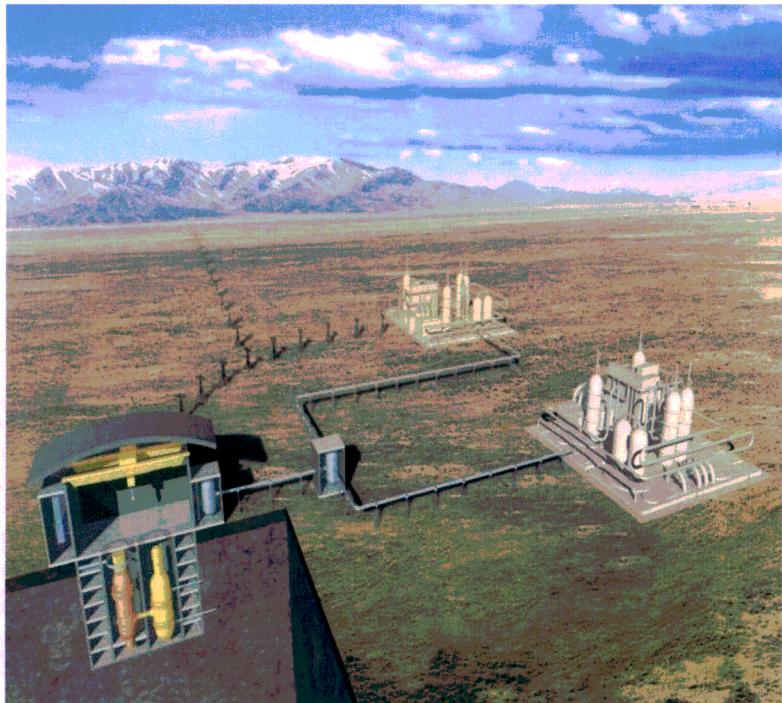


NGNP Engineering White Paper: Licensing & Permitting Special Study

Mark R. Holbrook

April 2007



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Mark R. Holbrook

April 2007

**Idaho National Laboratory
Next Generation Nuclear Plant Project
Idaho Falls, Idaho 83415**

**Prepared for the
U.S. Department of Energy
Office of Nuclear Energy
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14517**

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Executive Summary

The purpose of this white paper is to summarize and compare the different Next Generation Nuclear Plant (NGNP) licensing recommendations provided by the three subcontractors. Only one of the subcontractors (Westinghouse) was tasked to develop a licensing special study. However, the other subcontractors have provided limited information on their licensing suggestions that will be integrated into their pre-conceptual design products. This information has been included, where available. Recommendations based on the available licensing information are as follows:

- Continue to assume (as stated in the Preliminary Project Management Plan) that the two-step Part 50 licensing process will be used unless Westinghouse develops a cogent schedule based on the Part 52 process that meets the 2018 completion date.
- Continue to assume use of an Early Site Permit (ESP) with the two-step Part 52 process. However, after the pre-conceptual design studies are complete, conduct internal and external discussions to reevaluate the usefulness of this mixed licensing approach.
- Focus research & development (R&D) and engineering efforts during the conceptual design phase to 1) identify the design's safety analysis data needs, 2) evaluate where the license by test (LBT) approach is beneficial, 3) determine what type of integrated test program would be required, and 4) assess the potential impacts on the plant design.
- Conduct additional licensing discussions with subcontractors to determine the feasibility of developing a licensing strategy that allows for maximum flexibility in the configuration of the process heat applications for subsequent commercial applications of NGNP technologies.
- Initiate development of an Environmental Permitting Plan (EPP) during the conceptual design phase.
- Continue to monitor the PBMR Design Certification review discussions with the Nuclear Regulatory Commission (NRC) to gain experience in application of probabilistic risk assessments (PRA) in licensing products and to improve our overall understanding of risk-influenced licensing strategies.

