June 24, 2008

Mr. Ronnie L. Gardner
AREVA NP Inc.
3315 Old Forest Road
P.O. Box 10935
Lynchburg, VA 24506-0935

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION REGARDING ANP-10285P, "FUEL ASSEMBLY MECHANICAL DESIGN TOPICAL REPORT" (TAC NO. MD7040)

Dear Mr. Gardner:

By letter dated October 2, 2007, which can be accessed through NRC's Agencywide Documents Access and Management System (ADAMS) Accession No. ML072840180, AREVA NP submitted for U.S. Nuclear Regulatory Commission (NRC) staff review Topical Report (TR) ANP-10285P, "Fuel Assembly Mechanical Design," ADAMS ML072840180. The first set of request for additional information (RAI) was issued by the NRC on April 29, 2008 (ML081080360), and the AREVA NP responses were received on May 29, 2008 (ADAMS ML081560318) and June 13, 2008 (ML081560318).

The NRC staff's review has determined that some areas of this report require additional information in order to complete the review. The specific information requested is contained in the enclosure to this letter. A draft of this RAI was sent to you on June 10, 2008 (ML081760050), and discussed with your staff on June 17, 2008. As a result of that discussion, RAI Nos. 22, 23, 24, 25, and 29 have been revised to remove proprietary information and to provide clarification. AREVA NP has agreed to provide a response within 30 days of receipt of this letter.

If you have any questions regarding this matter, I may be reached 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:
Request for Additional Information

Mr. Ronnie L. Gardner
AREVA NP Inc.
3315 Old Forest Road
P.O. Box 10935
Lynchburg, VA 24506-0935

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION REGARDING ANP-10285P, "FUEL ASSEMBLY MECHANICAL DESIGN TOPICAL REPORT" (TAC NO. MD7040)

Dear Mr. Gardner:

By letter dated October 2, 2007, which can be accessed through NRC's Agencywide Documents Access and Management System (ADAMS) Accession No. ML072840180, AREVA NP submitted for U.S. Nuclear Regulatory Commission (NRC) staff review Topical Report (TR) ANP-10285P, "Fuel Assembly Mechanical Design," ADAMS ML072840180. The first set of request for additional information (RAI) was issued by the NRC on April 29, 2008 (ML081080360), and the AREVA NP responses were received on May 29, 2008 (ADAMS ML081560318) and June 13, 2008 (ML081560318).

The NRC staff's review has determined that some areas of this report require additional information in order to complete the review. The specific information requested is contained in the enclosure to this letter. A draft of this RAI was sent to you on June 10, 2008 (ML081760050), and discussed with your staff on June 17, 2008. As a result of that discussion, RAI Nos. 22, 23, 24, 25, and 29 have been revised to remove proprietary information and to provide clarification. AREVA NP has agreed to provide a response within 30 days of receipt of this letter.

If you have any questions regarding this matter, I may be reached 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:
Request for Additional Information

cc: DC AREVA – EPR Mailing List

DISTRIBUTION:
PUBLIC

NARP R/F	JDonoghue, NRO	JColaccino, NRO	GTesfaye, NRO
RidsNroDnrlNar1	PHearn, NRO	FForsaty, NRO	

ADAMS Accession Number: ML0810640135

OFFICE	PM:DNRL/NARP	LA:DNRL/NARP	PM:DNRL/NARP	BC:DSRA/SRSB	BC: DNRL/NARP
NAME	PHearn	JMclellan	GTesfaye	JDonohue	JColacccino
DATE	06/23/08	06/23/08	06/24 /08	06/24/08	06/24/08

OFFICIAL RECORD COPY

DC AREVA - EPR Mailing List
cc:

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

Marty Bowling
NUMARK Project Manager
86 WestBay Drive
Kilmarnock, VA 22482

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

Mr. Ray Ganthner
Senior Vice President
AREVA, NP, Inc. 3315
Old Forest Road
P.O. Box 10935
Lynchburg, VA 24506-0935

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

Russ Well
Advisory Engineering
New Plants Development
3315 Forest Road
P.O. Box 10935
Mail Stop OF-34
Lynchburg, VA 24506

