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

JAN 06 1994

DOCKET: 70-152

LICENSEE: Purdue University
West LaFayette, Indiana

SUBJECT: SAFETY EVALUATION REPORT: APPLICATION DATED MAY 22, 1992, RE LICENSE RENEWAL

Background

Purdue University was first issued Special Nuclear Materials License SNM-142 in December 1957. The license was last renewed in June 1987. The current license was scheduled to expire on June 30, 1992; however, the licensee submitted an application dated May 22, 1992 (transmitted by letter dated May 28, 1992) for renewal. Accordingly, the license has remained in effect in accordance with the timely renewal provisions of Subsection 70.33(b) of 10 CFR 70. The licensee submitted additional information on radiation worker training, emergency planning, and criticality alarms on February 16, 1993.

Scope of Review

The review of the renewal application included the application of May 22, 1992, the additional information submitted on February 16, 1993 and the licensee's compliance history during the past 6 years.

The topics of review included an evaluation of the licensee's radiation and nuclear criticality safety programs and the organization. The renewal application was discussed with Nuclear Regulatory Commission, Region III staff.

Discussion

The renewal application demonstrates that Purdue University has an adequate technical staff with the proper qualifications to administer effective and safe radiological safety and nuclear criticality safety programs. The following sections contain a description of their organization, radiological safety program, and nuclear criticality safety program, along with additional conditions developed by the Licensing Branch (FCLB) staff.

Possession Limits

Purdue University has requested authorization to possess and use or store the following materials:

A. Uranium enriched in the U-235 isotope	A. SPERT fuel rods, enriched $\leq$ 4.8 w/o	A. 57,058 grams U-235
B. Uranium enriched in the U-235 isotope	B. SPERT Fuel rods, enriched $\leq$ 4.8 w/o	B. 23,942 grams U-235

C. Uranium enriched in the U-235 isotope	C. Fuel rods, enriched ≤ 1.3 w/o	C. 821 grams U-235
D. Uranium enriched in the U-235 isotope	D. Fuel rods, enriched ≤ 1.3 w/o	D. 31,179 grams U-235
E. Uranium enriched in the U-235 isotope	E. Solid helices, enriched ≤ 20 w/o	E. 200 grams U-235
F. Uranium enriched in the U-235 isotope	F. Solid discs, enriched ≤ 3 w/o	F. 10 grams U-235
G. Uranium enriched in the U-235 isotope	G. Samples, enriched ≤ 20 w/o	G. 10 grams U-235
H. Plutonium	H. Encapsulated PuBe neutron sources	H. 80 grams Pu
I. Natural Uranium	I. UO_2 pellets clad in aluminum	I. 11,760 kilograms U
J. Natural Uranium	J. Samples, any form	J. 10,000 grams U
K. Californium	K. 10 doubly encapsulated sources	K. 0.007 gram Cf
L. Uranium 233	L. Plated source	L. 0.01 μCi U-233 (10.5μg)
M. Neptunium 237	M. Plated source	M. 100 μCi (0.014 gram)
N. Plutonium 238	N. Plated source	N. 100 μCi (0.58 μg)
O. Thorium 230	O. Plated source	O. 100 μCi (0.5 mg)
P. Actinium 227	P. Plated source	P. 100 μCi (0.14 μg)
Q. Curium 244	Q. Plated source	Q. 100 μCi (0.12 μg)

Activities

The use of U-235 enriched solid helices and discs is to measure the effects of rare earths on the thermal properties of UO_2 and to measure the effects of elevated temperatures on the mechanical properties of UO_2. The PuBe neutron sources are employed in activation analysis studies, for instrument calibrations, and for neutron studies in a subcritical assembly. The fuel rods listed in possession limit A and C are used in the operation of the Fast

Breeder Blanket Facility (FBBF). The fuel rods listed in items B and D are in storage only. Items L-Q are used as calibration sources. The following license condition applies:

> Authorized use: The materials specified in conditions 6.A, 6.C, and 6.E through 6.Q shall be used in accordance with the statements, representations, and conditions specified in the application dated May 22, 1992 and transmitted by letter dated May 28, 1993, and supplement dated February 16, 1993. The licensee is authorized to possess and store, but not use the materials specified in conditions 6.B and 6.D. Storage of the fuel elements shall be in accordance with statements, representations, and conditions specified in the application.

SNM is used and stored in two locations on the Purdue University campus; the Duncan Annex of the Physics building. SNM is stored in rooms B-84 and B-77A of the Duncan Annex. The FBBF is housed in Room B28c of the Physics Building. Room B28c is a concrete housing constructed within Room B28 to enclose the FBBF. The fuel storage cabinets are in Room B28. The following license condition applies:

> Authorized place of use: The materials specified in conditions 6.A, 6.C, and 6.E through 6.Q shall be used in locations specified in the application. The material specified in conditions 6.B and 6.D shall be stored in the Duncan Annex in accordance with the statements, representations, and conditions specified in the application.

