SAND2016-5194PE

Used Fuel Disposition R&D Campaign Working Group Meeting

Introduction and Summary

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Used Fuel Disposition R&D Campaign

Las Vegas, Nevada
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Used Fuel Disposition

The Used Fuel Disposition R&D Campaign Annual Meeting

- **What's different this year?**
  - More emphasis on breakout sessions, fewer sessions as a group

- **Summary of the UFD campaign**
  - Mission and Objectives
  - FY16 organization
  - FY17 planning

Used Fuel Disposition

Meeting Outline

- **Full-group presentations today**
  - Opportunity for campaign management to provide basic information and strategy
  - Opportunity for questions and discussion; all topics are welcome
  - Nuclear Fuel Storage and Transportation Planning Project (Mark Nutt)
  - Quality Assurance Update (Ram Murthy)
  - NE University Program Researchers (NEUP)
    - *Introduction by JC de la Garza*
- **Topical break-out sessions begin later today and continue through Thursday morning**
  - In-depth discussions
  - Space is available for impromptu meetings: contact campaign management for help
- **Reconvene as a full group Thursday noon**
  - Closing comments

Used Fuel Disposition R&D Campaign

Mission, Objectives and Organization

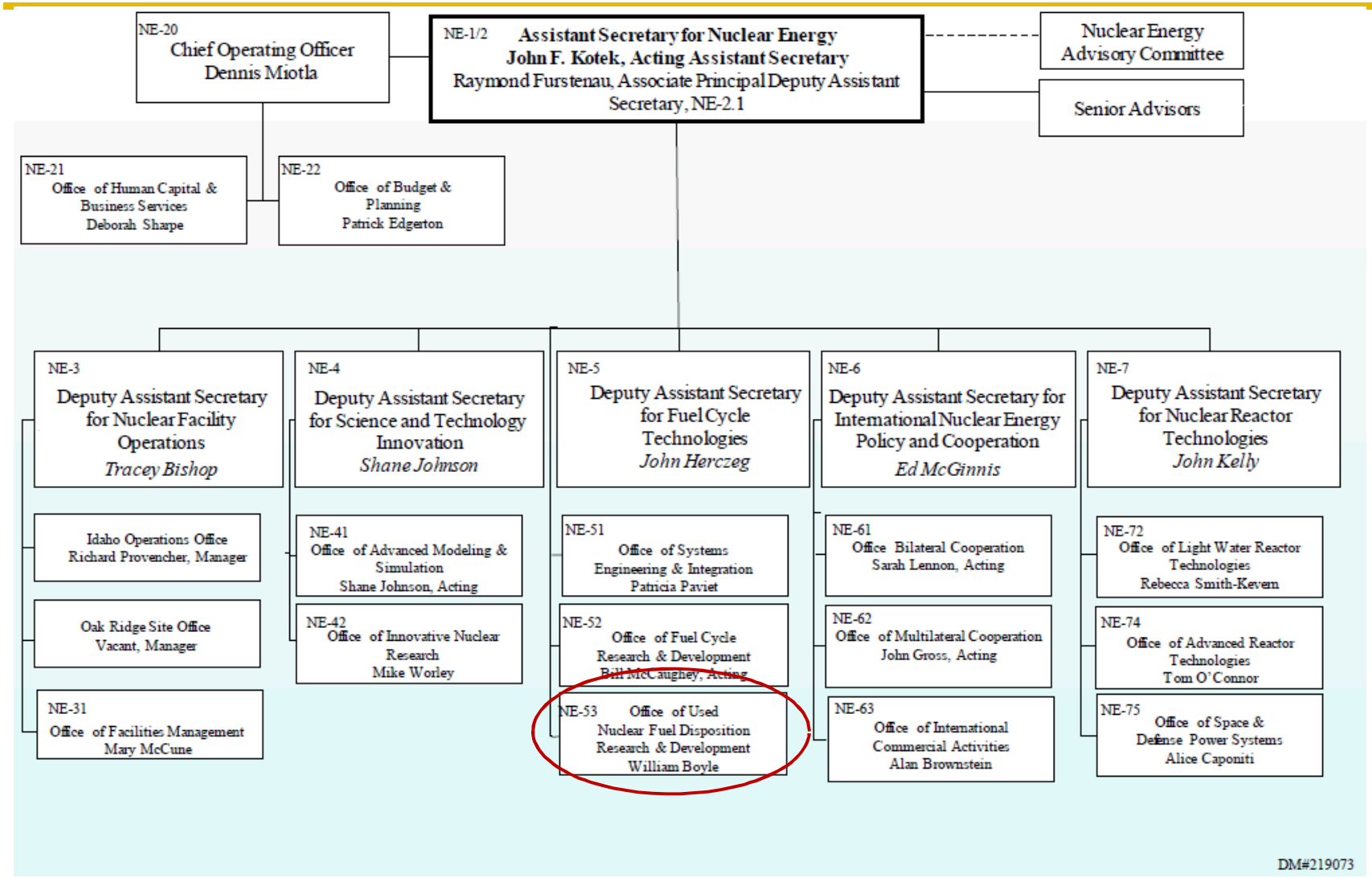
DOE Office of Nuclear Energy Mission Statement

- **The primary mission of the Office of Nuclear Energy is to advance nuclear power as a resource capable of meeting the Nation's energy, environmental, and national security needs by resolving technical, cost, safety, proliferation resistance, and security barriers through research, development, and demonstration as appropriate.**

- **NE's program is guided by the four research objectives detailed in its Nuclear Energy Research and Development Roadmap:**
  - Develop technologies and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors.
  - Develop improvements in the affordability of new reactors to enable nuclear energy to help meet the Administration's energy security and climate change goals.
  - Develop sustainable fuel cycles.
  - Understand and minimize the risks of nuclear proliferation and terrorism.

