AREVA NP

HTGR Technology Working Group

Technical & Licensing Priorities

HTGR TWG Members

AREVA NP

Duke Energy

StarCore Nuclear

X-Energy

Farshid Shahrokhi

DOE–NRC 3rd Workshop on Advanced Reactors

April 25-26, Rockville, MD

AREVA

Topics

- Overview of HTGR TWG composition, objectives, and schedules
- Highlights of key activities - present and planned
- Unique technical / licensing challenges
- How can DOE and/or NRC help
- Plans for external communication, collaboration, and consultation including interactions with DOE, NRC industry and academia

HTGR TWG
Developer members

- **AREVA**
  - **A four unit plant with block type HTGR modules. Each module is 625 MWt that can produce 272 MWe or steam at 560 °C**
- **StarCore Nuclear**
  - **A multi-module plant with block type HTGR modules. Each module is a small <25 MWt reactor that can produce electricity or process steam, remote sites and remote operation**
- **X-Energy**
  - **A one module plant with pebble bed reactor module. Each plant has a 200 MWt reactor module that can produce 75 MWe or process heat**

HTGR TWG
Objectives & Schedule

- The HTGR technology working group (TWG) was formed to engage with the US Department of Energy GAIN Initiative in order to communicate the common R&D needs of the HTGR reactor community
- The HTGR TWG is an independent sub-committee of the NEI Advanced Reactor Working Group and Technology Task Force.
- The purpose of our working group is to identify and coordinate our common R&D needs and advocate for its performance.
- We are an industry led working group
- Membership includes reactor developers, owner/operator utilities interested in HTGR reactors, and other potential industrial end users.
- We meet as needed but at least four times per year to coordinate our efforts
- We were organized as a group on Jan 1, 2017

Key Activities of the Group Present and Planned

- **Documented our needs –**
  - To date - we have prepared a consolidated list of short term and long term R&D needs for DOE GAIN Initiative
  - DOE – GAIN has responded positively and provided direction and avenues for engaging with the on-going and future R&D funding streams and activities
  - We also have regulatory and licensing needs
- **Participating in NEI activities**
  - Advanced Reactor Technology Task Force
  - Advanced Reactor Regulatory Task Force
- **Active in EPRI Advanced Reactor working Group**
  - Owners' Requirements Study
  - Owners' Requirements Document
- **Individual developer company activities**
  - X-Energy: 5-year cost shared ARC award activities
  - AREVA: Water based RCCS Experiment at ANL
  - AREVA: Reactor Building Response Experiment at Texas A&M
  - Group: TRISO coated particle fuel qualification topical report

Specific actions needed by DOE and/or NRC that would speed our efforts

- **Our contributions to date ….**
  - **NGNP Program white papers and interactions in 2010's**
  - **Supported DOE General Design Criteria for non-LWRs**

- **Continue support of current activities on**
  - **Funding for a "Public / Private" demonstration project**
  - **DG-1330 Advanced Reactor Design Criteria development and RG 1.232,**
  - **Security design criterial for non-LWRs (white paper)**
  - **DG-4026 Environmental Report update to and RG 4.2**
  - **Southern led "Licensing Technical Requirements Modernization Project" white papers preparation and interactions with the NRC**
  - **Completion of current DOE R&D**
    - Fuel and Graphite qualification (AGR, AGC programs)
  - **Modeling and Simulation activities**
    - Codes and methods development and commercialization

Unique technical/licensing challenges related to the HTGRs

- **Fuel and fuel cycle**
  - Source term
  - TRISO coated particle fuel qualification
  - Manufacturing and quality control
  - High Assay LEU (<20% enriched Uranium)
  - Dose calculation
  - Siting
- **HTGR safety concept**
  - Radionuclides retention strategy
  - Low pressure reactor building
  - No radiological impact beyond site boundary
- **Licensing bases events**
  - Use of PRA
  - Risk informed and performance based process
  - Uncertainty
  - Defense in depth (redundancy vs diversity)
- **Analysis codes and methods**
  - Certification/acceptance
  - Data quality, legacy data acceptability
- **Staffing**
  - Operating and maintenance staff
  - Security staff
  - Multi-module operation
  - Emergency planning
  - Site boundary
- **Off-grid regulation**
  - Steam-only plant
  - Co-generation where electricity not a primary output
  - On-going activities
  - Future activities

Our Plans

- As a group we intend to:
  - Continue our close communication with DOE GAIN Initiative
  - Advocate completion of the fuel and graphite R&D
  - Engage and support the NRC's non-LWR regulatory modernization efforts
  - Support DOE's M&S activities and adopt modern codes and methods
  - Continue our participation in the NEI Advanced Reactor working group and its Technology, Legislative, and Regulatory Task Forces
  - Engage with the NEI Advanced Reactor and SMR cross-cutting issue resolution, e.g. Staffing, EP, and Security
- As individual developers
  - Engage end-user and investment communities
  - Developer team building
  - Continue design activities
  - Develop our licensing project plan and NRC engagement strategy

Questions …..