NRC Staff Responses to Licensing Board's Initial Publicly-Available Questions Regarding Safety Matters

Note: Citations to the "SER" refer to the NRC staff's Safety Evaluation Report (September 2010) unless otherwise noted. Citations to the "SAR" refer to AREVA Enrichment Services, LLC's (AES's) safety analysis report. Citations to the "ISA" refer to the Integrated Safety Analysis Summary.

Question No. 1, SAR, e.g., Section 2.0, Page 2.0-1: *In the various sections of its SAR, applicant AREVA Enrichment Services (AES) states that the provisions of "this license application are similar to those submitted for Nuclear Regulatory Commission (NRC) review in the [Louisiana Energy Services (LES)] license application for the National Enrichment Facility (NEF)."*

(a) What did the NRC staff find to be the significant safety-associated differences between the AES and LES applications?

Response No. 1(a) (B. Reilly): The staff conducted its safety review of the applicant's proposed equipment, facility design, safety programs, and commitments in accordance with NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility" (NRC000031). In conducting the review, the staff did not focus on identifying the differences in the AES and LES applications, although the previous LES licensing review did inform the reviewer's evaluations. Although there may be differences in the license applications, the staff found that each applicant's descriptions of its proposed equipment, facilities, safety programs, specifications, and analyses provide an adequate basis for safety and safeguards of the facility operations and that operation of each facility would not pose an undue risk to worker and public health and safety.

The staff, however, notes several safety-associated differences in the application. These are listed below:

	AES License Application Reference	AES SER Reference	Description
Quality Assurance	SAR, Chapter 11, page 11.1-1	Chapter 11, page 11-1	In its application (ML060680653, NRC000034), LES committed to the guidelines of the ASME

Program Description (QAPD)	(AES000037)	(NRC000032)	NQA-1, the quality assurance (QA) standards typically applied to nuclear power plants. AES will use a graded approach and apply management measures commensurate to the reduction of the risk attributable to items.
Safe-by-Design Items Relied on For Safety (IROFS)	SAR, Section 5.1.6, page 5.1-8 (AES000037) ISA Summary, Tables 3.7 (NRC000035) and 3.8 (NRC000036)	Section 3.3.2, pages 3-9 to 3-10 (NRC000032) Section 5.3.8.2, pages 5-14 to 5-16 (NRC000032)	Both LES and AES identified passive engineered controls that by their geometry and configuration will prevent a criticality accident from occurring as safe-by-design components. AES has designated these safe-by-design components as a special class of IROFS (i.e., IROFS96, IROFS97, IROFS98, and IROFS99).
Automatic fire suppression	Supplement to Request for Additional Information (ML101730072, NRC000037)	Section 7.3.3, page 7-12 (NRC000032)	For new facilities, 10 CFR § 70.64(b) requires that facility and system design and facility layout be based on defense-in-depth practices. The design must incorporate to the extent practicable a preference for the selection of engineered controls over administrative controls. To meet this requirement for fire protection, AES identified pre-action fire sprinkler systems in areas containing uranic material as an IROFS (i.e., IROFS100) to ensure that the potential consequences to the public would be low. In its application, LES did not designate its sprinkler system as an IROFS since LES relied on administrative controls as IROFS. AES has identified both active and passive controls as IROFS.

(b) Please discuss how those variations resulted in differences in the staff's analysis of those matters, including any license conditions or exemptions/variances?

Response No. 1(b) (B. Reilly): The following describes the differences, including any license conditions or exemptions/variations, in the AES license review resulting from the staff's analysis of the above-mentioned safety-associated variations.

QAPD

As discussed in Chapter 11 "Management Measures" of the Eagle Rock Enrichment Facility (EREF) SER (NRC000032), the QAPD was reviewed by the staff, based on NUREG-1520 (NRC000031), and accepted. AES requested the expedited review and approval of its QAPD (ML093080196, NRC000038) in order to be able to apply the QAPD language during its

procurement of services and material. Based on that review, the staff found the program acceptable for application to the design, construction, operation, including maintenance and modification, and decommissioning of the proposed EREF. The staff's evaluation report, included in the letter accepting the QAPD (ML093570322, NRC000039), notes that the staff's review was based on NUREG-1520 and documents the staff's conclusion that the QAPD adequately describes the application of other QA elements and has adequately established other QA elements as part of the management measures required by 10 CFR § 70.62(d). The staff identified no license conditions specific to the QAPD.

In a letter dated January 29, 2010 (ML100341185, NRC000040), AES requested an exemption from the 10 CFR 21.3 definitions for commercial grade item, basic component, critical characteristic, dedication, and dedicating entity. NRC staff reviewed the request and granted it on July 27, 2010 (ML101690142, NRC000041). In the exemption request, AES committed to supplement its QAPD to reflect the commitments made in this exemption request prior to implementation. The supplement (ML102670071, NRC000042) has been submitted to NRC for review and will incorporate the revised definition of commercial grade item—along with associated definition clarifications for basic component, critical characteristics, dedicating entity, and dedication—and implement a revised commercial grade item procurement strategy and dedication process.

Safe-by-Design IROFS

To respond to the staff's Request for Additional Information (RAI) (ML092810266, NRC000043 & NRC000044) about the AES ISA Summary and IROFS and staff's concerns as to how the application of the safe-by-design components, as described in the initial AES license application, met the requirements in 10 CFR 70.61(e) that each engineered or administrative control or control system necessary to comply with the performance requirements be designated as an IROFS, AES re-categorized the attributes of safe-by-design components as IROFS in Revision 2 of the SAR (AES000037). A new Section 5.1.6 "Passive IROFS that

Contain Safe-by-Design Component Attributes**"** was added to the SAR (AES000037). In addition, AES added new IROFS (i.e., IROFS96, IROFS97, IROFS98, and IROFS99) to Sections 3.7 (NRC000035) and 3.8 (NRC000036) of the ISA Summary. Based on these changes, the staff developed no additional license conditions or exemptions/variances.

Automatic Fire Suppression

In an RAI (ML092810266, NRC000043 & NRC000044), the NRC staff requested a justification from AES for not using available engineered controls as IROFS for fire protection features at the EREF. Subsequently, staff provided written guidance to AES regarding Quality Assurance (QA) requirements for fire protection IROFS (ML100560385, NRC000045). In response to the staff's RAI and subsequent letter regarding QA requirements and grading of fire protection IROFS, AES designated the automatic fire suppression systems installed in buildings and/or over areas containing licensed material-at-risk as IROFS. AES supplemented its application by letter (ML101730072, NRC000037). As described in the supplement, various sections of the SAR have been updated to reflect this designation. In addition, a new IROFS has been added to Sections 3.7 (NRC000035) and 3.8 (NRC000036) of the ISA Summary to include automatic pre-action fire sprinkler systems in areas containing uranic material (i.e., IROFS100). Based on these changes, the staff developed no additional license conditions or exemptions/variances.

(c) Have lessons learned from construction and operation of the NEF facility been used in the staff's safety review of the Eagle Rock Enrichment Facility (EREF) application? If so, please describe those lessons and explain how they have been applied to the staff's EREF licensing review.

Response No. 1(c) (B. Reilly): The staff considered the following lessons learned from the construction and operation of the National Enrichment Facility (NEF) facility in the safety review of the EREF application:

IROFS Boundary Definitions

At the time of the AES license application and review, the IROFS were in a general

design phase. NRC's intent is to review the IROFS in more detail during the operational readiness review (ORR). An important issue for the applicant's implementation, NRC's inspection of IROFS, and the application of management measures is a clear understanding of the definition or scope of each IROFS. In Section 3.3.1 of the SAR (AES000037), AES states that on completion of the design of IROFS, the IROFS boundaries will be defined and that ISA Summary Appendix A (NRC000046), Guidelines for Development of Boundary Definitions for IROFS will be used.

One of the lessons learned for an enrichment facility is that in implementing its boundary definition package, an applicant should ensure that the resulting IROFS boundaries meet the guidance provided in Interim Staff Guidance (ISG)-01, "Methods for Qualitative Evaluation of Likelihood" (NRC000047) (also Appendix B to Chapter 3 of NUREG 1520, Revision 1). ISG-01 states that:

> The IROFS boundary includes everything necessary for the IROFS to perform its intended safety function. For example: (1) the boundary of an enhanced administrative IROFS includes all instrumentation (sensors, annunciators, circuitry, any controls activated by the operator, etc.) relied on to trigger the operator action; (2) the boundary of a simple administrative control includes the equipment necessary to correctly perform the action; and (3) the boundary of an active engineered control includes the attendant instrumentation, sensors, essential utilities, and any auxiliary equipment needed to perform its safety function. The reliability and availability qualities of every component within the IROFS boundary must be considered in evaluating the total IROFS likelihood.

As discussed in Appendix A, page A-22, of the SER (NRC000033), the staff will impose the following license condition to highlight the importance of ISG-01 and to ensure that the final design is adequate and acceptable:

> To define the boundaries of each item relied on for safety (IROFS), the licensee shall comply with Appendix B to Chapter 3 of NUREG 1520, Revision 1 (NRC, 2010) "Qualitative Criteria for Evaluation of Likelihood" and utilize the licensee's guideline "Guidelines for Development of Boundary Definitions for IROFS [items relied on for safety]," Appendix A of the ISA Summary, Revision 2, dated April 30, 2010. Completed IROFS boundaries for all IROFS shall be available for inspection prior to the operational readiness review.

