May 29, 2009

Ms. Sandra Sloan
Manager
AREVA NP, Inc.
3315 Old Forest Road
P.O. Box 10935
Lynchburg, VA 24506-0935

SUBJECT: NRC AUDIT REPORT RELATED TO THE U.S. EPR DESIGN CERTIFICATION APPLICATION CHAPTER 19 REVIEW (DOCKET NO. 52-020)

Dear Ms. Sloan:

Over the course of several days in 2008 and 2009, members of the Probabilistic Risk Assessment Licensing, Operations Support and Maintenance Branches 1 and 2 (SPLA and SPLB) audited supporting documents related to Chapter 19 of the AREVA NP Inc. (AREVA) U.S. EPR design certification (DC) application at the AREVA facility in Rockville, Maryland. The enclosed report presents the details of that activity.

The U.S. Nuclear Regulatory Commission (NRC) Probabilistic Risk Assessment (PRA) staff audited dozens of documents that describe U.S. EPR probabilistic risk assessment and severe accident analysis. These documents are first-tier references in Chapter 19 of the docketed U.S. EPR Final Safety Analysis Report (FSAR) and include a level of detail higher than is required in the FSAR. However, auditing such information allows the staff to conduct its review more efficiently. Specifically, the staff gains a better understanding of the basis underlying the formal application and identifies areas where additional information should be submitted to allow a licensing decision on the application.

As a result of the audit, the staff wrote a number of requests for additional information (RAI) to ensure that information needed for the staff's safety decision is properly included in the U.S. EPR docket file. These questions have been sent to AREVA as RAIs 22, 45, 54, 120, 133, and 138 (Agencywide Documents Access and Management System (ADAMS) accession numbers ML081910717, ML082340029, ML082350092, ML083110177, ML083120545, and ML083280064). Future RAIs may also result from the audit. The staff will refer to the FSAR, RAI responses, and the enclosed report, but not to the detailed documents reviewed at AREVA's site, in its safety evaluation of the U.S. EPR.

In accordance with Section 2.390, "Public inspections, exemptions, requests for withholding," of Title 10 of the *Code of Federal Regulations* Part 2, "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders," a copy of this letter, and its enclosures will be made available for public inspection at the NRC's Public Document Room, located at One White Flint North, Public File Area O1 F21, 11555 Rockville Pike (first floor), Rockville, Maryland, and via

the ADAMS Public Electronic Reading Room on the Internet at the NRC Web site, http://www.nrc.gov/reading-rm/adams.html.

If you have any questions regarding this matter, please contact me at 301-415-3361.

Sincerely,

/RA/

Getachew Tesfaye, Sr. Project Manager
EPR Projects Branch
Division of New Reactor Licensing
Office of New Reactors

Docket No.: 52-020

Enclosure:
As stated

cc: see next page

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NAME	PChowdhury	JMcLellan	PHearn	JRycyna
DATE	05/19/09	05/19/09	05/20/09	05/20/09
OFFICE	DNRL/NARP:PM	DSRA/SPLA	DNRL/NARP:BC	
NAME	GTesfaye	LMrowca	MMiernicki for JColaccino	
DATE	05/22/09	05/26/09	05/29/09	

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DC AREVA - EPR Mailing List (Revised 05/13/2009)

cc:

Mr. Glenn H. Archinoff
AECL Technologies
481 North Frederick Avenue
Suite 405
Gaithersburg, MD 20877

Ms. Michele Boyd
Legislative Director
Energy Program
Public Citizens Critical Mass Energy
and Environmental Program
215 Pennsylvania Avenue, SE
Washington, DC 20003

Dr. Charles L. King
Licensing Manager, IRIS Project
Westinghouse Electric Company
Science and Technology Department
20 International Drive
Windsor, CT 06095

Ms. Sherry McFaden
Framatome NP, Inc.
3315 Old Forest Road, OF-16
Lynchburg, VA 24501

