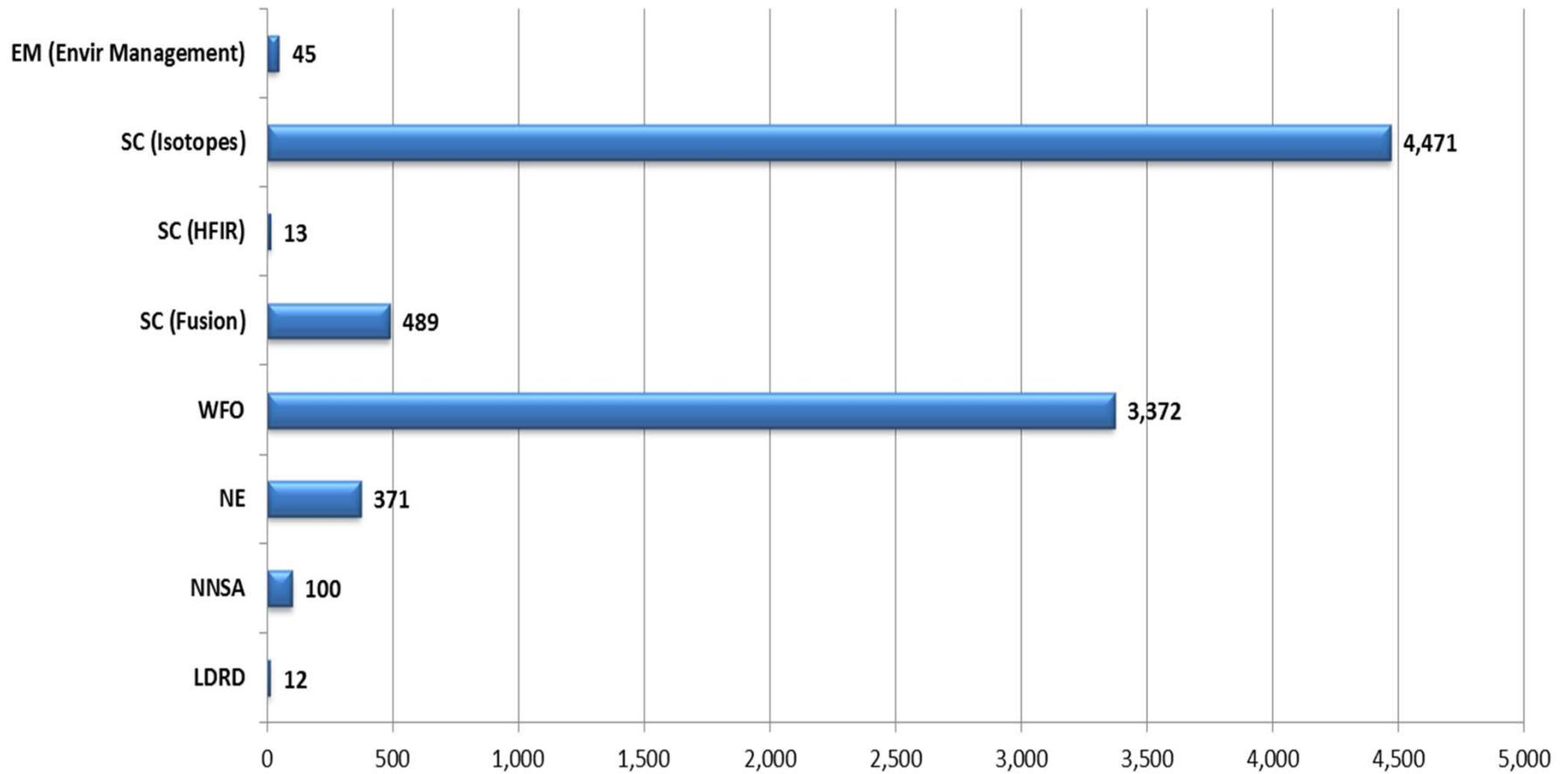
- Programmed maintenance operations
- Completed SPL AH maintenance
- Completed bimonthly FRM system checks
- Completed maintenance on S-10-1 cask gasket
- Fire alarm system upgrade in progress