<u>Margin of Subcriticality for Safety</u>

In reviewing the AES application, the staff considered that certain changes not be made to the SAR prior to NRC approval as a lesson learned from the NEF operational readiness review. The AES SAR contains the information and commitments regarding nuclear criticality safety methodologies and technical practices that define the approved margin of subcriticality for safety, required by 10 CFR 70.61(d) that AES will use. It is important that an applicant not change the commitments described in the SAR without NRC's prior approval, to ensure that the margin of subcriticality will be maintained.

AES addressed the staff's concern that it not make changes to the SAR that would decrease the effectiveness of its safety commitments by requesting a special authorization. The special authorization identifies the criteria that AES will use to make changes to the SAR without prior NRC approval. In Section 1.2.4.2.2 of the SER (NRC000032), the staff grants the authorization and would impose the following license condition:

> The licensee is hereby granted the special authorization as identified in Section 1.2.5 "Special Exemptions and Special Authorizations" of the Eagle Rock Enrichment Facility Safety Analysis Report:
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> a. The licensee shall not make changes to the license application that decrease the effectiveness of safety commitments in the license application, without prior NRC approval. For these changes, the licensee shall submit to the NRC, for review and approval, an application to amend the license. Such changes shall not be implemented until approval is granted.
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> b. Upon documented completion of a change request for a facility or process, the licensee may make changes in the facility or process as presented in the license application, or conduct tests or activities not presented in the license application, without prior NRC approval, subject to the following conditions:
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> 1. There is no degradation in the safety commitments in the license application and
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> 2. The change, test, or activity does not conflict with any condition specifically stated in the license application.
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> Records of such changes shall be maintained, including technical justification and management approval, in dedicated records to enable NRC inspection upon request at the facility. A report containing a description of each such change, and appropriate revised sections to the license application, shall be submitted to the NRC within three months of implementing the change.

Question No. 2, SAR, e.g. Sections 3.3, 4.1, & 5.1, Pages 3.3-1 to -2, 4.1-1 to -2, & 5.1-1: *There are numerous situations in the SAR (and the associated Integrated Safety Analysis (ISA)) which AES has made statements/commitments regarding the not-as-yet built EREF that cannot be verified immediately. In this regard, AES commits to a significant number of future actions and makes a significant number of analysis assumptions about future geometric arrangements, operational procedures, and in-place safety systems. Please describe the process (including timing considerations) by which the staff ensures that all of these commitments/assumptions/procedures are tracked and how it is determined that the assumptions are verified/commitments have been met/procedures are in place at the appropriate time prior to facility operation.*

Response No. 2 (C. Taylor): The licensee has the primary responsibility for constructing the facility as designed and licensed. However, Section 193(c) of the Atomic Energy Act of 1954 (AEA), as amended, provides that, "prior to commencement of operation of a uranium enrichment facility licensed hereunder, the Commission shall verify through inspection that the facility has been constructed in accordance with the requirements of the license for construction and operation." This requirement is codified in the NRC's regulations under 10 CFR §§ 40.41(g) and 70.32(k) and applies to each construction phase and each cascade planned to be placed into operation. The NRC staff will conduct construction inspections, in addition to operational readiness review (ORR) inspections, to confirm that the licensee has constructed the EREF in accordance with applicable commitments. Where appropriate, the construction and ORR inspections may be combined. The ORR inspections will address construction for each of the applicable phases and will also address the operational programs, or significant changes to those operational programs for each of the applicable phases.

A Senior Project Inspector from the Center of Construction (CCI), Region II Office, in conjunction with a Senior Project Manager from the Office of Nuclear Materials Safety and Safeguards (NMSS) will be assigned to the EREF facility to oversee and coordinate the construction inspection program. Regional construction inspectors along with other headquarters inspectors will perform inspections at the EREF to sample the licensee's compliance with applicable commitments. The inspectors are required to be familiar with the licensee's SAR, ISA Summary, and other license application commitments, and to develop their

inspection plans to verify implementation of the licensee's commitments through routine construction inspections. The Senior Project Inspector uses a spreadsheet to track inspection completion. Inspection results are assessed periodically to determine the licensee's level of compliance in meeting its commitments.

The Senior Project Inspector, in coordination with NMSS and the regional inspectors responsible for inspecting a specific technical area, is responsible for ensuring that an appropriate sample of these commitments and requirements is adequately incorporated into the construction and ORR inspections. The inspection sample is based upon the complexity of the IROFS and the risk methodology outlined in 10 CFR § 70.61, "Performance Requirements." NMSS ranks the IROFS according to high, intermediate, and low accident and criticality consequences.

The inspection program will be outlined in Inspection Manual Chapter (IMC) 2635, Fuel Facility Construction and Pre-Operational Readiness Review Inspection Programs. This IMC is expected to be issued in advance of the onset of construction at the EREF. Prior to the NRC authorizing operation of the facility, operational readiness review inspections will be conducted to verify safety programs and operational readiness. Typical areas covered by ORR inspections include radiation safety, environmental and waste, transportation, nuclear criticality, operations, fire protection, emergency preparedness and material control and accountability. Other program offices that participate in the construction and ORR inspections include the Office of Nuclear Security and Incident Response (NSIR), in conjunction with Region II physical security inspectors. These inspectors are responsible for verifying that the information security and physical security commitments are met. The operational readiness review inspections evaluate licensee construction of the facility and implementation of the safety programs in accordance with the regulations, licensee's SAR, ISA, and other license application commitments.

The Senior Project Inspector for the EREF will maintain weekly communications with the licensee to discuss the construction inspection schedule. Region II also obtains licensee

construction schedules in Primavera scheduling software (commonly used by many NRC licensees). The Primavera schedule is integrated into the NRC's construction inspection schedule. Currently, weekly scheduling meetings are held in Region II with key NRC staff to discuss and allocate inspection resources for inspections for each facility under construction. The goal is to inspect early in the process, identify issues early in the process, and verify implementation of appropriate corrective actions early in the process. The Region II construction inspection program is based on ongoing construction inspections while construction is occurring.

Question No. 3, SAR, Section 3.1.1, Page 3.1-5: *(a) The SAR states: "The potential for an external off-site wildland fire was dismissed as a non-credible threat to the facility." The staff's Safety Evaluation Report (SER) lists three independent acceptable sets of qualities (SER at A-24), any one of which could define an event as not credible. Which of these qualities was used to define off-site wildland fire as a non-credible event?*

Response No. 3 (a) (R. Wescott): Although the applicant dismissed the potential for an external offsite wildland fire as a non-credible threat, the staff concluded that a wildfire was highly unlikely for the rangeland or agricultural land proximate to the facility. The staff does conclude that criterion (c): "Process deviations for which there is a convincing argument, given physical laws that they are not possible or are, unquestioningly, extremely unlikely" could be applicable to this situation.

The staff's evaluation and subsequent conclusion that a wildfire capable of causing a release of material was highly unlikely is discussed in Appendix A of the SER, A.3.1.1, page A-7 (NRC000033). The staff found that a wildfire would be significantly less intense than the minimum diesel fire capable of rupturing a cylinder. This evaluation was based on two factors: (1) the distance between the cylinder storage pads and the controlled area boundary; and (2) a comparison of the heat content in the rangeland vegetation with the heat content of a diesel fuel spill. A diesel spill and fire was analyzed for the National Enrichment Facility (ML050810267, NRC000048) and found to be incapable of rupturing a UF_6 cylinder, if the cylinder transporter

contained no more than 74 gallons of fuel. The aerial distribution of heat content for the postulated diesel fuel spill (joules per unit area) is about 2 orders of magnitude (100 times) greater than that of range grass. Also, the fire from a spill was assumed to surround the cylinder, whereas the range grass (NRC000049) is at least 100 ft from the cylinders. Since the heat content of the range grass is much less and its distance from the cylinder storage pad is greater, staff concluded that a range grass fire cannot generate enough heat to rupture a cylinder.

Question No. 4, SAR, Section 5.1.2, Page 5.1-3: *The SAR states: "The product cylinders are only safe under conditions of limited moderation and enrichment. In such cases, both design and operating procedures are used to assure that these limits are not exceeded."*

Please describe in detail the process by which the staff validated this statement, including validation of computational methods, a description of the accident sequences considered, [items relied on for safety (IROFS)] and procedures required; and confirmatory analysis performed.

