January 13, 2012

Mr. Zachary Rad
Licensing Manager
Louisiana Energy Services, LLC
P.O. Box 1789
Eunice, NM 88231

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR MATERIALS LICENSE SNM-2010 AMENDMENT REQUEST (LAR-11-11) TO ADD "TC21 CENTRIFUGES" TO SAR TABLE 5.1-2, "SAFETY CRITERIA FOR BUILDINGS/SYSTEMS/COMPONENTS" (TAC NO. L33128)

Dear Mr. Rad:

We reviewed your licensing amendment request transmitted by letter dated September 22, 2011, and the supplemental information supplied in letters dated October 28, 2011, and December 2, 2011. We find that additional information is needed before final action can be taken on your submittal. We are enclosing a Request for Additional Information and ask that you provide a response within 30 days of the date of this letter.

If you have any questions, please contact Mr. Michael Raddatz at 301-492-3108 or via e-mail to Michael.Raddatz@nrc.gov.

Sincerely,
/RA/

Brian W. Smith, Branch Chief
Uranium Enrichment Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Enclosure:
As stated

Docket No. 70-3103
License No. SNM-2010

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Louisiana Energy Services, LLC
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Docket No. 70-3103
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OFFICE	FCSS/TSB	FCSS/FMB	FCSS/UEB
NAME	MRaddatz	LAllen	BSmith
DATE	1/3/2012	1/04/2012	1/13/2012

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Request for Additional Information
Louisiana Energy Services, LLC
TC21 Amendment Request (L33128)

1. Clarify whether the centrifuge array is considered safe-by-design (SBD). During the acceptance review, we questioned whether the centrifuge array could be considered SBD. You stated in your letter LES-11-00151-Nuclear Regulatory Commission, dated October 28, 2011, that "The TC21 machines are not considered to be SBD. Although analysis of an individual machine filled with uranic material shows k_{eff} remains less than 0.95, it also shows k_{eff} may exceed 0.95 for an array of four (4) or more filled or partially filled machines." However, your evaluation ETC4156706, "Criticality Safety Assessment of TC21 Centrifuge Cascades Arrangement at 6% Enrichment – Fully Filled Bores," refers to "SBD attributes" (Table 3); contains a lengthy discussion of SBD (Section 8, "Double Contingency Summary;" and states (Section 9, "Safety Margin") "Comparison of parameters geometry, interaction, neutron absorption, and enrichment shows the centrifuge cascade to be SBD." These responses are contradictory.

   If you consider the centrifuges to be SBD, justify their designation as SBD by addressing all the criteria in Section 3.2.5.2 of your Safety Analysis Report (SAR) and, in particular, the following criteria (taking neutron interaction appropriately into consideration):

   a. Clarify whether the centrifuges are the first or second category of SBD, and justify their designation as such.

   b. Justify why there is no credible means to failure other than a design change.

   c. Demonstrate how the centrifuges meet the double contingency principle.

   d. Demonstrate the existence of significant margin if the first category of SBD demonstrate the existence of 10 percent margin between the credited design attribute and its value at critical. If the second category of SBD, demonstrate k_{eff} < 0.95 when all components are full of uranium, breakdown material at the maximum enrichment, and consider worst credible moderation and reflection conditions existing.

   If you do not consider the centrifuges to be SBD, describe the items relied on for safety (IROFS) used to ensure that criticality is highly unlikely, as required by Title 10 of the *Code of Federal Regulations* (10 CFR) 70.61(e), and provide the necessary discussion of accident sequences and IROFS in your Independent Safety Analysis (ISA) Summary.

2. Demonstrate compliance of the TC21 machines with the double contingency principle. Section 7, "Double Contingency Evaluation," of your evaluation ETC4156706 does not contain any discussion of contingencies or demonstration that the centrifuge array will remain subcritical upon the occurrence of any single change in process conditions. While Section 8, "Double Contingency Summary," of ETC4156706, makes reference to SBD components, Section 3.2.5.2 of your SAR states that the evaluation of the potential to adversely impact the safety function of these (i.e., SBD) passive design features "includes consideration of adequate controls to ensure that the double contingency principle is met."

