Greg Gibson
Vice President, Regulatory Affairs

750 East Pratt Street, Suite 1600
Baltimore, Maryland 21202

UniStar
NUCLEAR ENERGY

10 CFR 50.4
10 CFR 52.79

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UN#10-094

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: UniStar Nuclear Energy, NRC Docket No. 52-016
Response to Request for Additional Information (RAI) for the Calvert Cliffs Nuclear Power Plant, Unit 3,
RAI 224, Reliability Assurance Program, and
Clarification of the Response to RAI 194, Question 17.04-4

References:
1) Surinder Arora (NRC) to Robert Poche (UniStar Nuclear Energy), "FINAL RAI 224 SPLA 4478" email dated April 5, 2010

2) Greg Gibson (UniStar Nuclear Energy) to Document Control Desk (NRC), Letter UN#10-001, Response to RAIs 61 and 194, Reliability Assurance Program, dated January 4, 2010

3) R. Wells (AREVA NP) to G. Tesfaye (NRC), "Response to U.S. EPR Design Certification Application RAI No. 268, FSAR Ch 17, Supplement 1," email dated October 30, 2009

The purpose of this letter is to respond to the request for additional information (RAI) identified in the NRC e-mail correspondence to UniStar Nuclear Energy (UNE), dated April 5, 2010 (Reference 1). This RAI addresses the Reliability Assurance Program, as discussed in Section 17.4 of the Final Safety Analysis Report (FSAR), as submitted in Part 2 of the Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Combined License Application (COLA), Revision 6.

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Additionally, this letter provides clarification of the UNE response to RAI 194, Question 17.04-4 (Reference 2). In Reference 2, UNE referred to U.S. EPR RAI 226, Question 17.04-16, with regard to the relocation of FSAR Tables 17.4-1 and 17.4-2 from the CCNPP Unit 3 COLA FSAR to the U.S. EPR FSAR. In the supplemental response to U.S. EPR RAI No. 268, Question 17.4-22 (Reference 3), AREVA added several systems to U.S. EPR FSAR Table 17.4-2. For clarification, the entire contents of U.S. EPR FSAR Table 17.4-2, as revised by the response to U.S. EPR RAI 268, Question 17.4-22, is incorporated by reference into the CCNPP Unit 3 COLA FSAR with no departures.

The enclosure provides our response to RAI 224, Questions 17.04-5 through 17.04-9, and includes revised COLA content. A Licensing Basis Document Change Request has been initiated to incorporate these changes into a future revision of the COLA.

Our response does not include any new regulatory commitments. This letter does not contain any sensitive or proprietary information.

If there are any questions regarding this transmittal, please contact me at (410) 470-4205, or Mr. Wayne A. Massie at (410) 470-5503.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on April 16, 2010

Greg Gibson

Enclosure: Response to NRC Request for Additional Information RAI 224, Questions 17.04-5 through 17.04-9, Reliability Assurance Program, Calvert Cliffs Nuclear Power Plant, Unit 3

cc: Surinder Arora, NRC Project Manager, U.S. EPR Projects Branch
Laura Quinn, NRC Environmental Project Manager, U.S. EPR COL Application
Getachew Tesfaye, NRC Project Manager, U.S. EPR DC Application (w/o enclosure)
Loren Plisco, Deputy Regional Administrator, NRC Region II (w/o enclosure)
Silas Kennedy, U.S. NRC Resident Inspector, CCNPP, Units 1 and 2
U.S. NRC Region I Office

GTG/RDS/mdf

Enclosure

Response to NRC Request for Additional Information RAI 224, Questions 17.04-5 through 17.04-9, Reliability Assurance Program, Calvert Cliffs Nuclear Power Plant, Unit 3

RAI 224

Question 17.04-5

Please describe the system boundary of the risk-significant systems identified in the CCNPP Unit 3 FSAR, Table 17.4-2 "Design Certification Scope Systems Included within RAP" and Table 17.4-3 "Site Specific Systems Included within RAP."

