

Enclosure 1  
(CCN 220379)

Next Generation Nuclear Plant Project Submittal  
(NRC Project #0748)  
Voluntary Response to Nuclear Regulatory  
Commission RIS 2010-03

## NGNP's Voluntary Response to NRC RIS 2010-03

### **Design and Licensing Submittal Information**

- 1. When (month and year) are applications planned for design-related applications and what NRC action will be requested (i.e., DC, DA, ML, or COL not referencing a DC or DA)?**

**RESPONSE:** In 2005, the Energy Policy Act of 2005 formally authorized the Next Generation Nuclear Plant Project. Sections 641 through 645 of the Energy Policy Act of 2005 established expectations for research, development, design, construction, and operation of a prototype nuclear plant that would provide electricity and/or hydrogen.

The provisions of the Energy Policy Act of 2005 establish two distinct phases for the project. Phase 1 is the phase that covers selecting and validating the appropriate technology, carrying out enabling research, development and demonstration activities, determination of whether it is appropriate to combine electricity generation and hydrogen production in a single prototype nuclear reactor and plant, and to carry out initial design activities for a demonstration reactor and plant, including development of design methods and safety analytical methods and studies. Phase 1 is currently in progress.

Phase 2 is the phase that covers development of a final design for the demonstration nuclear reactor and plant through a competitive process, application for an NRC license to construct and operate the demonstration nuclear facility, and construction and start up operations for the demonstration nuclear reactor and its associated electricity, process heat, and/or hydrogen production facilities. Phase 2 is expected to be completed via a public-private partnership with DOE.

The NGNP Licensing Strategy (Ref. b) provides the overview of the recommended licensing strategy for satisfying the Energy Policy Act of 2005. The Licensing Strategy was jointly developed by NRC and DOE, and provides a high level strategy for the research and development, licensing, construction, and deployment of a high temperature gas-cooled reactor (HTGR) via the adaptation of existing light water reactor regulations. As written in the Report to Congress, the current plans are for a Combined License (COL) application submittal in late FY 2013. The format and content of this application is expected to be consistent with COL applications that contain a final safety analysis report that describes the facility design, presents the design bases and the limits on its operation, and presents a safety analysis of the structures, systems, and components of the facility, as a whole.

The DOE will continue to maintain regular dialogue with the NRC regarding progress through the planned project phases and will communicate future submittal schedule adjustments, if any are identified.

- 2. Will the applicants be organized into DCWGs? If known, what is the membership of the DCWG and which party is the primary point of contact designated for each DCWG? Have protocols been developed to provide coordinated responses for RAIs with generic applicability to a design center?**

RESPONSE: The Idaho National Laboratory (INL) NGNP Project team, working under contract with the DOE, is the primary point of contact for the NGNP Project, consistent with its role as the lead nuclear energy research and development laboratory for DOE in support of HTGR deployment. In this role, the NGNP Project team has been, and continues to work closely with, the potential HTGR suppliers in areas related to conceptual design and priority HTGR licensing and policy issue resolution activities. The INL NGNP Project team is the primary point of contact for early development activities related to NRC licensing submittals that are applicable to the HTGR designs. In addition to this role, the NGNP Project team has engaged with other industry organizations and committees (e.g., ANS, NEI, ASME, etc.) chartered to develop resolutions for selected regulatory policy issues that are generic to advanced reactor technologies, and are applicable to HTGR licensing. These coordination activities are expected to become the responsibility of the applicant, to be identified as a part of the Phase 2 public-private partnership summarized in the response to Item 1 above.

These activities are supportive of a DCWG concept and are intended to promote the “one issue, one review, one position,” strategy advanced by NRC RIS 2006-06, “New Reactor Standardization Needed to Support the Design-Centered Licensing Review Approach.”