Evaluation that double contingency is met cannot rely on designation of components as SBD because the SAR states that designation as SBD must include an evaluation that the double contingency principle has been met. Provide this evaluation and the controls used to ensure that the double contingency principle is met.

3. Explain how the following statement in Section 8, "Double Contingency Summary," of ETC4156706 is consistent with Section 3.2.5.2 of your SAR: "The SBD method is an alternative ISA process used for criticality control at URENCO USA, as opposed to the conventional IROFS approach." Section 3.2.5.2 of your SAR states that "a qualitative determination of 'highly unlikely' can apply to passive design component features (e.g., tanks, piping, cylinders, etc.) of the facility that do not rely on human interface to perform the criticality safety function (i.e., termed 'safe-by-design')" and "For failure of passive safe-by-design components to be considered 'highly unlikely,' these components must also meet the criterion that the only potential means to effect a change that might result in a failure to function would be to implement a design change."

4. For the statement in Section 9, "Safety Margin," of ETC4156706, "Due to the high vacuum requirements of a centrifuge plant, in-leakage of air is controlled at very low levels," provide the following details:

    a. how the air in-leakage is controlled;

    b. to what value the air in-leakage is controlled; and

    c. whether controls used to control air in-leakage are IROFS and, if not, why not?

5. Table 3 of ETC4156706 states that "Mobile components containing uranic materials are not brought into the cascade hall during operation and are therefore not included in this assessment." Justify not including mobile containers in your cascade array analysis by addressing the following:

    a. What kinds of mobile components potentially containing uranic material exist in your facility?

    b. What prevents the movement of such components into the cascade halls? Is this an administrative control?

    c. If this is an administrative control, why is its failure sufficiently unlikely for the presence of such mobile components not to be considered in the centrifuge array models?

    d. Explain the effect of such mobile components on the designation of equipment as SBD. Section 3.2.5.2 of your SAR states: "For failure of passive SBD components to be considered 'highly unlikely,' these components must also meet the criterion that the only potential means to effect a change that might result in a failure to function would be to implement a design change." If the placement of a mobile component next to a centrifuge array could credibly cause the system k_{eff} to exceed 0.95, this would invalidate the designation of SBD.

6. Explain what parameters are being relied on to prevent criticality in a centrifuge cascade. Table 3 of ETC4156706 lists geometry and interaction as being controlled, yet your calculations show that a sufficiently large cluster of failed centrifuges (four or more) can exceed a k_{eff} of 0.95—given sufficient mass and moderator being present. Table 4

states that “Moderation effects are not controlled for the centrifuge cascade” and “Mass is not controlled for TC21 centrifuge cascades.” It is therefore unclear what parameters are being relied on to prevent criticality.

7. Explain whether criticality in the centrifuge array is considered “not credible” or merely “highly unlikely.” Your analysis ETC4156706 appears to be ambiguous on this point. If criticality is considered not credible, explain the basis of this determination in terms of the system parameters. Geometry and interaction are fixed, but are not by themselves sufficient to prevent criticality. Bounding moderation and maximum mass are assumed in all calculations because they are not being controlled. Moreover, as stated in Table 4, “Flooding is considered a credible accident.” Explain your determination of “not credible” or “highly unlikely” in terms of what parameter changes would be needed for criticality to be possible.

8. Section 13, “Summary and Conclusions,” of ETC4156706 contains the statement: “For machines positioned at the nominal design positions the maximum number of adjacent filled centrifuge recipients that remain within the safety criterion is three.” Subcriticality is not ensured for larger clusters of failed machines. What limits the size of such clusters to three or less?

9. Provide the following criticality safety analysis applicable to TC21 centrifuge cascades, or else identify the following information in ETC4156706, or revise ETC4156706 so as to include the following information. Section 5.2.1.4 of your SAR contains a list of required contents of criticality safety analyses, including:

    a. a description of the accident or abnormal conditions assumed (i.e., whether the parameters assumed are for normal or abnormal conditions); and

    b. a discussion of the analysis results, including identification of required limits and controls.