Organization

The licensee has maintained the Radiological Control Committee (RCC) referenced in the previously approved June 1987 application with the same composition and function. The title of the Radiological Control Officer has been changed to Radiation Safety Officer (RSO) with the same authority and responsibilities for administering the radiation protection program.

The license application upholds the minimum education and experience requirements for the principal members of the radiation safety staff. The current RSO and the FBBF project director have sufficient academic training and experience to meet these requirements.

Training

The licensee also has maintained the requirements for radiation safety training for all new employees and students. As in past applications, no refresher training course is provided for personnel on the basis that their usual stay at the University is limited to a time span that precludes the need for retraining. Because there may be students who are present for a number of years as well as staff members who need refresher training, the following condition will continue to apply:

> Refresher seminars which cover radiation safety procedures shall be conducted on an annual basis (maximum interval 15 months) for all employees and students who use radioactive material.

Radiation Safety Control

The licensee has committed to the same requirements as in past applications for the control of personnel exposure and contamination. As in previous applications, there is no reporting procedure described in the event that specified personnel decontamination levels cannot be achieved; therefore, the following condition is continued:

> If personal clothing or skin contamination levels are above background, persons shall not exit an area without approval of the Radiation Safety Officer.

While procedures for decontamination of personnel and surfaces remain well defined, there is no criteria for releasing contaminated equipment and packages from the facility for unrestricted use. To correct this the following condition will continue:

> Release of equipment, facilities, or packages to the unrestricted area or to uncontrolled areas onsite shall be in accordance with the attached "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, Or Special Nuclear Material" dated April 1993.

Effluent Control

The licensee has maintained, from the previously approved June 1987 application, the commitments necessary to ensure proper disposal of wastes. Solid wastes are compacted and transferred to a licensed disposal facility. Liquid wastes are either fixed for disposal by land burial or disposed of by release into the sewage system in accordance with 20.2003. Airborne contamination is not generated in the operation of the FBBF facility but could result from leakage. Air samples are taken before and after a HEPA filter which is located in the exhaust trains. Filters are counted weekly to monitor for potential leakage. In all cases, material is allowed to decay where possible, prior to disposal.

Nuclear Criticality Safety

A. General

SNM will be used or stored in two locations on the Purdue University Campus - the Duncan Annex Storage Facility and the Physics Building Fast Breeder Blanket Facility Laboratory. The FBBF control and operating procedures, as well as the storage of SNM, are under the control of the Department of Nuclear Engineering.

B. Duncan Annex Storage Facility

The Duncan Annex Storage facility (Rooms B-84 and B-77A), which will be used for storage of 1.3 and 4.8 percent enriched UO^2 fuel, is constructed of a steel frame with concrete and brick. The steel cabinets, designed to hold the rods vertically in a safe slab geometry, are fastened to the walls of the

room. The licensee maintains a 14 cm slab thickness on the 1.3 percent enriched fuel and a 3.5 cm slab thickness on the 4.8 percent enriched fuel. These thicknesses are below the subcritical limit for slab thickness as stated in ANSI/ANS8.1-1983. These cabinets and the rooms are locked and the keys are controlled by the RSO.

C. Physics Building Fast Breeder Blanket Facility Laboratory (Room B-28)

The Building is constructed of a steel frame with concrete and brick. The steel fuel storage cabinets are fastened to the southwest wall of Room B-28 and are surrounded by a wire-mesh cage. The licensee is imposing a 14 cm slab thickness on the 1.3 percent enriched fuel and a 3.5 cm slab thickness on the 4.8 percent enriched fuel. Both of these figures are below their respective subcritical limits for slab thickness as stated in ANSI/ANS-8.,1-1983.

Two independent sets of calculations indicate that k-eff $\approx$ 0.43. This assessment assumes that water is not present which would be the case under normal operating conditions. With flooding of the room, the calculated k-eff $\approx$ 0.74. These calculations were reviewed by the staff and found to be satisfactory (See NRC Safety Evaluation Report issued December 17, 1976). Therefore, it has been determined that nuclear criticality safety is assured. No changes in the current model were proposed in the application; therefore, the existing condition governing criticality shall be continued as follows:

> The Fast Breeder Blanket Facility shall not be operated with a measured normal operation k-eff greater than 0.45. In addition, the fuel loading shall be limited such that the calculated k-eff would not exceed 0.75 if the FBBF were accidentally flooded with water.

