AUG 2 5 1982

DOCKET NO.: 70-2950

APPLICANT: Washington Public Power Supply System

FACILITY: WPPSS Nuclear Station Unit 2

SUBJECT: REVIEW OF LICENSE APPLICATION DATED OCTOBER 2, 1981, THE SUPPLEMENTS THERETO DATED JUNE 23, and AUGUST 5, 1982

I. Introduction

A. General

By application dated October 2, 1981, and supplements dated June 23, and August 5, 1982, Washington Public Power Supply System (WPPSS) requests an NRC Materials License for the receipt, possession and use of the following:

Byproduct, source, and special nuclear material		Chemical and physical form	Maximum amount to be possessed
A.	Uranium enriched in the U-235 isotope	In unirradiated reactor fuel assemblies	4,342 kg of U-235 in uranium enriched to no more than 3.10% in U-235
B.	Uranium enriched in the U-235 isotope	Contained in sealed neutron detectors	73.5 mg of U-235; at any enrichment
C.	Antimony-Beryllium	Contained in sealed sources	14 sources enriched in Sb-124 with up to 1,200 curies/source

The finished fuel assemblies will be supplied by the General Electric Company. Each fuel assembly contains 62 fuel rods and two (2) nonfueled rods called water rods. The rods are spaced and supported in an 8 x 8 array by seven spacers and a lower and upper tie plate. Table 1 gives general fuel rod parameters that describe

TABLE 1

WNP-2 FUEL ROD PARAMETERS

Parameter	Initial Core
Rod Array	8 x 8
Number of Fuel Rods/Bundle	62
Fuel Rod Material	UO_2
Pellet Diameter (in.)	0.410
Pellet Length (in.)	0.410
Pellet Immersion Density (%) (Theoretical)	95 ± 2
Clad Material	Zr-2
Clad I.D. (in.)	0.419
Clad O.D. (in.)	0.483
Clad Thickness (nominal) (in.)	0.032
Pellet Clad Gap, Pellet to Clad ID. (cold, nominal) (in.)	.0045
Active Fuel Length (in.)	150.0
Plenum Length (in.)	9.48
Fuel Rod Pitch (in.)	0.640
Number of Water Rods/Assembly	2
Water Rod O.D. (in.)	0.591
Number of Spacergrids/Assembly	7
Grid Material	Zr-4 with Inconel springs
End Fittings Material (rods)	Zircaloy
Fill Gas Pressure (He) (atm)	3.0
Total Core Weight (MTU)	139.3
Core Average Enrichment w/o ^{235}U	1.87
U-235 Weight in Highest Enriched Assembly	4.0 kg

the fuel which will eventually be used in the WPPSS Nuclear Power Station, Unit 2. Unit 2 is a boiling water reactor (BWR). The Materials License is being issued to allow early receipt of the fuel for the purpose of inspection and preparation of the fuel for reactor loading. The license will automatically terminate upon issuance of the Part 50 operating license.

B. Location Description

The WPPSS Nuclear Station, Unit 2, is located in Benton County, Washington. It is scheduled to be the first WPPSS operating nuclear power reactor. Unit 1, located approximately one-half mile away and not yet completed, has been "mothballed" for the present. Unit 3, to be located approximately 200 miles away, is under construction, and Units 4 and 5 have been "terminated".

II. Authorized Activities

The applicant requests authorization for the receipt, possession, and storage of 764 finished fuel assemblies having a maximum enrichment of 3.10% U-235. The applicant also requests authorization to repackage any assembly, if necessary, for delivery to a carrier. It should be noted the license will not authorize insertion of a fuel assembly into the reactor vessel.

Authorization is also requested for the receipt, inspection, assembly and installation of in-core neutron detectors in the reactor core vessel. There will be a total of approximately 200 sealed detectors containing a total of approximately 74 mg U-235 of any enrichment. The BWR uses several types of in-core monitors to map power and flux levels and distributions.

