December 20, 2007

Mr. Ronnie L. Gardner, Manager
AREVA NP
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SUBJECT: FINAL SAFETY EVALUATION REPORT FOR ANP-10275P, "U.S. EPR INSTRUMENT SETPOINT METHODOLOGY TOPICAL REPORT" (TAC NO. MD4976)

Dear Mr. Gardner:

By letter dated March 26, 2007, U.S. Nuclear Regulatory Commission's ADAMS Accession Number (ML070880714), as supplemented by letters dated August 24, 2007 (ML072400032), and October 11, 2007 (ML073030202), AREVA NP (AREVA) submitted for U.S. Nuclear Regulatory Commission (NRC) staff review Topical Report (TR) ANP-10275P, "U.S. EPR Instrument Setpoint Methodology Topical Report", ADAMS Accession Number (ML070880719) (non-proprietary) and with a proprietary copy. By letter dated October 30, 2007, ADAMS Accession Number (ML072950546) a draft Safety Evaluation (SE) regarding our approval of ANP-10275(P) was provided for your review and comments. The staff's disposition of AREVA's comments ADAMS Accession Number (ML073440073) on the draft SE are discussed in the attachment to the final SE enclosed with this letter.

The staff has found that ANP-10275(P), Revision 0, is acceptable for referencing in licensing applications for U.S. EPR to the extent specified and under the limitations delineated in the TR and in the enclosed SE. The SE defines the basis for acceptance of the TR.

Our acceptance applies only to material provided in the subject TR. We do not intend to repeat our review of the acceptable material described in the TR. When the TR appears as a reference in regulatory applications, our review will ensure that the material presented applies to the specific application involved. Regulatory applications that deviate from this TR will be subject to further review in accordance with applicable review standards.

In accordance with the guidance provided on the NRC website, we request that AREVA publish the accepted version of this TR within three months of receipt of this letter. The accepted version shall incorporate this letter and the enclosed SE after the title page. Also, the accepted version must contain historical review information, including NRC requests for additional information and your responses. The accepted versions shall include a "-A" (designating accepted) following the TR identification symbol.

If future changes to the NRC's regulatory requirements affect the acceptability of this TR, AREVA will be expected to revise the TR appropriately, or justify its continued applicability for subsequent referencing.

If you have any questions, please contact me at gxt2@nrc.gov or (301) 415-3361.

Sincerely,

/RA/

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

Project No. 733

Enclosure: Final Safety Evaluation

cc w/encl: U.S. EPR Service List

If you have any questions, please contact me at gxt2@nrc.gov or (301) 415-3361.

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FINAL SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS
ANP-10275(P), "U.S. EPR INSTRUMENT SETPOINT METHODOLOGY
TOPICAL REPORT" (TAC NO. MD4976)
PROJECT NO. 733

1.0 INTRODUCTION AND BACKGROUND

By letter dated March 26, 2007, U.S. Nuclear Regulatory Commission's ADAMS Accession Number (ML070880714), as supplemented by letters dated August 24, 2007 (ML072400032), and October 11, 2007 (ML073030202), AREVA NP (AREVA) submitted for U.S. Nuclear Regulatory Commission (NRC) staff review Topical Report (TR) ANP-10275P, "[United States Evolutionary Power Reactor] U.S. EPR Instrument Setpoint Methodology Topical Report," Revision 0, ADAMS Accession Number (ML070880719 (non-proprietary and proprietary copy)]. AREVA requested that the NRC issue a safety evaluation report which approves the use of the correlation.

AREVA states that Topical Report ANP-10275P, Revision 0 (Reference 1) documents the instrument setpoint methodology applied to the U.S. EPR protection system. The protection system is a digital, integrated reactor protection system (RPS) and engineered safety features actuation system (ESFAS) implemented for the U.S. EPR. AREVA further states that the methodology described in this report will be used to establish technical specification setpoints for the U.S. EPR protection system.

The setpoint methodology is used to determine instrument setpoints for the protection system to detect plant conditions that indicate the occurrence of design basis events, and initiate the plant safety features required to mitigate the event. Reconciliation of the final trip setpoint calculation for each plant cannot be performed until the design for the plant is finalized. Prior to initial fuel load, a reconciliation of this setpoint study against the final design for each plant will be performed, as required by the Inspection, Test, and Analysis Acceptance Criteria (ITAAC).