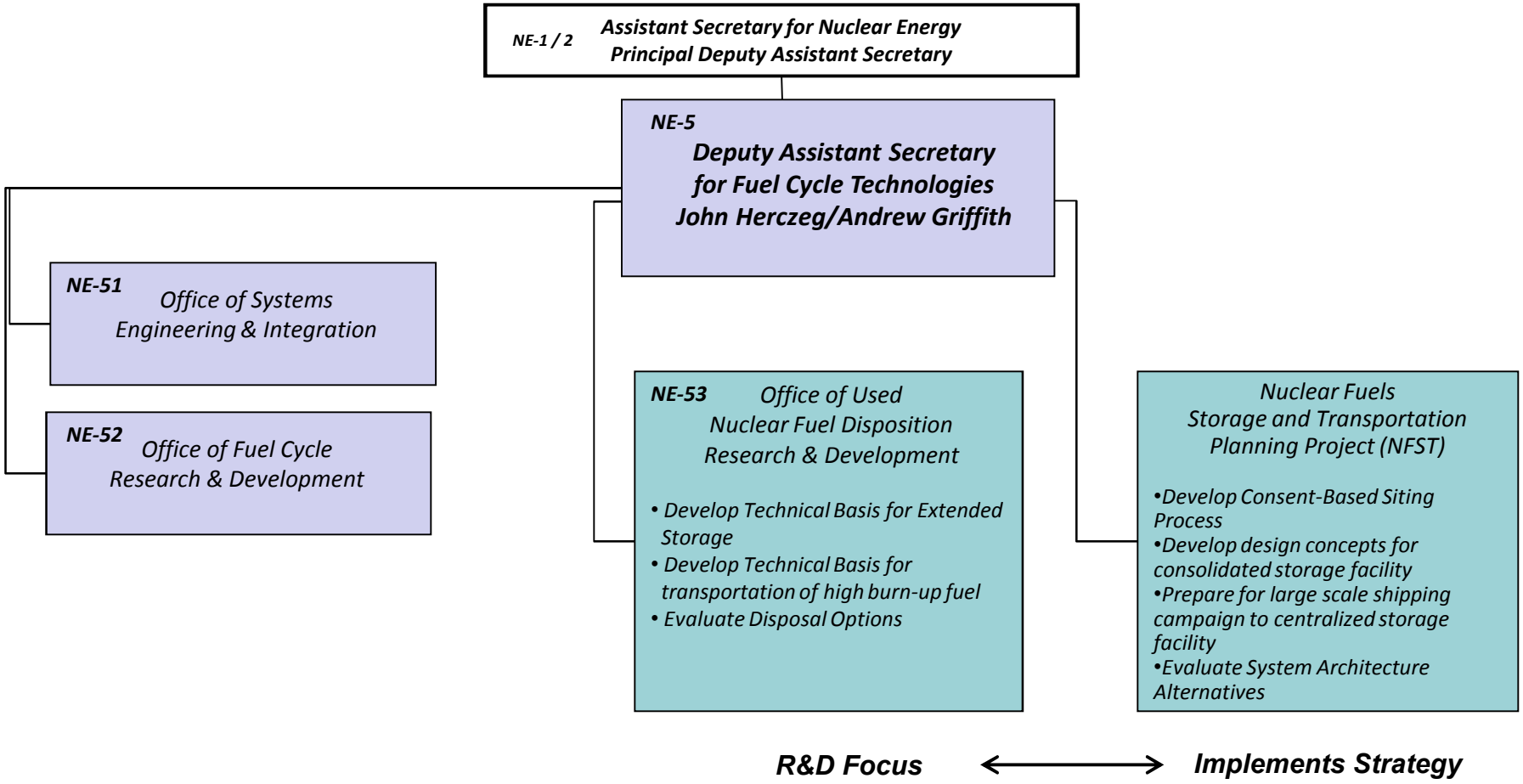
Source: http://energy.gov/ne/mission, downloaded 2 May 2016

DOE-NE Organization Chart



Used Fuel Disposition

DOE Office of Nuclear Energy
Office of Fuel Cycle Technologies (NE-5)



Used Fuel Disposition R&D Campaign Mission

The DOE Office of Used Nuclear Fuel Disposition Research and Development and nine national laboratories participate in the DOE Office of Nuclear Energy's "Used Fuel Disposition Campaign"

Campaign Mission: to identify alternatives and conduct scientific research and technology development to enable storage, transportation and disposal of used nuclear fuel and wastes generated by existing and future nuclear fuel cycles

Los Alamos NATIONAL LABORATORY

Pacific Northwest NATIONAL LABORATORY

Argonne NATIONAL LABORATORY

Sandia National Laboratories

BERKELEY LAB

SRNL SAVANNAH RIVER NATIONAL LABORATORY

INL Idaho National Laboratory

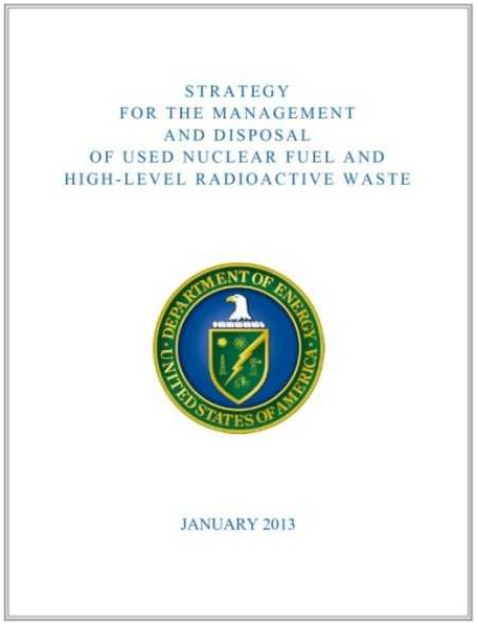
ornl OAK RIDGE NATIONAL LABORATORY

Science in the National Interest
Lawrence Livermore National Laboratory

Long-Term UFD R&D Campaign Objectives

- Support the implementation of a full-scale NRC-licensed confirmatory storage demonstration facility, in collaboration with industry
- Develop the technical basis necessary to support eventual transportation of used nuclear fuel, including high-burnup fuel
- Support the DOE's development of an Integrated Waste Management System that leads to implementation of integrated storage, transportation, and disposal concepts