- Completed maintenance on ARGOS 5 personnel monitors

NNFD FY 2014 business volume by customer metrics

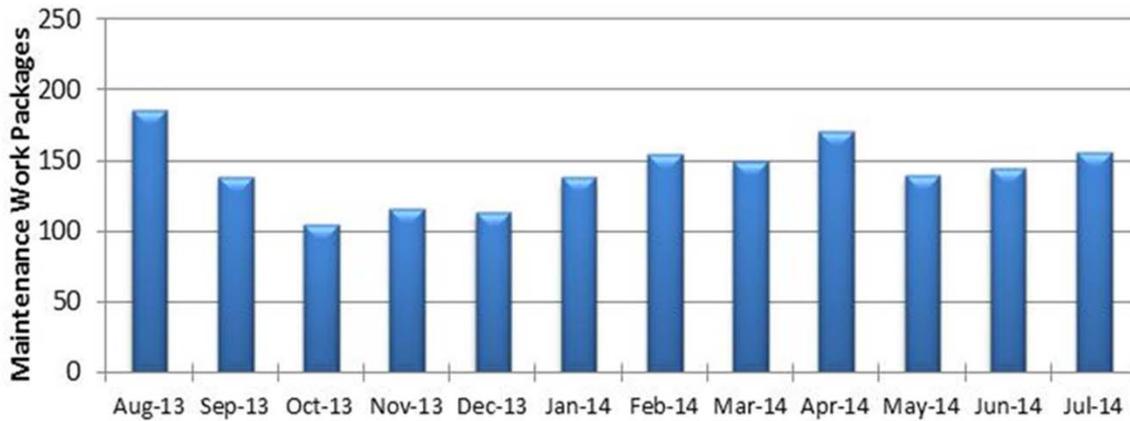
ORNL Hot Cell Usage by Sponsor
(12-month period ending June 30, 2014)



FY 2014 NNFD Maintenance Program* performance – last 12 months



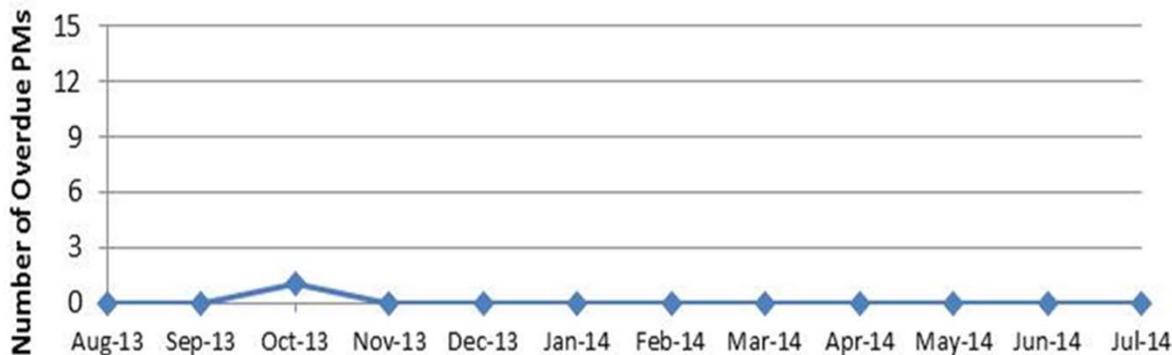
156 work orders open >90 days
Nuclear maintenance backlog meeting goal



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)

No safety-related overdue NNFD repetitive maintenance actions



Goal: Zero overdue

FY 2014 NSED STOP Observations



There were 136 Safe Observations and 13 Unsafe Observations for NSED during the month of July

NOTE: NNFD evaluates the ratio of Safe Observations to Unsafe Observations as a leading indicator in preventing future injuries. When the ratio goes down, the NNFD Director speaks to staff to raise awareness.

NSED assessments by division

July 2014

NNFD

1. **Conduct of Operations (COO) Assessments FY2014 - 3rd Quarter - 3025E/3525 Shift Routines and Operating Practices, Closed – 07/24/2014, #16591**
2. **Radiological Material Inventory Control (RMIC) Assessments FY2014 - 3047 RMIC Software and Inventory Verification - Database Annual Test, Closed – 07/30/2014, #16619**
3. **Radiological Material Inventory Control (RMIC) Assessments FY2014 - 3525 RMIC Software and Inventory Verification - Database Annual Test, Closed – 07/25/2014, #16620**
4. **Fissile Material Inventory Control (FMIC) Assessments FY14 - 3525 FMIC Software and Inventory Verification - Inventory Confirmation (NCSA material quantities are accurate & within limits), Closed – 07/25/2014, #16621**
5. **Safety System Walkdowns FY2014 - 7920 COG Ventilation System, Submitted – 07/16/2014, #16844**
6. **Safety System Walkdowns FY2014 - 7920 VOG Ventilation System, Closed – 07/21/2014, #16845**
7. **Safety System Walkdowns FY2014 - 7930 Building Exhaust System, Submitted – 07/23/2014, #16849**
8. **Safety System Assessment FY2014 - 7930 E-1 Cell Exhaust System, Submitted – 07/23/2014, #16858**