Topical Report ANP-10275P uses the latest industry guidance provided by American National Standards Institute (ANSI), and Instrument Society of America (ISA), ANSI/ISA-67.04.01-2006, "Setpoint for Nuclear Safety-Related Instrumentation," May, 2006. The basic uncertainty algorithm is the square-root-sum-of-squares (SRSS) of the applicable uncertainty terms, which is endorsed by the ISA standard. This setpoint methodology utilized ISA-RP67.04.02-2000 as a general guideline. The latest version of Regulatory Guide 1.105, Revision 3, "Setpoint for Safety-Related Instrumentation," endorses the 1994 version of ISA S67.04, Part 1. The setpoint methodology and calculations for the RPS/ESFAS functions are consistent with the guidance contained in Regulatory Guide 1.105.

2.0 REGULATORY EVALUATION

The following regulatory requirements and guidance documents are applicable to the staff's review of the ANP-10275P:

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, General Design Criterion (GDC) 13, "Instrumentation and Control," requires, in part, that instrumentation be provided to monitor variables and systems and that controls be provided to maintain these variables and systems within prescribed operating ranges.

In 10 CFR Part 50, Appendix A, GDC 20, "Protection System Functions," requires, in part, that the protection system be designed to initiate operation of appropriated systems to ensure that specified acceptable fuel design limits are not exceeded.

Paragraph (c)(ii)(A) of 10 CFR 50.36, "Technical Specifications," requires that the technical specifications include limiting safety system settings. This paragraph specifies, in part, that "where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be chosen so that automatic protective action will correct the abnormal situation before a safety limit is exceeded." Accordingly, the setpoints for instrument channels that initiate protective functions must be properly established in this setpoint methodology.

Regulatory Guide 1.105, "Setpoint for Safety-Related Instrumentation," describes a method acceptable to the NRC staff for complying with the NRC's regulations for ensuring that setpoints for safety-related instrumentation are initially within and remain within the safety limit.

The NRC staff's review was based on the evaluation of the technical merit of the submittal and compliance with any applicable regulations associated with reviews of TR and its supplements (Reference 1, 2, and 3).

3.0 TECHNICAL EVALUATION

The establishment of setpoints and the relationships between trip setpoints, allowable value (AV), as-left, as-found, and analytical limit, and safety limit are discussed in this report. A thorough understanding of these terms is important in order to properly utilize the total instrument channel uncertainty in the establishment of setpoints.

The safety limits are chosen to protect the integrity of physical barriers that guard against the uncontrolled release of radioactivity. The safety limits are typically provided in the plant safety analyses. The analytical limit is established to ensure that the safety limit is not exceeded. The analytical limit is developed from event analyses models that consider parameters such as process delays, rod insertion times, reactivity changes, instrument response times, etc.

The AV is a value that the instrument channel should be evaluated for operability to protect the safety limit when the test is performed. An "as-found value (setpoint)" within the AV ensures that sufficient margin allocation exists between this as-found value and analytical limit to account for instrument uncertainties that are not measured during periodic testing (channel operational test, calibration test). This periodic test provides assurance that the analytical limit will not be exceeded if the AV is satisfied. The AV also provides a means to identify unacceptable instrument performance that may require corrective action.

In 10 CFR 50.36(c)(1)(ii)(A) states that the limiting safety system settings (LSSS) are settings for automatic protective devices related to those variable having significant safety functions. Where an LSSS is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded. In the AREVA methodology, the trip setpoint is established to ensure that an instrument channel trip signal occurs before the safety limit is reached and to minimize spurious trips close to the normal operating point of the process.

The AREVA setpoint methodology combines the uncertainty of the components to determine the overall Channel Uncertainty (CU) for the functions of the RPS/ESFAS. All appropriate and applicable uncertainties have been considered for each RPS/ESFAS function. The methodology used to combine the uncertainty components for a channel is an appropriate combination of those groups which are statistically and functionally independent. Those uncertainties which are not independent are conservatively treated by arithmetic summation and then systematically combined with the independent terms. It includes instrument (sensor and process rack) uncertainties and non-instrument related effects (process measurement accuracy). The methodology used the SRSS technique which is approved by the NRC. Also, ANSI/ANS and ISA approve the use of the same probabilistic and statistical techniques for the various standards in determining the setpoints.

