Nuclear Energy Advisory Committee Meeting

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U.S. DEPARTMENT OF ENERGY

Presidential and Departmental Nuclear Energy Priorities

- President Trump ordered review of nuclear energy policy:

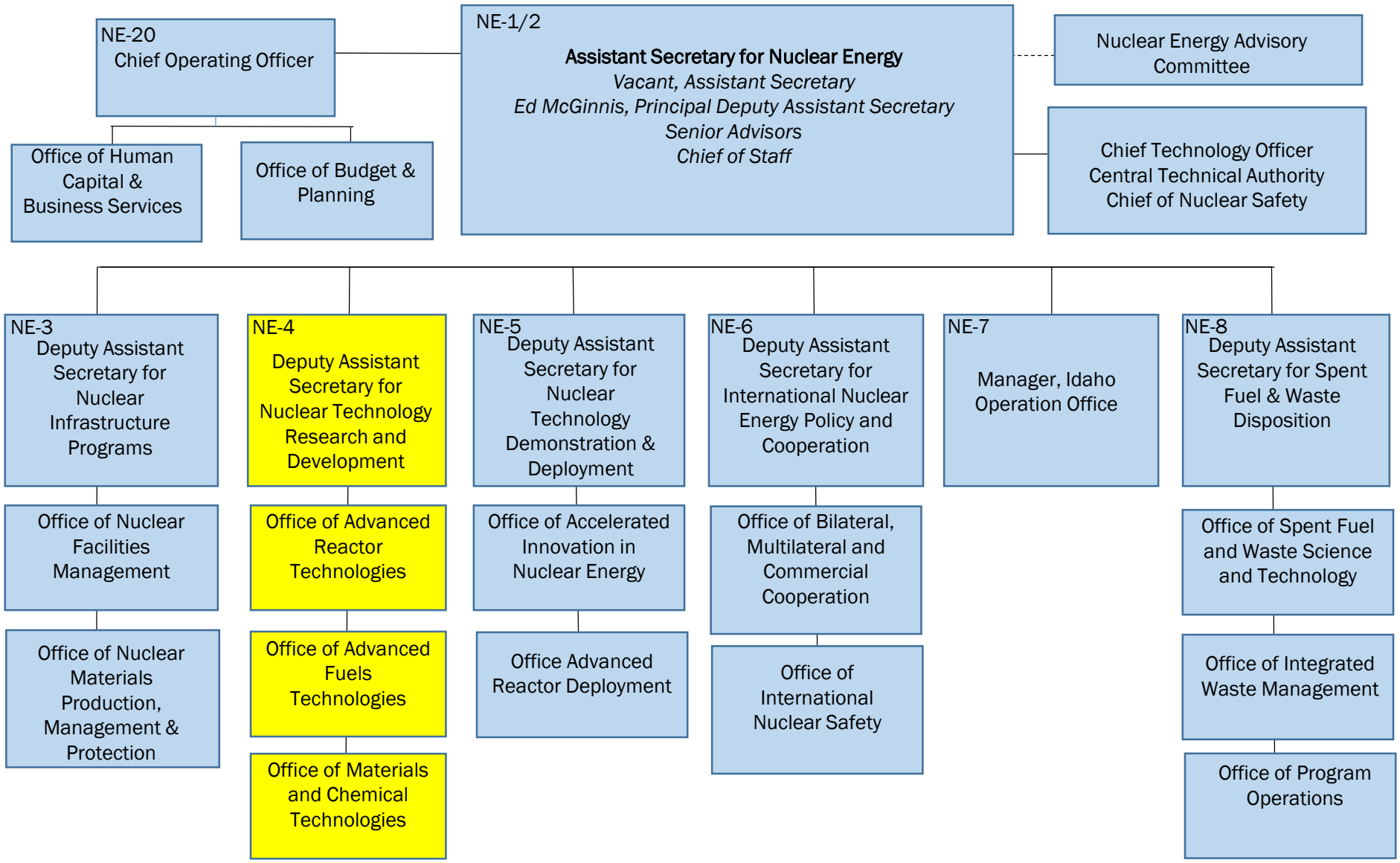
  "[W]e will begin to revive and expand our nuclear energy sector…which produces clean, renewable and emissions-free energy. A complete review of U.S. nuclear energy policy will help us find new ways to revitalize this crucial energy resource."

