

Leveraging Opportunities with the Global Nuclear Energy Partnership (GNEP)

National Academy of Sciences Visit

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The GNEP Initiative

- Expand Nuclear Energy
 - Build reactors at home and abroad for energy, to reduce carbon, and achieve development
- Recycle Nuclear Fuel & Reduce Nuclear Waste
- Enhance Nonproliferation Arrangements



"So tonight I announce the Advanced Energy Initiative... We will invest more in... clean, safe nuclear energy."

- President Bush, 01/2006



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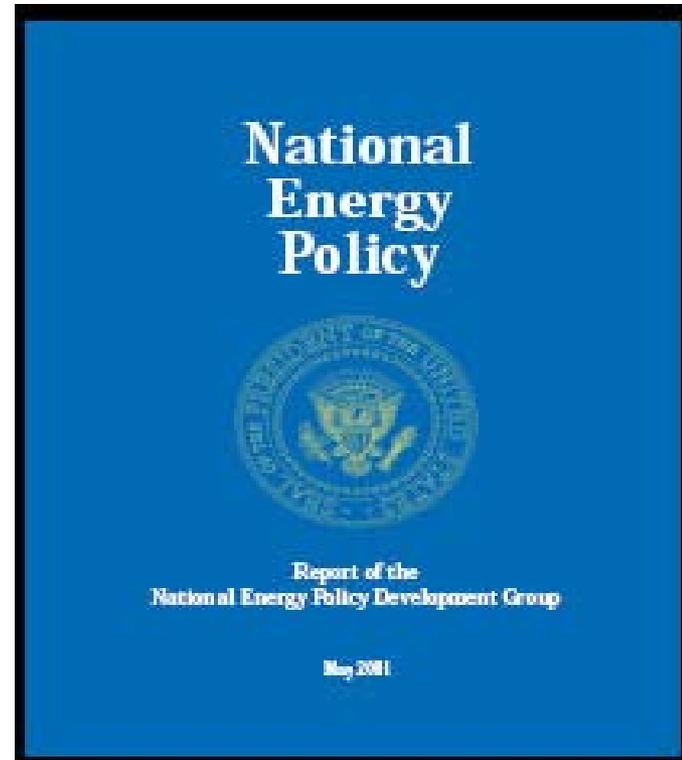


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GNEP Implements National Energy Policy

- Expand nuclear energy in the United States
- Develop advanced nuclear fuel cycles
- Pursue deployment of advanced recycling that reduces waste streams and enhances proliferation resistance
- Discourage accumulation of separated plutonium
- Cooperate with reliable international partners to develop advanced recycling technologies



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GNEP Benefits

- Reduce America's dependence on fossil fuels
- Provide abundant energy without generating carbon emissions or greenhouse gases
- Recycle used nuclear fuel to minimize waste and curtail proliferation concerns
- Safely and securely allow developing nations to deploy nuclear power to meet energy needs
- Assure maximum energy recovery from still-valuable used nuclear fuel
- Reduce the number of required U.S. geologic waste repositories to one for the remainder of this century



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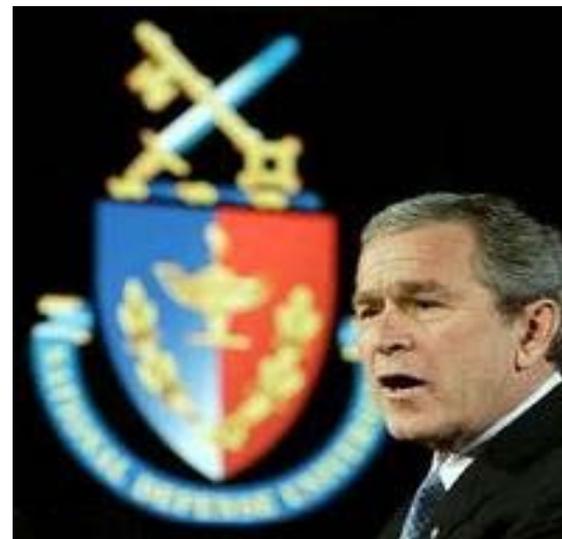


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Key Elements of GNEP

- Expand domestic use of nuclear power
- Minimize nuclear waste
- *Demonstrate more proliferation-resistant recycling*
- Develop advanced burner reactors
- Establish reliable fuel services
- Demonstrate small-scale reactors
- Develop enhanced nuclear safeguards



"To build a secure energy future for America, we need to expand production of safe, clean nuclear power"

