

July 6, 2012

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NRC Project #0748

U.S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D.C. 20555

SUBJECT: Contract No. DE-AC07-05ID14517 – Next Generation Nuclear Plant Submittal –  
Confirmation of Requested NRC Staff Positions – NRC Project # 0748

The Next Generation Nuclear Plant (NGNP) will be a commercial high-temperature gas-cooled reactor (HTGR) plant capable of producing electricity and high temperature process heat for a variety of energy intensive industries. It will be licensed by the Nuclear Regulatory Commission (NRC), consistent with the "NGNP Licensing Strategy – Report to Congress," dated August 2008. As a key part of the implementation process for that strategy, NGNP has been engaged in pre-licensing activities with NRC through a series of interactions that address high priority topics associated with NGNP licensing.

The Secretary of Energy confirmed in an October 2011 letter to Congress (Reference 1) that NGNP will continue to focus its near-term efforts and resources, in part, on interactions with NRC to develop a licensing framework for NGNP. The purpose of this letter is to identify specific areas where NGNP is requesting that NRC provide staff positions on key licensing topics, consistent with the Department of Energy (DOE) and NRC efforts to establish that licensing framework.

The NRC licensing process encourages early interactions to identify and resolve policy, regulatory, and key technical issues related to the proposed facility. Conducting effective interactions with NRC is a critical part of the NGNP licensing strategy because the early resolution of issues is key to the preparation of an acceptable license application, the subsequent application review schedule, and the ultimate deployment of NGNP. In keeping with this strategy, both DOE and NRC have previously agreed to focus efforts and resources on four key topics as summarized in a letter from the NRC to DOE (Reference 2). These four key topics are as follows:

- Containment functional performance
- Licensing basis event (LBE) selection
- Source terms
- Emergency planning

These topics represent the areas of greatest regulatory uncertainty for NGNP and the HTGR industry. As such, their resolution is critical to establishing the key parts of the NGNP licensing framework that will then allow a more clearly defined path to license application development and subsequent NRC review of that application. These topics were also discussed in SECY-10-0034, "Potential Policy, Licensing, and Key Technical Issues for Small Modular Nuclear Reactor Designs," as key issues to resolve in Fiscal Year 2011 or 2012 in order to support the further development of NGNP.

NRC working groups focused on NGNP licensing have previously completed assessments of key elements of the above four topics, based on submitted NGNP Project white papers and responses to NRC requests

for additional information regarding the proposals contained in those white papers. Results of those NRC assessments were communicated to NGNP via Reference 3.

Based on our dialogue with the staff and further clarification provided in the NGNP public meeting on April 16-17, 2012 (Reference 4), we understand that NRC intends to convert the content of the referenced working group assessments to reflect NRC staff positions. We also understand that the NRC plans for the appropriate Advisory Committee on Reactor Safeguards Subcommittee(s) to review those staff positions prior to their transmittal to NGNP. To support NRC's development of those staff positions, NGNP has thoroughly evaluated feedback provided in the assessment reports and has engaged the NRC in a series of working level meetings to specifically identify the policy and technical issue attributes to be addressed during the remainder of Calendar Year 2012. In addition, NGNP has completed its identification and prioritization of the technical and policy-related issues that can be usefully addressed through specific NRC interactions in 2012 to address the above key topics of containment functional performance, event selection, source terms, and emergency planning. A summary of the specific staff positions that NGNP is requesting in each of these four key focus areas is provided below.

## **Focus Areas and Requested NRC Staff Positions**

### ***1. Functional Containment Performance Requirements for NGNP***

#### Background

For an HTGR, radionuclide retention during normal operation and accident conditions will be highly dependent upon the ability of coated fuel particles to retain a majority of the fission products. Previous HTGR designs have relied on similar retention characteristics of coated particle fuel technology, and NGNP fuel qualification testing to date has demonstrated the feasibility of using the coatings of the fuel particles as the primary barriers to fission product release.

NGNP proposals in this topical area are aligned with staff conclusions made in SECY-95-299, "Issuance of the Draft of the Final Pre-application Safety Evaluation Report (PSER) for the Modular High-Temperature Gas-Cooled Reactor (MHTGR)" (excerpts below):

*If the overall safety of a plant design is improved ... by reducing the requirements on the containment and increasing the integrity of fuel on an advanced reactor design, then there is an incentive to improve the fuel and there is a basis for accepting a different containment design.*

*...the Commission decided that a conventional LWR, leak-tight containment should not be required for advanced reactor designs. It approved the use of containment functional design criteria for evaluating the acceptability of proposed containment designs rather than the use of prescriptive design criteria.*

#### Requested NRC Staff Positions

- a. Confirm plans being implemented by the Advanced Gas Reactor Fuel Development and Qualification Program are generally acceptable and provide reasonable assurance of the capability of coated particle fuel to retain fission products in a controlled and predictable manner. Identify any additional information or testing needed to provide adequate assurance of this capability, if required.