Response No. 4 (C. Tripp): 30B and 48Y product cylinders are large geometry storage and transport containers that are certified in accordance with 10 CFR Part 71 requirements, and are designed to comply with American National Standard (ANS) N14.1, "Nuclear Materials—Uranium Hexafluoride—Packaging for Transport" (NRC000050). 49 CFR § 173.420(a)(2) requires that uranium hexafluoride packages "must be designed, fabricated, inspected, tested, and marked in accordance with (i) [ANS] N14.1 in effect at the time the packaging was manufactured." Packages are certified in accordance with 10 CFR Part 71 and must meet ANS N14.1 to obtain certificates of compliance. The fact that UF_6 cylinders comply with ANS N14.1 is relied on extensively in NRC regulation of this material (e.g., NUREG/CR-6410, "Nuclear Fuel Cycle Facility Accident Analysis Handbook" (NRC000051); NRC Information Notices IN 1997-20 (NRC000052) and 2002-31 (NRC000053); NUREG-1851, "Safety Evaluation Report for the American Centrifuge Plant in Piketon, Ohio" (NRC000054); and NUREG-1827, "Safety Evaluation Report for the National Enrichment Facility in Lea County, New Mexico" (NRC000055)).

These product cylinders are designed with maximum enrichment limits: 5 wt% ^{235}U for 30B cylinders and 4.5 wt% ^{235}U for 48Y cylinders, for cylinders with moderation control equivalent to a UF_6 purity of 99.5%. (Without moderation control, the maximum permissible enrichment is 1 wt% ^{235}U (NRC000056).) These cylinders, with the above limits, are widely used throughout the nuclear industry, and the staff did not need to perform any evaluation or analysis to have reasonable assurance of subcriticality involving the product cylinders. UF_6 cylinders are of very robust construction due to the requirements of the ANS N14.1 standard and 10 CFR Part 71 regulations, are stored with solid UF_6, and do not contain significant amounts of moderator. Accordingly, the handling of product cylinders has been recognized to be a low risk operation, and in fact is often viewed as having sufficiently low risk so as to justify an exemption from the criticality accident alarm system requirements of 10 CFR § 70.24(a) (*e.g.*, Section 5.3.6 of NUREG-1851 (NRC000054)).

According to the shipping limits contained in ANS N14.1 (NRC000050), 30B cylinders would contain at most 2,277 kg UF_6, and 48Y cylinders would contain at most 12,501 kg UF_6. A moisture equivalent limit of 0.5 wt% would consist of 11.4 kg H_2O for a 30B cylinder and 62.5 kg H_2O for a 48Y cylinder. These limits are widely accepted in the industry as being sufficient to ensure the cylinders are safely subcritical (NRC000056). In addition, as stated in Section 5.3.5.1 of the SER (NRC000032), product cylinders will be limited to less than 9.3 kg H_2O, which is even more conservative than the industry limits and represents a safety factor of about 65 percent when compared to the applicant's safe value of 14.2 kg H_2O, as indicated in SAR Table 5.1-1, "Safe Values for Uniform Aqueous Solution of Enriched UO_2F_2" (AES000037). The staff's review of these values is described in Section 5.3.5.1 of the SER (NRC000032). Safe values were calculated assuming optimally moderated UO_2F_2 solution, full water reflection, and 5 and 6 wt% ^{235}U; safe values correspond to a calculated k_{eff} of 0.95. The staff noted that the applicant's tabulated safe values compare favorably with the widely accepted values from ANSI/ANS-8.1-1998 (NRC000057) (see Table 5.3-1 of the SER (NRC000032)).

The movement and storage of product cylinders is a commonplace operation in the nuclear fuel industry and is not expected to have any unusual complications. The specific movement and storage procedures have not been developed; however, AES has stated that it will have written procedures and that activities involving licensed materials will be conducted in accordance with AES-approved procedures (SAR, Section 11.4.3 (AES000037)). Once developed, specific procedures may be inspected as part of an NRC Operational Readiness Review.

Question No. 5, SAR, Section 5.1.2, Page 5.1-3: *The SAR contains the following statement: "Centrifuge array criticality is precluded by a probability argument with multiple operational procedure barriers. Total moderator or [hydrogen/uranium (H/U)] ratio control as appropriate precludes product cylinder criticality."*

Please describe/explain this probability argument and explain how the staff has quantified the probabilities involved and verified the argument.

Response No. 5 (C. Tripp): Neither the applicant nor the staff performed a quantitative probability analysis. The applicant's arguments demonstrating criticality safety in the centrifuge array are qualitative.

Criticality in a single centrifuge machine would require a massive operational upset, which would involve a build-up of sufficient mass, the introduction of sufficient moderator, and exceeding the design safe diameter of the equipment (NRC000058). With regard to mass, in the enrichment process, gas centrifuges are operated at low density and low mass per machine, such that there is insufficient mass available to sustain criticality. With regard to moderator, the UF_6 gas reacts vigorously with any water introduced, according to the reaction $UF_6 + 2H_2O \rightarrow 4HF + UO_2F_2$. This chemical reaction would eliminate much of the water introduced, removing the hydrogen bound in water as gaseous HF, and would also produce UO_2F_2 deposits within the cascade (NRC000056). With regard to geometry, centrifuges and other cascade equipment (e.g., chemical traps, cold traps, pumps) will be designed to have diameters less than the safe values in Table 5.1-1 of the SAR (AES000037) (i.e., more conservative). Based on the above

considerations, the occurrence of a sufficiently large failure of mass, moderation, and geometry conditions concurrently has been qualitatively determined to be extremely unlikely. Conditions within the cascade (e.g., pressures, flow rates, enrichment, etc.) are monitored continuously by instruments and overseen in the control room, and it is not feasible that such a massive upset would fail to be noticed by control room operators or allowed to continue long enough to result in criticality. Qualitatively, such a sequence of events would be at least highly unlikely.

An array of centrifuge machines is not necessarily geometrically safe, due to the possibility of neutron interaction. However, any such interaction is expected to be very weak, due to the separation between centrifuges, which will serve to cut down interaction between units through neutron absorption. Criticality in an array of centrifuges would require an upset similar to that described in the above paragraph to occur in more than one centrifuge. If the accumulation of sufficient mass and moderator in a single machine is highly unlikely, such an occurrence in multiple machines is even more unlikely.

Question No. 6, SER, Section 1.2.3.2, Page 1-8: *(a) The SER states that "little," if any, new restricted data (RD) is expected to be created as a result of the AES facility. Under what circumstances could new RD be created and what would that information concern?*

Response No. 6(a) (J.K. Everly): New RD could be created if the European centrifuge machines perform differently in the U.S. For example, it is believed that the climate in New Mexico may have an impact on the centrifuge machines such that their performance (i.e., speed/frequency, temperatures, pressures, efficiency, power consumption, etc.) may be outside of the historical ranges of the machines in Europe. Similar or other locality-specific factors may impact the performance of the centrifuge machines in Idaho. A Technology Guide, similar to the URENCO Technology Guide for Louisiana Energy Services Gas Centrifuge Plant (published on October 4, 2010 and approved by the NRC on November 16, 2010), will be used to verify whether the centrifuge machines are performing outside of the historical ranges of the machines in Europe. Any performance data found outside of the historical ranges would be considered

new RD.

(b) Is ratification/implementation of the Pentapartite Agreement a prerequisite to the issuance of the AES license and would ratification/implementation result in additional safety-related licensing submissions by AES and/or safety-related licensing review analyses by the staff?

Response No. 6(b) (J.K. Everly): The Pentapartite Agreement is not a prerequisite to the issuance of the AES license. This agreement is under development and would allow the transfer into the U.S. of the European centrifuge enrichment technology, for use by AES, and certain classified information related to it. Without the agreement, there is no mechanism to allow AES to receive these classified centrifuge machines for installation in its proposed EREF.

The agreement is, however, a prerequisite to NRC issuing AES a facility clearance in accordance with 10 CFR § 95.15, "Approval for processing licensees and others for facility clearance" for access to the European centrifuge technology. In accordance with 10 CFR § 70.22(m), AES submitted a classified matter plan (CMP) which addresses the requirements of 10 CFR Part 95. As described in Section 1.2.4.3.4 of the SER (NRC000032), AES has provided an acceptable CMP. Authorization for the applicant to begin implementation of the CMP (i.e., their facility clearance), however, is contingent upon an NRC inspection and finding prior to the receipt of classified matter. The NRC staff will impose the license condition described in Section 1.2.4.3.4 of the SER (NRC000032) to ensure that classified matter is not processed, stored, reproduced, transmitted, handled or accessed, except as permitted by the applicable personnel and facility clearances required under 10 CFR Part 25, "Access Authorization," and 10 CFR Part 95.

Question No. 7, SER, Section 1.2.3.4, Page 1-10: *There is a commitment to obtain liability insurance to cover the hazardous properties of chemicals containing licensed materials. Does this insurance cover all hazardous chemicals produced from licensed materials, e.g., hydrogen fluoride (HF)?*

Response No. 7 (I. Dinitz): In a letter to AREVA dated December 22, 2008 (ML090300656, NRC000059), American Nuclear Insurers (ANI) indicated that it expects to write nuclear liability

insurance for the EREF. The nuclear liability Facility Form policy provides coverage for bodily injury, property damage or environmental damage caused by the "nuclear energy hazard," which is defined in part as "the radioactive, toxic, explosive, or other hazardous properties of nuclear material." "Nuclear material" means source, special nuclear or byproduct material.