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
alex.miller@hse.gsi.gov.uk (Alex Miller)
APH@NEI.org (Adrian Heymer)
awc@nei.org (Anne W. Cottingham)
bennettS2@bv.com (Steve A. Bennett)
bob.brown@ge.com (Robert E. Brown)
BrinkmCB@westinghouse.com (Charles Brinkman)
carey.fleming@constellation.com (Carey Fleming)
chris.maslak@ge.com (Chris Maslak)
cwaltman@roe.com (C. Waltman)
david.hinds@ge.com (David Hinds)
david.lewis@pillsburylaw.com (David Lewis)
dlochbaum@UCSUSA.org (David Lochbaum)
erg-xl@cox.net (Eddie R. Grant)
frankq@hursttech.com (Frank Quinn)
gcesare@enercon.com (Guy Cesare)
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)
jgutierrez@morganlewis.com (Jay M. Gutierrez)
jim.riccio@wdc.greenpeace.org (James Riccio)
JJD1@nrc.gov (John Donohue)
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)
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)
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)
roberta.swain@ge.com (Roberta Swain)

DC AREVA - EPR Mailing List

Ronda.pederson@areva.com (Ronda Pederson)
sandra.sloan@areva.com (Sandra Sloan)
sfrantz@morganlewis.com (Stephen P. Frantz)
steven.hucik@ge.com (Steven Hucik)
tkkibler@scana.com (Tria Kibler)
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)

2nd REQUEST FOR ADDITIONAL INFORMATION (RAI)

ANP-10285P, "U. S. EPR FUEL ASSEMBLY MECHANICAL

DESIGN TOPICAL REPORT"

DOCKET NO. 52-020

RAI-21. The following questions address the methodology for determining whether the EPR design meets the SAFDL for preventing excess internal rod pressure.

a. Please provide the F_Q and $F_{\Delta H}$ and the average core power level for the fuel in the EPR. How are F_Q and $F_{\Delta H}$ related to the bounding power history and licensing analyses that demonstrate SAFDLs are met at these rod power limits?
b. The bounding power history is provided in Figure 5-5 of the topical, how is the uncertainty in measured rod powers accounted for in the analyses using this bounding power history?
c. Please provide the axial power shapes used for the example rod pressure analyses including AOOs (Condition 1 and 2 events) such that a confirmatory analysis can be performed with the NRC fuel performance code, FRAPCON-3.3. Please identify those transients that are bounding for the Condition 1 and 2 events in terms of fission gas release and rod pressure. Please justify the length of time for the limiting Condition 1 transient for the EPR (including xenon transients) in terms of fission gas release and rod pressure.
d. Section 5.1.8 of the topical report states "On a cycle-specific basis, if peak pin powers violate the envelope resulting in predicted pressure greater than the licensed limit, acceptable pin pressure results can be demonstrated by using fuel rod-specific power histories and fuel assembly as-built manufacturing data." How are the peak rod specific histories chosen to assure that the peak rod pressures are determined for the fuel batch? How are the uncertainties in rod specific power histories included in these analyses? A plant may deviate from planned operation, how is this considered in cycle-specific analyses? The as-built manufacturing data for a particular fuel batch has a distribution about a mean, how is this uncertainty included in these analyses?

RAI-22. The following questions address the methodology used for determining whether the EPR design meets the SAFDL for preventing fuel melting and excessive cladding strain. Please provide the axial power shapes used to determine the fuel melting limit as a function of burnup for both UO_2 and UO_2-Gd_2O_3 rods (at the maximum limit for Gd_2O_3 additions) and any other information needed to perform a confirmatory calculation with the NRC fuel performance code. Please provide the results of the cladding strain analysis as a function of burnup including axial power shapes and the necessary information needed to perform a confirmatory calculation with the NRC fuel performance code.

RAI-23. The SER providing approval of M5 cladding required that additional data on cladding oxide thickness, assembly length and bow, rod diameter (M5 creep

ENCLOSURE

data), rod length (growth data), guide tube oxide thickness and rod extraction measurements" be collected from LTAs. The SER also noted that the vendor "committed to obtain cladding strain, oxidation, hydride, rod bow and axial growth (including shoulder gap closure) data up to the current approved rod-average burnup levels ". Please provide this data along with comparison to the respective models for M5.