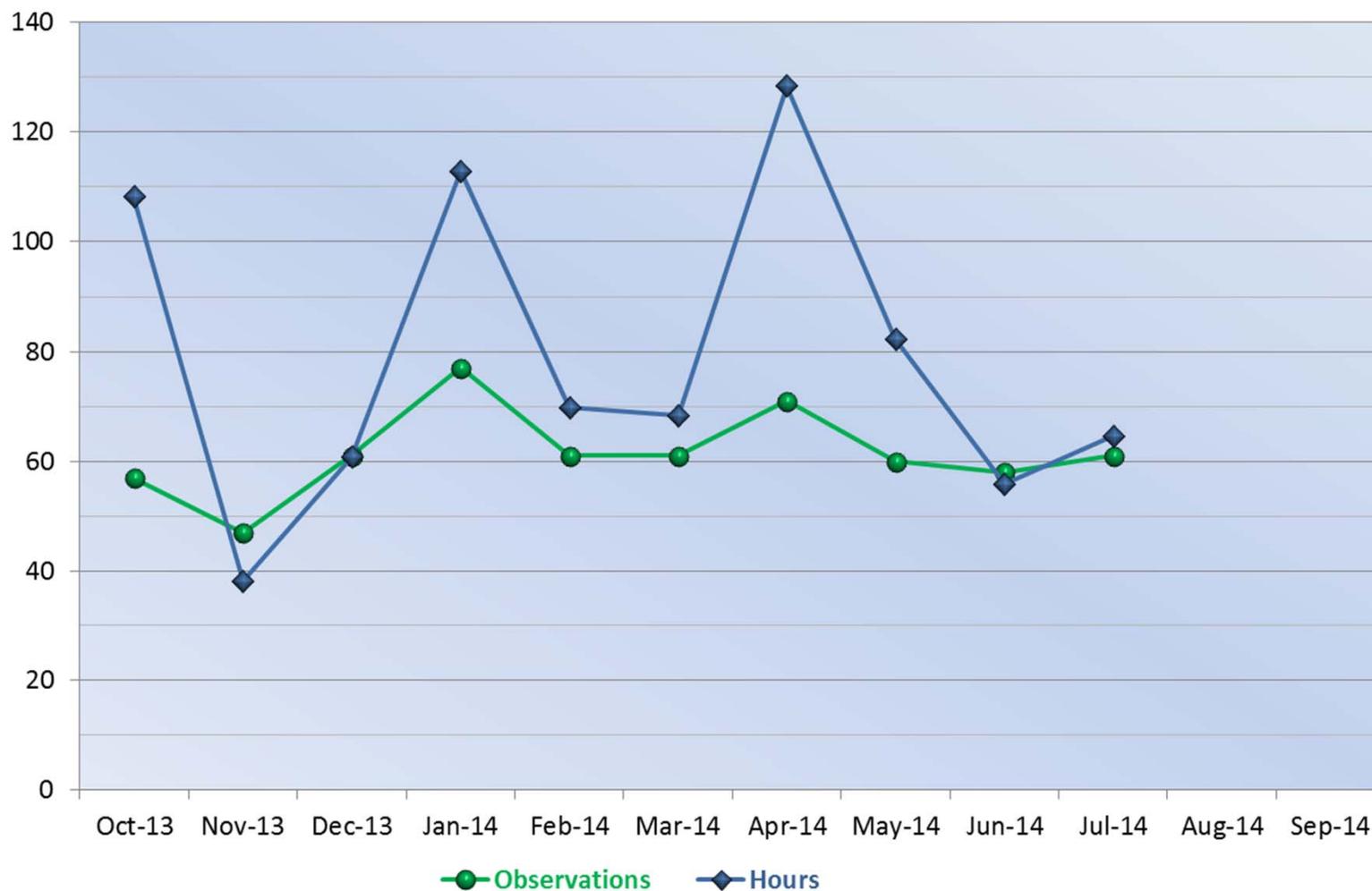
FMNSD

NSITD

RNSD

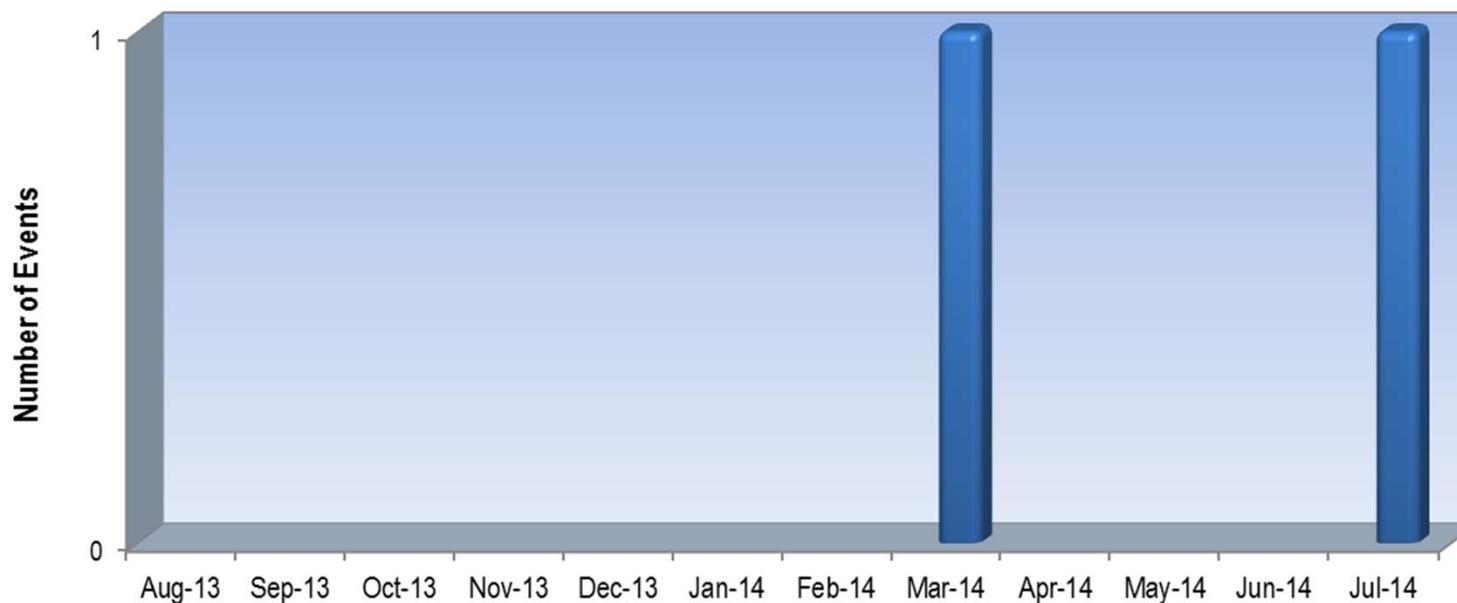
1. **Conduct FY2014 3rd Quarter screening summary and analysis of PAAA and WSH potential noncompliances, Closed – 07/25/2014, #16633**

FY 2014 NSED Management Observations



There were 61 Management Observations and 64.51 total hours for NSED during the month of July

