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Fuel Cycle Options (FCO) Campaign

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NEUP Webinar
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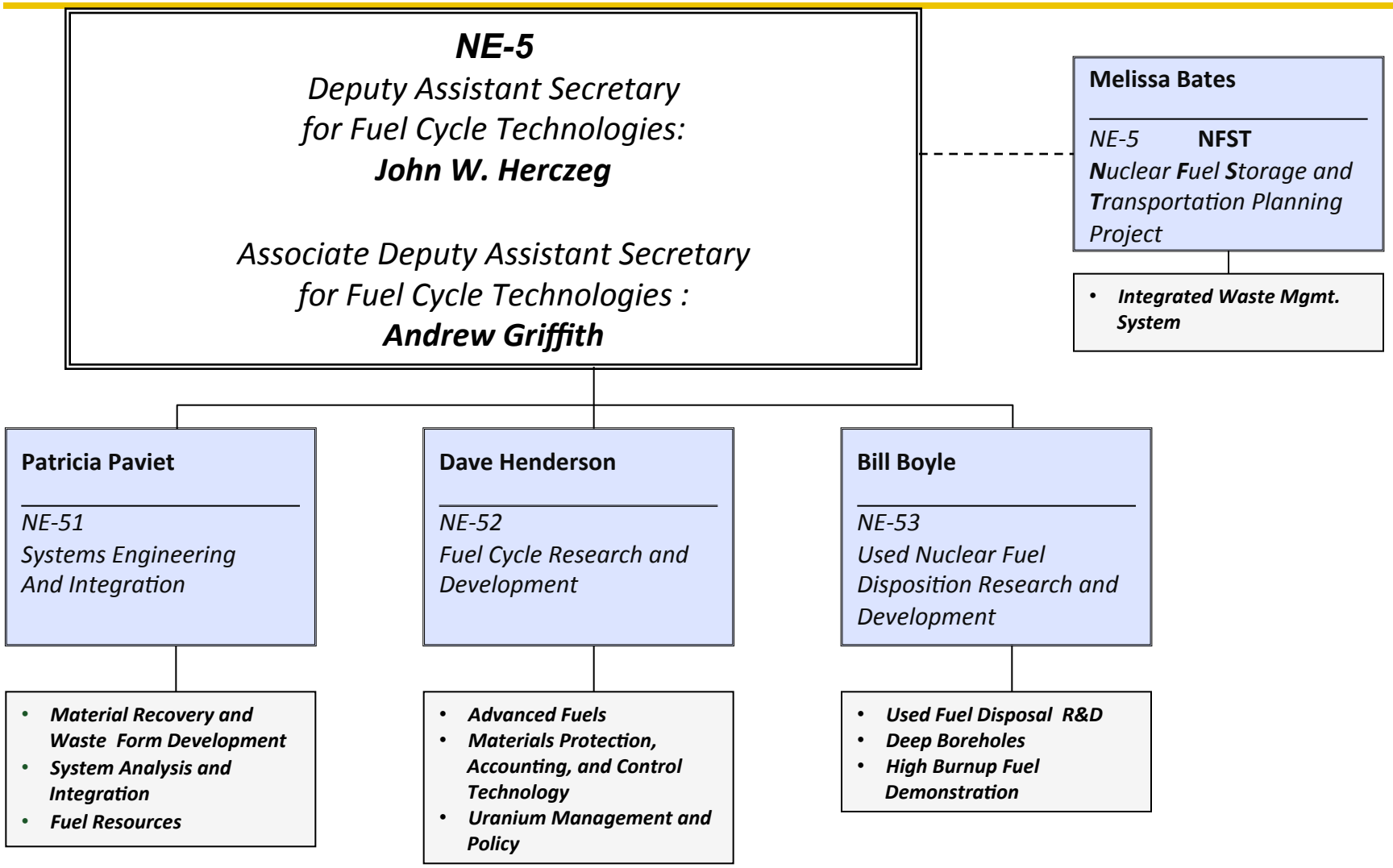
NE-5 Organization Structure



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Campaign Objective

- **Develop and implement analysis processes and tools and perform integrated fuel cycle evaluations to provide information that can be used to objectively and transparently inform DOE-NE as decisions are made about overall R&D directions and to integrate Office of Fuel Cycle Technologies activities through R&D efforts on common fuel cycle goals.**