Response

As provided in the updated response to Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 RAI 61, Question 17.04-1[1], the CCNPP Unit 3 FSAR was revised to delete Tables 17.4-1 and 17.4-2. The information that was previously provided by these tables was added to the U.S. EPR FSAR, as Tier 2, Tables 17.4-1 and 17.4-2 in the AREVA response to U.S. EPR RAI No. 226, Question 17.4-16[2]. U.S. EPR FSAR Tables 17.4-1 and 17.4-2 are incorporated by reference into the CCNPP Unit 3 FSAR. Site-specific supplemental information required by COL Item 17.4-1 is provided in CCNPP Unit 3 FSAR Table 17.4-1, "Site Specific Systems and Structures Included within RAP."

The reliability assurance program (RAP) used at CCNPP Unit 3 is an extension of the U.S. EPR RAP, using the same methodologies to identify risk significant structures, systems, and components (SSCs). The U.S. EPR FSAR used a two step process to identify risk significant SSCs for the plant design. The first step used probabilistic risk assessment (PRA) input to identify components with high risk significance. The PRA criterion used for this screening was a Fussell-Vesely (FV) ≥ 0.005, a Risk Achievement Worth (RAW) ≥ 2.0, and Common Cause Failure (CCF) RAW ≥ 20. The resulting list for this screening is shown in U.S. EPR FSAR Table 17.4-1. The second step of the process was the application of an expert panel which reviewed plant systems and structures for the potential to meet deterministic criteria described in the U.S. EPR FSAR, Section 17.4.2.3. These are the same deterministic criteria described in CCNPP Unit 3 FSAR Section 17.4.2 for the CCNPP Unit 3 expert panel. Any component of a system/structure that met one or more of the deterministic criteria was screened into the RAP. In addition, all components of any system for which at least one component had been screened into the RAP were considered potential RAP components.

The use of the RAP expert panel compensates for limitations of the PRA model. At this stage of program development, the expert panel screened only systems and structures for inclusion in the RAP. Since the PRA did not model all components, the RAP expert panel screened other systems and structures that could contain risk significant components. Systems or structures containing components that had been identified as risk significant through this process were then categorized to be risk significant, in their entirety, to support initial development of the list of risk significant SSCs.

U.S. EPR FSAR Table 17.4-2 includes systems and structures screened into the RAP by the expert panel. Additionally, the systems and structures listed in Table 17.4-2 encompass the components identified in U.S. EPR FSAR Table 17.4-1. CCNPP Unit 3 FSAR Table 17.4-1 lists

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1 G. Gibson (UniStar Nuclear Energy) to Document Control Desk (U.S. NRC), Letter UN#10-001, Response to RAI No. 61 and RAI No. 194, Reliability Assurance Program, dated January 4, 2010 (ML100060689).

2 AREVA NP Response to U.S. EPR Design Certification Application RAI No. 226, FSAR Ch 17, Supplement 1, dated 7/24/09 (ML092050316)

the CCNPP Unit 3 site-specific systems included in the RAP based on the deterministic criteria listed in CCNPP Unit 3 FSAR Section 17.4.2.

The CCNPP Unit 3 RAP expert panel will refine the list of risk significant SSCs. As design progresses, the CCNPP Unit 3 expert panel will further develop the RAP list by screening down to the component level for identified systems. This process will continue to identify risk significant components, based on established PRA and deterministic criteria. The same criteria and insights will be utilized by the RAP expert panel to eliminate non-risk significant components from the RAP list.

Plant components have a unique tag number that includes designators to group components by function. Engineering conventions are used to standardize the component grouping approach and ensure system interfaces are consistently and completely identified. As an example, heat exchangers are generally included with the higher pressure system. Instrumentation sensors are included as part of the associated mechanical system, as opposed to being included in the I&C systems to which they are connected. These groupings are referred to as systems. As such, each system has system boundaries that are defined as the point of demarcation at interface points where the physical transition is made from one system to another. A typical example of these system boundary points is the isolation valve between two mechanical systems. In the U.S. EPR design, system boundaries are shown on P&IDs and can be clearly identified by making reference to the component tag numbers. These system boundaries and associated interfaces are described in detailed design documents.