- Nuclear energy role as clean baseload power is key to environmental challenges:

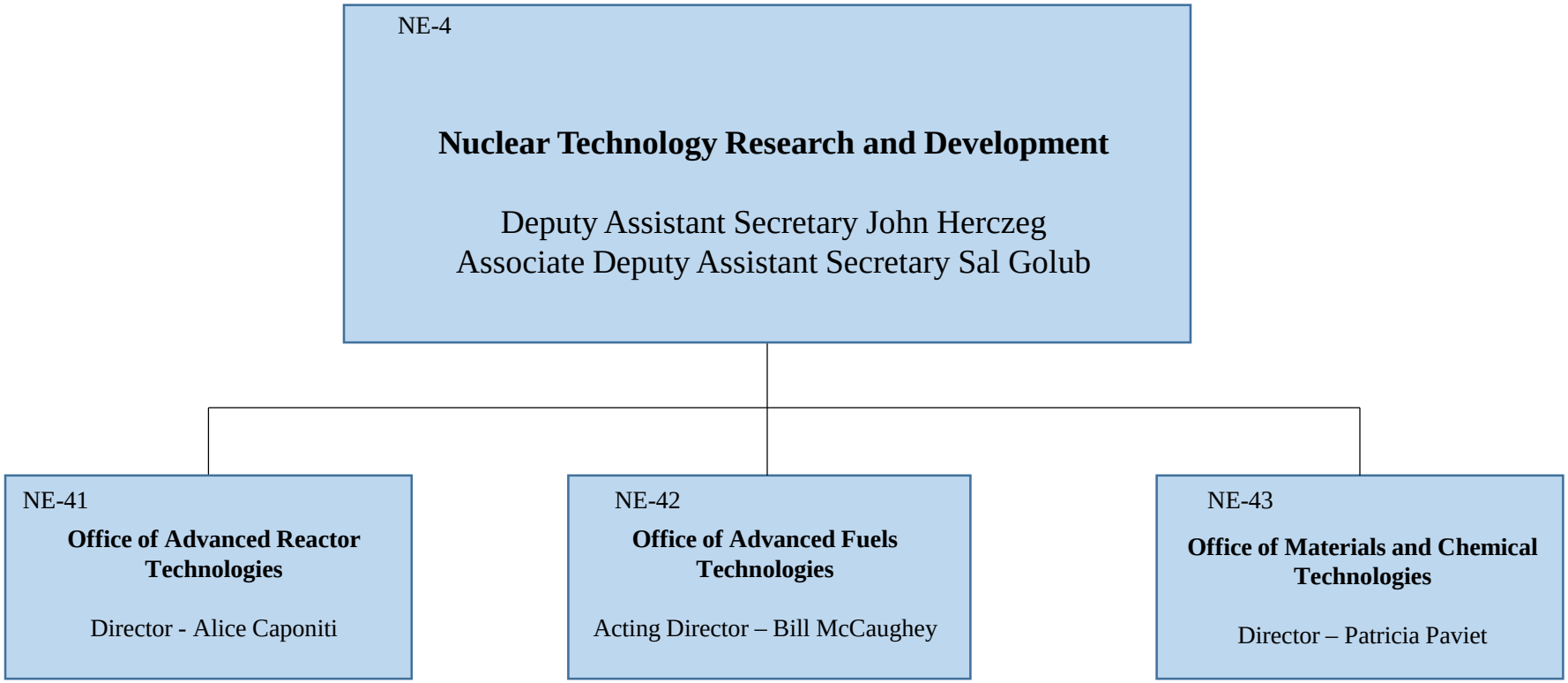
  "If you really care about this environment that we live in…then you need to be a supporter of this amazingly clean, resilient, safe, reliable source of energy." Secretary Rick Perry at Press conference, May 10th

- Executive Order Promoting Energy Independence and Economic Growth
- Commercialization of advanced SMRs crucial to future of US nuclear sector