- President Bush, 06/2004



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Reducing Nuclear Waste

- Significantly reduce the volume of nuclear waste to be disposed of in Yucca Mountain, making disposal less complex and minimizing the need for additional repositories
 - Repository needed in all cases
 - Aggressive plan to proceed
 - One repository can meet U.S. needs this century with GNEP



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Demonstrate Advanced Recycling

Demonstrate and deploy new technologies to recycle nuclear fuel that do not result in separated plutonium



- Demonstrate with advanced fuel cycle states, not for export
- Encourage transition to a fuel cycle that does not separate plutonium
- Provides fuel for advanced reactors
- Rest of recycled products become easier to deal with for waste management



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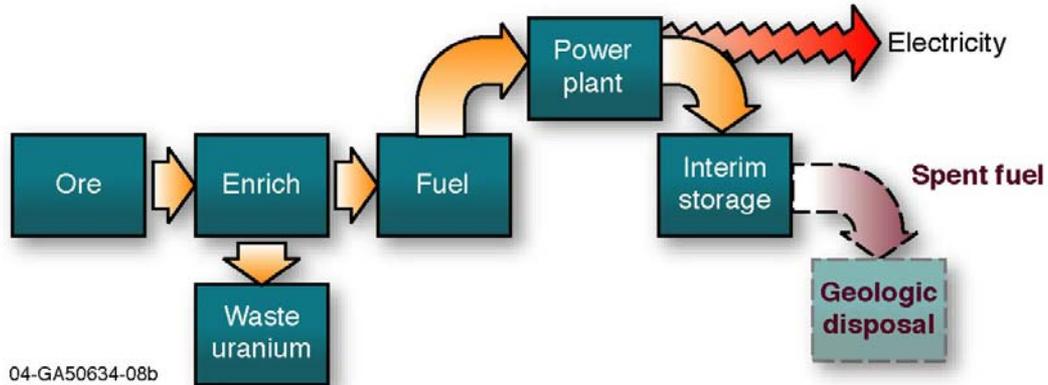
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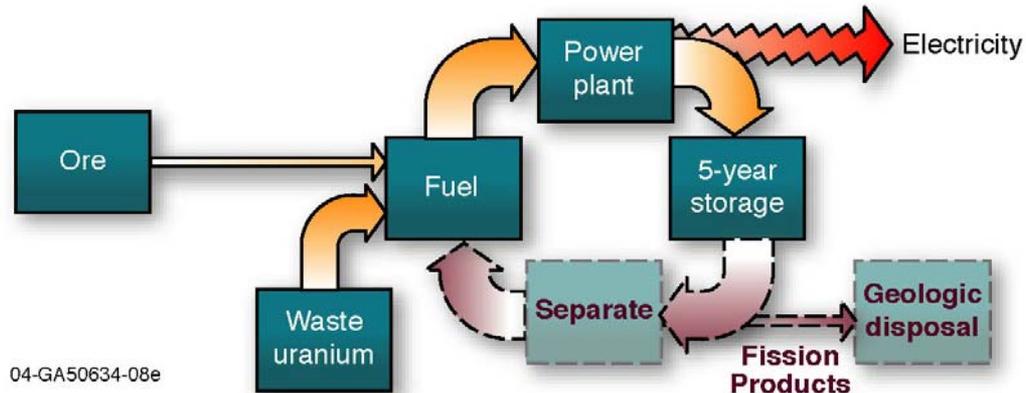
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Advanced Fuel Cycles



