



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

SAFETY EVALUATION BY THE
OFFICE OF NUCLEAR REACTOR REGULATION
SUPPORTING AMENDMENT NO. 3 TO LICENSE NO. R-115
UNIVERSITY OF ILLINOIS
DOCKET NO. 50-151

Introduction

By application dated October 16, 1980, the University of Illinois requested authorization to (1) substitute a BF_3 (boron-trifluoride) neutron detector for the fission neutron detector used in the reactor start-up channel, and (2) substitute counting procedures and administrative controls for the electronic interlock on the start-up channel which prohibits control rod withdrawal if the neutron source level is too low.

The University of Illinois has operated a licensed research reactor on its campus in Urbana for many years, and in 1969 they were licensed to operate the up-graded Advanced TRIGA Research Reactor. The instrumentation authorized for this reactor has included a fission neutron detector driving a start-up channel, and an electronic interlock on this channel to prohibit withdrawal of control rods if the neutron source level is too low. Recently the fission detector malfunctioned, and the University explored the alternatives and delivery times for obtaining a replacement. The minimum delivery time was quoted as 3 to 4 months. Since the reactor is essential to the continuation of the University's educational and research programs, they have requested authorization to make the substitutions listed above to permit resumption of operations with minimum delay.

Discussion

The University of Illinois started operating a TRIGA-type research reactor in about 1960, and after several years of successful operation, they planned and eventually installed an up-graded research facility known as the Advanced TRIGA Research Reactor. This reactor has operated safely and productively since it was licensed in 1969. The license authorizing the reactor (R-115) typically incorporates the Safety Analysis Report (SAR), and includes a set of Technical Specifications. The SAR discusses the neutron source and start-up channel, which insures that there are enough neutrons in the reactor fuel region to initiate a chain reaction when withdrawal of control rods makes the reactor critical. The Technical Specifications

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require that the reactor shall not be operated unless the initial counting rate on the start-up channel be greater than one count per second. The Safety Analysis Report describes the control rod prohibit mechanism, and specifies the use of a fission neutron detector feeding the start-up channel.

The University of Illinois has proposed the substitution of a BF_3 neutron detector in place of the fission detector because they have on hand a unit which is operable, and which they have determined experimentally will detect neutrons with usable sensitivity. They have also requested that they be authorized to operate the reactor without the requirement for the automatic counting-rate interlock and instead, be authorized to substitute operational written procedures and an accompanying administrative limiting operating condition. The reason for the request for this second condition is that even though the BF_3 counter system is a completely adequate neutron detector, its output pulse size and shape were not matched to the input of the start-up channel interlock circuits. Therefore, at the time the University requested this license amendment, it was not certain that the BF_3 counting system and the control console rod-prohibit interlock were compatible. In the meantime, they have determined that the interlock circuit functions with the BF_3 detector.

valuation

1. Most research reactors use a start-up channel very similar to the unit at the University of Illinois, in which the neutron detector is a fission counter. A BF_3 detector is a standard laboratory instrument whose operation is well understood and reliable, but its operating characteristics are more complex than a fission counter. Therefore, primarily because of relative simplicity, a fission detector is the preferred device for routine reactor instrumentation. However, we conclude that the BF_3 detector is an acceptable substitute, because of its comparable ability to detect neutrons in the presence of gamma rays.
2. The start-up procedures proposed by the University of Illinois are very similar to those used in the early years of operation of reactors and critical facilities. They are still used at many facilities in which the reactor operating characteristics may vary day to day. With the development of reliable instrumentation and the increasing operation of reactors in a routine way, a start-up interlock was substituted for the more time-consuming procedure. The University of Illinois' proposed procedures represent a temporary use of the counting procedures and administrative control which have been found in the past to be safe and reliable, so we conclude that this substitution does not cause a significant decrease in safety.

Environmental Considerations

We have determined that the amendment does not authorize a change in effluent types or total quantities, nor an increase in power level, and will not result in any significant environmental impact. Having made this determination, we concluded further that the amendment involves an action which is insignificant from the standpoint of environmental impact, and pursuant to 10 CFR §51.5(d)(4), that an environmental impact statement or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

Conclusion

We have concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously considered, and does not involve a significant decrease in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated: October 23, 1980