- b. Establish options regarding functional containment performance standards as requested by the Commission in the Staff Requirements Memorandum (SRM) to SECY-03-0047, "Policy Issues Related to Licensing Non-Light Water Reactor Designs," and discussed further in SECY-05-006, "Second Status Paper on the Staff's Proposed Regulatory Structure for New Plant Licensing and Update on Policy Issues Related to New Plant Licensing."
- c. Establish a staff position to support a final determination regarding how LBEs will be considered for the purpose of plant siting and functional containment design decisions, taking into consideration previous staff positions in SECY-95-299, that improved fuel performance is a justification for revising siting source terms and containment design requirements. In particular, we request that this staff position provide an adaptation of the guidance that has generally been applied to light water reactors (LWRs) for compliance with 10 CFR 100.21. (It is noted that for LWRs, this guidance has typically included the assumption of a substantial meltdown of the core with the subsequent release of appreciable quantities of fission products.) The NRC's development of the NGNP adaptation of this guidance, which should reflect the NGNP's unique event response characteristics, will rely heavily on the establishment of the NRC staff positions associated with Focus Areas 2 and 3 below.

## ***2. Licensing Basis Event Selection for NGNP***

### **Background**

For NGNP, NRC staff will need to consider a different set of accidents than those considered for large LWRs to provide a basis for selecting mechanistic siting source terms, for judging the adequacy of design features for radionuclide retention such as the functional containment design, and for the offsite emergency planning and emergency planning zone (EPZ) distances.

### **Requested NRC Staff Positions**

- a. Establish and endorse a structured, risk-informed, performance-based approach for selecting and categorizing licensing basis events as they may occur over a broad spectrum from normal operation to rare, off-normal events. The approach should address the concept of adequate protection through an appropriate balance between defense-in-depth and risk considerations. In developing staff positions on this approach, NRC is requested to:
  - Agree with the placement of top level regulatory criteria (TLRC) on a frequency-consequence (F-C) curve.
  - Establish frequency ranges based on mean event sequence frequency for the LBE event categories.
  - Endorse the "per plant-year" method for addressing risk at multi-reactor module plant sites.
  - Agree on key terminology and naming conventions for event categories.
  - Agree on the frequency cutoffs for the Design Basis Event (DBE) and Beyond Design Basis Event (BDBE) regions.
  - Endorse the overall process for performing assessments against TLRC, including issues with uncertainties and the probabilistic risk assessment (PRA), the calculational methodologies to be employed (conservative vs. best estimate), and the adequate incorporation of deterministic elements.

- Endorse the proposed process and categorizations for structures, systems, and components (SSC) classification.

### ***3. Establishing Mechanistic Source Terms for NGNP***

#### Background

Source terms are used for the assessment of dose to workers and the public, comparison against regulatory dose criteria, and assessment of equipment reliability and capability.

As discussed in SECY-10-0034 and the footnotes in 10 CFR 52.79(a), the current regulations on siting are based on a deterministic evaluation of a large fission product release from a substantially melted core to an intact reactor containment building, with design leakage to the environment, and calculation of cumulative dose to a reference person at two different locations offsite. The staff stated in SECY-10-0034 that these accident assumptions may not be applicable to HTGRs and for some small modular reactor (SMR) designs, which may call into question the applicability of the dose criteria as well.

#### Requested NRC Staff Positions

- a. Endorse the proposed NGNP mechanistic source terms definition - the quantities of radionuclides released from the reactor building to the environment during the spectrum of LBEs, including timing, physical and chemical forms, and thermal energy of the release.
- b. Agree that NGNP source terms are event specific and determined mechanistically using models of radionuclide generation and transport that account for fuel and reactor design characteristics, passive features, and the radionuclide release barriers.
- c. Agree that NGNP has adequately identified the key HTGR fission product transport phenomena and has established acceptable plans for evaluating and characterizing those phenomena and associated uncertainties.