NSED NTS Reportable Events – last 12 months

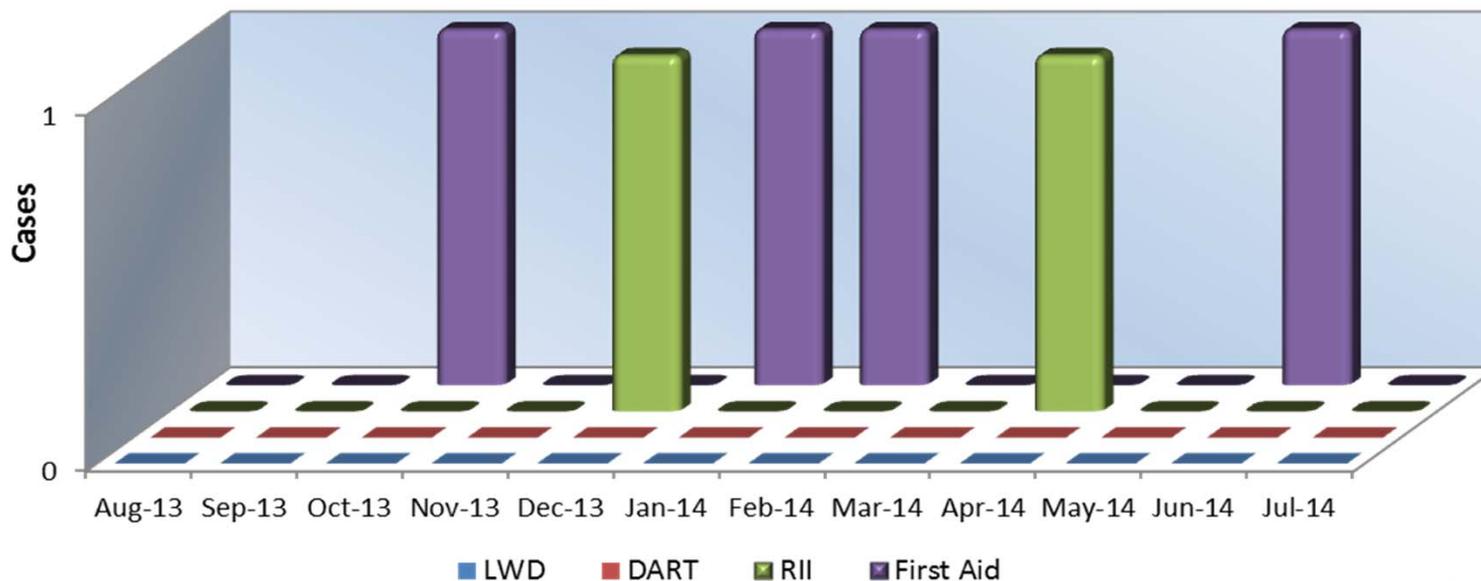


There were 2 NTS Reportable Events filed in NSED during the past 12 months

- 07/02/14: NTS-ORO--ORNL-X10REDC-2014-0001, Near Miss While Installing Glove Box {NNFD}
- 03/24/14: NTS-ORO--ORNL-X10BOPLANT-2014-0001, Energized Electrical Line Inadvertently Severed During Light Fixture Removal {NNFD}