Support the Administration's 2013 Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste



Used Fuel Disposition

Three-Year UFD Campaign Objectives (2016-2019)

Storage and Transportation R&D

- Support the high burn-up fuel full-scale storage demonstration project
- Develop understanding of how temperature and pressure affect cladding integrity in high-burnup UNF
  - *Predictive modeling*
  - *Experimentation*
- Develop understanding of how corrosion and stress corrosion cracking affect performance of stainless steel dry storage canisters
  - *Material and environmental data; predictive modeling*
- Characterize external loadings on UNF during normal conditions of transport

Disposal R&D

- Field a deep borehole test
  - *Initiate drilling in 2016, complete testing in 2019*
- Complete evaluation of the direct disposal of dual-purpose canisters
- Develop experimental and modeling basis for understanding long-term performance of disposal systems in argillaceous rock, salt, crystalline rock, and deep boreholes
  - *Leverage international disposal R&D*
- Develop reference cases for generic disposal concepts

DOE HLW and SNF R&D

- Initiate a repository program for disposal of defense HLW and some DOE-managed SNF

Used Fuel Disposition Campaign External Collaborations

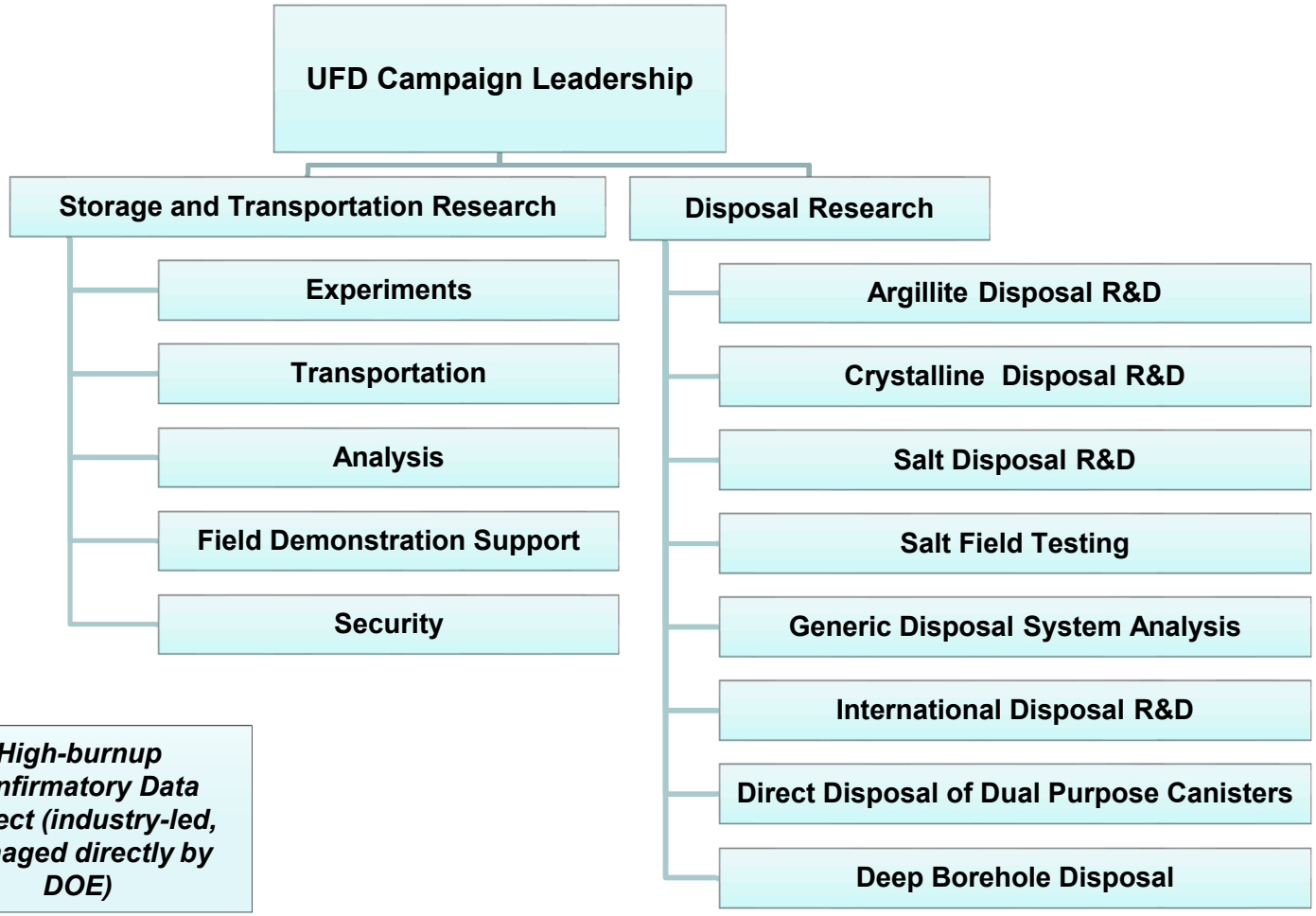
- **Collaboration among Fuel Cycle Technology Campaigns**
  - Full collaboration and shared resources with Nuclear Fuels Storage and Transportation Planning Project (NFST)
  - Support for Fuel Cycle Options Campaign
  - Close interactions with Material Recovery/Waste Form Campaign
    - *Waste form modeling work transitioning from MR/WF to UFD in FY14*
- **Collaboration with DOE-EM**
  - Canister concepts for deep borehole disposal
- **Industry (Advisory and Assistance Contracts)**
  - E.g., Areva; engineering services task for deep borehole field test
- **DOE/Industry Storage High-Burnup Data Project initiated FY13**
  - Dominion, Areva, Westinghouse
- **EPRI**
  - Extended Storage Collaboration Program (ESCP) (with NRC, utilities, vendors, and international organizations)
- **NEI**
  - Meetings to coordinate prioritization of funded activities

