

Advanced Nuclear Transformation Technology Subcommittee  
of the Nuclear Energy Research Advisory Committee

# Status Report to NERAC

February 21, 2007

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# Background

- **Two ANTT Subcommittee meetings and status reports issued to NERAC in 2006**
  - February 28-March 1, 2006
  - August 31-September 1, 2006
- **FY07 funding of at least \$120 M announced February 2007.**
- **Next ANTT Subcommittee meeting planned March 5-6, 2007**

# Background (continued)

- **GNEP**
  - Initially rolled out Summer 2006.
  - Altered course of AFCI R&D
    - Engineering Scale Demonstration Facility and Advanced Burner Test Reactor eliminated
    - Additional reprocessing scenarios considered
    - Research altered to support changing course
  - Evolved during 2006
    - Two commercial facilities and one government laboratory facility
    - Industry participation in commercial facilities

# Subcommittee Recommendations

- Subcommittee focused on AFCI R&D
  - Reviewed FY06 technical progress
  - Identifying inconsistencies and gaps in proposed research to support evolving GNEP
- Seven key recommendations in latest report
  - Recommendations encompassed those submitted in prior subcommittee report
  - Some recommendations already implemented

# Mission Statement Needed for Each Major GNEP Facility

- **Three key facilities proposed**
  - ABR for TRU reduction
  - CFTC for LWR spent fuel treatment
  - AFCF for long range R&D and potentially for fabricating TRU lead test assemblies
- **Multiple and possibly inconsistent facility objectives under consideration**
  - ABR: facility to demonstrate NRC licensing, test facility for TRU-bearing fuel certification, or all of these?

# **Mission Statement Needed for Each Major GNEP Facility (continued)**

- **Many mission-related facility parameters not specified**
  - ABR power rating, conversion ratio, and initial fuel type (metal or oxide), enrichment, or qualification path
  - AFCF fuel fabrication rate
  - CFTC fuel fabrication rate and separation process
- **Some proposed facility objectives lead to design selections**
  - Desire for NRC licensing may preclude ABR initially being loaded with TRU containing fuel

## **Integrated GNEP Program Timeline Needed**

- **GNEP based on multiple recycles**
- **Timeline should include period through demonstration of multiple transmutation recycles including qualification of required fuels.**
- **Expand current use of Technology Readiness Level (TRL) approach to assess research performed and additional research needed to accomplish GNEP objectives.**

# **Review Availability of Necessary Test Facilities**

- **Development and qualification of transmutation fuel is long term process requiring irradiation facilities.**
- **Research programs require fuel and materials irradiations in thermal, fast, and pulse reactors.**

# **Review Availability of Necessary Test Facilities (continued)**

- **Limited US and foreign facilities**
  - Currently using INL's Advanced Test Reactor (ATR) and PHENIX.
  - Initial ABR fuel qualification assumed in ABR.
    - Vendor will propose fuel type (metal or oxide) and present qualification plan to DOE.
  - TRU qualification requires significantly more testing in
    - Existing facilities: INL's ATR and SNL's ACRR
    - International facilities with uncertain futures: PHENIX, JOYO, or BOR60
    - Unavailable facilities requiring restart: INL's TREAT
    - New facilities: addition of GTL to ATR or modifications to LANCE to create MTS at LANL.

## **Consider Various Transmutation Scenarios**

- **Current technology base supports ABRs with 0.5 to 0.6 conversion ratios**
  - Lower conversion ratios require higher enriched fuel but reduce required number of fast reactors
  - Higher enriched fuels may have undesirable effects (reactivity swings in smaller reactors, thermal cycling on metallic structures, increased proliferation risk, etc.).
- **Transmutation scenarios beyond 2050 should include possibility that breeder reactors will be main type of reactor deployed for power production.**

# **Continue to Support Several Reprocessing Technologies**

- **UREX+ or COEX processes suitable for LWR and FR fuel**
- **Pyro process suitable for FR metal fuel**
- **Technology readiness levels approach should be increasingly used to prioritize additional required research**

# Ensure Universities Sufficiently Supported

- **GNEP requires personnel with unique backgrounds**
  - Actinide chemists
  - Nuclear engineers
  - Nuclear physicists (cross sections)
  - Advanced computational skills
  - Material scientists
- **NERAC should develop a long-range plan for university funding that ensures sufficient GNEP workforce.**



# **Establish NE, RW, NNSA, and SC Coordinating Committee**

- **Research and actions of NE, RW, NNSA, and SC related**
  - GNEP could impact need for additional repository
  - Office of Science funding to be available to support basic GNEP-related research in FY07
  - New NNSA requirements for controlling nuclear material may impact GNEP selections for reprocessing.
- **Coordination needed at higher levels**
  - Informal coordination occurring among staff
  - Higher level program coordination needed
  - NE should create and chair high level coordinating committee that includes representatives from RW, NNSA , and SC.

# Summary

- **DOE-NE nuclear transformation technology programs evolved considerably since committee's initial formation.**
- **GNEP offers unique and much needed opportunity**
  - **Begin reduction of separated plutonium**
  - **Eliminate need for second repository**
  - **Path forward for power production**
  - **Slow (or perhaps stop) growth of fuel cycle countries.**
- **Funding and opportunity shouldn't be wasted**
  - **Subcommittee urges NERAC to recommend that DOE-NE develop an achievable path and stick to it.**
  - **International community watching to see if US is serious.**