NSED safety snapshot – last 12 months

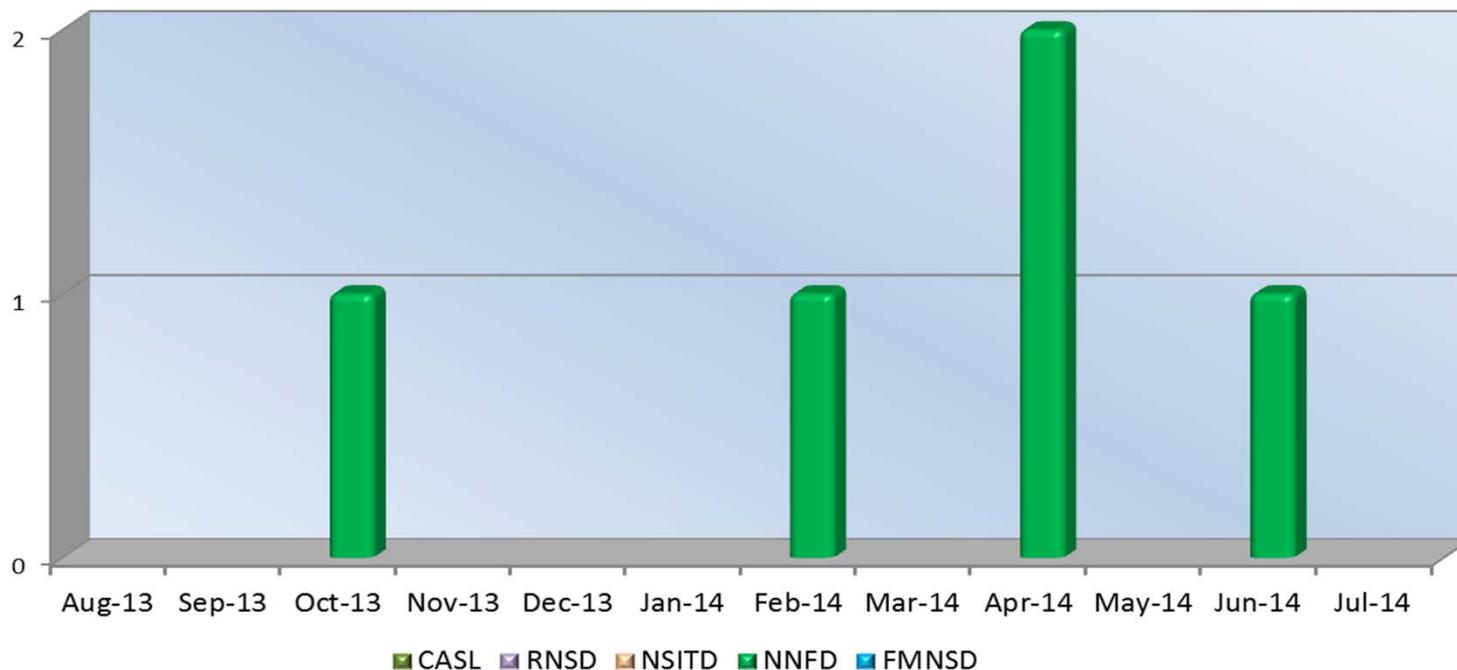
Last Lost Work Day Case - 8/30/2012



There were 2 recordable injury/illness cases in NSED during the past 12 months

- 06/25/14: Employee reported jamming finger when closing lab-bench storage door {NNFD} [First Aid]
- 04/14/14: Employee reported 'pop' in calf when moving pallet of drums {NNFD} [RII]
- 02/18/14: Employee injured finger (laceration) in lab {FMNSD} [First Aid]
- 01/13/14: Employee reported being splashed on left side of head/face with chemical [NNFD] [First Aid]
- 12/06/13: Employee reported back spasm when moving foot-stool with foot {NNFD} [RII]
- 10/16/13: Employee injured finger (laceration) in lab {NSITD} [First Aid]