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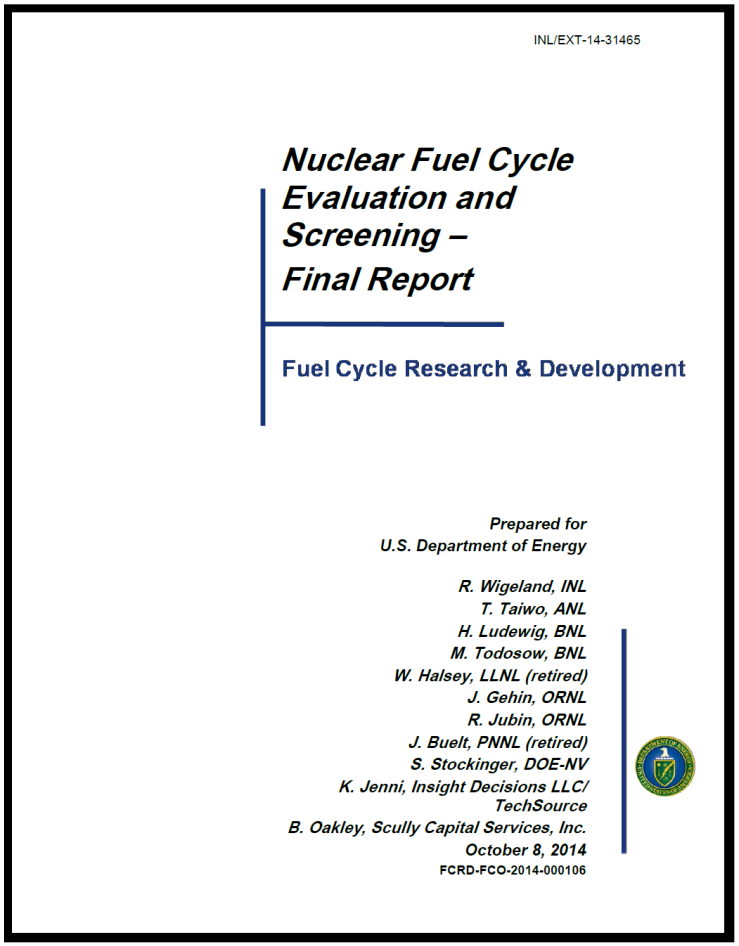
Release of Evaluation and Screening Study


INL/EXT-14-31465

Nuclear Fuel Cycle Evaluation and Screening – Final Report

Fuel Cycle Research & Development

Prepared for
U.S. Department of Energy

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October 8, 2014

FCRD-FCO-2014-000106

- **The Evaluation and Screening (E&S) Study was released by the DOE-NE Fuel Cycle Options Campaign on October 15, 2014**
  - E&S report provides information about the potential benefits and challenges of nuclear fuel cycle options
  - Provides useful information to strengthen the basis of DOE-NE R&D programs
- **Report is comprised of the Main Report and Appendices A-H that provide more details on approach, results, and participants**
- **The Report is available on the INL Website**

https://inlportal.inl.gov/portal/server.pt/community/nuclear_science_and_technology/337/nuclear_fuel_cycle_evaluation_and_screening_final_report

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Release of Evaluation and Screening Study (Cont.)

- Among all options, four groups of fuel cycles consistently provided the highest improvements compared to the current once-through fuel cycle in the U.S

Table E1. Most Promising Fuel Cycle Groups from the E&S Study.

Evaluation Group	Most Promising Fuel Cycle Groups
EG23	Continuous recycle of U/Pu with new natural-U fuel in fast critical reactors
EG24	Continuous recycle of U/TRU with new natural-U fuel in fast critical reactors
EG29	Continuous recycle of U/Pu with new natural-U fuel in both fast and thermal critical reactors
EG30	Continuous recycle of U/TRU with new natural-U fuel in both fast and thermal critical reactors

Note: U= uranium; Pu = plutonium; TRU = transuranic elements, i.e., atomic number higher than uranium (Neptunium, Plutonium, Americium, Curium, etc.); the term "U/Pu" indicates that uranium and Pu are recycled together, similarly the term "U/TRU" indicates that uranium and TRU are recycled together.