The policy should apply if the bodily injury, property damage or environmental damage is caused by a hazardous chemical (e.g. hydrogen fluoride) that is produced from "nuclear material." The key is that the definition of "nuclear energy hazard" must be satisfied for coverage to apply. ANI can confirm policy coverage only in the event of an actual claim and the specific circumstances involving that claim.

Question No. 9, SER, Sections 1.2.4.2.1 & 10.3.3.1.1, Pages 1-13 to -14 & 10-8 to -12:
Please describe/explain how the exemption that allows incremental decommissioning funding, and the license condition regarding that funding regime, is different from what was approved by the staff relative to the LES application, see NUREG-1827, at 1-9 to -1, 10-12 to 15?

Response No. 9 (R. Przygodzki): As described in the SER for LES (NUREG-1827) (NRC000055), LES's approach for providing financial assurance (FA), upon receipt of licensed material, was to fully fund the estimated cost of decontamination and decommissioning of the full-size facility, and to fully fund the estimated cost to disposition the depleted uranium (DU) tails generated during the first three years of operation. This approach was reflected in license conditions 16 and 17 of the original license issued to LES on June 23, 2006 (ADAMS Accession No. ML061780384, NRC000060). LES's license was later modified to incrementally fund operational areas and buildings as they were placed into operation, as reflected in revised license condition 16 of the LES license (ML080530355, NRC000061). The staff documented its review in connection with revised license condition 16, among other things, in a Safety Evaluation Report (ML080530351, NRC000062). After initial plant production, both approaches would provide funding for DU disposition on a forward-looking basis to reflect projections of DU byproduct generation.

AES's exemption for providing FA on an incremental basis is consistent with LES's

amended license. Both LES and AES will provide FA on an incremental basis as new plant areas are put into operation. Both LES and AES will update their DU disposition cost estimates annually on a forward looking basis after initial plant production.

In addition, AES has committed to providing NRC with more frequent updates to the decommissioning cost estimate (DCE) and DU disposition cost estimate than LES. AES committed to: (1) supplement the incremental facility DCE updates with annual updates to the facility DCE until the facility is at its full capacity; and (2) provide annual DU disposition cost estimate updates during initial plant production.

The attached table provides additional information comparing the LES and AES approaches for providing initial financial assurance; incremental funding and updates until the facilities would be operating at full capacity; and updates after the facilities are operating at full capacity.

Attachment for Question 9

Summary Table Comparing LES and AES Approach for Financial Assurance

	LES (NUREG-1827) (NRC000055)	**LES (Amendment 6) (NRC000061)**	**AES (NUREG-1951) (NRC000032)**
Initial FA Coverage	Full-size facility and three years of estimated DU generation.	Centrifuge Test Facility, the Post Mortem Facility, the Cylinder Receipt and Dispatch Building, and all other plant areas where licensed material is used.	Centrifuge Assembly Building and all other plant areas where licensed material is stored or used, any plant area not fully decommissioned.
Frequency & Coverage of Incremental Updates until Full Capacity Operations (Facility)	NUREG-1827 is ambiguous; LES would provide FA for the full size facility and update its decommissioning funding plan (DFP) and decommissioning cost estimate (DCE) and FA instruments for facility decommissioning at	Six months in advance of plant areas being put into operation. Covers plant areas being put into operation, plant areas not decontaminated and decommissioned, as well as all other areas where licensed material is used.	Six months in advance of plant areas being put into operation. Covers plant areas being put into operation, plant areas not decontaminated and decommissioned, as well as all other areas where licensed material is used.

	least triennially		
Frequency of Supplemental Facility DCE Updates	N/A	N/A	Annually, until full capacity operations.
Incremental Updates (DU)	After first three years of operations, updated annually, on a forward looking basis	After first three years of operations, updated annually, on a forward looking basis	After first two years of operations, updated annually, on a forward looking basis.
Frequency of Supplemental DU Disposition Estimate Update	N/A	N/A	Annually, for the first two years of operations.
Full Capacity Operation Updates	Facility DFP/DCE would be updated at least triennially. DU disposition estimates updated annually, on a forward looking basis	Facility DFP/DCE would be updated at least triennially. DU disposition estimates updated annually, on a forward looking basis.	Facility DFP/DCE would be updated at least triennially. DU disposition estimates updated annually, on a forward looking basis.

Question No. 10, SER, Section 1.2.4.2.2, Pages 1-14 to -15: *How is the proposed license-condition endorsed general criteria for changes to the SAR that do not require prior NRC approval of "no degradation in the safety commitments in the license application" consistent with, or different from, the licensee "change" determination that otherwise would have to be made under the specific criteria of 10 C.F.R. § 70.72(c)?*

Response No. 10 (B. Reilly): Under Section 11.1.4, "Change Control," of the SAR (AES000037), AES states that each change to the facility or activities of personnel would be evaluated in accordance with the requirements of 10 CFR § 70.72. In addition, AES requested special authority, which NRC would grant through a license condition, to make certain changes to the SAR without prior NRC approval. Several criteria in 10 CFR § 70.72(c) focus on changes to the ISA Summary (accident sequences and IROFS) (NRC000035 & NRC000036). The criteria from 10 CFR § 70.72(c) include whether the changes create a new type of accident sequence; use new processes, technologies, or control systems for which the licensee has no prior experience; remove, without at least an equivalent replacement of the safety function, an IROFS; and alter any sole IROFS. These criteria may not be appropriate or applicable for

changes in information or commitments in the SAR.

In a supplement to the SAR, dated August 20, 2010 (ML102530031, NRC000064), AES requested a special authorization for making certain changes to the SAR that would not decrease the effectiveness of its safety commitments. The request identified the criteria that AES would use to evaluate changes to the SAR without requiring prior NRC approval. This authorization is consistent with the approach used for 10 CFR 70.72 changes in that it parallels the three elements of 10 CFR 70.72: (1) criteria to evaluate changes to determine when preapproval by the NRC is required; (2) documentation of the evaluation of changes and recordkeeping; and (3) timeliness of updates to onsite documentation and reporting of changes to the staff. The request is similar to authorizations granted to other licensees, for example, the Mixed Oxide Fuel Fabrication Facility (described in the Draft SER, Section 16.2.2.3, ML102280191, NRC000065) and Westinghouse (described in SER, Section 14.1.1, ML072180276, NRC000066). The staff's consideration for this authorization is discussed in Section 1.2.4.2.2 of the EREF SER (NRC000032), along with the license condition to be imposed on AES.

Question No. 11, SER, Section 1.3.3.4.2, Page 1-33: *(a) The Probabilistic Volcanic Hazard Analysis (PVHA) accepted by the staff used a volcanic event recurrence rate developed by Hackett (2002) for the entire axial volcanic zone. Explain why the close proximity of the 5.2 ka Hell's Half Acre volcanic field to the EREF site does not demonstrate that the probability of an eruption in this part of the axial volcanic zone is greater than the value determined by the spatially homogeneous model.*

(b) The PVHA concluded, and the staff accepted, that the annual probability of lava inundation at the EREF site is 5 x 10E-6, which corresponds to a 200,000 year site-inundation recurrence interval. In contrast, Champion (2002) (cited in the reference list in Appendix D of the application), gives inundation recurrence values of 40,000 years for the area of the INL closest to the EREF site. Please explain why the two estimates are so different and why it is appropriate to accept the longer inundation recurrence interval in the PVHA.

Response No. 11 (a) & (b) (J. Stamatakos): The answers to both questions are closely related and center on how the temporal and spatial variations of past events should be included in the probabilistic volcanic hazard assessment. In the analysis developed by Hackett (2002)

(AES000049), temporal and spatial variations within the broad axial volcanic zone are smoothed on the premise that future activity could occur anywhere within the axial volcanic zone with equal likelihood. Areas of higher or lower activity are thus viewed as random occurrences within the axial volcanic zone in both space and time. As noted in Appendix D of the ISA summary (NRC000067), the applicant supports this premise by stating that the limited geochronology data, which mainly come from potassium-argon and argon-argon radiometric ages and accumulation rates based on paleomagnetic polarity observations, is too uncertain to allow reliable construction of detailed temporal volcanic models. The applicant does not discuss the potential for spatial clustering that could result from fault or other structural controls on the location of past volcanic events beyond the concept that volcanic activity is generally higher within the volcanic rift zones, as defined by Kuntz, et al. (1992) (NRC000068).

The 40,000 year recurrence interval (2.5×10^{-5}/yr annual rate) in Champion, et al., (2002) (AES000047) is based on analysis of borehole data. Specifically, the recurrence interval is estimated from linear age versus depth relationships in combination with an estimate of the count of lava flows within each bore hole. As noted by these authors, however, mean recurrence intervals vary significantly among even adjacent boreholes, typically by factors of 50-100 percent, and thus, indicate that lava flow inundation at any given locality is nonuniform. One reason for the large variability is that accurate counts of the number of individual flows within a borehole are difficult to determine because many of the counted flow horizons may simply represent overlapping lava flows from a single eruption. In addition, Champion, et al. (2002) (AES000047) note that much of the eastern Snake River Plain has experienced a relative hiatus in lava accumulation over the past 200,000 years.