NGNP Engineering White Paper: Licensing & Permitting Special Study

Introduction

Westinghouse was requested to prepare a study that compares licensing the NGNP under NRC regulations 10 CFR Part 50 vs. use of 10 CFR Part 52. The advantages and disadvantages of each approach and the risks associated with each approach were requested. Also, the following issues were to be evaluated:

- The feasibility of using Part 52 for development of an ESP and Part 50 for licensing the reactor facility (construction permit and operating license),
- The availability and pros and cons of using the new advanced reactor licensing framework (to become Part 53) being developed by the NRC,
- The feasibility of applying a “license by test” philosophy for obtaining an NRC license for the NGNP demonstration facility,
- Identify the issues and recommend an approach for licensing an integrated nuclear facility/hydrogen production plant,
- Identify applicable Environmental Protection Agency (EPA) and State permit requirements associated with construction and operation of an integrated nuclear facility/hydrogen production plant,
- Develop an approach for integrating PRA methodologies early into the design process so that the reactor facility design is optimized from a safety perspective, and
- Integrate licensing considerations while performing economic assessments and construction scheduling.

Of the three contractors (Westinghouse, AREVA, and General Atomics), only Westinghouse was tasked to perform a licensing special study. However, the other two contractors were directed to consider licensing issues associated with the NGNP that were to be incorporated into their respective preconceptual design studies reports. The licensing work scope for these two contractors is provided below.

AREVA

AREVA was requested to perform engineering and design activities for the NGNP pre-conceptual design and preliminary planning for permitting and licensing their recommended design for NGNP. This was to include establishment of NGNP safety strategy, licensing and permitting provisions and evaluation of overall nuclear system operation. The Preconceptual Design Studies Report will describe the AREVA NGNP Team’s recommended licensing strategy, but the decision process and evaluation of alternatives will not be described.

General Atomics

General Atomics was asked to develop a strategy for licensing their recommended design for NGNP under 10 CFR Part 50 vs. 10 CFR Part 52, and to evaluate these evolving licensing and regulatory requirements. This included:

- Considering the feasibility of using Part 52 for development of an ESP and Part 50 for licensing the reactor facility,
- Evaluate the availability and pros and cons of using the new advanced reactor licensing framework being developed by the NRC (to become Part 53),
- Evaluation of the feasibility of applying a “license by test” philosophy for obtaining an NRC license for the NGNP demonstration facility,
- Identify the issues and recommend an approach for licensing an integrated nuclear facility/hydrogen production plant,
- Identify applicable EPA and State permit requirements associated with construction and operation of an integrated nuclear facility/hydrogen production plant.
- Perform a Preliminary Hazard Assessment (PHA) that defines the hazard levels associated with the high-temperature heat transport system and hydrogen plant, and chemical systems in the hydrogen plant, and
- Integrate licensing considerations into construction scheduling.

Summary of the Results

The following table provides a side-by-side comparison of the licensing recommendations provided by the three subcontractors. As noted above, only one of the subcontracts (Westinghouse) included a licensing special study. However the other subcontractors are addressing similar licensing issues as they develop their pre-conceptual designs. Therefore, the table organizes the key licensing issues in accordance with the Westinghouse special study work scope (see above) and includes corresponding information from the other two subcontractors, where currently available. Sources for the non-Westinghouse licensing data include presentation slides provided as part of the 50% Special Studies meetings and system requirements manuals.