Current Once Through Cycle



Sustained Recycle



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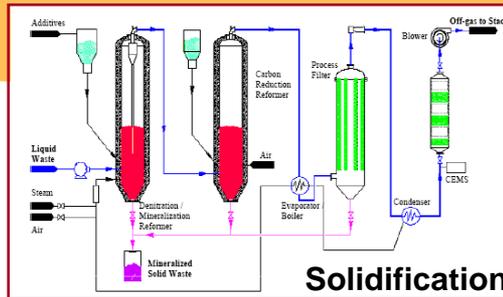
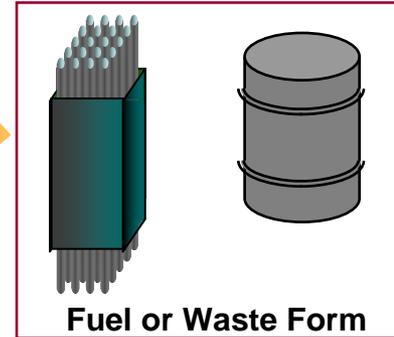
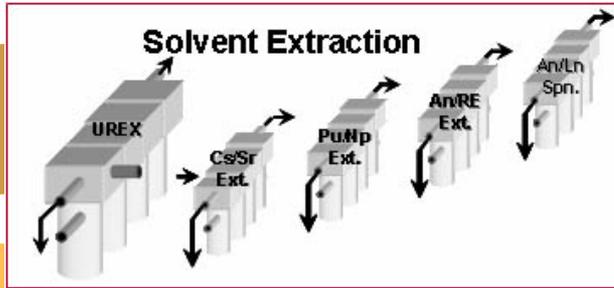
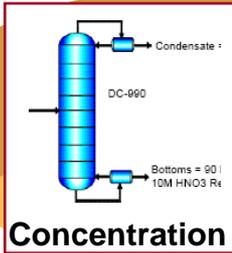
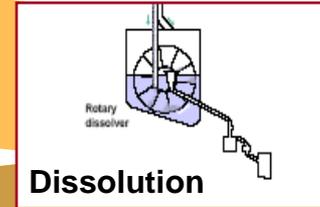
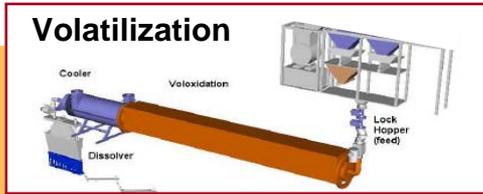
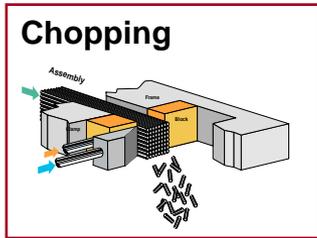
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Reprocessing Flowsheet



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Collaboration

- DOE-EM is charged with the treatment and disposal of legacy wastes from decades of defense nuclear materials handling
- DOE-NE is studying the option of closing the commercial nuclear fuel cycle which includes treatment and disposal of the wastes generated
- There are distinct similarities in the technologies related to waste treatment and disposal
 - Although there are distinct differences between the legacy wastes being managed by EM and those that would be generated under the closed fuel cycle option
- Collaboration on waste treatment and disposal is in the best interest of DOE



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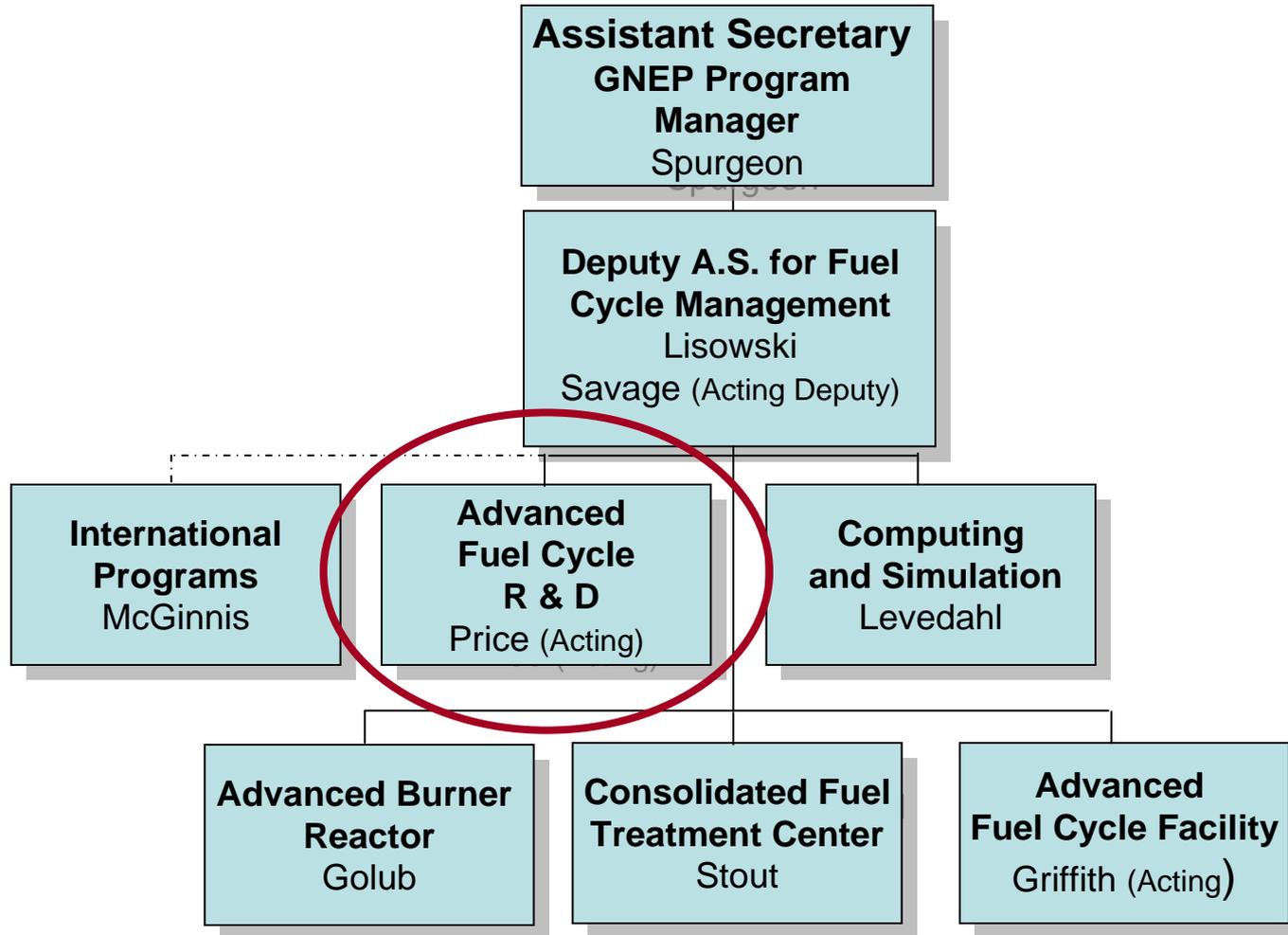
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GNEP Program Structure