Used Fuel Disposition Campaign External Collaborations (cont.)

- **Deep Borehole Field Test**
  - Battelle-led team includes Schlumberger, Solexperts
- **International Collaborations**
  - Participation in international Underground Research Laboratories in Europe and Korea and in multi-national disposal research activities
  - Bilateral agreements on storage and disposal R&D with Korea, Japan, China
  - MOU for salt disposal R&D with Germany
  - IAEA working groups in storage and transportation
  - Collaboration with Germany and Japan on extended performance of bolts and seals for bolted storage casks and on SS canister stress corrosion cracking
- **DOE NE University Programs**
  - UFD R&D is affiliated with 15 active NEUP research projects (not including FY16 awards)
    - *7 projects in Storage R&D*
    - *1 projects in Transportation R&D*
    - *3 projects in Disposal R&D*
    - *4 Integrated Research Projects in Storage R&D*
- **Other university collaborations (MIT, U. of Oklahoma, University of Sheffield UK)**

Used Fuel Disposition

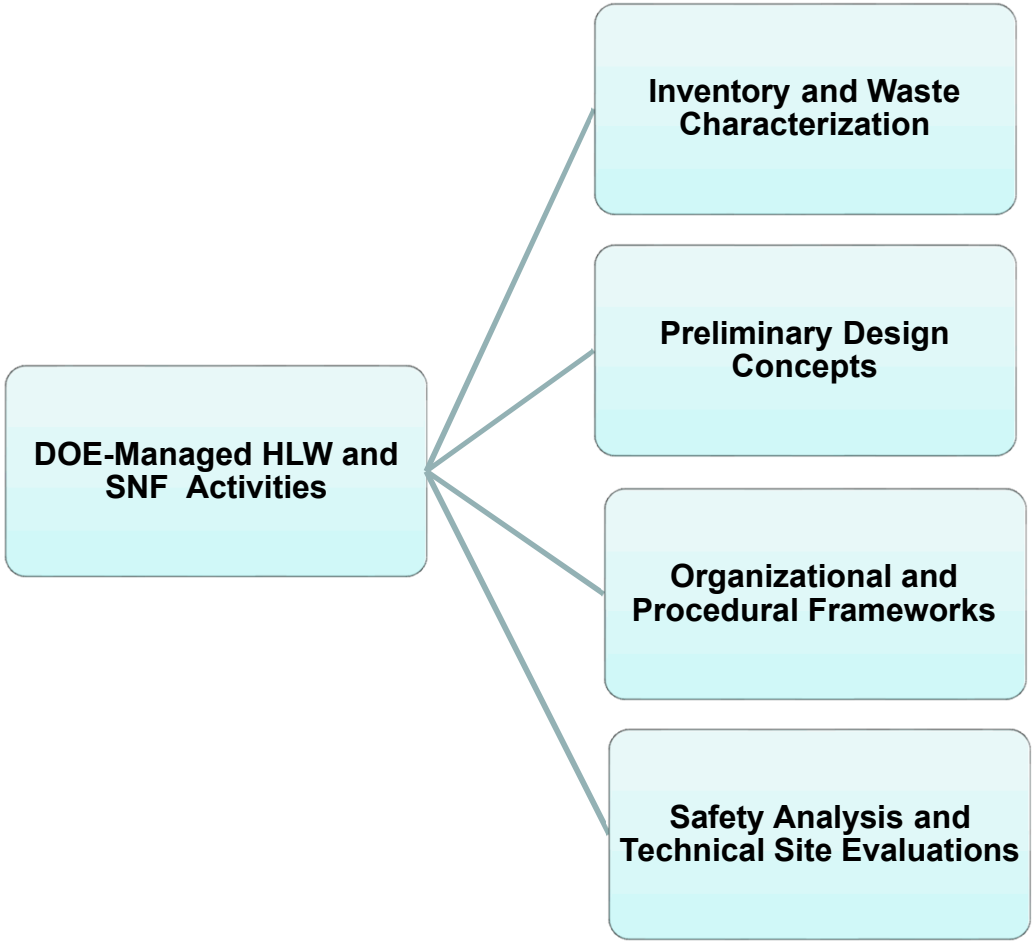
UFD R&D Campaign Structure



High-burnup Confirmatory Data Project (industry-led, managed directly by DOE)

Deep Borehole Field Test (procurement managed directly by DOE)