The staff agrees with the applicant that nonhomogeneous spatial or temporal models are not appropriate for the volcanic hazard analysis. The variations in volcanic activity implied by the borehole data in Champion, et al. (2002) (AES000047) coupled with the large uncertainties inherent in those data and the uncertainties in applying borehole data to this problem (as

described in the previous paragraph) are, in staff's judgment, too large to support construction of reliable temporal or spatial volcanic hazard models. At present, the most reasonable application of the data is in the estimate of a long-term rate. The staff, therefore, concludes that the probabilistic volcanic hazard analysis in the application based on the homogeneous model is sufficient to demonstrate that volcanism at the site is highly unlikely (i.e., less than ~ 1×10^{-5}/yr per NUREG 1520).

The staff notes however that even if the 40,000 year (2.5×10^{-5}/yr) recurrence interval for future volcanism in Champion, et al. (2002) (AES000047) is used as the best estimate of future activity in the vicinity of the site, disruption of the facility by volcanism would be deemed highly unlikely. The staff determined that even if an eruption were likely to occur within the Hell's Half Acre volcanic field at an annual rate of 2.5×10^{-5}/yr, it is not certain that the lava flow would inundate the site. According to the analysis provided by the applicant in Appendix D in the ISA summary (NRC000067), the average size of a lava flow at the INL covers about 97 km^2 [37.5 mi^2]. Based on Figure D-1 of Appendix D in the ISA summary (NRC000067), Lava-Ridge-Hell's Half Acre covers an area of approximately 240 km^2 [92.7 mi^2]. Thus, the conditional probability of inundation at the proposed site is about 40 percent (97 km^2/240 km^2 = 0.40). Thus, the annual probability of inundation at the site is estimated at 1.0×10^{-5}/yr (2.5×10^{-5}/yr × 0.40 = 1.0×10^{-5}/yr). The staff's judgment is that the probability under these assumptions is also highly unlikely.

Question No. 12, SER, Sections 1.3.3.4.4 & 1.3.3.4.5, Page 1-34: *The SER indicates that AES is still studying site liquefaction and settlement and has committed to evaluating the results of these studies based on various approved regulatory guidance documents in the context of final facility design. Does the staff consider the completion of these studies and staff review of their results as prerequisites for staff authorization to AES to operate the EREF?*

Response No. 12 (B. Reilly): The results of these studies are important aspects for consideration in the final design of the structure and system IROFS to ensure that these IROFS will be able to perform their intended safety function. However, the level of detail required for a

licensing decision (i.e., a license for AES to operate the EREF) generally does not require a final facility design. The licensing decision is based, in part, on the identification of all IROFS and information about those IROFS.

Regarding site liquefaction, the staff reviewed the information that the applicant provided concerning the depth of the groundwater table (150 m (500 ft) below ground surface) and classification of soils (primarily clays) and concurred with the applicant's conclusion that the liquefaction potential for the site is highly unlikely. In addition, in the ISA Summary, Section 3.2.7 (AES000040), AES states that, to support the final design of the EREF, it intends to conduct additional site subsurface investigations and verify through investigation its conclusion that soil liquefaction potential is highly unlikely. These investigations will be evaluated in accordance with the Regulatory Guide (RG) 1.1.98 "Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites" (NRC000069). Based on this information, the staff found that the application met the regulatory requirements in 10 CFR § 70.65(b)(1).

Regarding settlement, AES states in the ISA Summary that, to support the final design of the EREF, it intends to conduct additional geotechnical investigations using standard guidance listed in Section 3.2.7 of the ISA Summary (e.g., Naval Facilities Engineering Command Design Manual (NAVFAC) DM7.02) (AES000040) applicable to settlement and allowable bearing pressure. Based on AES's plans to conduct geotechnical studies and use standard guidance, the staff found that the application met the regulatory requirements in 10 CFR § 70.65(b)(1).

In addition to the license application review, NRC will conduct inspections through its Regional Office, to ensure that the AES's programs have been sufficiently implemented and commitments have been properly applied in the final facility design and in the constructed facility. 10 CFR § 70.32(k) requires the NRC to verify through inspection that the facility has been constructed in accordance with the requirements of the license prior to the commencement of operations; this requirement will be imposed as a license condition. NRC will

conduct inspections to ensure that the programmatic commitments made by the licensee are properly applied in the final design and the as-built facility.

Question No. 13, SER, Section 1.3.4, Page 1-35: *NUREG-1520 (revision 1), the standard review plan (SRP) for fuel cycle facilities, indicates in section 1.3.3 (at 1-10) that the applicant should provide a hydrological description of water table depth/ground water flow/uppermost aquifer characteristics. The SER indicates the staff reviewed site hydrology. Please provide a citation to the staff's SER hydrology analysis.*

Response No. 13 (B. Reilly & R. Wescott): As described in Section 1.3.3.3.4 of the SER (NRC000032),[1] the nearest large surface waters are the Snake River, which is approximately 32 km (20 mi) east, and Lake Wolcott, which is approximately 120 km (75 mi) southwest of the site. The potential for flooding as an event for accident analysis was considered in the staff's review of the ISA Summary. Appendix A, Table A-1 of the SER identifies the potential for flooding as non-credible since there are no nearby surface water bodies or streams (NRC000033). In Section A.3.1.1, the staff further evaluates the potential for local site flooding for the accident analysis.

Also, in Section 1.3.3.4.4 of the SER (NRC000032), the staff concluded that the liquifaction potential for the soil at the proposed site is highly unlikely, in part because the groundwater table is deep. This was the only consideration of groundwater hydrology in the safety analysis, as groundwater (given the depth of the groundwater table at depths between 199.5 m (654.4 ft) and 219.4 m (719.9 ft) [SAR, Section 1.3.4, page 1.3-8 (AES000037)]) should have no other impacts on the safety of licensed material.

Question No. 15, SER, Section 2.3.2, Page 2-7: *Please explain why the qualifications of a bachelor of science degree with four years of nuclear experience and one year of direct experience are sufficient for the Nuclear Criticality Safety Manager.*

Response No. 15 (C. Tripp): NUREG-1520, Section 11.4.3.3, page 11-15 (NRC000031), indicates the following acceptance criteria for managers and supervisors:

[1] As discussed in its answer to Question 25 below, the staff notes that it used NUREG-1520 (2002 version) (NRC000031) for purposes of the AES license application review.

a. Managers should have a minimum of a B.S. or B.A. or the equivalent. Each manager should have either management experience or technical experience in facilities similar to the facility identified in the application.

b. Supervisors should have at least the qualifications required of personnel being supervised, plus, either 1 additional year of experience supervising the technical area at a similar facility or completion of a supervisor training course.

c. Technical professional staff identified in the ISA Summary whose actions or judgments are critical to satisfy the performance requirements identified in 10 CFR Part 70 (i.e., related to an IROFS) should have a B.S. in the appropriate technical field and 3 years of experience.

The Manager of Nuclear Criticality Safety position meets or exceeds the acceptance criteria for supervisors and managers in NUREG-1520 (NRC000031). This is also fairly standard across the nuclear fuel industry and is consistent with what has been accepted for other Part 70 licensees, as indicated in the following examples:

	NCS Manager Experience	**NCS Manager Education**
USEC American Centrifuge Plant	Bachelor's degree in engineering, math, or related science or equivalent technical experience	Four years nuclear experience, including six months at a uranium processing facility
LES National Enrichment Facility*	Bachelor's degree (or equivalent) in an engineering or scientific field	Five years responsible nuclear experience in Health, Safety, and Environment or related discipline; One year direct experience in the administration of NCS evaluations and analyses
MOX Fuel Fabrication Facility	Bachelor's degree in science or engineering, or equivalent	Three years nuclear industry experience in NCS
Westinghouse Electric Company, Columbia Fuel Fabrication Facility	Baccalaureate degree, or equivalent, with a science or engineering emphasis	Two years experience in assignments involving regulatory activities in the nuclear business
Babcock & Wilcox	Bachelor's degree in a physical science or engineering	Two years experience as a nuclear criticality safety engineer at the facility or three years experience as a nuclear criticality safety engineer at another nuclear facility

*Applies to "Health, Safety, and Environment Manager" related to NCS (slightly broader duties).

Question No. 18, SER, Section 4.3.7, Page 4-15: *In its SAR at section 4.2, AES has committed to apply "as low as reasonably achievable" (ALARA) principles to EREF personnel. See SAR at 4.2-1 ("Annual doses to individual personnel are maintained ALARA. In addition, the annual collective dose to personnel . . . is maintained ALARA."). AES then sets a 1 rem/year administrative limit in Table 4.1-1 of the EREF SAR, which represents twenty percent of the annual NRC limit of 5 rem/year given in 10 C.F.R. § 20.1201. AES states that this limit is*

consistent with ALARA and the staff appears to remain silent on this point. See SAR at 4.1-1 ("This [administrative limit] provides assurance that legal radiation exposure limits are not exceeded and that the ALARA principle is emphasized."); SER at 4-15. Given AES's additional explanation that 1 rem/year bounds "operating experience of similar facilities in Europe," including the Urenco Capenhurst site (maximum annual dose of 341 mrem in 2007), and its statement that "since additional exposures occur at the Capenhurst Site, it is likely that the exposures at the EREF will be lower," SAR at 4.1-1, why is 1 rem/year an appropriate administrative limit for external exposure consistent with ALARA?