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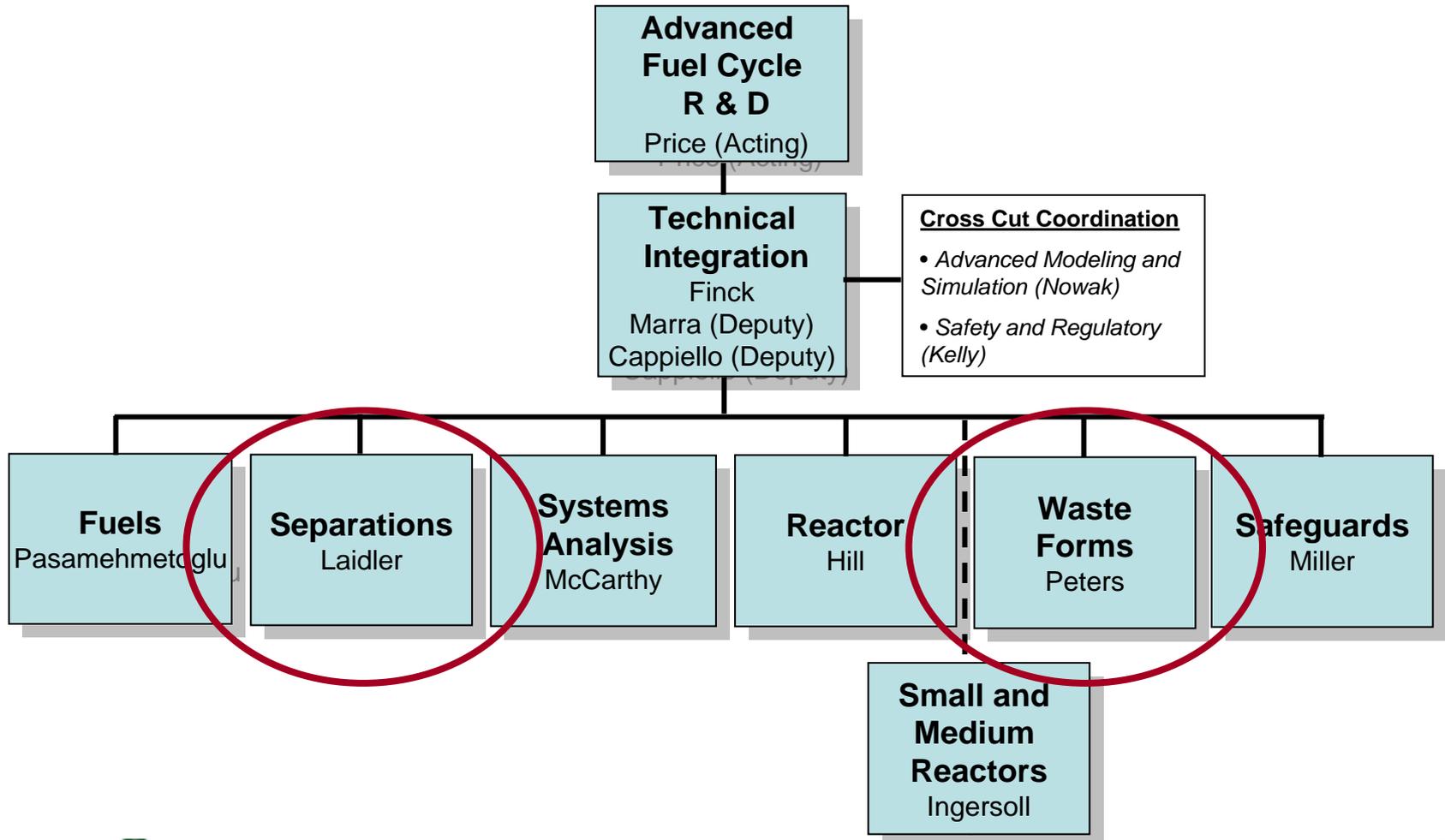
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GNEP Campaign Structure