Licensing Task	Westinghouse Special Study	AREVA Licensing Presentation	General Atomics
Should we use Part 50 or Part 52 to license the NGNP?	Use Part 52 to obtain an ESP with an embedded Limited Work Authorization (LWA) followed by a COL. Maintain a Part 50 fallback strategy for a two-step license pending the success of the pre-application interactions.	Utilize Part 50 two-step licensing rule to obtain a Limited Work authorization (LWA) and Construction Permit (CP) by 2011. Use Part 50 Rules w/ exceptions and conditions and obtain Operating License (OL) by 2018.	Licensing the prototype NGNP facility in accordance with 10CFR50 is the preferred option. Part 50 and its associated guidance are well understood; The 2-step process supports plant construction activities in parallel with the evolution of the final design.
Feasibility of using Part 52 ESP with Part 50 two-step process	If the fallback Part 50 approach is applied, this option can be exercised with or without an optional LWA prior to issuance of the ESP. Provides early site approval and allows early site work.	AREVA's Part 50 strategy recommendation includes obtaining an Early Site Permit (ESP) under Part 52.	Licensing under 10CFR52, while possible, may not be advantageous for initial licensing of the prototype NGNP production facility.
Evaluate pros and cons for using new Part 53 advanced reactor licensing framework	The time-frame for the rule is inconsistent with the development of a licensing application for the NGNP under Part 52, since there will not be a final rule against which the application can be reviewed. Moreover, the review of the first application for a particular reactor design type under Part 53 will be especially difficult since there is no experience that shows how compliance of an application can be evaluated against the expected technology-neutral regulatory requirements. Therefore, implementation of Part 53 is not recommended.	Support the NRC's development of the new licensing framework, but not rely on it for prototype licensing. Develop bases and exercise Part 53.	Licensing under 10CFR53, while promising, does not appear to be a viable near-term option.

Licensing Task	Westinghouse Special Study	AREVA Licensing Presentation	General Atomics
<p>Practicality of using the "license by test" concept</p>	<p>Consider selective use of license by test (LBT). Implementation of the EMDAP process would identify what additional data is required to adequately support approval of the evaluation models. Then a cost/benefit/risk study would be performed to determine what data should be generated by LBT. The studies would evaluate the tradeoff with required instrumentation, design changes, and potential power level limitations. The end result would be to use LBT selectively only when justified by risks and benefits. Finally, any LBT would more than likely be included in the ITAAC, increasing the steps toward achieving full power operation.</p>	<p>Not addressed by licensing presentation.</p>	<p>License by test does not appear viable. It is considered to be a high-risk option because the testing could create severe stress on the systems, structures, and components, requiring repair and analysis.</p>
<p>Identify approach for licensing an integrated nuclear/hydrogen facility</p>	<p>Licensing of an integrated nuclear power / hydrogen plant must address the regulations that apply to each plant plus consideration of potential interactions between the plants. Each plant design should initially meet its own regulatory criteria. In addition, the transient and accident consequences of potential interfacing events should have sufficiently limited impact on the other plant so that the combined regulations for both plants are met. Finally, depending on normal plant operation, safety system operation, transient/accident consequences and required operator actions, some regulatory criteria for one plant may apply to the other plant. Establish and demonstrate the licensing requirements commensurate with the chosen hydrogen production design(s) reflecting separation distance and facility interactions stemming from such design(s).</p>	<p>Not addressed by licensing presentation.</p>	<p>Not addressed by licensing presentation.</p>

Licensing Task	Westinghouse Special Study	AREVA Licensing Presentation	General Atomics
Identify EPA and State permits	EPA, State and local permitting are not expected to present any significant licensing impediment for the NGNP. Develop an Environmental Permitting Plan (EPP) to ensure that permits that are required prior to procurement of construction materials and the commencement of construction will be obtained in a timely manner to avoid negative schedule impacts on the overall schedule. The EPP will also ensure that environmental permits required prior to operations will be obtained in a timely manner to avoid the situation of having the facility completed and ready for operation, but having these permits as a constraint on such operation.	Not addressed by licensing presentation.	General Atomics noted that air quality, water quality, and waste management permits will be required. They noted that the environmental permitting process was estimated to require 3 to 4 years at a cost of \$9 to \$12 million.
Approach of integrating PRA into the design process	Build on PBMR (Pty) Ltd–NRC pre-application interactions, including adoption of the PRA methodology for HTGR/MHTGR/PBMR to the NGNP to the maximum degree possible, including selection of licensing basis events (LBEs), classification of systems, structures, and components (SSCs), and implementation of the DID principles. Build on specific PRA system models for HTGR/MHTGR/PBMR wherever model similarities between the plants allow. Develop new models that may be needed for the NGNP.	Not addressed by licensing presentation.	System Requirements Manual: The NGNP license application shall be supported by a full-scope probabilistic risk assessment analysis for internal and external events. The analysis shall be conducted in accordance with the requirements of either 10 CFR 50 or 10 CFR 52.