Response No. 18 (G. Chapman): Staff considered an administrative limit that is 20 percent of the regulatory limit to be appropriate because it is both significantly below the regulatory limit and the applicant believes it can be achieved prior to beginning operations. After operations have begun, the applicant is expected to generate administrative controls and goals within the radiation monitoring and ALARA programs to both ensure that the regulatory limit is not exceeded and that operations are ALARA consistent with 10 CFR § 20.1101(b).

As discussed in Section 4.2.1 of the EREF SAR (AES000037), the applicant's Safety Review Committee (SRC) would regularly review the effectiveness of the ALARA program and determine if exposures, releases and contamination levels are in accordance with the ALARA concept. The SRC would also periodically review the goals and objectives of the ALARA program. These goals and objectives would be revised to incorporate, as appropriate, new technologies or approaches and operating procedures or changes that could cost-effectively reduce potential radiation exposures.

Because developing ALARA goals that are more precise than the stated administrative limit may not be practical until operational data are evaluated, and because the ALARA goals will be subject to frequent review and/or revision, the staff believes AES's proposal to implement an administrative limit of 20 percent of the regulatory limit is appropriate.

Question No. 20, SER, Section 10.3.3, Page 10-6: *In the SER, the staff indicates that AES "has assumed that DOE will take title and possession of DU for disposal." Currently, the staff is considering an application for a commercial depleted uranium deconversion facility located near Hobbs, New Mexico. Assuming that deconversion facility is licensed, constructed, and begins operating:*

(b) If AES wished to use that deconversion facility in the future, would that require any changes/amendments to any Part 70 license that might be issued in this proceeding?

Response No. 20 (b) (B. Reilly): No amendment to the license would be required if AES wished to use the deconversion facility.

In Section 10.3 of the SAR (AES000037), AES describes that, for purposes of providing funding assurance, AES has assumed that the depleted uranium tails will be transported to the Department of Energy (DOE) facilities at Portsmouth, Ohio or Paducah, Kentucky for conversion and disposal in accordance with regulatory requirements. A change in this assumption could impact the cost estimates. As described in Chapter 10 of the SER (NRC000032), the staff will impose a license condition to require updates of the cost estimates and financial assurance instruments for depleted uranium disposition, including a requirement that AES update their DU disposition cost annually on a forward looking basis after initial plant production. Any change in the assumptions underlying the cost estimate for the disposition of depleted uranium would be required to be addressed in these updates.

Question No. 21, SER, Sections 10.3.2 & 10.4, Pages 10-4 & 10-16: *The statement of the license condition at p. 10-16 differs from the statement of what seemingly is intended to be the same license condition on p. 10-4 by the addition of a sentence. Which statement of this license condition is correct?*

Response No. 21 (B. Reilly): The statement on page 10-4 is correct. The license condition on page 10-4 would be incorporated into the license as the correct condition.

Question No. 25, SER: *The AES application was prepared and submitted prior to the May 2010 issuance of revision 1 to the fuel cycle facility SRP, NUREG-1520. What were the significant changes adopted in NUREG-1520, revision 1, and was the AES application reviewed in accord with those revisions?*

Response No. 25 (B. Reilly): The revision of NUREG-1520 (NRC000031) did not create new guidelines for reviewers. In general, the changes to NUREG-1520, Revision 1 (NRC000070) consisted mostly of editorial and formatting changes for consistency; updates to references; and expanded technical rationale concerning the acceptance criteria, including incorporation of

interim staff guidance (ISG) and internal guidance issued to staff. A summary of the changes to NUREG-1520 can be found under ADAMS Accession Number ML100550079 (NRC000071).

The AES application was submitted in December 2009, and the staff review was underway at the time that the revised NUREG was issued (May 2010). Thus, the staff used NUREG-1520 (2002) (NRC000031) for its review of the AES application. Below is a list of the changes incorporated into NUREG-1520, Revision 1 (NRC000070) and their impact on the AES license review.

Changes Incorporated into NUREG-1520, Revision 1 (NRC000070)	**AES License Review**
Improved linkage of review content to regulatory requirements.	This change has no impact on the review. In the SER, reviewers identified the regulatory requirements and acceptance criteria applicable to their subject area.
Incorporated the following ISG's into the SRP: • ISG-01, "Methods for Qualitative Evaluation of Likelihood" is incorporated as Appendix B to Chapter 3. • ISG-03, "Nuclear Criticality Safety Performance Requirements and Double Contingency Principle" is incorporated as Appendix A to Chapter 5. • ISG-04, "Baseline Design Criteria" was incorporated into multiple sections. • ISG-8, "Natural Phenomena Hazards" is incorporated as Appendix D to Chapter 3 of NUREG-1520, Revision 1. • ISG-09, "Initial Event Frequencies" is incorporated as Appendix C to Chapter 3 of NUREG-1520, Revision 1.	This change has no impact on the review. These ISGs were available to staff and the applicant as stand-alone documents.
Incorporated lessons learned from licensing experience and provided technical clarifications. Examples include: added interim staff guidance relevant to radiation protection (Section 4.4.8); expanded the discussion of code validation (Chapter 5); incorporated a list of information to facilitate review of the fire safety aspects of the facility design (Chapter 7); included criteria for ISA review of fire initiated accident sequences and fire associated IROFS and management measures (Chapter 7); added details on categorical exclusions (Chapter 9); and incorporated current practices including information to facilitate the review of new applications (Chapter 11).	This change has no impact on the review. The lessons learned were included as guidance for reviewers.
Added a new subsection in each chapter: "Review Interfaces."	This change clarifies expectations for reviewers and has no impact on the review.
Added additional guidance, clarification, and references for meeting regulatory requirements.	This change clarifies expectations for reviewers and has no impact on the review.

Changes Incorporated into NUREG-1520, Revision 1 (NRC000070)	AES License Review
Boundary package definition was added.	In the SAR, the applicant committed to defining IROFS boundaries upon completion of the design of IROFS in accordance with its (the applicant's) guidelines. The staff considered the applicant's approach for developing IROFS boundary definition packages during the review. As described in the SER (Appendix A, Page A-22) (NRC000033) the staff would impose a license condition to require the applicant to comply with Appendix B to Chapter 3 of NUREG 1520, Revision 1 (NRC, 2010) "Qualitative Criteria for Evaluation of Likelihood" (NRC000070) and to utilize its (the applicant's) guidelines. The applicant will make completed IROFS boundaries for all IROFS available for inspection prior to the operational readiness review.
Provided discussion regarding level of detail and completeness for the license application review.	This change has no impact on the review. This information was available to staff as internal guidance on the level of information needed for a 10 CFR Part 70 licensing review (ML062160073, NRC000072).
A new appendix was added regarding human factors engineering for personnel activities (Appendix 3E).	Human factors were considered in the review, thus this change has no impact on the review. Staff used criteria adapted from NUREG-800,"Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (NRC000073), NUREG-0711, "Human Factors Engineering Program Review Model" (NRC000074), and NUREG-0700, "Human-System Interface Design Review Guideline" (NRC000075). Although the new appendix was adapted from NUREG-1718, "Standard Review Plan for the Review of a License Application for a Mixed Oxide (MOX) Fuel Fabrication Facility" (NRC000076) to support the review of a 10 CFR Part 70 applicant and NUREG-800 (NRC000073) is typically used in evaluating 10 CFR Part 50 and 10 CFR Part 52 applications, these NUREGs cover similar criteria.
A subsection regarding deviations from National Fire Protection Association (NFPA) codes and standards was added to Chapter 7, Fire Safety (NRC000070). Clarification concerning the "authority having jurisdiction" was also added.	This change has no impact on the review. The staff reviewed the applicability and level of compliance with NFPA 801 (NRC000078) and applicable standards referenced within and the fire codes and standards listed by AES in Section 7.6 of the SAR (AES000037).

Changes Incorporated into NUREG-1520, Revision 1 (NRC000070)	AES License Review
Almost all details about NEPA reviews and preparation of EAs and EISs were removed from Chapter 9, Environmental Protection, since they are addressed in detail in NUREG-1748, Environmental Review Guidance for Licensing Actions Associated with NMSS Programs (NRC000077).	This change has no impact on the review. The staff issued the draft EIS and is preparing the final EIS in accordance with NUREG-1748 (NRC000077).

Question No. 26, SER: *Please provide a listing, including the SER page citation, of the terms of all staff-approved license conditions and exemptions set forth in the SER*.

Response No. 26 (B. Reilly): The following table summarizes the license conditions and exemptions described in the SER.