During development of the above response, it was identified that CCNPP Unit 3 FSAR Table 17.4-1 includes the Feedwater Heating System. However, in the AREVA supplemental response to U.S. EPR RAI No. 268, Question 17.4-22[3], U.S. EPR FSAR, Table 17.4-2 was revised to include the Feedwater Heating System. Therefore, the Feedwater Heating System is being removed from CCNPP Unit 3 FSAR Table 17.4-1.

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3 AREVA NP Response to U.S. EPR Design Certification Application RAI No. 268, FSAR Ch 17, Supplement 1, dated 10/30/09 (ML093030258).

COLA Impact

FSAR Table 17.4-1 (as provided in the updated response to RAI 61, Question 17.04-1[1]) is being revised as follows:

Table 17.4-1 – {Site Specific Systems and Structures Included Within RAP}

SSC Names	Qualitative Determination for Inclusion Within RAP
STRUCTURES	
UHS Makeup Water Intake Structure	System failure modes may affect multiple trains/systems.
UHS Electrical Building	System failure modes may affect multiple trains/systems.
Switchgear Building	System failure modes may affect multiple trains/systems. (Station Blackout)
~~**POWER CONVERSION SYSTEMS**~~	
~~Feedwater Heating System~~	~~Contains components important to maintaining system reliability~~
DISTRIBUTED UTILITIES	
UHS Makeup Water System	Considered in design basis analysis. The system function is considered important in the Safety Analysis Report. A contribution to initiators. Technical Specification considerations.
ELECTRICAL SYSTEMS	
Offsite Power System-partial (plant specific scope)	Contains components important to maintaining system reliability; System failure modes may affect multiple trains/systems; Technical Specification considerations
Switchyard	Contains components important to maintaining system reliability; System failure modes may affect multiple trains/systems; Technical Specification considerations

Question 17.04-6

Provide the rationale for the criteria used for selecting the expert panel provided in Section 17.4.4.1.3 "Expert Panel" of the CCNPP Unit 3 FSAR.

Response

The selection criteria used to establish an expert panel for the RAP to screen SSCs is found in ASME RA-Sb-2005, Section 6, which provides general information on the selection process and personnel qualifications associated with a peer review of PRA.

The minimum number of expert panel members and experience requirements are provided in CCNPP Unit 3 FSAR Section 17.4.4.1.3. This establishes the minimum requirements for membership and ensures that personnel on the expert panel are adequately versed in key plant areas and PRA modeling. Expert panel members are replaced during the life of the plant to ensure the minimum is met when the expert panel is called upon to assess reliability and availability issues. This minimum must satisfy the requirement in ASME RA-Sb-2005, Section 6, which states that the peer review team "shall consist of personnel whose collective qualifications include: a) the ability to assess PRA elements, and b) the collective knowledge of the plant NSSS design, containment design, and plant operation."

COLA Impact

The COLA will not be revised as a result of this response.

Question 17.04-7

Provide the rationale for the deterministic categorization process provided in Section 17.4.4.1.4.2 "Deterministic Risk Ranking" of the CCNPP Unit 3 FSAR, especially, the classification of the weighted score range of 0-40 as a low safety or no risk significance.

Response

The deterministic categorization process presented in CCNPP Unit 3 FSAR Section 17.4.4.1.4.2 was developed to establish an objective, quantitative measure of deterministic risk significance for SSCs. The process was modeled after techniques used for probabilistic risk determination, and the methodology used for other risk based industry programs such as Maintenance Rule and risk-informed in-service inspection (ISI). The process was developed through the engineering judgment of experienced industry professionals including many with previous experience in risk assessment, such as those qualified for participation in the RAP expert panel discussed in FSAR Section 17.4.4.1.3.