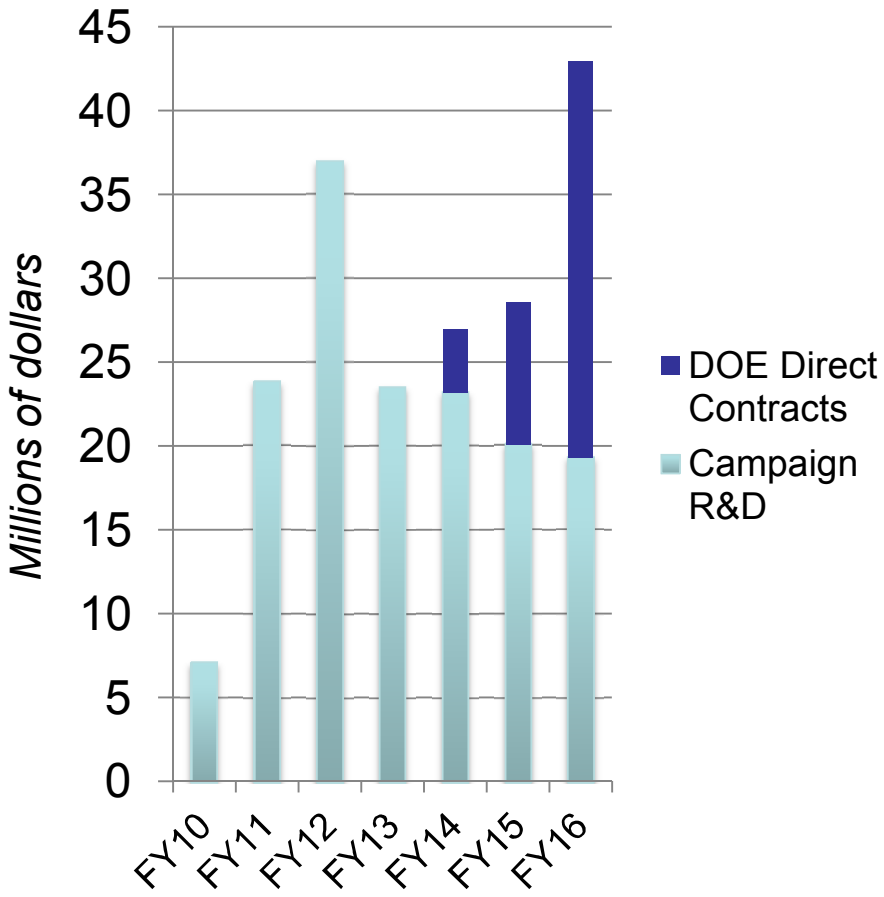
DOE-Managed HLW and SNF Research



UFD R&D Funding 2010-2016

- FY09: UFD R&D Planning meeting at ANL June 2009
- FY11: Storage and Transportation R&D added
- FY12: Temporary funding increase
- FY13: Formation of NFST
- FY14-FY16: increasing importance of industry contracts for large-scale R&D projects
  - High-Burnup Data Project
  - Deep Borehole Field Test

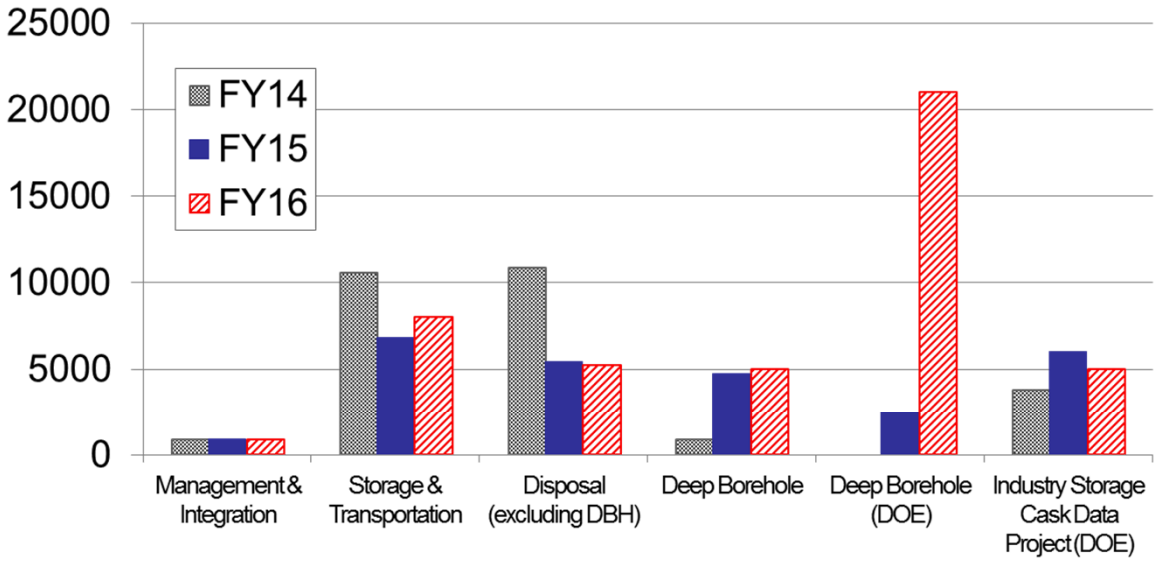
Approximate total funding for UFD R&D
(including DOE-managed HLW and SNF R&D in FY16)



Implementing UFD R&D Priorities from FY14 to FY16

Overall campaign funding planned to increase from $26.4M in FY15 to $45.4M in FY16

