UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 13, 2014

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SUBJECT: TEXAS A&M UNIVERSITY – REQUEST FOR ADDITIONAL INFORMATION REGARDING THE TEXAS A&M UNIVERSITY AEROJET GENERAL NUCLEONICS MODEL 201-MODIFIED REACTOR CONFIRMATORY ACTION LETTER NO. EA-2013-154 (TAC NO. M79581)

Dear Dr. Hassan:

The U. S. Nuclear Regulatory Commission (NRC) is continuing the review of your commitment to restore the analog hardwire portions of the Texas A&M University (TAMU) Aerojet General Nucleonics Model 201-Modified (AGN-201M) reactor safety system dated December 17, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14015A315), as supplemented by letter dated March 10, 2014 (ADAMS Accession No. ML14087A006). During the course of the NRC staff review, some questions have arisen for which we require additional information and clarification. Please provide responses to the enclosed request for additional information within 60 days of the date of this letter.

In accordance with Title 10 of the *Code of Federal Regulations*, your response must be executed in a signed original under oath or affirmation. Information included in your response that is considered sensitive or proprietary that you seek to have withheld from the public, must be marked in accordance with 10 CFR 2.390, "Public inspections, exemptions, requests for withholding." Any information related to security should be submitted in accordance with 10 CFR 73.21, "Protection of Safeguards Information: Performance requirements." Following receipt of the additional information, we will continue our evaluation of your confirmatory actions.

If you have any questions regarding this review, please contact me at (301) 415-3724 or by electronic mail at Duane.Hardesty@nrc.gov.

Sincerely,

/William Schuster for RA/

Duane A. Hardesty, Project Manager
Research and Test Reactors Licensing Branch
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Docket No. 50-59

Enclosure:
Request for Additional Information

cc: See next page

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If you have any questions regarding this review, please contact me at (301) 415-3724 or by electronic mail at Duane.Hardesty@nrc.gov.

Sincerely,

/William Schuster for RA/

Duane A. Hardesty, Project Manager
Research and Test Reactors Licensing Branch
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REQUEST FOR ADDITIONAL INFORMATION

REGARDING CONFIRMATORY ACTION LETTER NO. EA-2013-154

FOR THE TEXAS A&M UNIVERSITY

AEROJET GENERAL NUCLEONICS MODEL 201-MODIFIED REACTOR

DOCKET NO. 50-59

The U. S. Nuclear Regulatory Commission (NRC) is continuing the review of your commitment to restore the analog hardwire portions of the Texas A&M University (TAMU) Aerojet General Nucleonics Model 201-Modified (AGN-201M) reactor safety system dated December 17, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML14015A315), as supplemented by letter dated March 10, 2014 (ADAMS Accession No. ML14087A006). During the course of the NRC staff review, some questions have arisen for which we require additional information and clarification.

As required by Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.9, "Completeness and accuracy of information," information provided by a licensee to the Commission shall be complete and accurate in all material respects. Provide the following additional information pertaining to the restoration of the analog hardwire portions of the TAMU AGN-201M reactor safety system:

1. The TAMU AGN-201M staff have stated that the restoration of the "log and linear instrument channels" to an analog system will be made pursuant to 10 CFR, Section 50.59, "Changes, tests, and experiments." Provide for NRC review the facility's 50.59 evaluation, approved by the Reactor Safety Board per TAMU AGN-201M Technical Specification (TS) 6.4.2 and, if not contained within the facility's 50.59 evaluation, also include information that describes in detail:

    a. All changes made as part of the commitment to restore the analog portions of the reactor safety system including a detailed description of the function, theory of operation, functional block diagrams, circuit diagrams, safety analysis, and human factors evaluation.

    b. A listing of affected components and their function (indicating manufacture part number and circuit reference designation) and applicable component data sheets for the new components.

    c. Overall simplified schematic diagram(s) that illustrates the location of all replaced and affected circuit components.

Enclosure

2. The TAMU AGN-201M staff stated that corresponding revisions will be made to update the TAMU AGN-201M Safety Analysis Report (SAR) dated August 30, 1972, for the restoration of the analog system. Provide the updated SAR including information that describes in detail:

   a. Any impact on the facility's design basis, potential limits on operation, and a safety analysis of the system and components to ensure they will be able to continue to perform their intended function.

   b. Any potential impact on possible and reasonable accident scenarios as compared with facility operating experience.

   c. Diagrams or pictures of the newly arranged system showing the location, identification, and grouping of affected systems and displays relative to the human-machine interface.