The process ranks the risk significance of SSCs by assessing potential impact on the functions associated with the questions presented for evaluation in FSAR Section 17.4.4.1.4.2. These questions were developed from industry methods adopted for use in the scoping and screening of systems and components for inclusion in Maintenance Rule programs. The questions are intended to capture all SSCs, regardless of their safety classification, that could credibly affect reliable and safe operation.

Using this process along with an expert panel, the list of risk-significant SSCs developed in the design phase is updated when plant-specific information is available, and forms the basis for the Maintenance Rule Program, which ensures that risk-significant SSCs operate throughout the life of the plant with performance consistent with the assumptions in the PRA. The PRA and other sources, such as industry codes and standards and operating history, are used to identify and prioritize SSCs that are important to prevent or mitigate plant events that could present a risk to the public.

The quantitative limits presented in FSAR Section 17.4.4.1.4.2 represent a cumulative summation determined through the approach described above, with consideration for qualifiers and caveats presented in the discussion of each SSC's overall risk ranking. The rationale for the upper limit of 40 for low safety significance was specifically determined to be the level at which there is reasonable assurance that SSC failure will not cause the loss of a required function.

The risk associated with those components determined to be of "Medium Safety Significance (MSS)" does not mandate a level of surveillance that is appreciably less than that for components determined to be of "High Safety Significance (HSS)." The CCNPP Unit 3 FSAR is being revised to combine the MSS classification with HSS. Additionally, the No Risk Significance (NRS) classification is being combined with the Low Safety Significance (LSS) classification.

COLA Impact

COLA FSAR Section 17.4.4.1.2.2 is being revised as follows:

17.4.4.1.2.2 Design Change Feedback

The design control and change processes provide feedback to the PRA organization via identification of components on the MED that are affected by a proposed change. Those affected SSCs with ~~medium or high~~ risk <u>significance</u> are given additional review in accordance with approved criteria to ensure there is no potential impact to the risk ranking of the affected components. If potential impact is identified then the Risk and Analysis Organization must concur in the change.

COLA FSAR Section 17.4.4.1.4.1 is being revised as follows:

17.4.4.1.4.1 PRA Risk Ranking

A component's risk determination is based upon its impact on the results of the PRA. Both core damage frequency (CDF) and containment response to a core damaging event, including large release frequency (LRF) are calculated. The PRA models internal initiating events at full power and low power shutdown, and also accounts for the risk associated with external events. The PRA risk categorization of a component is based upon its Fussell-Vesely (FV) importance, which is the fraction of the CDF and LRF to which failure of the component contributes, its risk achievement worth (RAW), which is the factor by which the CDF and LRF would increase if it were assumed that the component is guaranteed to fail. Specifically, PRA risk categorization to identify SSC is based upon the following:

PRA Ranking	<u>PRA</u> Criteria
Greater than Low <u>Significance</u>	FV ≥ 0.005 or RAW ≥ 2.0 or CCF RAW ≥ 20
Low <u>Significance</u>	FV < 0.005 and RAW < 2.0 and CCF RAW < 20

COLA FSAR Section 17.4.4.1.4.2 is being revised as follows:

17.4.4.1.4.2 Deterministic Risk Ranking

Components are subject to a deterministic categorization process, regardless of whether they are also subject to the PRA risk categorization process. ~~This deterministic categorization process can result in an increase, but not a decrease (from the PRA risk) in a component's categorization.~~

A component's deterministic categorization is directly attributable to the importance of the system function supported by the component. In cases where a component supports more than one system function the component is initially classified based on the highest deterministic categorization of the function supported. In categorizing the functions of a system, five critical questions regarding the function are considered, each of which is given a different weight.