NSED Occurrence Reports filed – last 12 months



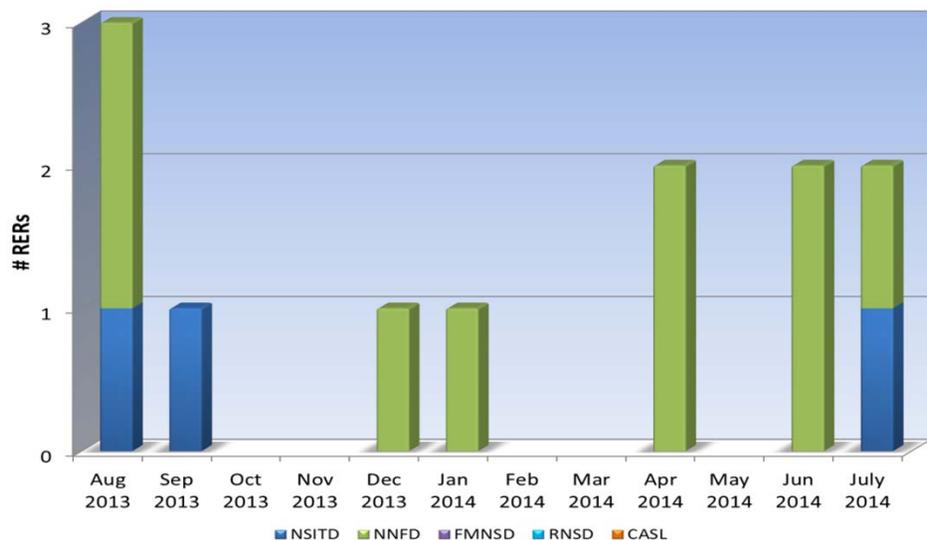
There were 5 Occurrence Reports filed in NSED during the past 12 months

- 06/06/14: SC-ORO--ORNL-X10NUCLEAR-2014-0003: "Near Miss While Installing Glove Box" {NNFD}
- 05/06/14: SC-ORO--ORNL-X10NUCLEAR-2014-0001, "Personnel Clothing Contamination, Building 3525" {NNFD}
- 04/29/14: SC-ORO--ORNL-X10NUCLEAR-2014-0002, "Personnel Clothing Contamination, Building 3047" {NNFD}
- 02/19/14: SC-ORO--ORNL-X10BOPLANT-2014-0001, "Uncontrolled Electrical Hazardous Energy Source Severed" {NNFD}
- 10/25/13: SC-ORO--ORNL-X10NUCLEAR-2013-0003, "Lock Out/Tag Out Administrative Control Violation on a Steam Condensate System" {NNFD}

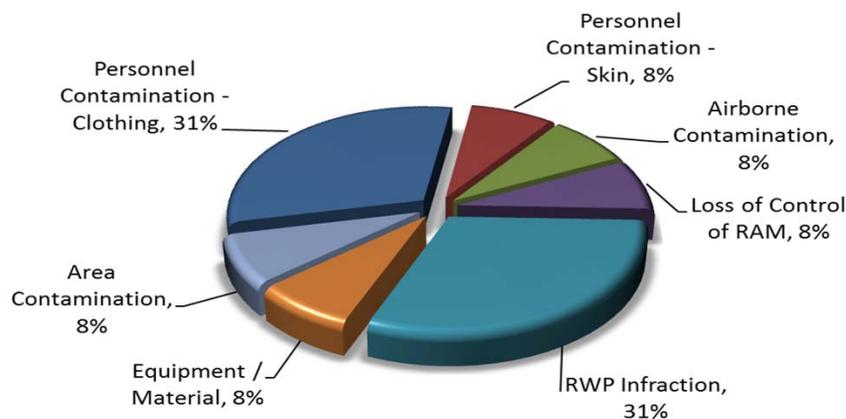
NSED Radiological Event Reports – last 12 months

There were 12 RERs filed in NSED during last 12 months

- 07/14/14: REDC-3797 Area Contamination {NSITD, 7920}
- 07/01/14: 3025-3794 Personal Contamination – Clothing {NNFD, 3025E}
- 06/26/14: 3047-3792 RWP Infraction {NNFD, 3047}
- 06/25/14: 3047-3791 RWP Infraction {NNFD, 3047}
- 04/25/14: 3047-3781 Personal Contamination – Skin {NNFD, 3047}
- 04/21/14: 3525-3780 Personal Contamination – Clothing {NNFD, 3525}
- 01/16/14: REDC-3773 Airborne Contamination {NNFD, 7920}
- 12/11/13: 3025-3769 RWP Infraction, entry control {NNFD, 3025E}
- 09/19/13: 4501-3759 Loss of Control of RAM {NSITD, 4501}
- 08/19/13: 3025-3757 Personnel Contamination – Clothing {NNFD, 3025E}
- 08/09/13: REDC-3755 Personnel Contamination – Clothing {NSITD, 7920}
- 08/01/13: 4501-3753 Equipment/Material Contamination {NNFD, 4505}