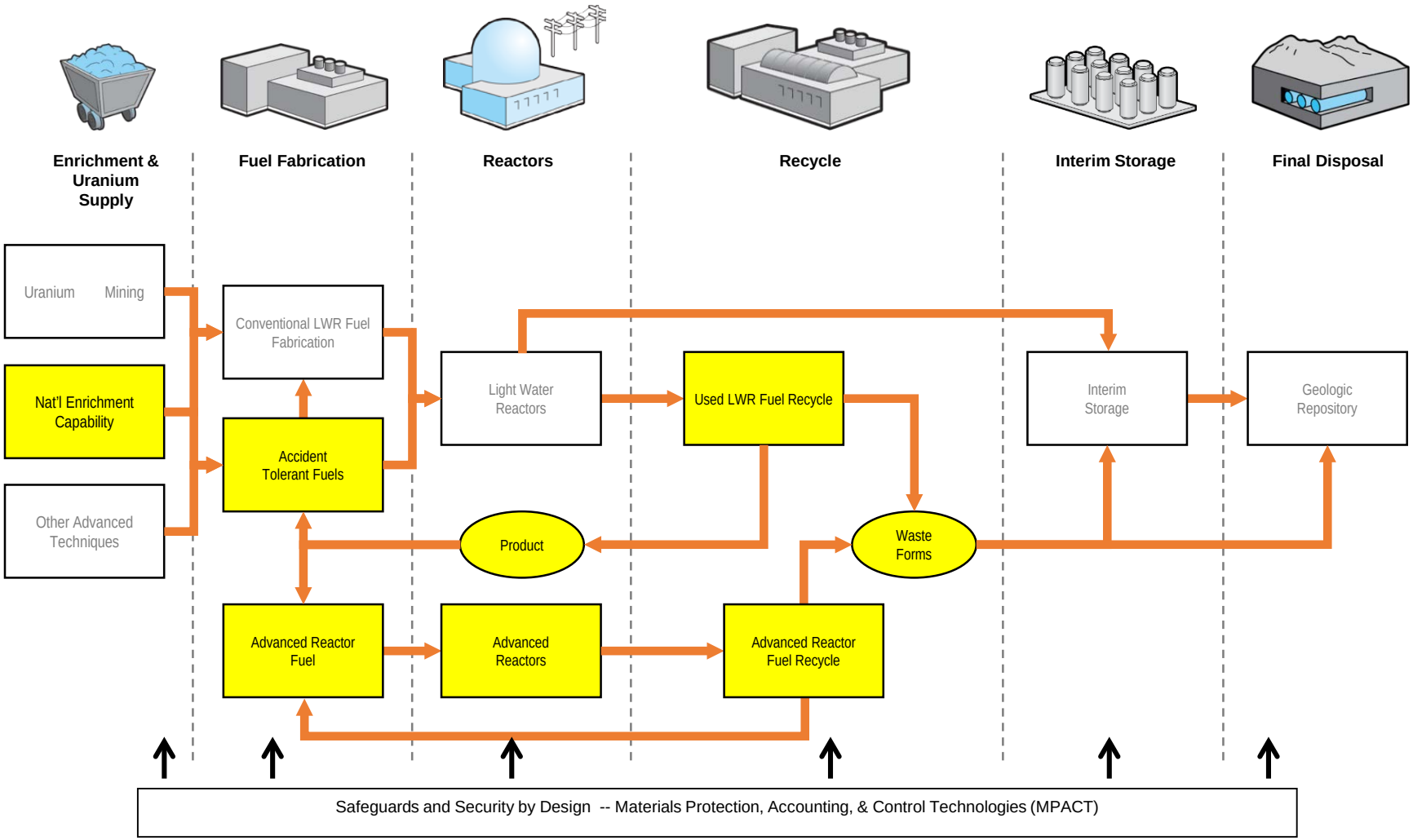
NE Organizational Chart



NE-4 Organizational Chart



Focus Areas: Nuclear Technology Research and Development



Accident Tolerant Fuel Development Plan

- Phase 1: Feasibility Assessment and Down-Selection
  - Collaborative partnership between DOE, industry, and universities.
  - Completed in FY 2016 with three concepts for further development.

- Phase 2: Development and Qualification
  - Industry led efforts supported by DOE national infrastructure and universities.
  - By the mid 2020s, install first reload quantities in commercial reactors.

- Phase 3: Commercialization
  - Industry commercial activity deploying ATF into existing and future reactor systems.
  - By the early 2030s, full cores of ATF in multiple reactors and benefits realized by utilities.

Industry-led Development of ATF Concepts in Phase 2

- **Framatome**
  - Chrome coated zirconium cladding
  - Doped uranium dioxide fuel

- **General Electric**
  - Iron-chrome-aluminum cladding (FeCrAl)
  - Conventional uranium dioxide fuel

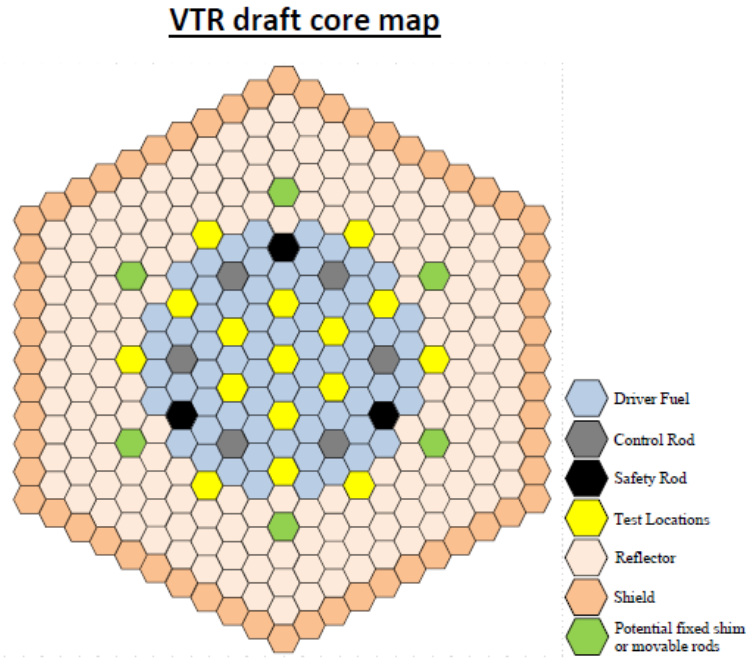
GE imagination at work

- **Westinghouse**
  - Silicon carbide cladding
  - Uranium silicide fuel

DRAFT REQUIREMENTS/ASSUMPTIONS

OF VERSATILE TEST REACTOR (VTR)

