United States Department of the Interior
GEOLOGICAL SURVEY
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DENVER, COLORADO 80225

IN REPLY REFER TO:

January 17, 1991

U.S. Nuclear Regulatory Commission
Marvin Mendonca, Senior Project Manager
Non-Power Reactors, Division of Advanced Reactors
and Special Projects
Office of Nuclear Reactor Regulation
Washington, D.C. 20555

Re: USGS TRIGA Reactor Facility
License amendment request dated October 30, 1990
Docket No. 50-274, License R-113

Dear Mr. Mendonca:

In response to your request for additional information dated December 5, 1990, the enclosed information is hereby submitted. If further information or clarification of our amendment request is required, please contact Tim DeBey, Reactor Supervisor, at (303) 236-4726. I appreciate your attention to this matter.

Sincerely,

David B. Smith

David B. Smith
Reactor Administrator
U.S. Geological Survey

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ADDITIONAL INFORMATION TO SUPPORT USGS REQUEST
FOR LICENSE AMENDMENT TO TRIGA RESEARCH REACTOR FACILITY

1. The Technical Specification (TS) change pages are attached to this response. The asterisk in TS Table I specifies that the pulse timer does not scram the reactor but only drops the pulse rod following a pulse. This asterisk is not applicable to the new TS because the new control system pulse timer does scram the reactor.

2. Verification and Validation Plan: The new console was received in the fall of 1988 and was installed shortly thereafter. The new console has been operating in parallel with the original console to the maximum extent possible since about December of 1988. This parallel operation includes reactor parameter monitoring but does not include control functions performed by the new console. The new stepping motor drive was wired and tested in 5/89, while the pulse rod drive was momentarily wired to the new console and tested in 6/89. The NM1000 digital power monitor has been functional since the spring of 1989. The testing has reached a point where the new console cannot be tested further without assuming control functions from the old console. This final testing is proposed to occur during a 3 to 4 week period during final installation of the new console. The final installation will not be performed until the console installation is approved by the NRC, and the manufacturer has allowed two weeks for final checkout and calibration before the console is put into routine operation.

   Below is a list of the major problems and resolutions found during the two year test period:

   A. Console dot matrix printer functions sporadically - cause was a bad printer cable connection.
   B. Interfacing problems between DAC and external radiation monitors - new interface modules were installed and calibrated to provide proper inputs.
   C. Noise problems with the NM1000 digital power channel - improper cable grounding, poor cable routing, and noisy power supply all contributed to noise in monitor.
   D. High resolution monitor in CSC repeatedly failed - the monitor was eventually replaced to resolve problem.
   E. NP1000 and NPP1000 analog power channels had excessive drift and occasional problems resetting trips - both units received design modifications to resolve problems.
   F. DAC computer failed - problem was with power supply. New power supplies on both the DAC and CSC computers were replaced.
   G. Control rod magnet power supply failed - cause unknown; a new power supply was installed.
   H. Improper wiring of the pulse rod circuitry caused a failure of the DAC analog input board, the NP1000, the NPP1000, and a fuel temperature channel. All damaged units were replaced and the pulse rod wiring was corrected.

I. CSC keyboard developed "sticky" keys - the keyboard was replaced.
J. Water conductivity instrument did not have temperature compensation - a new, stand-alone water conductivity instrument with temperature compensation was installed.
K. Pulse data collection circuit failed - circuit boards were repaired.
L. Computer communications network failed - bad circuit card was repaired.
M. Computers locked up at a rate up to 3 times per week - problems appear to be isolated to network cards. Lockup frequency has been reduced to approximately 1 time per week.
N. CSC computer hard disk failed - disk replaced.

All control system components will be functional before the final console installation is begun.

3.a The new console will be located in the reactor control room, Room 150 of Building 15. This is the same location as the existing reactor console. The DAC, NM1000, and regulating rod translator will be located in the reactor room, Room 149 of Building 15. Both of these rooms have typical office environments with the temperature normally between 65°F and 75°F and the relative humidity normally between 10% and 70%.

b The system enclosures and cabinets are standard commercial units. The DAC and CSC enclosures are free standing while the NM1000 enclosure is mounted on Unistrut channels that are mounted with expansion bolts into a solid concrete wall.

c The scram system relays are designed to cause a scram by opening their contacts. These relays are used such that the contacts are normally open (i.e., open when the relay is deenergized), and the relays are energized during reactor operation. This configuration ensures that the scram system relays are "fail-safe" and relay chatter or loss of power will cause the reactor to scram.

d All power and signal cables to the power safety channels are shielded, coaxial type cables to reduce electro-magnetic interference.

e Several steps have been taken to reduce the effects of AC power transients on the new console. The system DC power supplies are buffered to mitigate small AC power fluctuations. The NM1000 digital power instrument uses a battery back-up for retaining random access memory (RAM) data. In addition, although not required, an uninterruptible power supply (UPS) unit provides filtering and regulation of the line AC in addition to emergency AC power. The UPS provides power to the CSC, DAC, and NM1000 cabinets.

f Typical industrial insolation devices are used to provide fault isolation between instrument channels. These devices minimize the chance of an electromagnetic interference damaging multiple instrument channels.

4. The NM-1000 provides two rod withdrawal interlock functions. These prevent reactor startup unless sufficient source neutrons are available and pulsing operations from a power level above 1 kilowatt. The TS require that all reactor interlocks be verified operable at least once semi- annually. The control rod withdrawal interlock that prevents sourceless startups will, in fact, be tested every time a preoperational check is performed. Preoperational checks are normally performed 4 days per week. The interlock to prevent sourceless startups will be tested by physically removing the startup neutron source from the core and verifying that the interlock is actuated. The source interlock test result will be noted in the daily checklist. Testing of the 1 kW interlock will be performed monthly (unless the reactor is inoperable) by raising the reactor power until the 1 kW interlock annunicator indicates "ON" and then pressing the "Pulse" mode button to verify that the pulsing sequence is not initiated. The power level at which the interlock actuates will be recorded in the monthly checklist.

5. Safety system maintenance and surveillance: All safety system functions will be tested during each preoperational check. This check is performed automatically by the console when the operator presses the "PRESTART CHECKS" button. Test signals are generated by the control system and input to the safety system circuits to ensure that safety system functions are operable. The required safety system scrams checked by this method are the NP1000 high power and NPP1000 high power. The period scram is also checked, although not required by the TS. The manual scram button on the console will be manually checked during each preoperational check. The rod drop timer that initiates a scram following a reactor pulse will be tested on each day that pulse mode operation is planned. The above tests will be documented on the daily checklist. At least once semiannually, the NP1000 and NPP1000 power instruments will be verified to be indicating the correct power level as determined by a thermal power measurement.

6. Operator training on the new console: A one week training course at the General Atomics site in San Diego was attended by all USGS reactor operators. This training included lectures and hands-on training at the Mark I facility with their new console. The hands-on training consisted of both steady state and pulsing operations. A test was given at the end of the training to verify the student's knowledge. Following the training at General Atomics, the USGS staff has over two years experience at installing, testing, and maintenance on the new control system. Although the new control system was not controlling the reactor during this time, some inputs were available or simulated to allow the console to be used in the "monitoring" mode. The operator requalification program will be changed to cover the new console after its installation.