F. Exemptions

The area monitors in the FBBF facility meet the requirements of 10 CFR 70.24; however, the licensee has requested, pursuant to 10 CFR 70.24(a), an exemption from the provisions of 10 CFR 70.24 for special nuclear material stored in the Duncan Annex. The fuel rods are locked in steel cabinets in critically safe racks and procedural controls preclude situations in which inadvertant nuclear criticality might occur. The only activity authorized for this fuel is storage. Therefore, the following condition applies:

> The licensee is hereby exempted from the requirements of 10 CFR 70.24 insofar as the Section applies to the stored material in the Duncan Annex.

Emergency Planning

In accordance with 10 CFR 70.22(i)(1)(i), the licensee has submitted an evaluation showing that the maximum dose to a member of the public offsite due to a release of radioactive materials would not exceed 1 rem effective dose equivalent or an intake of 2 milligrams of soluble uranium. Accordingly, the licensee is not required to submit an Emergency Plan. The licensee has established procedures that are to be followed in the event of emergencies or accidents involving actual or potential radiation hazards. The procedures cover such events as fires, spills, unauthorized entry, accidental

criticality, and injury.

Environmental Protection and Categorical Exclusion

The licensing of the Purdue University activities is in accordance with 10 CFR 51.22(c)(14)(v) and, therefore, neither an Environmental Impact Statement nor an Environmental Assessment is warranted for this action.

Physical Security

The security plan submitted by Purdue University meets the requirements of 10 CFR 73.67 for SNM of moderate strategic significance. The following, therefore, applies:

> As it pertains to License SNM-142, the licensee shall fully implement and maintain in effect all provisions of the approved 10 CFR 73.67 physical security plan, including changes and amendments made pursuant to 10 CFR 70.32(e) and 10 CFR 70.34. The approved physical security plan, which was submitted by letter dated May 15, 1987, consists of a document containing Safeguards Information entitled, "Security Plan for the Purdue University Reactor, the Fast Breeder Blanket Facility and the Nuclear Fuel Storage Areas," Revision 3, dated May 15, 1987.

Compliance History

The inspection and enforcement record of the licensee since the last renewal was reviewed and discussed with Region III staff. There were no violations reported during this period. The Region feels the license as written is adequate from an inspection and enforcement perspective and has no objection to the issuance of the renewal.

Conclusion and Recommendation

Upon completion of the safety review of the licensee's application and discussion with the Region III staff, the staff has concluded that the licensee has the necessary technical staff to administer effective radiological safety and nuclear criticality safety programs. Conformance by the licensee to their proposed conditions, as well as those developed by FCLB staff, should ensure that licensed activities will not constitute an undue risk to the health and safety of the public or the environment.

Based on the discussion above, it is recommended that the license be renewed for a 5-year period in accordance with the application and subject to the recommended conditions

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GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT PRIOR TO RELEASE FOR UNRESTRICTED USE OR TERMINATION OF LICENSES FOR BYPRODUCT, SOURCE, OR SPECIAL NUCLEAR MATERIAL

U.S. Nuclear Regulatory Commission
Division of Fuel Cycle Safety
and Safeguards
Washington, DC 20555

April 1993

The instructions in this guide, in conjunction with Table 1, specify the radionuclides and radiation exposure rate limits which should be used in decontamination and survey of surfaces or premises and equipment prior to abandonment or release for unrestricted use. The limits in Table 1 do not apply to premises, equipment, or scrap containing induced radioactivity for which the radiological considerations pertinent to their use may be different. The release of such facilities or items from regulatory control is considered on a case-by-case basis.

1. The licensee shall make a reasonable effort to eliminate residual contamination.

2. Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Table 1 prior to the application of the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.

3. The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces of premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement shall be presumed to be contaminated in excess of the limits.

4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to, special circumstances such as razing of buildings, transfer of premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:

   a. Provide detailed, specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature, extent, and degree of residual surface contamination.

   b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment, or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Table 1. A copy of the survey report shall be filed with the Division of Fuel Cycle Safety and Safeguards, U. S. Nuclear Regulatory Commission, Washington, DC 20555, and also the Administrator of the NRC Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report shall:

   a. Identify the premises.

   b. Show that reasonable effort has been made to eliminate residual contamination.

   c. Describe the scope of the survey and general procedures followed.

   d. State the findings of the survey in units specified in the instruction.

   Following review of the report, the NRC will consider visiting the facilities to confirm the survey.

TABLE 1

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDES[a]	AVERAGE[b,c,f]	MAXIMUM[b,d,f]	REMOVABLE[b,e,f]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-23', Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000dpm/100cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 dpm $\beta\gamma$/100 cm^2	15,000 dpm $\beta\gamma$/100 cm^2	1000 dpm $\beta\gamma$/100 cm^2

[a]Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b]As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c]Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d]The maximum contamination level applies to an area of not more than 100 cm^2.

[e]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

[f]The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at ' cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.