

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

- ▶ **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 criteria 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