https://inlportal.inl.gov/portal/server.pt/community/nuclear_science_and_technology/337/nuclear_fuel_cycle_evaluation_and_screening_final_report

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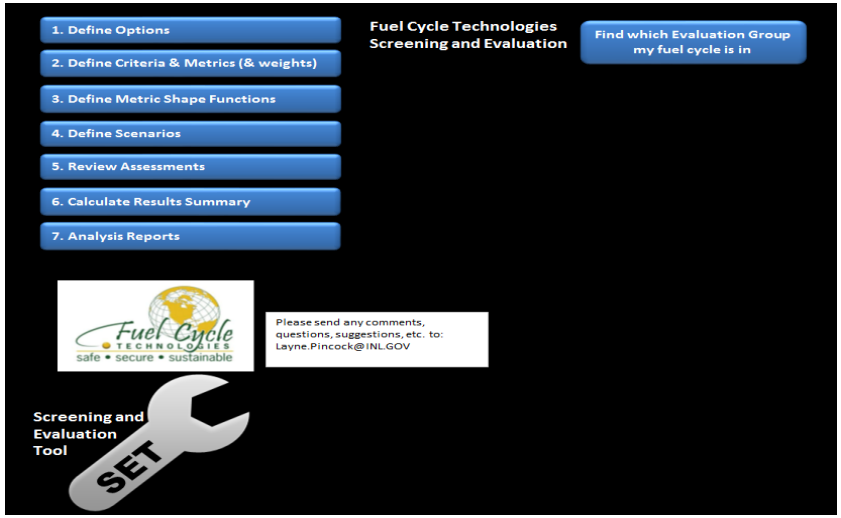
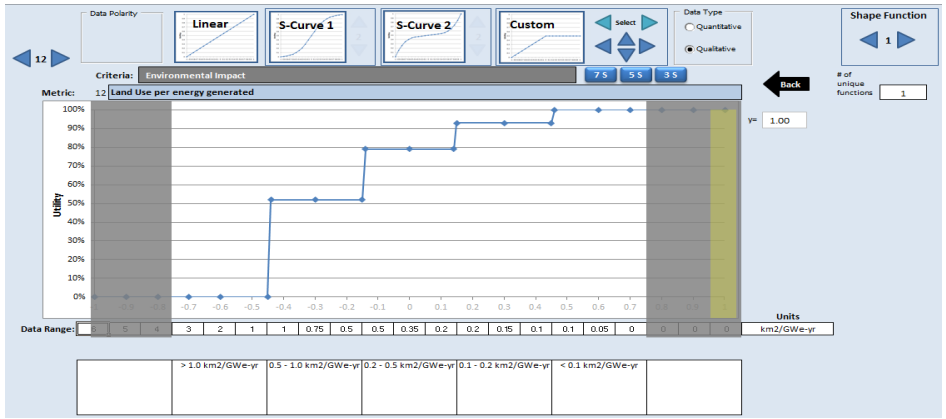
Fuel Cycle Evaluation and Screening Software (SET Tool)

- Developed to support the Nuclear Fuel Cycle Evaluation and Screening Study, and is intended to be used in conjunction with the information contained in the final report on the Study
- Excel-based application that contains the evaluation data for the fuel cycle Evaluation Groups analyzed in the Study, representing the performance with respect to the evaluation metrics used to identify fuel cycle options that offer the potential for significant improvement as compared to the current U.S fuel cycle.





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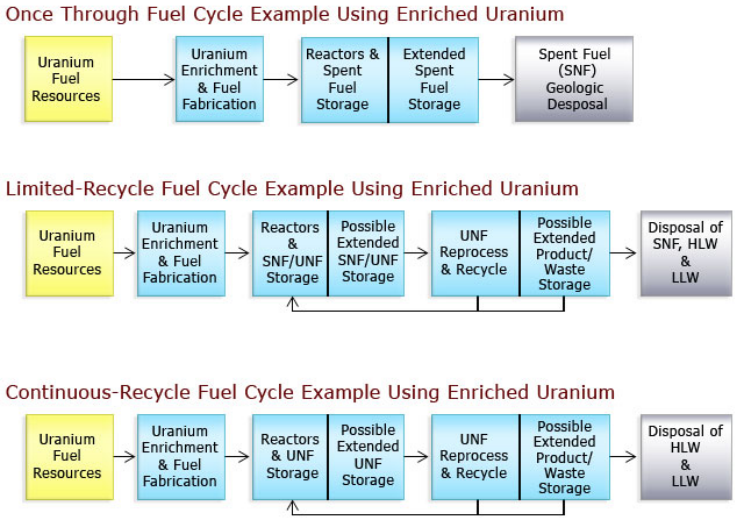
Online Nuclear Fuel Cycle Options Catalog