### ***4. Development of an Emergency Planning and EPZ Distances for NGNP***

#### Background

Work dating to 1978 established the basis for the current plume exposure pathway EPZ (of about 10 miles) and an ingestion exposure pathway EPZ (of about 50 miles) for existing large LWRs. As NRC codified these EPZ definitions, an allowance in the regulation was included noting that the size of the EPZ could also be determined on a case-by-case basis for gas-cooled nuclear reactors and for reactors with an authorized power level less than 250 MWt.

In SECY-11-0152, "Development of an Emergency Planning and Preparedness Framework for Small Modular Reactors," NRC staff discussed its intent to develop a technology-neutral, dose-based, consequence-oriented emergency preparedness (EP) framework for SMR sites that takes into account the various designs, modularity, and co-location, as well as the size of the EPZ. This planned path forward generally aligns with the NGNP proposal provided in its white paper submittal on this topic (Reference 5) that was discussed with the NRC staff in a subsequent public meeting (Reference 6).

Requested NRC Staff Positions

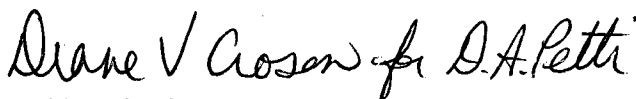
Develop a technology-neutral, dose-based EP framework that takes into account the modular HTGR design and its co-location with industrial processes to determine the appropriate size of the EPZ considering the proposals contained in the NGNP white paper above. Specifically, NGNP requests that the NRC:

- a. Propose a new policy or revised regulations for how the emergency planning zone sizing can be scaled to be commensurate with the accident source term, fission product release, and associated dose characteristics. Key issues include:
  - Using NGNP's proposed risk-informed, performance-based approach to calculate the frequency of exceeding Protective Action Guideline (PAG) values as a function of distance from the plant for a spectrum of accidents.
  - Establishing criteria for determining the point at which the frequency of exceeding the PAG values is acceptably low.
- b. Establish guidance for how specific emergency planning requirements in 10 CFR 50 can be applied with a graded approach, when compared to current emergency plans for LWRs, that allows for site and offsite emergency plans to be developed commensurate with the NGNP design and a plume exposure EPZ at a distance from the plant for which the PAG values are demonstrated to be met (e.g., approximately 400 meters from the reactor centerline).
- c. Propose guidance regarding how issues related to modularity of the designs and the co-location of multi-module plants near industrial facilities should be considered in EP planning.

NGNP will continue to support a focused path to resolution of these key licensing framework topics through regular NRC interactions, consistent with plans made as a result of the DOE and NRC efforts described in Reference 2. In support of that path, NGNP requests that NRC identify information necessary for establishment of the requested staff positions, so that a schedule of remaining NRC and NGNP actions, milestones, and deliverables for calendar year 2012 can be established.

If you have any questions or require additional information regarding this request, please contact me at (208) 526-7735 or Jim Kinsey, Director of Regulatory Affairs, at (208) 569-6751.

Sincerely,



David Petti, Director  
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JCK:DES

References:

1. Letter, Secretary of Energy to Congress - Chairman, Subcommittee on Energy and Water Development, dated October 17, 2011

2. Letter, NRC to DOE, "Next Generation Nuclear Plant – Planning Steps In View of White Paper Assessment Results," dated February 15, 2012 (ADAMS Accession ML120240682)
3. Letter, NRC to the NGNP Project, February 15, 2012, "Next Generation Nuclear Plant – Assessment of White Papers on Fuel Qualification, Mechanistic Source Terms, Defense-In-Depth Approach, Licensing Basis Event Selection, and Safety Classification of Systems, Structures, and Components," (ADAMS Accession ML120240651)
4. NRC Summary of April 16-17, 2012, "Public Meetings on Risk-Informed Performance-Based Licensing Approach and Fuel Qualification and Mechanistic Source Terms for the Next Generation Nuclear Plant Project," (ADAMS Accession ML12132A467)
5. Letter, NGNP to NRC, October 28, 2010, "Contract No. DE-AC07-05ID14517 – Next Generation Nuclear Plant Project - Determining the Appropriate Emergency Planning Zone Size and Emergency Planning Attributes for an HTGR – NRC Project #0748," (ADAMS Accession ML103050268)
6. NGNP Public Meeting Presentation, January 26, 2011, "Determining the Appropriate Emergency Planning Zone Size and Emergency Planning Attributes for an HTGR," (ADAMS Accession ML110390622)

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