Conclusions

Use Part 50 or Part 52?

AREVA and General Atomics both recommend using NRC Part 50 two-step licensing process to obtain an operating license by 2018. Westinghouse recommends using the one-step Part 52 licensing process with a fallback alternative to use Part 50, if necessary.

While it is desirable to use Part 52 to reduce risk, it is not clear that using Part 52 will allow development of a rational schedule that supports plant startup by 2018, because the design must be complete before the licensee can submit a combined operating license (COL) application. In addition, construction is delayed until the COL is reviewed and approved by the NRC. Unfortunately, Westinghouse will not have an integrated schedule available until their final products are complete. So, it is difficult to understand how the 2018 completion date can be met until the schedule assumptions are reviewed. It's interesting to note that Westinghouse hedged their bets by identifying use of a two-step Part 50 process in case pre-application discussions with the NRC don't go well.

Use Early Site Permit (ESP) with Part 50 Process?

If Part 50 is used, both Westinghouse and AREVA recommend that an Early Site Permit (ESP) be obtained to reduce risk and allow partial site preparation. Neither subcontractor identified any regulatory issues that would prevent use of this mixed approach. The limited information available from General Atomics did not address this option.

Developing an ESP application has some advantages; however, as the project schedule becomes more compressed due to funding issues, the advantages become minimal. The commercial industry is not in total agreement concerning the usefulness of ESPs, especially if a project for a given site is planned for completion in the near term. After further consideration and initial discussions with the NRC, we may find that it is more efficient to include all of the environmental information as part of a standard construction permit application.

Consider Use of Part 53?

All three of the subcontractors agree that new Part 53 technology-neutral advanced reactor licensing framework will not be developed in time to be used to license the NGNP demonstration plant. This recommendation is appropriate. In addition, it would be appropriate to look for opportunities to assist the NRC with Part 53 development, possibly through exercising the framework in some fashion.

Should We Consider "License by Test"?

Westinghouse recommends a selective use of the license by test (LBT) concept, based on results from studies to determine what data will be needed and cost/benefit analyses to determine where LBT is best used. The limited information available from General Atomics noted that they did not believe that the LBT concept was feasible. This issue was not addressed by AREVA.

It is beneficial to consider the Westinghouse recommendation with the understanding that this type of testing may lead the NRC to impose additional restrictions on the demonstration plant design to account for plant performance uncertainties to ensure that public safety is maintained.

Approach for Licensing an Integrated Nuclear/Hydrogen Facility

Westinghouse proposed a method for addressing the licensing requirements for each individual plant and then to consider any interactions that may occur that would exceed the regulatory limits that govern the individual plant. This issue was not addressed in the available materials from AREVA and General Atomics.

It is highly desirable to have the licensing of the nuclear plant be independent of the process heat systems. Meeting this objective would allow for maximum flexibility of facility design and increase the NGNP's ability to adapt to a wide range of process heat applications (e.g., hydrogen production, oil extraction from tar sands, or syn-fuel generation). None of the three subcontractors has suggested a reactor licensing approach that addresses this issue.

Identify EPA and State Permits

Westinghouse recommends development of an Environmental Permitting Plan (EPP) to ensure that required permits will be obtained in a timely manner to avoid negative schedule impacts on the overall schedule. The EPP will also ensure that environmental permits required prior to operations will be obtained in a timely manner. This issue was not addressed in the available materials from AREVA. General Atomics noted that the effort was estimated to require 3 to 4 years at a cost of \$9 to \$12 million.