3. The control console and other display instruments present current and past operating parameter and system status information for use in evaluating reactor operating conditions. This information enables the operator to decide on further action, such as when to take manual control of the reactor. Per the referenced commitment letters, the description of the changes state "[t]he AGN computer will continue to provide users with a real-time indication of reactor power and rod position indication as a secondary indication but will have no input to the reactor protection system" and "[i]nstallation of hardwired rod position indication will also be included to ensure rod position can be verified in the case of an automatic shutdown, independent of the computer display."

   a. Consistent with your response to requests for additional information (RAIs) 1 and 2, provide, as appropriate, a more detailed description of the function, theory of operation, component listing, functional block diagrams, schematic diagrams, safety analysis, and human factors evaluation in the SAR and 50.59 evaluation for both the AGN computer and hardwired rod position indication.

   b. Specifically indicate whether circuitry and hardware for organizing and processing the display information is analog or digital. If any of this circuitry is new (whether analog or digital), provide a circuit diagram and description.

   c. Provide for NRC review, any processes, description, or procedures explaining expected operator interaction with, and use of, the AGN computer vs. the equivalent analog systems providing indication of reactor power.

   d. Relative rod position is stated to "continue to be monitored through the Visual Basic user interface" and that "[f]acility operating procedures will be modified to include operator actions in the event that relative rod position is lost or unresponsive during normal operations." Provide for NRC review, any processes, description, or procedures explaining or stating expected operator interaction with systems providing rod position indication for operation and control of the AGN-201M reactor.

e. As part of these analyses and evaluations, provide specific detail demonstrating the described changes do not impact the TAMU AGN-201M TSs, their bases, or surveillances.

4. Per the referenced commitment letters, the description of the changes infers that the original analog system will be updated through the use of modernized analog components (e.g., operational amplifiers, etc.). Provide an analysis documenting that these changes, consistent with your response to RAIs 1 and 2, as appropriate, will not affect the TAMU AGN-210M TSs, their bases, or surveillances.

5. The referenced commitment letters state "installation of improved analog components previously outlined has no effect on the timing requirements set forth in the facility Technical Specifications" (e.g., TSs 3.2.a and 3.2.b). The bases for TAMU AGN-201M TS 2.2.b relies on the AGN Hazard Report using previously documented and tested instrumentation response times and scram tests. Provide the analysis of the timing for the new circuit showing relative comparison to original circuit timing and documenting that the new timing has no effect on the overall scram processing (whether faster or slower).

6. The referenced commitment letters state, "[f]urthermore, no single random failure of the system will result in the RPS [reactor protection system] losing its ability to carry out its intended function of safely shutting down the reactor." Provide the results of a failure modes and effects analysis (or similar analysis) validating this statement.

7. Per the referenced commitment letters, the instrumentation and control (I&C) system will include an analog and digital system operating in parallel. Figures 1.1, 1.2, and 7.2.1-1 of the commitment letters do not explicitly show this parallel configuration for the I&C system. Update the figures or provide new figures identifying both the analog and digital blocks and their corresponding signal paths for the parallel configuration.

8. TAMU AGN-201M TS 4.2.e requires a daily channel check of the nuclear safety channels whenever the reactor is in operation. Provide a description of any changes, if required, to the required daily check procedure for the "new" analog systems for the Channel 2 (Log Channel) or Channel 3 (Linear Channel). Alternately, state if no changes are deemed required to either the TS or procedure.

9. Per the referenced commitment letters, "[t]esting and verification of circuit design will be completed using LT SPICE and reviewed by an independent consultant upon completion of the design." Provide the consultant's independent evaluation for review.

10. Per the referenced commitment letters, "[o]nce the analog system is installed and tested, the computer input(s) to the reactor protection system will be removed to ensure that scram signals are not received from the computer system."

    a. Provide a testing plan and procedure for validating the operation of the reactor protective system, including the "new" analog portions *prior* to reactor operations.

b. Explain why the digital computer input(s) to the reactor protection system will remain connected until "the analog system is installed and tested." Additionally, provide details for system testing *after* the digital computer input(s) are removed.

c. Provide the summary test results for NRC review.

11. The description for the Channel 2 (Log Channel) is inconsistent between the TAMU AGN-201M SAR, the commitment letter dated December 17, 2013, and the supplemental commitment letter dated March 10, 2014. The original commitment letter makes reference to a Keithly model 6487 Picoammeter. The SAR and supplemental commitment letter makes reference to a Keithly Model 420 Log n amplifier. Confirm which component was part of the previously approved Channel 2 (Log Channel) and which component will be used in the proposed circuit that restores the analog functionality.