Mr. Steve Seitz
AREVA
100 Dean Road
East Lyme, CT 06333

Mr. Tom Sliva
7207 IBM Drive
Charlotte, NC 28262

Mr. Robert E. Sweeney
IBEX ESI
4641 Montgomery Avenue
Suite 350
Bethesda, MD 20814

Mr. Gary Wright, Director
Division of Nuclear Facility Safety
Illinois Emergency Management Agency
1035 Outer Park Drive
Springfield, IL 62704

DC AREVA - EPR Mailing List

Email

APH@NEI.org (Adrian Heymer)
awc@nei.org (Anne W. Cottingham)
BrinkmCB@westinghouse.com (Charles Brinkman)
carey.fleming@constellation.com (Carey Fleming)
chris.maslak@ge.com (Chris Maslak)
christian.clement@unistarnuclear.com (Chrisitan Clement)
cwaltman@roe.com (C. Waltman)
david.hinds@ge.com (David Hinds)
david.lewis@pillsburylaw.com (David Lewis)
erg-xl@cox.net (Eddie R. Grant)
gcesare@enercon.com (Guy Cesare)
greg.gibson@unistarnuclear.com (Greg Gibson)
greshaja@westinghouse.com (James Gresham)
james.beard@gene.ge.com (James Beard)
james.p.mcquighan@constellation.com (Jim McQuighan)
jason.parker@pillsburylaw.com (Jason Parker)
jerald.head@ge.com (Jerald G. Head)
jgutierrez@morganlewis.com (Jay M. Gutierrez)
jim.riccio@wdc.greenpeace.org (James Riccio)
JJNesrsta@cpsenergy.com (James J. Nesrsta)
John.O'Neill@pillsburylaw.com (John O'Neill)
Joseph_Hegner@dom.com (Joseph Hegner)
junichi_uchiyama@mnes-us.com (Junichi Uchiyama)
KSutton@morganlewis.com (Kathryn M. Sutton)
kwaugh@impact-net.org (Kenneth O. Waugh)
lchandler@morganlewis.com (Lawrence J. Chandler)
Marc.Brooks@dhs.gov (Marc Brooks)
maria.webb@pillsburylaw.com (Maria Webb)
mark.beaumont@wsms.com (Mark Beaumont)
matias.travieso-diaz@pillsburylaw.com (Matias Travieso-Diaz)
mbowling@numarkassoc.com (Marty Bowling)
media@nei.org (Scott Peterson)
mike_moran@fpl.com (Mike Moran)
MSF@nei.org (Marvin Fertel)
mwetterhahn@winston.com (M. Wetterhahn)
nirsnet@nirs.org (Michael Mariotte)
patriciaL.campbell@ge.com (Patricia L. Campbell)
paul.gaukler@pillsburylaw.com (Paul Gaukler)
Paul@beyondnuclear.org (Paul Gunter)
pshastings@duke-energy.com (Peter Hastings)
RJB@NEI.org (Russell Bell)
RKTemple@cpsenergy.com (R.K. Temple)
Ronda.pederson@areva.com (Ronda Pederson)
rrsgarro@pplweb.com (Rocco Sgarro)

DC AREVA - EPR Mailing List

russell.wells@areva.com (Russell Wells)
sabinski@suddenlink.net (Steve A. Bennett)
sandra.sloan@areva.com (Sandra Sloan)
sfrantz@morganlewis.com (Stephen P. Frantz)
stephan.moen@ge.com (Stephan Moen)
Steve.Graham@hse.gsi.gov.uk (Steve Graham)
steven.hucik@ge.com (Steven Hucik)
tkkibler@scana.com (Tria Kibler)
tlharpster@pplweb.com (Terry Harpster)
tom.miller@hq.doe.gov (Tom Miller)
trsmith@winston.com (Tyson Smith)
Vanessa.quinn@dhs.gov (Vanessa Quinn)
VictorB@bv.com (Bill Victor)
vijukrp@westinghouse.com (Ronald P. Vijuk)
Wanda.K.Marshall@dom.com (Wanda K. Marshall)
wayne.marquino@ge.com (Wayne Marquino)
whorin@winston.com (W. Horin)

U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NEW REACTORS
DESIGN CERTIFICATION AUDIT

Report No: 05200020-2008-001

Organization: AREVA NP Inc.