These questions and their weight are as follows:

Question	Weight
Is the function used to mitigate accidents or transients?	5
Is the function specifically called out in the Emergency Operating Procedures (EOPs)?	5
Does the loss of the function directly fail another risk-significant system?	5
Is the loss of the function safety significant for shutdown or mode changes?	4
Does the loss of the function, in and of itself, directly cause an initiating event?	3

Based on the impact on safety, if the function is unavailable and the frequency of loss of the function, each of the five questions is given a numerical answer ranging from 0 to 5. This grading scale is as follows:

"0" — Negative response

"1" — Positive response having an insignificant impact and/or occurring very rarely

"2" — Positive response having a minor impact and/or occurring infrequently

"3" — Positive response having a low impact and/or occurring occasionally

"4" — Positive response having a medium impact and/or occurring regularly

"5" — Positive response having a high impact and/or occurring frequently

The definitions for the terms used in this grading scale are as follows:

Frequency Definitions

- Occurring Frequently - continuously or always demanded
- Occurring Regularly - demanded > 5 times per year
- Occurring Occasionally - demanded 1-2 times per cycle

- Occurring Infrequently - demanded < once per cycle

- Occurring Very Rarely - demanded once per lifetime

Impact Definitions

- High Impact - a system function is lost which likely could result in core damage and/or may have a negative impact on the health and safety of the public

- Medium Impact - a system function is lost which may, but is not likely to, result in core damage and/or is unlikely to have a negative impact on the health and safety of the public

- Low Impact - a system function is significantly degraded, but no core damage and/or negative impact on the health and safety of the public is expected

- Minor Impact - a system function has been moderately degraded, but does not result in core damage or negative impact on the health and safety of the public

- Insignificant Impact - a system function has been challenged, but does not result in core damage or negative impact on the health and safety of the public

Although some of these definitions are quantitative, both of these sets of definitions are applied based on collective judgment and experience.

The numerical values, after weighting, are summed; the maximum possible value is 100. Based on the sum, functions are categorized as follows:

Score Range	Category
100-~~71~~ 41	High Safety Significance (HSS)
~~70-41~~	~~Medium Safety Significance (MSS)~~
40-~~21~~ 0	Low Safety Significance (LSS)
~~20-0~~	~~No Risk Significance (NRS)~~

A function with a ~~low~~ LSS categorization due to a low sum can receive a higher deterministic categorization if any one of its five questions received a high numerical answer. Specifically, a weighted score of ~~25~~ 15 or more on any one question results in an HSS categorization~~; a weighted score of 15-20 on any one question results in a minimum categorization of MSS; and a weighted score of 9-12 on any one question results in a minimum categorization of LSS~~. This is done to ensure that a function with a significant risk in one area does not have that risk contribution masked because of its low risk in other areas.

COLA FSAR Section 17.4.4.4 is being revised as follows:

17.4.4.4 Maintenance Rule/Operational Programs

The {Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC} MR program is described in Section 17.7. Risk significant SSCs identified by reliability assurance activities are included in the MR program as high safety significance (HSS) components (Section 17.7). The opportunity to judge SSC performance under the MR program is provided by the operational programs discussed in Section 17.7.

Many SSCs would meet the criteria to be in the MR program without considerations related to the RAP. In cases where the RAP identifies a ~~high or medium~~ risk significant SSC that would not otherwise have been in the MR program, the SSC is added. For those SSCs already in the Technical Specifications (TS), Inservice Inspection (ISI), or Inservice Testing (IST) programs, their performance under these programs is factored into the performance monitoring accomplished under the MR program.

In cases where a SSC requires periodic testing or inspection not already accommodated by an existing program, then special provisions will be made to accommodate the necessary testing or inspection, for example, in the Preventive Maintenance (PM) program.

Question 17.04-8

Section 17.4.4.4.1 "Performance Goal" of the CCNPP Unit 3 FSAR states that "the performance monitoring criteria are established consistent with the reliability and availability assumptions used in the PRA." For those risk-significant SSCs identified by the deterministic categorization methods (e.g., not modeled in the PRA), describe the performance criteria and goals.