1. Approach to Design: Conducting a 3 year research & development effort on core design.
2. Reach fast flux of approximately 4.E15 n/cm^2-s, with prototypical spectrum
3. Load factor: as large as possible *(maximize dpa/year to > 30 dpa/year)*
4. Provide flexibility for novel experimental techniques
5. Be capable of running loops representative of typical fast reactors *(Candidate Coolants: Na, Lead, LBE, Gas, Molten Salt)* – May be a single location with replaceable loops.
6. Effective testing height ≤ 1 m
7. Ability to perform large number of experiments simultaneously
8. Metallic driver fuel (possible options: HA-LEU, LEU+Pu)



Materials and Chemical Technologies

Mission: to develop advanced material recovery as well as advanced waste form development technologies that improve current fuel cycle performance and enable a sustainable fuel cycle, with minimal processing, waste generation, and potential for material diversion.

Electrochemical Processing of Used Nuclear Fuel

- Develop and demonstrate deployable and sustainable technology for fast reactor fuel recycling
- Demonstrate flowsheets with irradiated used nuclear fuel under Joint Fuel Cycle Study with Republic of Korea

Off-Gas Capture and Immobilization

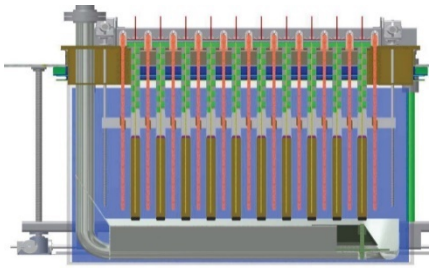
- Management of process off-gasses (I-129, H-3, Kr-85, and C-14) to meet U.S. regulatory constraints

Waste Management

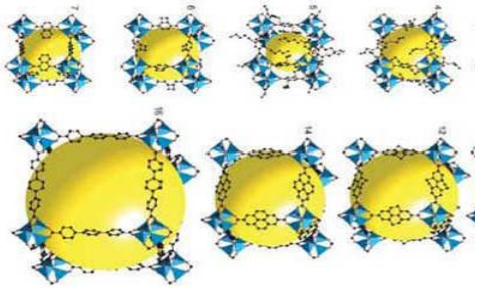
- Demonstrate technologies at laboratory scale for advanced ceramic and glass ceramic waste forms and understand long-term performance of waste forms

Aqueous Processing of Used Nuclear Fuel – CoDCon Project and Advanced Recycling

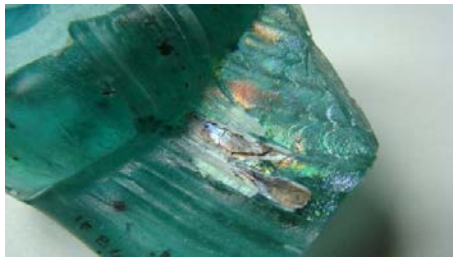
- Demonstrate recovery of useful materials, Uranium, Plutonium and Minor Actinides from used nuclear fuel thereby enabling recycle options for the sustainability of the nuclear fuel cycle



Next generation electrorefiner



Metal organic frameworks (MOFs) for Kr capture and immobilization



Ancient glass from the Roman ship-wreck ~1800 y ago, giving understanding of glass corrosion over long time scales

FY 2018 Omnibus (Dollars in Thousands)

Program Name	FY 2018 Omnibus
STEP	$5,000
Reactor Concepts RD&D	
Advanced SMR R&D	-
Transformational Challenge Reactor Light Water Reactor Sustainability	$47,000
Advanced Reactor Technology	$155,000
Versatile Advanced Test Reactor unallocated	$35,000
Reactor Concepts RD&D TOTAL	$237,000
Fuel Cycle R&D	
Materials Recovery and Waste Form Dev't	$30,000
Advanced Fuels	$125,000
Systems Analysis and Integration MPACT	$8,641
MPACT	$10,000
Used Nuclear Fuel Disposition R&D	$63,915
Integrated Waste Management System	$22,500
Fuel Resources	-
Fuel Cycle R&D TOTAL	$260,056

CONCLUSIONS

- In parallel, DOE-NE is also investing in the R&D infrastructures (with emphasis on the test reactor) to assure a sustainable fast-reactor industry in the long-run.
  - TREAT already restarted
  - Versatile Test Reactor (VTR) targeted for availability by 2026