Applicant Contacts: Ronda Pederson
Deputy Licensing Manager
AREVA NP Inc.
3315 Old Forrest Road
P.O. Box 10935
Lynchburg, VA, 24506-0935

Nuclear Industry: AREVA NP Inc., designs, builds, and starts up nuclear steam supply systems and supplies fuel, engineering services, and replacement components to U.S. nuclear utilities. AREVA NP Inc. is one of the three major regions under AREVA NP. The other major regions include France (AREVA NP SAS) and Germany (AREVA NP GmbH).

Dates: May 15 and 20, 2008, June 12 and 18, 2008; July 24 and 30, 2008; August 27, 2008; October 21, 2008; March 3, 26, and 27, 2009

NRC Staff: Getachew Tesfaye, Lead Project Manager, DNRL/NRO
Peter Hearn, Senior Project Manager, DNRL/NRO
John Rycyna, Project Manager, DNRL/NRO
Theresa Clark, Reliability and Risk Engineer, SPLA/DSRA/NRO
Hanh Phan, Senior Reliability and Risk Engineer, SPLA/DSRA/NRO
Edward Fuller, Senior Reliability and Risk Engineer, SPLB/DSRA/NRO

NRC Contractors: Mohsen Khatib-Rahbar, Energy Research, Inc. (ERI)
Roy Karimi, ERI
Michael Zavisca, ERI
Zhou Yuan, ERI
James Fulford, Consultant to ERI

NRC Management: Lynn Mrowca, Chief, SPLA/DSRA/NRO

1.0 SUMMARY

Over the course of several days in 2008 and 2009, U.S. Nuclear Regulatory Commission (NRC) staff audited supporting documents related to Chapter 19 of the AREVA NP Inc. (AREVA) U.S. EPR design certification (DC) application at the AREVA facility in Rockville, Maryland. The NRC staff audited dozens of documents that describe U.S. EPR probabilistic risk assessment (PRA) and severe accident analysis. These documents are first-tier references in Chapter 19 of the docketed U.S. EPR Final Safety Analysis Report (FSAR) and include a level of detail higher than is required in the FSAR. However, auditing such information allows the staff to conduct its review more efficiently. Specifically, the staff gains a better understanding of the basis underlying the formal application and identifies areas where additional information should be submitted to allow a licensing decision on the application.

ENCLOSURE

The bases for the audit were:

- Title 10 of the *Code of Federal Regulations* (10 CFR), Section 52.47, "Contents of Applications"
  - (a)(8): The information necessary to demonstrate compliance with any technically relevant portions of the Three Mile Island requirements set forth in 10 CFR 50.34(f), except paragraphs (f)(1)(xii), (f)(2)(ix), and (f)(3)(v).
  - (a)(23): For light-water reactor [LWR] designs, a description and analysis of design features for the prevention and mitigation of severe accidents, e.g., challenges to containment integrity caused by core-concrete interaction, steam explosion, high-pressure core melt ejection, hydrogen combustion, and containment bypass.
  - (a)(27): A description of the design-specific PRA and its results.

- 10 CFR 50.9, "Completeness and Accuracy of Information."

- SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor Designs"

- Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," Sections C.I.17, "Quality Assurance," and C.I.19, "Probabilistic Risk Assessment and Severe Accident Evaluation"

- NUREG-0800, "Standard Review Plan," Sections 17.4, "Reliability Assurance Program (RAP)," and 19.0, "Probabilistic Risk Assessment and Severe Accident Evaluation for New Reactors"

As a result of the audit, the staff wrote a number of requests for additional information (RAI) to ensure that information needed for the staff's safety decision is properly included in the U.S. EPR docket file. These questions have been sent to AREVA as RAIs 22, 45, 54, 120, 133, and 138 (Agencywide Documents Access and Management System (ADAMS) accession numbers ML081910717, ML082340029, ML082350092, ML083110177, ML083120545, and ML083280064). Future RAIs may also result from the audit. The staff will refer to the FSAR, RAI responses, and the enclosed report, but not to the detailed documents reviewed at AREVA's site, in its safety evaluation of the U.S. EPR.