Funding at National Laboratories was planned to increase from $17.9M to $19.2M



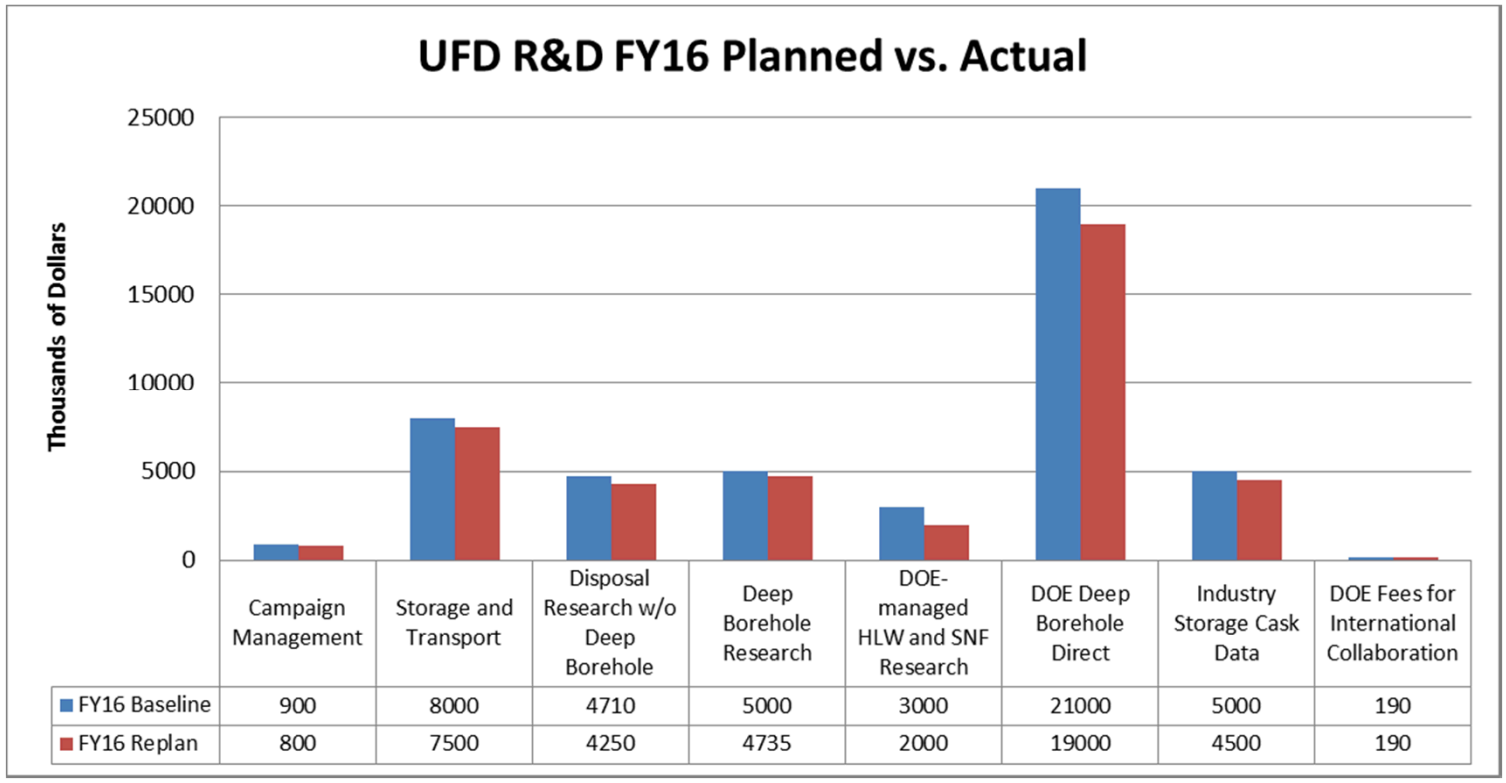
FY14*	900	10557	10845	860	0	3800
FY15*	900	6815	5455	4755	2500	6000
FY16**	900	8000	5225	5000	21000	5000

Does not include $3M planned for DOE HLW and SNF R&D

* *Based on FY actuals, PICSNE targets not including carryover*
** *Based on FY16 US Senate Mark (7/13/15)*
*** *Does not include 275k in FY15 or 225k in FY16 held back by DOE NE to fund membership fees associated with international collaboration memberships.*

FY16 Replan

FY16 Omnibus Appropriation Bill cut the UFD R&D budget by ~$4.8M
(includes the DOE-managed HLW and SNF R&D Program)
Cuts implemented in February 2016, mid-2Qtr



	Campaign Management	Storage and Transport	Disposal Research w/o Deep Borehole	Deep Borehole Research	DOE-managed HLW and SNF Research	DOE Deep Borehole Direct	Industry Storage Cask Data	DOE Fees for International Collaboration
FY16 Baseline	900	8000	4710	5000	3000	21000	5000	190
FY16 Replan	800	7500	4250	4735	2000	19000	4500	190