- The Catalog contains information about nuclear fuel cycles in general and background information for many of the technologies.
- The Catalog also contains almost 60 detailed examples of nuclear fuel cycles, including the 40 Analysis Examples used for the Nuclear Fuel Cycle Evaluation and Screening study.
- Quantitative information such as fuel compositions, resource needs, and waste generation is provided along with interactive diagrams that show how the parts of the fuel cycle interact with each other.



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FCO NEUP Call for FY 2016 (FC-5)
Topic 1 - Visualization Tool

- **Topic 1: Visualization Tools**

- **This program element is interested in the development of visualization tools which can perform the following tasks for communication to and enhancing understanding of public and other stakeholders about benefits and drawbacks of nuclear power and nuclear fuel cycle alternatives:**

Topic 1 - Visualization Tool (Cont.)

- **Comparative analysis of nuclear energy systems::**
  - in the context of an integrated energy generation infrastructure including e.g., solar, biomass, oil, natural gas, wind, etc., and
- **Demonstrate and explore the potential of nuclear power in future energy systems. The target audience is a technically oriented layperson. The tool should model the strengths and weaknesses of energy options in a realistically demanding environment. At a minimum it should have a business (electricity generator) perspective and an electricity consumer perspective. Market considerations and government subsidy consideration should be included.**

Topic 1 - Visualization Tool (Cont.)

- The software user must see and experience the challenge of providing reliable electricity service, reflecting the variable nature of some generation sources such as wind and solar in contrast to stable sources of power such as natural gas and nuclear.
- The product should address both short and long time scales. Short scales address daily electricity demand variability, supply variability of renewable sources (wind shifts, solar level changes).
- The tool should be populated with “boiler plate data” to allow easy initial use. The data could be specific to the United States or a state or a region. A desirable feature would be for the boiler plate to be easily updated regularly (continuously or at least annually)

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Topic 1 - Visualization Tool (Cont.)

- For example, the ability to click on “my state” and view a model with a fairly accurate energy supply and demand portfolio would enhance usefulness. At this level, only few representative technologies should be needed. For example for nuclear energy, it should be adequate to pick from a modern PWR, SMR, or a recycling fast spectrum reactor . Similarly other sources need only have one or two technology options.
- The boiler plate data should be easily modifiable for more interested or advanced users. Layers of modification would be desirable. The first layers offering simple variable manipulation with possibly more details modifications in deeper layers.
- When completed this tool must be publicly available, easy and intuitive to use, and should be usable on different computer platforms, including laptop and perhaps even handheld devices

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FCO NEUP Call for FY 2016 (FC-5) Topic 2 – Maintaining and Advancing Fuel Cycle Simulation Capability

- **Topic 2: Maintaining and advancing Fuel Cycle Simulation Capability**
- **The current nuclear fuel cycle is a well-established and well-understood system. Fuel cycle analysis is important for understanding how a transition to an alternative fuel cycle will impact that system.**
- **Cyclus (www.fuelcycle.org) is an open-source nuclear fuel cycle simulator that is designed to enable collaborative enhancements and improvements that accommodate different fuel cycle analysis questions and use cases. Projects which can maintain and advance this capability developed in part due to past NEUP support are invited.**

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Topic 2 – Maintaining and Advancing Fuel Cycle Simulation Capability (Cont.)

- For Example:
- Develop modules that support specific types of fuel cycles or fuel cycle technologies
- Develop capability for sensitivity analysis and/or optimization
- Interfacing with tools designed to model broader energy & climate futures (e.g. MARKAL, GCAM, etc.)
- Developing capability for economic and financial modeling
- Incorporation of time and geospatial considerations for the transportation of material
- Maintaining and enhancing Cycamore, the basic module library for Cyclus and providing the Cyclus community facilitator role and a resource for developers of archetype modules and analysis tools.

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