2.0 STATUS OF PREVIOUS AUDITS

A summary of the previous audit was sent to AREVA on September 11, 2008 (ADAMS accession number ML081720159). This summary indicated that related questions were sent to AREVA in RAI 6, 7, 8, and 14 (ADAMS accession numbers ML081610751, ML081610591, ML081640035, and ML081640055, respectively). The staff has received responses to these RAIs and is reviewing them as part of the U.S. EPR FSAR Chapter 19 review.

3.0 RESULTS OF AUDIT

3.1 Documents Audited

AREVA made the following documents available at its Rockville, Maryland, facility for audit by the NRC staff:

- U.S. EPR PRA - RCS Depressurization System PRA System Analysis
- U.S. EPR PRA - Start-up and Shutdown PRA System Analysis
- U.S. EPR PRA - Essential Service Water System (ESWS) PRA System Analysis
- U.S. EPR PRA - Emergency Feedwater System (EFWS) PRA System Analysis
- U.S. EPR PRA - Main Steam Supply System (MSSS) PRA Systems Analysis
- U.S. EPR PRA - Protection System (PS) PRA System Analysis
- U.S. EPR PRA - SIS/RHR System PRA System Analysis
- U.S. EPR PRA - Reactor Coolant Pump Seal LOCA PRA System Analysis
- U.S. EPR PRA - Electrical Power System PRA System Analysis
- U.S. EPR PRA - Safeguards Building HVAC (QK\QN\SAC) PRA Systems Analysis
- U.S. EPR PRA - Component Cooling Water System (CCWS) PRA System Analysis
- U.S. EPR PRA - Severe Accident Heat Removal System (SAHRS) PRA System Analysis
- Analysis of Common Cause Events for the U.S. EPR Design Certification
- Analysis of Failure Events for the U.S. EPR Design Certification
- U.S. EPR PRA - Initiating Events Notebook
- U.S. EPR PRA - Level 1 Success Criteria Notebook
- U.S. EPR PRA - Level 1 Accident Sequence Analysis Notebook
- Human Reliability Analysis (HRA)
- U.S. EPR PRA - Based Seismic Margins Assessment
- U.S. EPR PRA - Low Power Shutdown (LPSD) PRA Notebook
- U.S. EPR PRA - System Modeling Approach
- U.S. EPR PRA - Level 1 Quantification Results Report
- U.S. EPR PRA - Internal Fires Report
- MAAP [Modular Accident Analysis Program] 4.0.7 Justification for Level 1 PRA Analysis
- EPR Design Certification Core Damage End State Definition
- U.S. EPR Design Certification-Level 2 PRA Supporting Severe Accident Analysis
- U.S. EPR Design Certification Containment Fragility Phenomenological Evaluation
- Phenomenological Evaluation No. 1 - Induced Rupture of the Reactor System Pressure Boundary
- U.S. EPR PRA - Phenomenological Evaluation No. 4 - Phenomena at Vessel Failure
- Phenomenological Evaluation No. 2 - Fuel Coolant Interactions
- Phenomenological Evaluation No. 6 - Long Term Containment Challenges
- U.S. EPR Design Certification Level 2 for Shutdown States
- Human Action Modeling in the Level 2 PRA
- Phenomenological Evaluation No. 3 In-Vessel Core Recovery
- Phenomenological Evaluation No. 7 - Level 2 Equipment Survivability
- Phenomenological Evaluation No. 5 - Hydrogen Deflagration, Flame Acceleration, and Deflagration-to-Detonation Transition
- U.S. EPR PRA - Containment Event Tree Structure Quantification and Sensitivity/Uncertainty Analysis
- U.S. EPR PRA - Source Term Methodology and Identification of Key Uncertainties