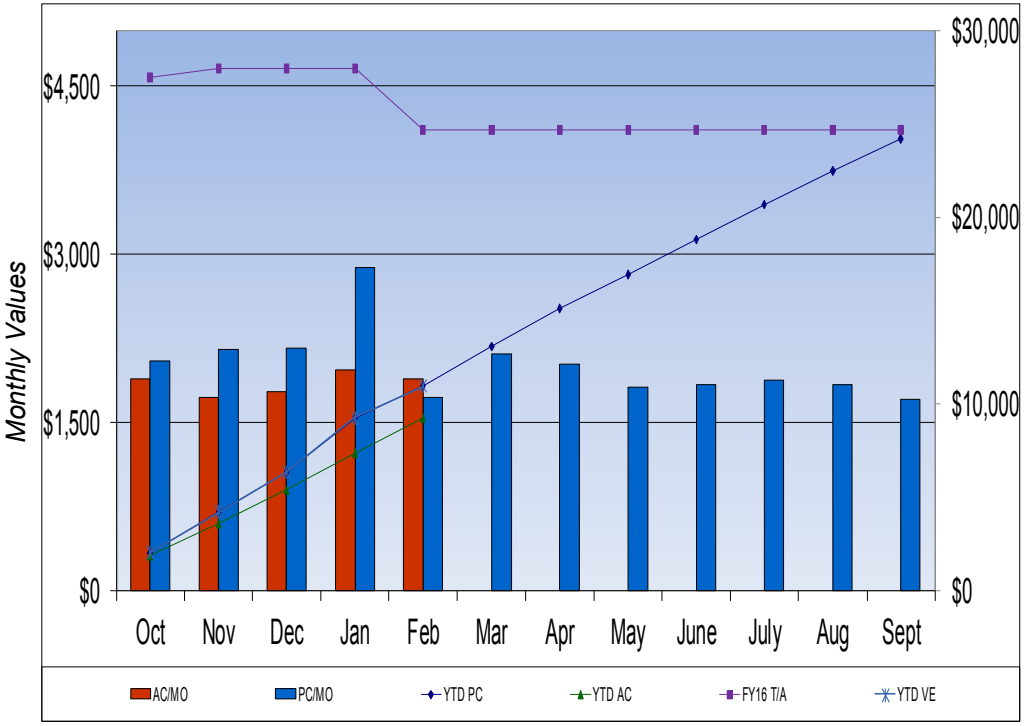
Used Fuel Disposition

Used Fuel Disposition Cost Performance ($k) (February 2016 data)

			MONTHLY					CUMULATIVE					CHANGE (%)
WBS	Title	Total Available	PC	VE	AC	Var (VE-AC)	Var (%)	PC	VE	AC	Var (VE-AC)	Var (%)	From Prior Month
1.02.08	UFD - PMB	24,657	1,723	1,692	1,894	(202)	-11.94%	10,973	10,940	9,255	1,685	15.40%	5.00%
1.02.08	UFD - Non PMB	23,690	0	0	0			0	0	0			

- ***Cost Variation***
  The cost underrun variation November through January is due to cautious spending associated with appropriation uncertainty; subsequent events have demonstrated that the cautious approach was justified. The February results have improved the underrun from the previous month (20.4% in January vs. 25.4% in February), and we expect to see continued improvements to the underrun as projects are fully funded (with respect to omnibus allocations) sometime in April.

- ***Open Commitments - $664K***
  Open commitments have changed little (up slightly from $625k in January), consistent with invoicing of contractor costs.



PC = Planned Cost; AC = Actual Cost; VE – Value Earned; TA = Total Available (FY16 Allotments plus PY Carryover)

Used Fuel Disposition R&D Campaign

FY17 Planning

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Schedule for FY17 Planning

- June 2016: Campaign management works with NE-53 to prepare FY17 plan at the control account level
- June 28-29, 2016: NE-5 Budget Planning Review
- July-September 2016: Preparation of final FY17 planning packages

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Comparing the President's FY17 Budget Request with the House and Senate Bills

	FY 2015	FY 2016	FY 2017						
	Current	Enacted	Request	House Subcommittee (4/13/16)	Delta		SAC (4/14/16)	Delta	
Used Nuclear Fuel Disposition	70,224	85,000							
UNFD R&D	[47,724]	[62,500]	74,338	61,128	(13,210)	D/		(74,338)	d/
Integrated Waste Management System	[22,500]	[22,500]	76,300	0	(76,300)	E/	61,050	(15,250)	
Unallocated	0	0	0	8,000	8,000		89,290	89,290	
Fuel Cycle R&D	**191,242**	**203,800**	**249,938**	**177,228**	**(72,710)**		**219,730**	**(30,208)**	

All amounts are "Pre-tax": historically, approx. 20% of the NE R&D budget has gone to University programs and 10% to other HQ programs

HOUSE NOTES

D/ $6M for rail cars, $12M for high burnup fuel

E/ Hard Zero

SENATE NOTES

d/ includes 14.25M for long term storage R&D (?)