	License Condition	Section and Page in SER
Exemptions and Special Authorizations	Exemption to provide forward-looking incremental funding for decommissioning. The license condition addressing AES's commitments for updating the decommissioning funding plan over time is provided in Chapter 10 of the SER (see below).	Section 1.2.4.2.1, Pages 1-13 to 1-14 (NRC000032)
Exemptions and Special Authorizations	Authorization to Make Certain License Application Changes Without Prior NRC Approval. The following license condition will be imposed: The licensee is hereby granted the special authorization as identified in Section 1.2.5 "Special Exemptions and Special Authorizations" of the Eagle Rock Enrichment Facility Safety Analysis Report: a. The licensee shall not make changes to the license application that decreases the effectiveness of safety commitments in the license application, without prior NRC approval. For these changes, the licensee shall submit to the NRC, for review and approval, an application to amend the license. Such changes shall not be implemented until approval is granted. b. Upon documented completion of a change request for a facility or process, the licensee may make changes in the facility or process as presented in the license application, or conduct tests or activities not presented in the license application, without prior NRC approval, subject to the	Section 1.2.4.2.2, Pages 1-14 to 1-15 (NRC000032)

	License Condition	Section and Page in SER
	following conditions: 1. There is no degradation in the safety commitments in the license application and 2. The change, test, or activity does not conflict with any condition specifically stated in the license application. Records of such changes shall be maintained, including technical justification and management approval, in dedicated records to enable NRC inspection upon request at the facility. A report containing a description of each such change, and appropriate revised sections to the license application, shall be submitted to the NRC within three months of implementing the change.	
Financial Qualifications	Construction of each incremental phase of the EREF shall not commence before funding for that increment is available or committed. Of this funding, AES must have in place before constructing such increments, commitments for one or more of the following: equity contributions from AES or its parents, a commitment from the parent company to provide the necessary funds for the project, and lending and/or lease arrangements that solely or cumulatively are sufficient to ensure funding for the particular increment's construction costs. AES shall make available for NRC inspection, documentation of both the budgeted costs for each incremental phase and the source of funds available or committed to pay those costs.	Section 1.2.3.3.1, Page 1-9 (NRC000032)
Liability Insurance	The licensee shall provide proof of full liability insurance of $300 million, as required under 10 CFR 140.13(b), at least 30 days prior to the planned date for obtaining licensed material.	Section 1.2.3.4, Page 1-10 (NRC000032)
Information Security	The licensee shall not use, process, store, reproduce, transmit, handle, or allow access to classified matter except as provided by applicable personnel and facility clearances required under 10 CFR Part 95.	Section 1.2.4.3.4, Page 1-17 (NRC000032)
Information Security	Prior to designating areas where the use and handling of classified information will routinely occur, NRC will be notified to determine if additional security measures are required. If NRC does determine the need for additional security measures, an amendment request must be submitted, and approved, prior to establishment and use of the area(s).	Section 1.2.4.3.4, Page 1-17 (NRC000032)
Decommission-ing Activities	Prior to the commencement of construction, AES shall collect additional surface soil samples and analyze them for radiological constituents. The site property will be divided into four survey units, and 15 surface soil samples shall be taken per survey unit (i.e., 60 additional soil samples). The sample collections shall be taken from	Section 10.3.2, Page 10-3 to 10-4 (NRC000032)

	License Condition	Section and Page in SER
	areas that include (1) the detention and retention basins, (2) Full Tails, Full Feed, and Empty Cylinder Storage Pads north of the main facilities, (3) the Technical Services Building, Blending, Sampling and Preparation Building, SBMs, UF6 Handling Areas, and Full Product Cylinder Storage Pad, and (4) areas on-site, but outside those that are scheduled to be disturbed during plant construction.	
Financial Assurance	The licensee shall provide financial assurance (FA) on the following schedule: a. The licensee shall provide an updated DFP, updated facility decommissioning cost estimate, and final copies of proposed financial assurance instruments to the NRC for review at least six months prior to the following dates: (1) planned date for obtaining test material (≤ 20 kg U) for the CAB (2) planned date for obtaining feed material (> 50 kgU) for initial production in the first SBM (3) planned date for obtaining feed material (> 50 kgU) for initial production in the second SBM (4) planned date for obtaining feed material (> 50 kgU) for initial production in the third SBM (5) planned date for obtaining feed material (> 50 kgU) for initial production in the fourth SBM The updates shall be forward-looking through the 12-month period beginning on the applicable date listed above. For each update, the licensee shall provide final executed copies of the NRC-reviewed financial assurance instruments to NRC at least 21 days prior to receipt of test material or receipt of feed material for initial production in an SBM. b. After the first SBM begins operations, and until the plant reaches full capacity, the licensee shall, on an annual basis, provide an updated DFP, an updated facility decommissioning cost estimate, and final copies of proposed financial assurance instruments to NRC for review. These annual updates shall be provided six months prior to the anniversary date of obtaining feed material for initial production in the first SBM, and shall be forward-looking through the 12-month period beginning on the anniversary date. For each annual update, the licensee shall provide final executed copies of the NRC-reviewed financial assurance instruments to NRC at least 21 days prior to the anniversary date. If the licensee provides an annual update at least six months prior to the planned date for obtaining feed	

	License Condition	Section and Page in SER
	material for initial production in the second, third, or fourth SBM, that annual update may also serve as the update required in paragraph (a) for that date. c. The updated DFPs, updated cost estimates, and financial assurance instruments described in paragraphs (a) and (b) shall include full funding for decontamination and decommissioning of: (1) any part of the facility currently in operation; (2) any part of the facility that has been in operation, or any other part of the site or facility reasonably believed to be contaminated, that has not been fully decontaminated and decommissioned as approved by NRC (including the CAB); (3) all plant areas where licensed material is stored or used; and (4) any part of the facility (including SBMs) expected to be in operation by the end of the applicable forward-looking 12-month period in paragraph (a) or (b). d. The licensee shall provide an initial depleted uranium (DU) disposition cost estimate and final copies of proposed financial assurance instruments for DU disposition in conjunction with the updated DFP, updated facility decommissioning cost estimate, and financial assurance instruments that will be submitted at least six months prior to obtaining feed material for initial production in the first SBM. The DU disposition cost estimate and proposed financial assurance instruments shall include full funding to cover disposition of the first three years of DU tails generation. The DU disposition cost estimate shall include an update to the U.S. Department of Energy (DOE) DU disposition cost estimate. The total amount funded for DU disposition shall not be less than the updated DOE cost estimate. For the initial DU disposition cost estimate, the licensee shall provide final executed copies of the NRC-reviewed financial assurance instruments for DU disposition to NRC at least 21 days prior to the receipt of feed material for the first SBM. e. The licensee shall provide updates to the DU disposition cost estimate and financial assurance instruments for DU disposition as described below: (1) During the first two years of operation, the licensee shall provide updated DU disposition cost estimates and final copies of proposed financial assurance instruments for DU disposition in conjunction with the updates required in paragraphs (a) and (b). The updated cost estimates shall provide full funding to cover disposition of the first	

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	three years of DU tails generation. (2) After the first two years of operation and until the facility reaches full capacity, the licensee shall provide updated DU disposition cost estimates and final copies of proposed financial assurance instruments for DU disposition in conjunction with the updates required in paragraphs (a) and (b). The updated DU disposition cost estimates shall provide full funding to cover disposition of all DU stored onsite and all DU expected to be generated by the end of the applicable forward-looking 12-month period in paragraph (a) or (b). (3) After the plant reaches full capacity, the licensee shall continue to provide annual updates to the DU disposition cost estimate, along with revised financial assurance instruments. These annual updates shall include full funding to cover disposition of all DU stored onsite and all DU expected to be generated by the end of the 12-month period beginning on the anniversary date of obtaining feed material for initial production in the first SBM. The annual updates to the DU disposition cost estimate and final copies of proposed financial assurance instruments shall be provided to NRC for review six months prior to the anniversary date. The licensee may exclude from the updated DU disposition cost estimates any DU that the DOE has taken title to and possession of pursuant to Section 3113 of the USEC Privatization Act. All updates to the DU disposition cost estimates shall include an update to the DOE cost estimate for DU disposition. The total amount funded for DU disposition shall not be less than the updated DOE cost estimate. For DU disposition cost estimate updates, the licensee shall provide final executed copies of the NRC-reviewed financial assurance instruments for DU disposition to NRC at least 21 days prior to the receipt of feed material for an SBM, or the anniversary date of obtaining feed material for initial production in the first SBM, as applicable. f. If the construction and/or operation of any SBM is delayed or cancelled, the licensee is not relieved of its commitment to provide updated DFP, facility decommissioning cost estimates, DU disposition cost estimates, and final copies of proposed financial assurance instruments to NRC as described in paragraphs (a)-(e). g. When an update to the DFP, cost estimates for facility decommissioning and DU disposition, and financial	