Response

The performance criteria and goals for those risk-significant SSC identified by the deterministic categorization methods (i.e. categorized as HSS or cumulative score > 40) are modeled after the performance criteria established for the Maintenance Rule program, which is described in FSAR Section 17.7. Those performance criteria (e.g., failure rate, unavailability or condition-based) are chosen that are reasonable, measurable, and technically appropriate for the purpose of timely identification of degraded SSC performance or condition. FSAR Section 17.4.4.4.1, "Performance Goal," is being revised to include this clarification.

COLA Impact

FSAR Section 17.4.4.4.1 is being revised as follows:

17.4.4.4.1 Performance Goal

Reliability performance assumptions for SSCs are established under the MR at two levels of performance monitoring. The first level of performance monitoring (10 CFR 50.65(a)(2)) (CFR, 2008b) establishes conservative criteria used to judge that SSCs are meeting expected performance objectives. For SSCs that entered the RAP program through the expert panel and the PRA criteria discussed in Section 17.4.4.1.4.1, the performance monitoring criteria are established consistent with the reliability and availability assumptions used in the PRA. For SSCs that entered the RAP Program through the expert panel and criteria other than the PRA criteria specified in Section 17.4.4.1.4.1, performance criteria and goals are established per the Maintenance Rule program, which is described in Section 17.7. Those performance criteria (e.g. failure rate, unavailability, or condition-based) are chosen such that they are reasonable, measurable, and technically appropriate for the purpose of timely identification of degraded SSC performance or condition. Failure to meet these objectives would trigger performance monitoring at the second level (10 CFR 50.65(a)(1)) accompanied by the establishment of specific defined goals to return the component to expected performance levels (Section 17.7). These specific defined goals also consider the reliability and availability assumptions used in the PRA.

Question 17.04-9

Please justify the exclusion of the following systems from the scope of D-RAP:

- Normal Heat Sink (NHS)
- Startup and Shutdown System (SSS)
- Auxiliary Cooling Water System (ACWS)
- Closed Cooling Water System (CLCWS)
- Raw Water Supply System (RWSS)

Response

The list of systems provided were qualitatively and quantitatively evaluated by the same expert panel as was used for the U.S. EPR design certification. The reasoning for exclusion of the listed systems from the RAP is as follows:

- Normal Heat Sink (NHS): The NHS combines the circulating water supply system (CWS) and the cooling tower structure. The CWS was not considered risk-significant by PRA risk importance measures, and was deterministically evaluated to be not risk-significant by the design certification expert panel. The cooling tower structure was not considered risk-significant by PRA risk importance measures and was also deterministically evaluated to be not risk-significant by the design certification expert panel.
- Startup and Shutdown System (SSS): The SSS was not considered risk-significant by PRA risk importance measures, and was deterministically evaluated to be not risk-significant by the design certification expert panel.
- Auxiliary Cooling Water System (ACWS): The ACWS not considered risk-significant by PRA risk importance measures, and was deterministically evaluated to be not risk-significant by the design certification expert panel.
- Closed Cooling Water System (CLCWS): The CLCWS is currently in the design certification list of within-scope systems and structures, U.S. EPR FSAR Chapter 17.4, Table 17.4-2 – "Design Certification Scope Systems and Structures Included within RAP." CLCWS safety valve 30PGB19AA191 was screened into the RAP by PRA importance measures.
- Raw Water Supply System (RWSS): The RWSS was not considered risk-significant by PRA risk importance measures, and was deterministically evaluated to be not risk-significant by the design certification expert panel.

For the non-risk-significant systems discussed in this question, specifically the NHS, SSS, ACWS, and RWSS, the following deterministic characteristics contributed to the expert panel determination of non-risk-significant:

- Not considered in design basis analysis
- Not important to the safety analysis report
- No technical specification considerations

COLA Impact

The COLA will not be revised as a result of this response.