- Level 2 PRA - Introduction, Scope And Methodology
- Combustible Gas Control System [CGCS] Analytical Input Requirements Specification
- Combustible Gas Control System Description
- Core Melt Stabilization System Analytical Input Requirements Specification
- Core Melt Stabilization System Description
- Severe Accident Heat Removal System Analytical Input Requirements Specification
- Severe Accident Heat Removal System Design Description
- U.S. EPR Severe Accident Containment Performance Evaluation
- Development of MAAP4 Models for EPR-Specific Plant Design Features
- Qualification of MAAP Version 4.0.7 FAI [Fauske & Associates, LLC]
- U.S. EPR MAAP 4.07 Model Development
- Relevant Scenario Selection and Uncertainty Analysis Methodology for Severe Accident Safety Issue Resolution
- Analysis of Relevant Severe Accident Scenarios for U.S. EPR Ex-vessel Safety Issues
- Uncertainty Analysis of Severe Accident Scenarios for U.S. EPR Ex-vessel Safety Issues
- Representative Analysis of Transient Melt Spreading Using MELTSPREAD Version 1.4
- Description, Verification and Application of the Computer Code WALTER
- CGCS Performance Analysis
- U.S. EPR Hydrogen Mitigation Strategy
- U.S. EPR Standard Plant – Ultimate Capacity Analyses
- U.S. EPR Core Melt Stabilization System Assessment
- High Pressure Melt Ejection
- Evaluation of Steam Explosion in the U.S. EPR
- Equipment Survivability Evaluation
- OL3 [Olkiluoto 3] Severe Accidents Thermal-Mechanical Study of SG [Steam Generator] Tubes for Relevant Core Melt Accidents
- OL3 Severe Accidents Synthesis of RCS [Reactor Coolant System] Material High Temperature Properties
- U.S. EPR MAAP 4.07 Severe Accident Source Term Analysis
- Seismic Fragilities for U.S. EPR
- U.S. EPR PRA Draft Peer Review Report
- Level 1 PRA Reconciliation for Severe Accident Relevant Scenarios
- Justification of the Type of Refracrory Layer Used in the Reactor Pit of OL3

3.2 Interaction with AREVA Staff

During the period covered by this summary, no meetings concerning the audited PRA and severe accident documents were held with AREVA staff at the Rockville, Maryland, facility. Because the audit process was similar to that of the previous audit, no entrance or exit briefings were held.

3.3 Issue Resolution

As a result of the audit, the staff identified various issues with the underlying analyses used to develop the U.S. EPR FSAR, as well as information useful to clarify the discussion in the FSAR. To ensure that the docketed material supporting the U.S. EPR DC application is complete, the staff wrote many questions on these issues. These have been sent to AREVA as RAIs 22, 45, 54, 120, 133, and 138 (ADAMS accession numbers ML081910717, ML082340029, ML082350092, ML083110177, ML083120545, and ML083280064). The staff has received

responses to these questions (ADAMS accession numbers ML08224688, ML082540121, ML082790023, ML082790026, ML082790029, ML082680049, ML083380077, ML083380074, ML083430815, ML090360734, ML090420622, ML090650603, ML083590353, and ML090420621). Future RAIs may also result from the audit. The staff will refer to the FSAR, RAI responses, and this report, but not to the detailed documents reviewed at AREVA's site, in its safety evaluation of the U.S. EPR.

3.4 Conclusions

The audit of supporting documents for the U.S. EPR PRA and severe accident analyses allowed the staff to conduct its review of the U.S. EPR FSAR more efficiently. Specifically, the staff gained a better understanding of the basis underlying the formal application and identified areas where additional information should be submitted to allow a licensing decision on the application.

4.0 APPLICANT STAFF PARTICIPATING IN SUBSTANTIVE DISCUSSIONS

None