The CU calculation is based on the followings:

I. Random uncertainties are eligible for the SRSS combination propagated from the process measurement module through the signal conditioning module of the instrument channel to the device that initiates the actuation.

II. Dependent uncertainties are combined algebraically to create a larger independent uncertainty that is eligible for SRSS combination.

III. Bias uncertainties are those that consistently have the same algebraic sign. If they are predictable for a given set of conditions because of a known positive or negative direction, they are classified as bias with a known sign. If they do not have a known sign, they are treated conservatively by algebraically adding the bias in the worst direction. These are classified as bias with an unknown sign.

The CU value is established at a 95 percent probability and a 95 percent confidence level, which are consistent with the requirement of RG 1.105. This CU value is compared with the total allowance (TA) for determination of instrument channel margin. The TA is established by adding margin to the CU. The vendor provides acceptable commitment that the margin is large enough for AV assurance that the purpose of the AV is still satisfied by providing a large enough allowance to account for those uncertainties not measured during the test. Having determined the safety analytical limit (SAL) and TA, the nominal trip setpoint (NTSP) can be calculated by subtracting (adding) TA from (to) SAL, depending on the direction of process variable change when approaching the SAL.

The “as-left” value is established by the required accuracy band (calibration accuracy) that a device or instrument channel must be calibrated to the NTSP within during surveillance. The “as-left” condition is the state which the instrument channel is left after calibration or trip setpoint verification. Additionally, if the “as-found” value is within the “as-left” tolerance then re-

calibration is not required. The AVs are set equal to the Performance Test Acceptance Criteria, referred to as the “as-found” tolerance in the U.S. EPR instrument setpoint methodology. The AV defines the maximum possible value at which the analytical limit is protected. These acceptance criteria are established to provide reasonable assurance that the protection system performs as required and that there is no degradation of the protection system. The determination of the AV tolerance shall include those effects expected during the test such as the rack accuracy, instrument uncertainties during normal operation including drift, and measurement & test equipment uncertainties. Periodic testing is required to verify that safety-related or important-to-safety instrumentation performs as required. The capability of the racks to be calibrated to within these tolerances defines channel operability as the AV. If the “as-found” value exceeds the AV during surveillance testing, the channel is declared inoperable. The associated criteria included in technical specification will be determined at time of the plant specific design. If this TR is referenced in a design certification application, the application needs to include ITAAC for the plant specific setpoint analysis which details the procedures for establishing the setpoints including the margins. The staff will review the proposed ITAAC during the design certification review.

4.0 CONCLUSION

The staff has reviewed the U.S. EPR Instrument Setpoint Methodology Topical Report and the associated supplements (References 1, 2, 3) and found that this methodology provides assurance for the margins such that the AV is satisfied by providing large enough allowance to account for those uncertainties not measured during the surveillance tests to protect the safety limit. Therefore, the staff concludes that the proposed ANP-10275P “U.S. EPR Instrument Setpoint Methodology Topical Report,” is acceptable. If this TR is referenced in the design certification application, the plant specific setpoint analysis including margins and associated criteria in accordance with the 10 CFR 50.36 will be verified by the ITAAC.

5.0 REFERENCES

1. U.S. EPR Instrument Setpoint Methodology Topical Report (ANP-10275P, Revision 0), dated March 2007 (AREVA Proprietary)

2. Letter from R. L. Gardner (AREVA) to NRC, dated August 24, 2007, Response to a Request for Additional Information Regarding ANP-10275P "U.S. EPR Instrument Setpoint Methodology Topical Report" (TAC No. MD4976)

3. Letter from R. L. Gardner (AREVA) to NRC, dated October 11, 2007, Revised Response to a Request for Additional Information Regarding ANP-10275P "U.S. EPR Instrument Setpoint Methodology Topical Report" (TAC No. MD4976)

Principal Contributor: Sang Rhow

The Staff's Disposition of AREVA's Comments on the Draft SE

1. Page 1, Section 1.0: ANSI/ISA-67.04.01-2000 has been revised. AREVA NP requests a revision to the DSER since AREVA NP is using the latest revision to the standard which is ANSI/ISA-67.04.01-2006.