Integration of Probabilistic Risk Assessment (PRA) Methods

Westinghouse and General Atomics agree that a full-scope probabilistic risk assessment (PRA) be developed for the NGNP demonstration plant. Westinghouse provides more detail; in that the PRA should be used for selection of licensing basis events, selection of safety related equipment, and implementation of defense in depth principles. This approach can be used with either the Part 50 or Part 52 licensing process. In addition, this approach is consistent with current industry efforts to implement PRA techniques as part of NRC licensing activities (e.g., PBMR Design Certification).

The Westinghouse recommendations are acceptable. Note that this approach is consistent with the PRA licensing discussion in the Preliminary Project Management Plan.

Recommendations

- Continue to assume (as stated in the Preliminary Project Management Plan) that the two-step Part 50 licensing process will be used unless Westinghouse develops a cogent schedule based on the Part 52 process that meets the 2018 completion date.
- Continue to assume use of an ESP with the two-step Part 52 process. However, after the pre-conceptual design studies are complete, conduct internal and external discussions to reevaluate the usefulness of this mixed licensing approach.
- Focus R&D and engineering efforts during the conceptual design phase to 1) identify the design's safety analysis data needs, 2) evaluate where the LBT approach is beneficial, 3) determine what type of integrated test program would be required, and 4) assess the potential impacts on the plant design.
- Conduct additional licensing discussions with subcontractors to determine the feasibility of developing a licensing strategy that allows for maximum flexibility in the configuration of the process heat applications for subsequent commercial applications of NGNP technologies.

- Initiate development of an Environmental Permitting Plan (EPP) during the conceptual design phase.
- Continue to monitor the PBMR Design Certification review discussions with the NRC to gain experience in application of PRA in licensing products and to improve our overall understanding of risk-influenced licensing strategies.

May 22, 2007

CCN 209674

Mr. T. L. Cook
NGNP Project Manager
NE- 33
U.S. Department of Energy
19901 Germantown Road
Germantown, MD 20874

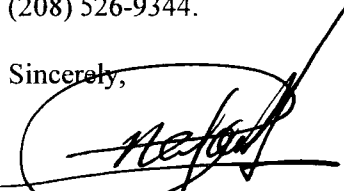
SUBJECT: Contract No. DE-AC07-05ID14517 – Milestone Completion for G-IN07NG0701, “Issue Summary Report on Next Generation Nuclear Plant Project Special Studies”

Dear Mr. Cook:

This letter submits seven white papers (enclosed) that summarize the results of Special Studies performed as part of the Next Generation Nuclear Plant (NGNP) Pre-Conceptual Design work. This submittal satisfies the requirements of NGNP Project M1 Milestone ID 6356: “Issue Completed Special Studies” under Work Package: G-IN07NG07, “NGNP Pre-Conceptual Design Studies.”

If you have any questions, please contact me at (208) 526-4250 or Larry Demick, NGNP Director, Engineering (208) 526-9344.

Sincerely,

A handwritten signature in black ink, appearing to read "Rafael Soto", is written over a circular scribble.

Rafael Soto, Deputy Project Director
Next Generation Nuclear Plant Project

LD:cn

Enclosures:

1. NGNP Engineering White Paper: Reactor Type Trade Study
2. NGNP Engineering White Paper: Power Level Trade Study
3. NGNP Engineering White Paper: NGNP Project Pre-Conceptual Heat Transfer and Transport Studies
4. NGNP Engineering White Paper: Power conversion System Trade Study
5. NGNP Engineering White Paper: Primary and Secondary Cycle Trade Study
6. NGNP Engineering White Paper: Licensing and Permitting Special Study
7. NGNP Engineering White Paper: By-Products Trade Study

cc: M. L. Adams, DOE-ID, MS 1221
A. Clark, INL, MS 3695 (w/o Enc.)
C. P. Fineman, DOE-ID, MS 1235
P. Hildebrandt, INL, MS 3780
L. A. Sehlke, INL, MS 3810
R. M. Versluis, DOE-HQ