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	assurance instruments encompasses the first delivery of natural uranium hexafluoride (> 50 kgU) as feed material to an SBM not previously in operation, the licensee shall not receive such initial feed material until the NRC reviews the updated DFP and cost estimates and confirms the executed financial assurance instrument(s). h. All updates to the DFP, cost estimates for facility decommissioning and DU disposition, and financial assurance instruments, shall be updated to current year United States dollars and shall encompass all current cost data, taking into account changes in inflation, foreign currency exchange rates, possession limits, licensed material, labor rates, disposal and shipping rates, and site and facility factors. All costs shall be based on the costs of a third party contractor and shall not take credit for any salvage value that might be realized from the sale of potential assets during or after decommissioning. All costs (including those for DU disposition) shall include a contingency factor of at least 25 percent.	
IROFS	To define the boundaries of each IROFS, the licensee shall comply with Appendix B to Chapter 3 of NUREG 1520, Revision 1 (NRC, 2010) “Qualitative Criteria for Evaluation of Likelihood” and utilize the licensee’s guideline “Guidelines for Development of Boundary Definitions for IROFS [items relied on for safety],” Appendix A of the ISA Summary, Revision 2, dated April 30, 2010. Completed IROFS boundaries for all IROFS shall be available for inspection prior to the operational readiness review.	Appendix A, Page A-22 (NRC000033)
IROFS	For those IROFS requiring operator actions, a human factors engineering review of the human-system interfaces shall be conducted using the applicable guidance in NUREG- 0700, "Human-System Interface Design Review Guidelines," Revision 2, dated May 2002; NUREG-0711, "Human Factors Engineering Program Review Model," Revision 2, dated February 2004; and as described in Section 3.3.8 of the Safety Analysis Report, “Human System Interface Design.”	Appendix D, Page D-2 (NRC000079)
IROFS	Currently, the design information concerning any IROFS that may use software, firmware, microcode, programmable logic controllers, and/or any digital device, including hardware devices which implement data communication protocols (for example, Fieldbus devices and Local Area Network controllers) is preliminary and not complete. Should the completed design of any IROFS (including every component within an IROFS boundary) include any of the preceding features, the licensee shall	Appendix E, Page E-20 (NRC000080)

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	obtain Commission approval prior to implementing the IROFS."	
Material Control and Accounting	The licensee shall maintain and follow the Fundamental Nuclear Material Control Program for control and accounting and measurement control of uranium source material and special nuclear material at the facility pursuant to 10 CFR 74.33. The licensee shall make no change to material control procedures essential for the safeguarding of uranium source material or special nuclear material that would decrease the effectiveness of the material control and accounting program implemented pursuant to 10 CFR 74.33 without prior approval of the Commission. If the licensee desires to make changes that would decrease the effectiveness of its material control and accounting program or its measurement control program, the licensee shall submit an application for amendment to its license pursuant to 10 CFR 70.34. The licensee shall maintain records of changes to the material control and accounting program made without prior Commission approval a period of 5 years from the date of the change. The licensee shall furnish to the Director, Division of Nuclear Material Safety and Security, using an appropriate method listed in 10 CFR 70.5(a), a report containing a description of each change within 6 months of the change if it pertains to uranium enriched less than 20 percent in the uranium-235 isotope.	Appendix H, Page H-7 to H-8 (NRC000081)

In addition to the license conditions set forth in the SER, the staff would impose additional standard license conditions at the time that the license is issued. These conditions are listed in the following table:

	License Condition
Requirement under 10 CFR § 70.32(k) for Operational Readiness Review	Introduction of uranium hexafluoride (UF_6) into any module of the EREF shall not occur until the Commission completes a construction inspection in accordance with 10 CFR § 40.41(g) and 10 CFR § 70.32(k) and an operational readiness and management measures verification review to verify that management measures that ensure compliance with the performance requirements of 10 CFR 70.61 have been implemented and confirms that the facility has been constructed and will be operated safely and in accordance with the requirements of the license. The licensee shall provide the Commission with 120 days advance notice of its plan to introduce UF_6 into any

	License Condition
	module of the EREF.
Tie-Down Condition	The licensee shall conduct authorized activities at the EREF in accordance with the statements, representations, and conditions, or as revised in accordance with Section 19 of the Quality Assurance Program Description, 10 CFR 40.35(f), 10 CFR 51.22, 10 CFR 70.72, or 10 CFR 95.19 in: 1. Safety Analysis Report, Revision 3, dated [TBD] 2. Environmental Report, Revision 3, dated [TBD] 3. Physical Security Plan, Revision 3, dated [TBD] 4. Fundamental Nuclear Control Plan, Revision 3, dated [TBD] 5. Quality Assurance Program Description, dated [TBD] 6. Emergency Plan, dated Revision 3, dated [TBD] 7. Standard Practice Procedures Plans for Protection of Classified Matter, Revision 3, dated 8. [TBD]Decommissioning Funding Plan, Revision 3, dated [TBD]
Exemption requests from license application.	The licensee is hereby granted the exemption requests from certain provisions of 10 CFR 40.36 and 10 CFR 70.25, as identified in Section 1.2.5 “Special Exemptions and Special Authorizations” of the Eagle Rock Enrichment Facility Safety Analysis Report, Revision 2, dated April 30, 2010.
Request in license application for 30 years.	This license will expire 30 years after the date of license issuance.

In addition, the staff has granted the following exemptions requested by AES in licensing actions separate from the license application:

Preconstruction Exemption Request (ML093220446, NRC000082)

On March 17, 2010, the NRC staff granted AES an exemption from the requirements of 10 CFR §§ 30.4, 30.33(a)(5), 40.4, 40.32(e), 70.4, and 70.23(a)(7) which govern the commencement of construction, in response to a request from AES dated June 17, 2009 (NRC000083). The exemption allows AES to commence certain construction activities associated with the proposed EREF before completion of the NRC’s environmental review under 10 CFR Part 51 provided that none of the facilities or activities subject to the exemption will be, at a later date, a component of AES’s Physical Security Plan or its Standard Practice

Procedures Plan for the Protection of Classified Matter or otherwise subject to NRC review or approval.

Part 21 Exemption Request (ML101690142, NRC000084)

On July 27, 2010, NRC staff granted AES an exemption from the 10 CFR 21.3 definitions for commercial grade item, basic component, critical characteristic, dedication, and dedicating entity, in response to a January 29, 2010 request from AES (NRC000085).

Question No. 27, SER & SAR, SER App. A & SAR App. D: *Please provide an explanation/justification as to why these appendices are considered official use only (OUO) information, particularly as they relate to accident sequences associated with natural phenomena (e.g., wildfires, earthquakes, or volcanoes).*

Response No. 27 (B. Reilly): The source of much of the information provided in the Appendices to the SER (e.g., Appendices A, B, D, E, F and G) is based on the applicant's ISA Summary. The ISA Summary was withheld from public disclosure as security-related sensitive unclassified non-safeguards information (SUNSI). The NRC RIS 2005-31, "Control of Security-Related Sensitive Unclassified Non-Safeguards Information Handled by Individuals, Firms, and Entities Subject to NRC Regulation of the Use of Source, Byproduct, and Special Nuclear Material" (NRC000086) provides procedures for handling documents containing SUNSI as well as the screening criteria for identifying SUNSI. Appendix 1 to the RIS is specific to fuel cycle facility reviews. Appendix 1 identifies various types of information which are sensitive and should be withheld, including any detailed accident analysis which contains accident sequences, identifies accident consequences, identifies systems and components relied on for safety, or identifies which accidents have significant consequences and which ones do not. Information related to accident sequences is withheld whether the sequences are initiated by natural hazards, process hazards, or failure of controls. Such information appears in the ISA Summary. Because the ISA Summary contains SUNSI information, the staff's evaluations also contain SUNSI information and are marked as "Official Use Only."

In addition, Sections 3.4.1 through 3.4.5 and Sections 3.4.7 and 3.6 of the ISA Summary

are marked as Export-Controlled Information under 10 CFR 810 and were withheld from public disclosure. In these sections, the applicant provided information about functional descriptions, major components, design descriptions, interfaces, design and safety features, and operating limits for the UF_6 Feed System, Cascade System, Product Take-Off System, Tails Take-off System, and Dump System. The staff's evaluations, as presented in Appendices A and G, contain Export-Controlled Information in addition to SUNSI information.

In cases where the reviewers could easily segregate the sensitive, non-public information from the public information, the SER provides a public chapter (for example, Chapters 3 and 5) (NRC000032) and a non-public appendix (for example, Appendix A and Appendix G).

Appendix C

AES also provided confidential financial information, in accordance with 10 CFR § 2.390(b), concerning the details of its cost estimates to construct and operate the EREF. Appendix C provides the staff's review of this proprietary cost estimate information. Thus, Appendix C has been withheld from public disclosure and marked as "Official Use Only." Chapter 1, Section 1.2.3.3.1, of the SER (NRC000032) provides AES's publicly-available estimate of the total cost of construction.

Appendix H

Under 10 CFR 2.390(d), AES submitted its Physical Security Plan (PSP), Classified Matter Plan (CMP), Emergency Plan (EP), and Fundamental Nuclear Material Control (FNMC) Plan as confidential commercial information. In addition, Chapter 9 of the FNMC Plan contains information classified as Restricted Data and was submitted to NRC separately, in accordance with 10 CFR 95.39. In evaluating the PSP, CMP, and EP, the reviewers avoided providing sensitive, non-public information; thus, the SER provides their reviews as public chapters (the PSP is discussed in Chapter 12, the CMP in Chapter 1, and the EP in Chapter 8). The staff's

findings from the review of the FNMC Plan incorporate sensitive information and are described in Appendix H which was withheld from public disclosure and marked as “Official Use Only.”