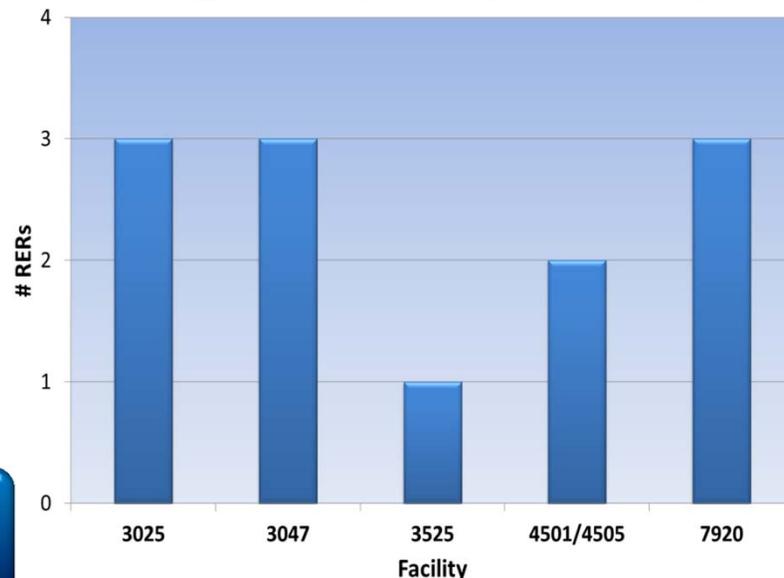


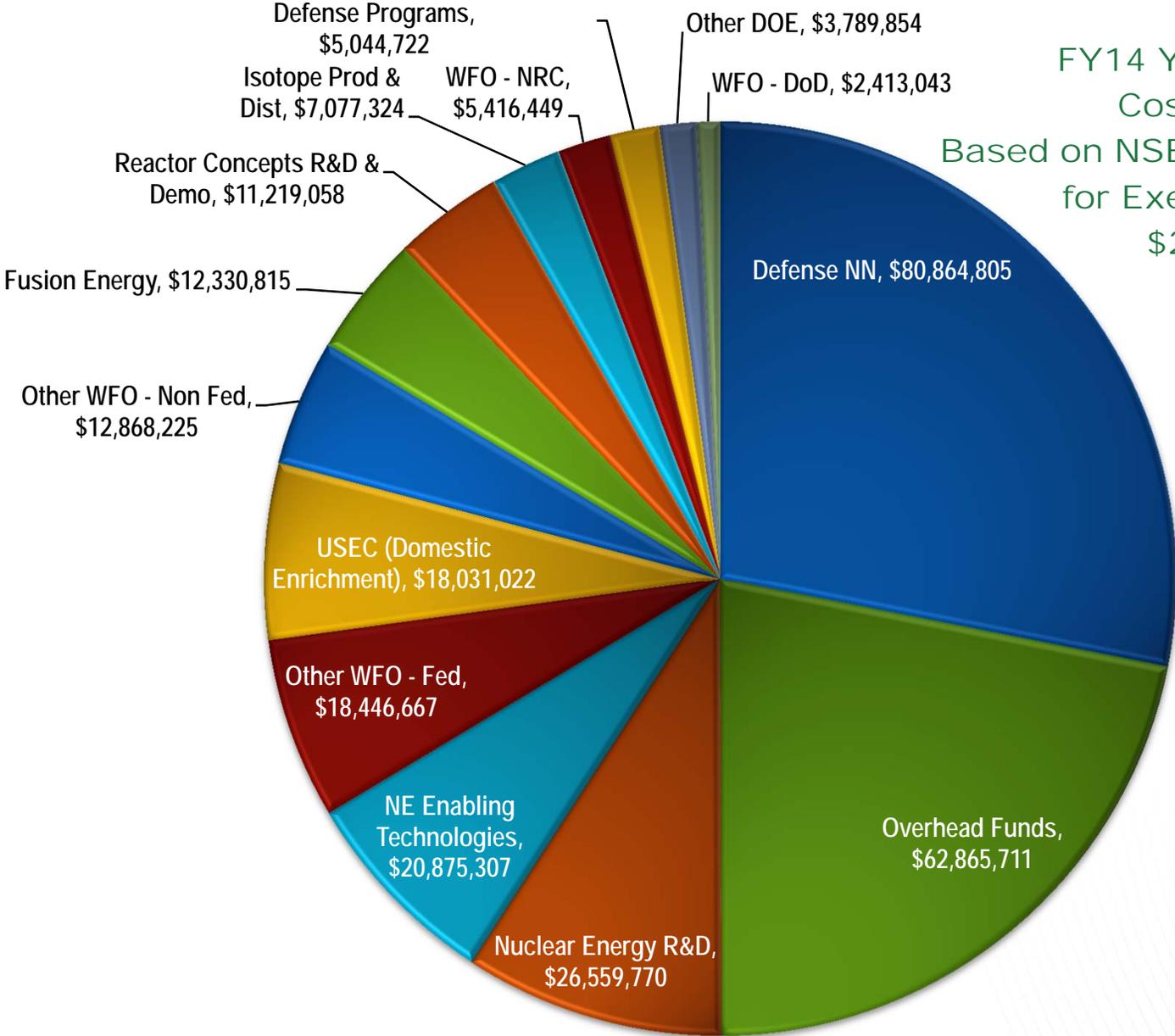
Radiological Events (12 Months)