RAI-24. Please identify the fuel assembly designs for the rod bow data presented in the submittal. From this figure the mean of the three M5 fuel rods from which rod bow measurements were obtained appear to be different from the mean of the Zr-4 rod bow data. Please explain why the mean of the M5 data appears to be different than that observed in the Zr-4 rods. Also, please provide rod bow results from any additional M5 rods collected since the submittal.

RAI-25. The following questions are related to fuel assembly (M5 guide tube growth).

a. Please provide the data (including calculated stress versus burnup and fluence of M5 guide tubes for each datum) used as the basis of the empirical correlations used for determining the upper core plate to upper fuel assembly nozzle gap along with the calculated guide tube stresses as a function of burnup/fluence for the EPR fuel assemblies with M5 guide tubes. Please provide the data for determining this same gap for Mark-BW and Mark-B12 fuel designs with M5 guide tubes along with calculated stresses versus burnup/fluence. How do the predicted stresses for each datum compare to those for the EPR predicted stresses versus burnup? Discuss how prototypical each design and associated data is to the proposed EPR design. Please provide the as-fabricated fuel assembly to upper core plate gaps and their predicted gaps at end-of-life (EOL) equivalent burnups for EPR, Mark BW and Mark B designs with M5 guide tubes?

b. Please provide a list of those current and future plants and assembly designs where guide tube measurements are planned in the future that are applicable to EPR and an explanation why they are applicable to EPR. Please discuss whether the extra fuel assembly length in EPR will result in additional growth compared to an equivalent 12 foot assembly.

RAI-26. Please provide data for M5 grid growth and corrosion (including hydrogen pickup) compared to Zr-4 grid data at equivalent burnup/fluence.

RAI-27. Please provide the distribution (numbers) of assembly's versus burnup with HMP end grids and have there been any fretting wear failures in designs with HMP (inconel) grids?

RAI-28. Please provide the irradiated M5 strain data that confirms that the EPR 1% (elastic plus plastic) limit will be met at the maximum expected hydrogen level for EPR and at the upper limit for hydrogen set for AREVA fuel designs. If irradiated M5 strain data are not available at the upper limit, how can AREVA be assured that the 1% limit can be met at this hydrogen level?

RAI-29. Please provide example small and large break LOCA initialization results (time zero for transient) from the approved fuel performance code such as fuel stored energy, gap conductance and rod pressure. This should include the input for the fuel performance code and the output results such that a confirmatory analysis can be performed with the NRC fuel performance code. The output results provided should include those parameters used to initialize the LOCA such as peak node (identify node) stored energy, gap conductance, rod pressure, etc. If the input at time zero are estimated by the LOCA system code from a fuel performance code result the methodology used by the LOCA code to simulate the fuel performance code result should be described along with the initialization results such as stored energy, gap conductance and rod pressure. What methodology is used to determine the limiting initial conditions for small and large break LOCA because these results change with burnup? The following input information is needed to perform confirmatory analyses:

a. Rod Size
Outer diameter, Inner diameter, Pellet diameter, Stack length, Plenum length

b. Spring Dimensions
Spring outer diameter, Spring wire diameter, Number of spring turns

c. Pellet Shape
Pellet height, Central hole radius, Dish radius, Dish depth

d. Pellet Isotopics
Fuel U-235 enrichment, O/M ratio, Gadolinia content

e. Pellet Fabrication
Pellet density, Pellet surface roughness, Expected density increase (max densification)

f. Cladding Fabrication
Cladding type, Cladding cold work, Cladding surface roughness

g. Rod Fill Conditions
Fill gas pressure, Fill gas

h. Reactor Conditions
Type of plant, rod pitch, coolant pressure, coolant inlet temperature, coolant mass flux

i. Power History
Time, Linear heat generation rate (preferably rod average), Index for axial power profile shape, Axial power profiles

RAI-30. Were rods included or excluded from the grids for the impact and static load tests? If the rods were present were the springs relaxed to simulate EOL conditions? Section 5.1.1.5 notes that a 95/95 one sided confidence of the mean elastic limit from the tests was used to verify that the grids remain within the elastic range; however, most licensing analyses require a 95/95 one sided confidence of the data and not a 95/95 of the mean. Please discuss this discrepancy.