- 3. Which applicant referencing the design will be designated as the reference COL (R-COL) applicant?**

RESPONSE: The plant design for the NGNP project is being conducted in two phases as stated in Item 1 above. The DOE plans for the COL applicant to be identified in Phase 2 of the project. Commencement of Phase 2 is dependent on a decision by the Secretary of Energy and is currently planned to occur in FY2011.

- 4. When (month and year) will COL or ESP applications be submitted for review? In addition, what are the design, site location, and number of units at each site?**

RESPONSE: As summarized in Item 1 above, the COL application submittal for the NGNP Project demonstration plant is planned for FY 2013. Detailed information associated with that application (site selection, etc.) will be established as a part of Phase 2, and will be communicated to the NRC staff at that time. The DOE does not currently plan for the submittal of an Early Site Permit (ESP) application associated with the demonstration plant site, although the ESP application option may be reconsidered by the COL applicant, once the applicant is identified. The plan, schedule, and scope for the ESP application would be communicated to the NRC staff at that time.

**5. Are there vendors and/or consultants assisting in the preparation of the application(s)? If so, please describe roles and responsibilities for the design and licensing activities.**

RESPONSE: As described in the response to Item 2 above, the NGNP Project consists of the research, development, design, licensing, construction, and operation of a demonstration plant, including a nuclear reactor that is based on research and development (R&D) activities supported by the Generation IV Nuclear Energy Systems Initiative for the HTGR technology. Three (3) primary reactor suppliers have been identified to date that provide the HTGR technology. They are: AREVA, General Atomics, and Pebble Bed Modular Reactor (PBMR) Limited. In addition, the NGNP Project team is engaged with various national laboratories, universities, and international advance reactor communities in R&D activities that support the Generation IV initiatives.

On March 8, 2010, the DOE announced the participants in the development of the pebble bed and prismatic reactor conceptual design reports and planning work, which are necessary to complete Phase 1 of the project. This includes work by two teams:

Team 1 includes: Westinghouse Electric Co. (Pittsburgh), Pebble Bed Modular Reactor Limited, Shaw Environmental & Infrastructure Inc., Toshiba, Doosan, Technology Insights, and M-Tech Industrial (PTY) Ltd.

Team 2 includes: General Atomics (San Diego), General Dynamics Electric Boat Division, URS Washington Division, Korea Atomic Energy Research Institute, and Fuji Electric Systems.

If a decision is made to move into Phase 2, the members of the Phase 2 team will be established at that time, along with associated roles and responsibilities.

**Design, Testing, and Application Preparation**

**6. What is the current status of the development of the plant design (i.e., conceptual, preliminary, or finalizing)? Has a schedule been established for completing the design? If so, please describe.**

RESPONSE: Phase 1 is now in progress, as summarized in Item 5 above. The additional design work necessary to develop and complete the COL application will be completed in Phase 2 of the project. Phase 2 covers development of a final design for the demonstration nuclear reactor and plant through a competitive process, application for an NRC license to construct and operate the demonstration nuclear reactor, plant construction, and start up operations for the demonstration nuclear reactor and its associated electricity, process heat, and/or hydrogen production facilities. The additional Phase 2 design work necessary to support the COL application is currently expected to be completed in FY2013.

7. ***What is the applicant's current status (i.e., planning, in progress, or complete) for the RIS 2010-03 qualification of fuel and other major systems and components? Has a schedule been established for completing the qualification testing? If so, please describe.***

RESPONSE: As stated in Item 1 above, qualification of major systems and components is an integral activity that has been in progress since the early stages of the NGNP Project. Numerous research, development, and qualification activities are underway in support of HTGR design, licensing, and plant operation. These activities are intended to focus on many of the qualification issues that are expected to be addressed in the NRC's pending Advanced Reactor Research Plan.