Mr. T. L. Cook
May 22, 2007
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Page 2

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Cheryl A
Noble/NOB/CC01/INEEL/US

06/04/2007 01:09 PM

To: Julie S Banks/BANKSJS/CC01/INEEL/US@INEL

cc

bcc

Subject: Fw: Milestone Completion for G-IN07NG0701, "Issue Summary Report on Next Generation Nuclear Plant Project Special Studies"

Record



Cheryl Noble
Executive Administrative Assistant to the Project Director for
Next Generation Nuclear Plant Project

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----- Forwarded by Cheryl A Noble/NOB/CC01/INEEL/US on 06/04/2007 01:09 PM -----



"Cook, Trevor"
<TREVOR.COOK@nuclear.energy.gov>

06/04/2007 12:52 PM

To: "Rafael Soto" <Rafael.Soto@inl.gov>

cc: "Furstenau, Raymond V (NE-ID)" <fursterv@id.doe.gov>, "Henderson, David (NE-ID)" <henderad@id.doe.gov>, "Adams, Michael L (NE-ID)" <adamsm@id.doe.gov>, "Art Clark" <Art.Clark@inl.gov>, "Fineman, Clifford P (NE-ID)" <finemacp@id.doe.gov>, "Phil Hildebrandt" <Phil.Hildebrandt@inl.gov>, "Lisa A Sehlke" <Lisa.Sehlke@inl.gov>, robert.versluis@nuclear.energy.gov, "O'Connor, Tom" <Tom.Oconnor@nuclear.energy.gov>

Subject: RE: Milestone Completion for G-IN07NG0701, "Issue Summary Report on Next Generation Nuclear Plant Project Special Studies"

This email acknowledges receipt and acceptance of the referenced report. The milestone "Issue Summary Report on Next Generation Nuclear Plant Project Special Studies" is hereby closed.

One important comment, in the future, when the INL places multiple contracts seeking evaluations, a common set of evaluation criteria should be provided to each contractor.

Trevor Cook
NGNP Program Manager
301 903 7046

From: Cheryl A Noble [<mailto:Cheryl.Noble@inl.gov>] **On Behalf Of** Rafael Soto

Sent: Tuesday, May 22, 2007 6:54 PM

To: Cook, Trevor

Cc: Furstenau, Raymond V (NE-ID); Henderson, David (NE-ID); Adams, Michael L (NE-ID); Art Clark; Fineman, Clifford P (NE-ID); Phil Hildebrandt; Lisa A Sehlke; robert.versluis@nuclear.energy.gov

Subject: Milestone Completion for G-IN07NG0701, "Issue Summary Report on Next Generation Nuclear Plant Project Special Studies"

Trevor,

Attached is the transmittal letter and enclosed white papers for Milestone Completion for G-IN07NG0701 - *"Issue Summary Report on Next Generation Nuclear Plant Project Special Studies."* This letter and enclosed white papers satisfies the Level 1 Milestone and associated deliverables.

Please let me know if you have any questions or comments.

Rafael

Rafael
Soto/RS2/CC01/INEEL/US
Sent by: Cheryl A Noble

05/22/2007 04:54 PM

To trevor.cook@nuclear.energy.gov

cc FURSTERV@ID.DOE.GOV, HENDERAD@ID.DOE.GOV,
ADAMSML@ID.DOE.GOV, Art
Clark/CLARKA/CC01/INEEL/US@INEL,
bcc Julie S Banks/BANKSJS/CC01/INEEL/US

Subject Milestone Completion for G-IN07NG0701, "Issue Summary
Report on Next Generation Nuclear Plant Project Special
Studies"

Trevor,

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Please let me know if you have any questions or comments.

Rafael



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