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Areas of Potential Collaboration

- Use of communities-of-practice (staff, expertise, facilities, etc.)
- Joint R&D (leveraged research on common technology)
- Integration activities
 - Technology Readiness Assessments
 - Joint technical workshops
 - Lessons-learned



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Potential Communities-of-Practice

- Sharing capabilities
 - Staff with key expertise
 - Unique or expensive laboratory capabilities (e.g., hot cells, specialized furnaces, etc.)
 - Ties to international subject matter experts
 - Experienced laboratory staff (e.g., technicians)
- Decrease the cost to each program and accelerate technology development
- Example communities-of-practice include:
 - Waste immobilization
 - Separations/pretreatment
 - Spent nuclear fuel management
 - Special nuclear materials handling



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Example Joint Research Tasks

- Cold-Crucible Induction Melter (CCIM) development and testing
 - Candidate technology for SRS HLW, GNEP Cs/Sr, GNEP Ln/FP, INL Calcine
 - Currently funded by EM-ART for SRS HLW, and EM-Russian program for SRS and Hanford HLW
- Ceramic waste form processing
 - Potential for INL Calcine, GNEP Cs/Sr, GNEP I
 - Currently funded by GNEP for Cs/Sr and I, and EM for INL calcine



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Example Joint Research Tasks

- Multi-phase waste form characterization and repository qualification
 - Potential for many EM wastes (including HLW) and many GNEP wastes
 - Currently funded by EM for HLW multi-phase glass and by GNEP for Cs/Sr, I, Ln/FP, Echem wastes
- Hot-Walled Induction Melter process development
 - Potential for EM non-MOx Pu and GNEP Ln/FP
 - Currently funded by EM for Pu immobilization



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Example Joint Research Tasks

- Solvent extraction technology
 - Baseline process for GNEP aqueous separations (UREX, FPEX, TRUEX, TALSPEAK...) and baseline for SRS Cs extraction
 - Similarity in scope for centrifugal contactor design, testing, and flowsheet development and modeling activities; other aspects of process development (solvent recycle, etc.)
 - Currently funded by EM for SRS Cs extraction and by GNEP for aqueous processing



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Example Joint Research Tasks

- Broader, strategic activities
 - I, Tc, actinide chemistry (significant interest by RW and possibly SC)
 - Performance-based qualification for repository (collaboration with RW)
 - Advanced materials development for next generation waste forms
 - Materials behavior and reactive transport modeling (behavior in wide variety of environmental situations, RW and SC collaboration)
 - HLW, greater than class C (GTCC), and LLW disposal approaches



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Example Integration Activities

- Technology Readiness Assessments
 - TRA's to be performed by EM and NE for various processes and flowsheet options
 - Upfront efforts to develop TRA guidance can be shared between EM and NE
 - Conduct of TRA's on similar/related technologies may be joint EM-NE efforts to improve the process and share knowledge (e.g., NE representative on EM lead TRA teams and vice-versa)
- Joint technical workshops
 - Technical workshops on topics of joint interest can be held (e.g., iodine capture and immobilization, technetium chemistry, waste form performance testing and modeling, reactive transport of radionuclides, etc.)
 - Joining efforts will expand the knowledge base and add perspectives



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Moving Forward

- Integrate current program plans
 - GNEP Technology Development Program Plan is being developed based on current budget guidance
 - Initial draft of EM Engineering & Technology Multi-Year Program Plan is in review
 - *Develop and agree on areas of potential collaboration*
- Develop joint research and test plans
 - Funding allocations
 - Test planning and review
- Initiate regular communication to ensure integration (includes DOE and laboratory R&D leads)



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