As an example, the fuel qualification program for the NGNP Project has been ongoing for a number of years, and details of the schedule and plan are discussed in the INL's Advanced Gas Reactor (AGR) Fuel Development and Qualification Program. The objective of the AGR Fuel Development and Qualification Program is to qualify TRISO (TRi-ISotropic)-coated particle fuel for use in the HTGR being designed and licensed by the NGNP Project. Both pebble bed and prismatic block reactors employ TRISO fuel particles, which consist of a microsphere (i.e., kernel) of nuclear material encapsulated by multiple layers of pyrocarbon and a silicon carbide layer.

There are five elements in the AGR Fuel Development and Qualification Program: fuel manufacture, fuel irradiation, post-irradiation examination (PIE) and safety testing, fuel performance modeling, and fission product transport and source term. An NGNP Project licensing white paper covering the proposed fuel qualification process is currently nearing completion, and is planned for NRC submittal on the schedule noted in the response to Item 14 below.

8. ***What is the applicant's status (i.e., planning, in progress, or complete) in developing computer codes and models to perform design and licensing analyses? Has the applicant defined principal design criteria, licensing basis events, and other fundamental design/licensing relationships? Has a schedule been established for completing the design and licensing analyses? If so, please describe.***

RESPONSE: The NGNP Project is engaged in the design, construction, and operation of thermal-fluidic testing facilities to validate system and computational fluid dynamics software used for high temperature safety analysis and design. See the response to Item 9 below for additional details. In addition, NGNP Project licensing white papers are currently in progress, or planned, to address this area. A paper is currently in development that will describe the process to be used for establishing licensing basis events. This paper will be submitted to the NRC for review per the schedule provided in the response to Item 14 below. In addition, one of the key NGNP Project licensing white papers planned for future development is the description of the analytical code verification and validation (V&V) program. A submittal date (to the NRC) for the NGNP V&V white paper will be determined as part of the effort to develop the conceptual and detailed design for the NGNP.

**9. *What is the applicant's status in designing, constructing, and using thermal-fluidic testing facilities and using such tests to validate computer models? Has a schedule been established for completing the thermal-fluidic testing? If so, please describe.***

RESPONSE: The NGNP Project is engaged in the design, construction, and operation of thermal fluidic testing facilities. The main objective of this work is the validation of system and computational fluid dynamics software used for high temperature reactor safety analysis and design. These facilities and experiments cover a range of separate effects and integral phenomena that have been identified in the NGNP Phenomena Identification and Ranking Table (PIRT) as having a significant impact on one or more safety or performance parameters and possessing a high degree of uncertainty. The PIRT process provides an expert panel assessment of safety-relevant phenomena and identifies research and development (R&D) needs. The detailed PIRT exercises have been documented in NUREG/CR-6844 (July 2004) and NUREG/CR-6944 (March 2008). These data are further analyzed and reduced to an actionable level in the "Next Generation Nuclear Plant Gap Analysis Report" (ORNL/TM-2007/228, July 2008).

The two major integral test facilities are: 1) the High Temperature Test Facility (HTTF) being constructed at Oregon State University, and 2) the Natural Circulation Shutdown Test Facility (NSTF) being refurbished at Argonne National Laboratory. The HTTF will be used to simulate heat and thermal fluid transfer within and out of a prototypical high temperature reactor vessel under steady state and severe loss of forced cooling conditions. The NSTF will be used to simulate and study vessel cooling and ex-core heat transfer phenomena. Both of these facilities are scheduled to be available for testing in 2011.

**10. *What is the applicant's status in defining system and component suppliers (including fuel), manufacturing processes, and other major factors that can influence design decisions? Has a schedule been established for identifying suppliers and key contractors? If so, please describe.***

RESPONSE: The NGNP Project has implemented the Technology Readiness Level (TRL) process, which is a tool used by NASA and Department of Defense projects as part of the overall project risk management program. The reactor design suppliers have identified those Structures, Systems, and Components (SSCs) that have development needs with the potential to impact the NGNP Project. Plans and preliminary schedules to progress through the TRL maturity levels for those SSCs have been developed and documented as Technology Development Roadmaps (TDRMs) and associated Test Plans. The TDRMs and Test Plans, along with various technology development studies, also performed by the suppliers, such as for heat transport system and power conversion system alternatives, provide a preliminary overview of the current international status of large equipment suppliers, such as circulators and steam generators, and forging vendors to support the NGNP. This process may be utilized during the two project phases for making down-selections and selecting components, suppliers, and key contractors.