    Describe the limits and controls derived from your criticality safety calculations and the associated normal and abnormal conditions defined by the controls and limits (i.e., the normal condition exists when all controlled parameters are within their applicable limits).

10. With regard to the operating history data submitted by letter dated December 2, 2011, please provide the following technical details:

    a. The observed failure rate of TC21 machines (as compared to that for the TC12 machines

    b. The size distribution of clusters of failed machines in the TC21 cascades (how many adjacent failures have been observed together)

    c. The expected failure rate of TC21 machines as a function of time (including an allowance for infant mortality and the forecast increase in failure rate with time)

    d. The effect of the bias towards failure of feed stage machines on the randomness of the spatial distribution of failures in the cascade

11. Clarify whether the table in Attachment 1 to your letter dated November 11, 2011, is applicable to the sequence of events necessary for criticality in a TC21 cascade. If it is not, provide the list of events necessary for criticality in a TC21 cascade. If it is, answer the following questions:

    a. For each event listed as being "independent," clarify from what other events you are considering it independent (e.g., independent from the preceding event, from all preceding events, from all subsequent events, from all events in the table).

    b. Event #2, involving air in-leakage, is listed as being independent from Event #1, crash of a single centrifuge. The justification stated is that "Operating experience shows no correlation that a crash leads to in-leakage." However, you have also stated that there are events resulting from a cascade breach that could result in centrifuge failures. Justify the independence of these events, considering the possibility that Event #2 could precede and precipitate Event #1.

    c. Event #4 is listed as being independent. If you consider this independent from Event #2, justify that designation, considering that you have stated there are events that could cause failure of multiple centrifuges and considering your answer to part (b) above.

    d. Event #10 involves formation of a cluster of four adjacent failed centrifuges with air in-leakage sufficient to cause uranium deposits to form. You listed this event as being independent. However, you previously considered (Events #2, 4, 6, and 8) air in-leakage and concluded it was independent from machine failure. Adding Event #10 appears to double-count the air in-leakage scenario, as this had been previously considered for each of the four machines in the array separately. Justify why Event #10 represents a separate independent event.

    e. Events #11, 12, 13, and 14 all involve the failure of operators to notice abnormal cascade behavior. Noticing an abnormal event does not in itself do anything to prevent the accident sequence from progressing. State what operator actions, the values at which those actions would be triggered, and the time frames associated with those actions, are required in the event any of these abnormal occurrences are noticed.

    f. Events #11 and 12 both involve operators noticing an increase in vent frequency. Events #13 and 14 both involve operators failing to notice a trip or a change in indication, from the Medium Frequency System. These events are all considered to be independent. Given that the observation of these abnormalities depends on instrumentation, and instrumentation could fail, justify the independence of the instrumentation relied on by operators to detect these occurrences.

    g. 10 CFR 70.61(e) requires that engineered or administrative controls relied on to make criticality highly unlikely be designated as IROFS. Section 3.2.5.2 of your SAR states that "The fact that an event is not 'credible' must not depend on any facility feature that could credibly fail to function." If the accident sequence is "highly unlikely," state whether the instrumentation relied on in Events #11 – 14 are IROFS; if not, justify why not. If the accident sequence is "not credible," justify how the use of such instrumentation is consistent with Section 3.2.5.2 of your SAR.

h. Events #15 and 16 involve failure of taking the required annual cascade sample due to air-inleakage. State what leakage rate would be required to preclude the sample from being taken, and how that compares to the leak rate necessary for the long-term accumulation of uranium sufficient to cause criticality.

i. Event #18 involves flooding. This does not appear necessary for a cluster of four failed machines to exceed the subcritical k_{eff} limit of 0.95. Justify including it in this table.

j. The accident scenario considered in the table (and in the analysis ETC4156706) revolves around having a cluster of four failed machines, completely filled, under the worst-case moderation (with H/U = 7), and flooded up to 60 cm. This is not necessarily the only case that could result in criticality. For example, a larger cluster of partially filled machines, with or without the worst-case moderation and/or flooding, needs to be considered. These configurations may be more or less likely than the one analyzed herein. Justify the bounding nature of the models and accident scenarios considered.