There were 5 reportable personnel contaminations (skin and/or clothing) in NSED during last 12 months

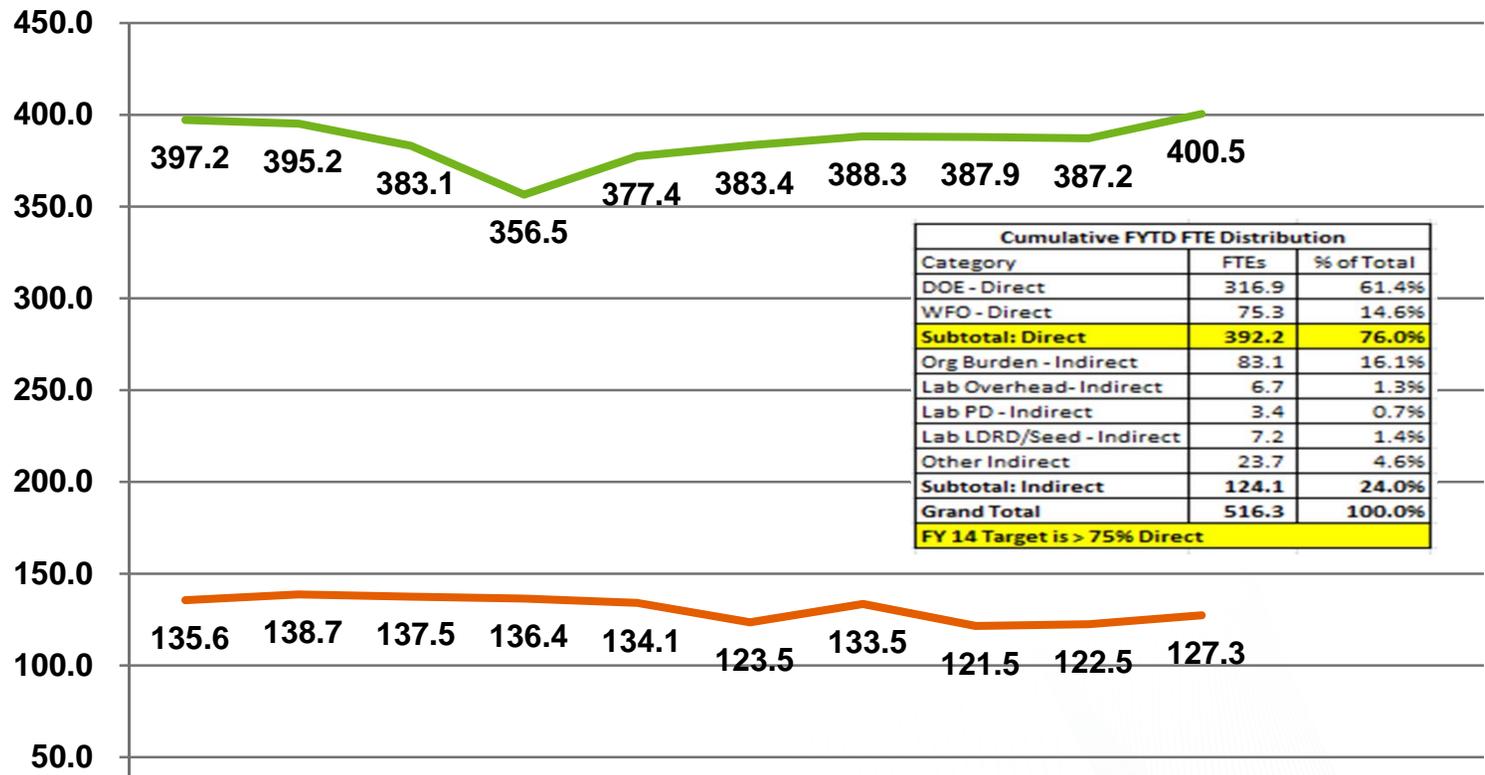
Radiological Events by Facilities (12 Month Period)





FY14 YTD Through July
Cost by Program
Based on NSED Division Responsible
for Executing the Work
\$288,873,579

Nuclear Science and Engineering Directorate FTEs FY 2014



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
Direct FTEs By Month	397.2	395.2	383.1	356.5	377.4	383.4	388.3	387.9	387.2	400.5		
Indirect FTEs By Month	135.6	138.7	137.5	136.4	134.1	123.5	133.5	121.5	122.5	127.3		