The NGNP Project is continuing to support the development and codifying of high temperature materials and manufacturing processes, such as diffusion bonding for heat

exchangers. This work is being performed in conjunction with, and within the overall goals of, the ASME as identified in their draft "Roadmap for the Development of ASME Code Rules for High Temperature Gas Reactors." Although firm schedules have not been established, the target is to support a 2021 deployment of the NGNP.

Reactor fuel manufacturing and supply/acquisition issues are addressed by various elements of the Advanced Gas Reactor Fuel Development and Qualification Program. A summary of the current status for fuel acquisition options will be provided in the NGNP Fuel Qualification Program White Paper listed in Item 14 below.

**11. What is the applicant's status (i.e., planning, in progress, complete) for implementing a business model, including identifying and securing funding sources, for the completion of design, testing, and licensing activities?**

RESPONSE: See the response to Item 1 above. Also, it should be noted that in accordance with EAct 2005, Section 988, a public-private government cost share program is planned for the NGNP Project's demonstration activities.

**12. What are the applicant's current staffing levels (e.g., full time equivalent staff) working on the design and testing of the reactor design? Does the applicant have plans to increase staffing, and if so, please describe future staffing plans.**

RESPONSE: See the response to Items 1 and 5 above for current overall project status. Future staffing levels will be better defined when the decision is made to move into Phase 2, and more detailed project planning is developed for Phase 2 of the project .

**13. What are the applicant's current and future plans for the use of contractors to support plant design and testing (e.g., how many part-time and how many full-time contractors does or will the applicant employ)?**

RESPONSE: See the responses to Items 1 and 5 above.

**White papers and technical/topical reports**

**14. What are the applicant's plans regarding the submittal of white papers or technical/topical reports related to features of their design or the resolution of policy or technical issues? Has a schedule been established for submitting such reports? If so, please describe.**

RESPONSE: To provide additional detail regarding project plans for implementing the NGNP licensing strategy described in Item 1 above, the DOE issued the NGNP Licensing Plan in June, 2009 (Reference c). The plan identifies those highest priority licensing topics that were deemed necessary for early interaction with the NRC staff to identify and resolve policy, regulatory, and key technical issues related to the NGNP Project. The Plan also describes a process to be used for addressing those topics with the NRC, via a series of licensing white paper submittals, NRC public meetings, and NRC disposition of

the identified issues. The first of those NGNP white papers, covering the topic of Defense in Depth, was submitted to the NRC for review on December 9, 2009, and was discussed in a public meeting at NRC Headquarters on March 10, 2010. Additional white papers are currently in development, and the NGNP Project team plans to submit them for NRC staff review as follows:

FY 2010, Third Quarter:

- a. NGNP High Temperature Materials
- b. NGNP Fuel Qualification Program
- c. NGNP Mechanistic Source Term

FY 2010, Fourth Quarter:

- d. NGNP Licensing Basis Event Selection Process
- e. NGNP Structures, Systems, and Components Classification Process

Submittal schedules for other key licensing white papers will be provided to the NRC Staff at a later date, as associated design activities proceed and future fiscal year resource allocations are established. Topical reports, which will form a portion of the COL application, are expected to be submitted to the NRC by the license applicant during Phase 2 of the project.

**15. For ESP applicants, will the applicant be seeking approval of either “proposed major features of the emergency plans” per 10 CFR 52.17(b)(2)(i), or “proposed complete and integrated emergency plans” per 10 CFR 52.17(b)(2)(ii)?**

RESPONSE: See the response to Item 4 above.