12. The description for the Channel 3 (Linear Channel) is inconsistent between the TAMU AGN-201M SAR, the commitment letter dated December 17, 2013, and the supplemental commitment letter dated March 10, 2014. The original commitment letter makes reference to a Keithly model 6487 Picoammeter. The SAR and the supplemental commitment letter makes reference to a Keithly Model 410 Picoammeter [Keithly model 410 Micro-micro ammeter]. Confirm which component was part of the previously approved Channel 3 (Linear Channel) and which component will be used in the proposed circuit that restores the analog functionality.

13. Per the referenced commitment letters, "[t]he upgraded analog circuitry will perform their intended function reliably during the normal range of environmental conditions anticipated at the AGN reactor facility." Provide the listing of the "normal range of environmental conditions anticipated at the AGN reactor facility" and, justification if different from the SAR values.

14. The AGN-201M SAR, page 4-14, discusses specific rod sequencing requirements and corresponding control system interlocks: (a) an interlock to prevent startup, unless all four rods (Safety #1, Safety #2, Coarse and Fine) are fully removed from the core, (b) an interlock that sequences the order of insertion of Safety Rod #1 first, Safety Rod #2 once Safety Rod #1 is fully inserted, (c) insertion of the coarse control rod after Safety Rod #1 and Safety Rod #2 are fully inserted, and (d) insertion of the fine control rod only after the coarse control rod is fully inserted. These sequence constraints affect the analyzed reactivity insertion rates, however, these safety interlocks are not diagrammed in the provided documentation.

a. Specifically indicate whether circuitry and hardware for rod sequencing is analog or digital. If any of this circuitry is new (whether analog or digital), provide circuit diagram(s) of the rod sequence interlocks and a description of operation.

b. If the rod sequencing system is unaffected, so state, and provide a description of any interfaces affected by the changes being performed under the TAMU AGN-201M commitment.

15. In addition to the Limiting Safety System Setting (LSSS) required scrams, the TAMU AGN-201M Limiting Conditions for Operation (LCO's) also require the following scrams: (a) Shield Water Tank Level, (b) Shield Water Tank Temperature, (c) Channel #1 low count rate, (d) Channel #2 low power, (e) Channel #3 low power, (f) Reactor Period, (g) manual, (h) seismic, and (i) loss of power. Furthermore, the AGN-201M SAR, page 7-11, states:

> The reactor protective system, known as the Reactor Control Safety Systems consists of Interlock System as well as the Scram System. The interlock System was designed as an add-on to the original Scram System when it was found over the years of AGN operations that more automatic protective devices need to be added to ensure that none of the LSSS and LCO were exceeded as the reactor power levels were raised.

a. The TAMU AGN-201M response to the NRC license renewal RAI dated March 6, 2013 (ADAMS Accession No. ML13073A122), states "…the scram functions that were previously managed by the interlock relay have been incorporated on the scram circuit." Figure 7.2-1.1 of the AGN-201M commitment letter identifies the scram for Water Level Float, Water Temperature, and Earthquake Switch as direct inputs to the Scram Circuit Block. However, the commitment letter does not provide any other detail to how these scrams are implemented (unchanged, new analog, or digital). Provide a detailed description of how these scrams are implemented. Specifically, indicate whether circuitry and hardware for these scram circuits are analog or digital. If any of this circuitry is new (whether analog or digital), provide a description of operation of the associated scram circuitry and corresponding circuit diagram(s).

b. Figure 7.2.1-1 of the AGN-201M SAR shows a functional block for the Rod Drive System Plug (Rod Cables) and a Relay Chassis Interlock (Rod & Cables). Figure 7.2-1.1 of the AGN-201M commitment letter does not appear to have any corresponding functionality or provide any other detail to how these scrams are implemented (unchanged, new analog, or digital). Provide a detailed description of how these scrams are implemented. Specifically, indicate whether circuitry and hardware for these scram circuits are analog or digital. If any of this circuitry is new (whether analog or digital), provide a description of operation of the associated scram circuitry and corresponding circuit diagram(s). If this Interlock system functionality is no longer part of the design, provide an explanation and corresponding safety analysis as to why they are no longer required.

16. Figure 7.2-1.1 of the commitment letter is different than Figure 7.2-1.1 of the SAR.

a. Map or explain the differences between the commitment letter figure and the same figure in the SAR. In particular, for each block in the "SCRAM SYSTEM" and the "INTERLOCK SYSTEM" for Figure 7.2-1.1 of the SAR identify the corresponding circuit on Figure 7.2-1.1 of the commitment letter. Provide an analysis and justification for or any functionality not carried forward to the new system design.

b. Provide a legend or explain the meaning and significance of the colors for interconnecting lines in the commitment letter, Figure 7.2-1.1.

c. Explain the purpose and operation of the block labeled “Control Rod Switches” on the commitment letter figure and provide a more detailed diagram depicting the interface between this block and the remainder of the Reactor Control Safety System.