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June 9, 1992

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Re: Docket No. 50-27

Gentlemen:

In accordance wi: your request dated April 2, 1992 addressed to Dr. Gerald E. Tripard, Director, WSU Nuclear Radiation Center, and signed by Marvin Mendonca, Sr. Project Manager, and subsequent telephone conversation with Mr. Mendonca, the following response to your request of the above-stated date is hereby submitted. The submittal consists of the requested safety analysis and a complete retyping of the Technical Specifications for Facility License No. R-76 as was agreed upon in telephone conversations between Mr. W.E. Wilson and Mr. Marvin Mendonca. The retyping of the Technical Specifications delayed the submittal and in a telephone conversation of May 26, 1992 Mr. Mendonca agreed to a late submittal to allow time for the retyping of facility Technical Specifications in their entirety, instead of just submitting a few pages of changes.

Sincerely,

G E Tripard

Gerald E. Tripard
Director

STATE OF WASHINGTON

County of Whitman

Sealed and sworn to this 10th day of June, 1992 by

Christy Bens
Notary Public in and for the State of
Washington, County of Whitman

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**Safety Analysis for Use of the Sealed Sources in the WSU TRIGA Reactor Pool**

The three potential hazards associated with the use of sealed sources in the WSU TRIGA reactor pool are: 1) contamination of the reactor core in the event of a sealed source failure, 2) contamination of the reactor pool water in the event of a sealed source failure, and 3) any increased radiological hazard produced in the event of a reactor accident with the presence of sealed sources in the reactor pool. The design basis accident (D.B.A.) for a TRIGA reactor is the loss of fuel cladding integrity with a simultaneous loss of pool water. The D.B.A. is covered in Section 6 of the WSU TRIGA Reactor SAR of May, 1979 and the loss of coolant accident is covered in Section 9 of the SAR.

The only potential hazard to the reactor core presented by the presence of sealed sources in the reactor pool would be the plating out of $^{60}Co$ on the reactor fuel elements. If the pool water were to contain a significant amount of dissolved $^{60}Co$, such contamination could plate out on the reactor fuel if the reactor were to be operated for an extended period of time under such conditions. First, the reactor would not be operated with significantly contaminated pool water. Second, the $^{60}Co$ in the sealed sources is in metallic form and thus very little $^{60}Co$ would be present in the pool water in the event of a sealed source cladding leak. In other words, the solubility of metallic $^{60}Co$ in water is very, very small. Last, but not least, the monitoring program for the pool water would detect the presence of a very small amount of $^{60}Co$ in the pool water and appropriate action would be taken before the $^{60}Co$ level became a problem. Also, the core cannot be closer than five (5) feet from the sealed sources which precludes the activation of the sources by the operation of the reactor. The neutron flux level falls off to an insignificant value within five (5) feet of the core.

The sealed sources stored in the reactor pool were designed and tested as meeting all the requirements of ANSI Standard N542 and are licensed as such under Washington State Radioactive Material License no. WN-C003-1. All of the sources were smear tested in 1988 before being shipped to WSU to verify the integrity of the encapsulation of the sources. Also, source types USN-368 and AECL-C-132 were subjected to impact, percussion, bending, and heat tests as per 49 CFR 173 to verify that the sources meet the applicable standards. The reactor pool water does not function as a coolant, only as a shielding material. The sealed sources are stored and used in an irradiation device shown in Figure 1. The minimum storage container shielding thickness is six (6) inches of lead. With 20,000 curies of $^{60}Co$ in the irradiation unit, the original design calculations predict a dose rate of 26 mr/hr at the pool surface for an emergency condition with an empty pool. If the irradiation unit contains 100,000 curies of $^{60}Co$, the dose rate at the pool surface in the event of a loss of pool water would be 130 mr/hr.

The calculations for the D.B.A. for the WSU TRIGA in the SAR arrived at a 36 mrem/hr whole body dose in the pool room for the volatized fission products and an 8 mrad lung dose. The thyroid dose was calculated to be 30 rem. The presence of the sealed sources in the reactor pool in the event of a reactor accident will not contribute any additional airborne radionuclides and thus would not increase the dose rates or airborne radiological hazard associated with the D.B.A. That is, there is no mechanism by which the sealed sources stored in their irradiation unit can contribute airborne radionuclides in the event of any credible reactor accident. The only increased hazard that the sources can produce is that from direct radiation exposure as a result of a loss of pool water.

The total fission product inventory of a TRIGA reactor operated at a power level of one (1) megawatt for an extended period of time is approximately 80,000 curies. The dose rate 25 feet above the pool surface in the event of a complete loss of pool water has been calculated to be $6.5 \times 10^3$ r/hr 10 seconds after the loss of water accident and $7.5 \times 10^2$ r/hr a day later (see Torrey Pines SAR GA-9064). The scattered dose rate or sky shine for a thick roof has been estimated to produce a .3 r/hr dose rate at the pool floor level at the 10 second time and .03 r/hr one day later. Thus, it is quite evident that the major problem in the event of a loss of pool water accident is the reactor core and the presence of the sealed sources in the pool stored in the irradiation unit would increase the direct dose rates from the empty pool by less than 2%, even a day after the accident.