   DISPOSITION
   The text is revised to reflect ANSI/ISA-67.04.01-2006.

2. Page 1, Section 1.0: AREVA NP is using the guidance provided in RIS 2006-17 in addition to Regulatory Guide 1.105 to comply with the latest industry and NRC concerns regarding performance test acceptance criteria.

   DISPOSITION
   The SE wording pointed to in this request remains unchanged.

3. Page 3, Section 3.0: ANP-10275P does not make the statements currently shown in the DSER. AREVA NP requests that Items I, II, and III be re-written to summarize the treatment of random, dependant, and bias terms as stated in Section 2.1.3 of ANP-10275P.

   AREVA NP requests replacing the DSER statements in Items I, II, and III after "The CU calculation is based on the following" with:

   I. "Random uncertainties are eligible for the SRSS combination propagated from the process measurement module through the signal conditioning module of the instrument channel to the device that initiates the actuation."

   II. "Dependent uncertainties are combined algebraically to create a larger independent uncertainty that is eligible for SRSS combination."

   III. "Bias uncertainties are those that consistently have the same algebraic sign. If they are predictable for a given set of conditions because of a known positive or negative direction, they are classified as bias with a known sign. If they do not have a known sign, they are treated conservatively by algebraically adding the bias in the worst direction. These are classified as bias with an unknown sign."

   DISPOSITION
   The text is revised to reflect AREVA's requests I, II, and III as written above.

4. Page 3, Section 3.0: AREVA NP requests rewording the second to last paragraph as follows to remove terms that are not used by AREVA NP and add terms used in ANP-10275P to comply with ANSI/ISA-67.04.01-2006 and RIS 2006-17:

   The CU value is established at a 95 percent probability and a 95 percent confidence level, which are consistent with the requirement of RG 1.105. This CU value is compared with the analytical limit (AL) for determination of the limiting trip setpoint (LTSP). The nominal trip setpoint (NTSP) is established by adding margin to the CU. The vendor provides acceptable commitment that the margin is large enough for AV assurance that the purpose of the AV is still satisfied by providing a large enough allowance to account for those

uncertainties not measured during the test. Having determined the AL and CU, the LTSP can be calculated by subtracting (adding) CU from (to) AL, depending on the direction of process variable change when approaching the AL.

DISPOSITION
The SE wording pointed to in this request remains unchanged.

5. Page 3 **[4]**, Section 3.0: AREVA NP requests the following rewording change to the beginning of the last paragraph for clarification.

   The "as-left" value is established by the required accuracy band (calibration accuracy) that a device or instrument channel must be calibrated to the NTSP within during surveillance. The "as-left" condition is the state which the instrument channel is left after calibration or trip setpoint verification. Additionally, if the "as-found" value is within the "as-left" tolerance then re-calibration is not required. The AVs are set equal to the Performance Test Acceptance Criteria, referred to as the "as-found" tolerance in the EPR instrument setpoint methodology. The AV defines the maximum possible value at which the analytical limit is protected. These…

   DISPOSITION
   The text is revised to reflect AREVA's request and match the paragraph above.

6. Page 3 **[4]**, Section 3.0: AREVA NP requests replacing "calibrated" with "perform" and adding the following sentence "The digital protection system modules (DPS) cannot be calibrated; therefore, the "as found" and "as-left" tolerance are equal" to the last paragraph.

   AREVA's digital protection system cannot be calibrated; therefore, the "capability of the racks to be *calibrated* within these tolerances" needs to be replaced with the "capability of the racks to *perform* within these tolerances".

   DISPOSITION
   The SE wording pointed to in this request remains unchanged.

7. Page 3 **[4]**, Section 3.0: AREVA NP requests deleting "as the AVs along with the NTSP" in the last paragraph.

   It is the intent of AREVA's technical specifications to use "LTSP", not "AV or NTSP". AREVA NP prefers not to provide technical specifications details in ANP-10275P.

   DISPOSITION
   The text is revised to reflect AREVA's request.

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