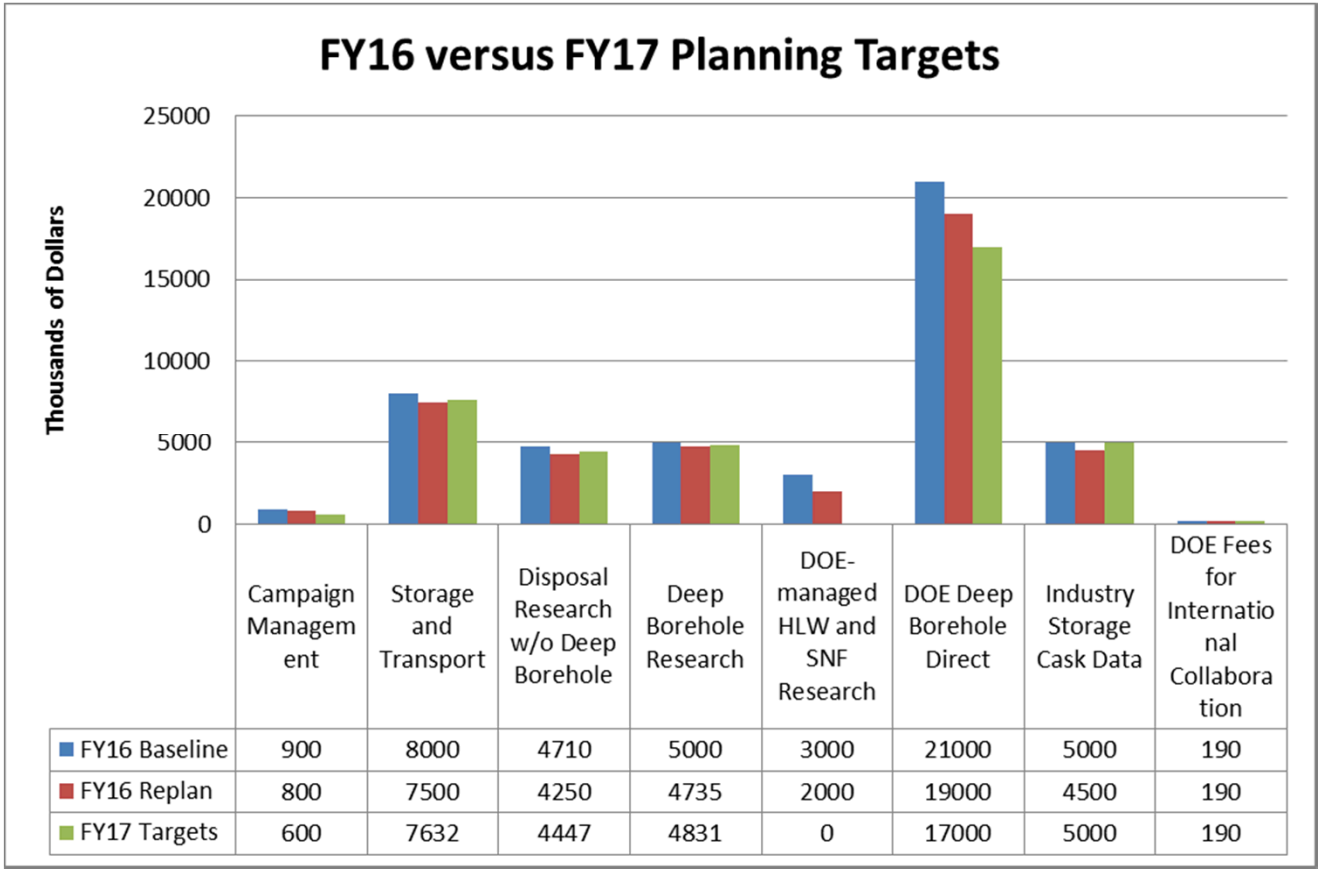
050 - Defense Function Funding within Request

Dollars in Thousands

	FY 2015	FY 2016	FY 2017						
	Current	Enacted	Request	House Subcommittee (4/13/16)	Delta		SAC (4/14/16)	Delta	
050 Funding									
Fuel Cycle R&D - UNFD - IWMS	4,500	-	15,260	**0**	**(15,260)**		**0**	**(15,260)**	

Possible FY17 Planning Targets

- **NE-5 Planning guidance for UFD R&D received 24 May 2016**
  - Total for UFD R&D including industry contracts is $39.7M
- **Guidance still pending for DOE-Managed HLW/SNF research**
- **Guidance at the work package level will come from control account managers**



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- FY17 (proposed, but without DOE HLW/SNF)

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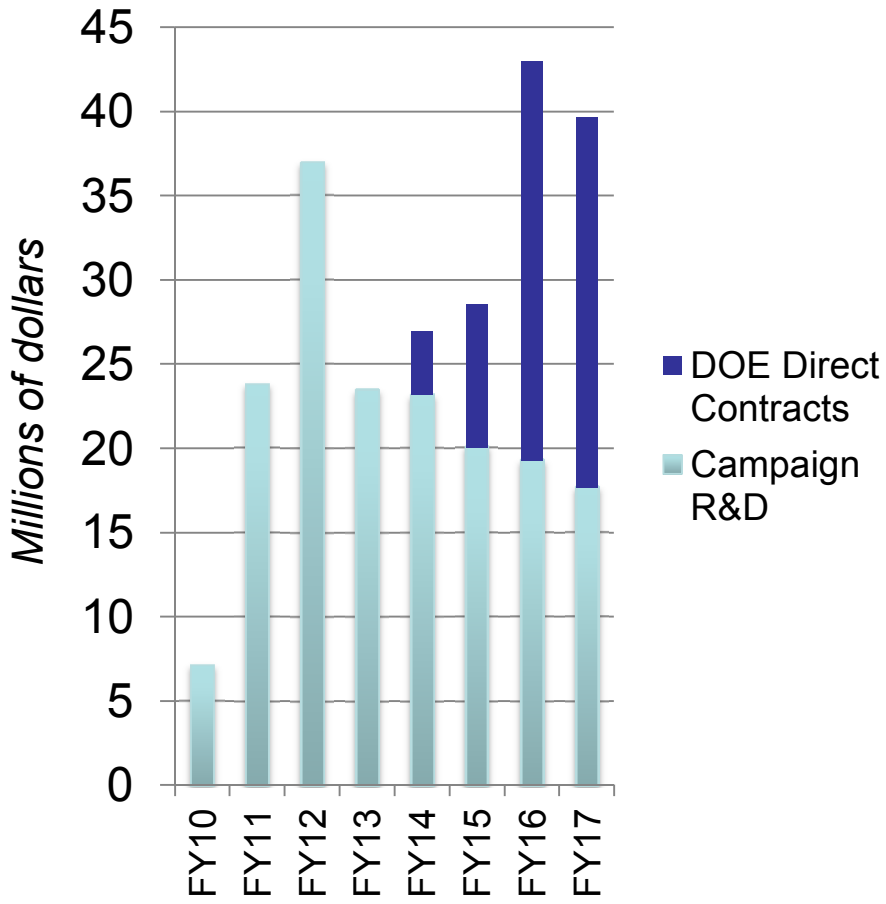

What Does This Mean for FY17 Planning?

- A continuing resolution seems likely until after the November election
- FY17 funding will be determined by Congressional appropriation
- Stay flexible

Questions and Discussion?