Authorization is also requested for the receipt, possession, assembly into their source holders, and installation in the reactor vessel of a total of 14 antimony-beryllium sources containing a maximum of 1,200 curies/source. The multiplication of neutrons from these sources is measured to determine the approach to critical during start-up of a reactor. It is desirable to install and calibrate the neutron detectors and sources before the operating license is received.

III. Scope of Review

The safety review of the WPPSS request for a Materials License included an evaluation of the application dated October 2, 1981, and supplements dated February 16, March 11, June 23, and August 5, 1982. The June 23 supplement incorporated the information in the February 16 and March 11 supplements, added the request for authorization to receive, possess, store and use the neutron detectors and sources, and replaced the exterior alternate storage area by a contingency storage area in the warehouse. The August 5 supplement provided the additional information related to

the neutron detectors and sources necessary to evaluate the safety of the proposed storage and handling procedures and the design of the temporary metal covers used to cover each row of new fuel to preclude interspersed water moderation between rows of assemblies in the new fuel vault. A detailed review was made of the WPPSS organization, administration, nuclear criticality safety, radiation protection, and fire protection programs.

Discussions were held with the NRR project manager, the resident inspector and with staff members of the applicant during the course of the reviews. The evaluation of the physical security plan was made by the Physical Security Licensing Branch, Division of Safeguards, Office of Nuclear Material Safety and Safeguards.

IV. Possession Limits

Because of measurement and enrichment variations usually encountered, we propose to license a maximum enrichment of 3.25% ^{235}U and that the maximum possession limit be 4,553 kg of contained ^{235}U.

The applicant requested a total of 205 incore neutron detectors of several types. Since it is estimated these detectors will have a total of 73.5 mg contained ^{235}U, it is recommended the license should authorize a total of 1 g contained ^{235}U.

In addition, the applicant requested 14 radioactive antimony-beryllium (Sb-Be) sources, each containing a maximum of 1200 Ci (total 16,800 Ci). It is recommended the requested quantity be granted.

It is recommended Conditions 6, 7, and 8 be added to the license to authorize the indicated quantities of byproduct, source and/or special nuclear material, chemical and/or physical form, and the maximum quantities the licensee may possess at any one time under this license, respectively.

6. Material	7. Form	8. Quantity
A. Uranium enriched in the U-235 isotope	A. In unirradiated reactor fuel assemblies	A. 4,553 kilograms of U-235 in uranium
B. Uranium enriched in the U-235 isotope	B. Contained in sealed neutron detectors	B. One (1) gram of U-235; any enrichment
C. Antimony-Beryllium	C. Contained in sealed neutron sources	C. 14 sources enriched in Sb-124 with up to 1,200 curies/source

V. Organization

A. Nuclear Criticality Safety and Radiation Protection Responsibilities

The Plant Manager has overall responsibility for special nuclear materials on the plant site. As such, the responsibility for the administrative controls for the fuel, neutron detector, and source handling and storage rests with the plant manager. The fuel responsibilities are delegated to the nuclear materials custodian (either the Technical Department Manager or the Reactor Engineering Supervisor).

The responsibility of the Technical Department Manager includes the provision of technology support in the areas of fuel management and environmental programs. He reports to the Plant Manager.

The responsibilities of the Reactor Engineering Supervisor include technical and administrative procedure preparation and review and the evaluation and interpretation and/or preparation of licensing documents such as FSAR, plant technical specifications, and regulatory guides. He also supervises the activities of the reactor engineering staff. He reports to the Technical Department Manager.

The Health Physics/Chemistry Manager is responsible for managing the plant radiation protection and chemistry control programs and reports to the Plant Manager. He is assisted by the Health Physics Supervisor. The latter supervises the health physics program and is responsible for ensuring that radiation protection procedures and programs are implemented by assigning health physics/chemistry technicians to various plant activities, monitoring their performance, and specifying radiation protection requirements for radiologically controlled areas.

B. Minimum Qualifications

The Technical Department Manager has a BS degree in engineering and has had at least 8 years' experience in responsible positions including 3 years in nuclear power plants. He meets the minimum qualifications for personnel selection and training criteria specified in Regulatory Guide 1.8.

The Reactor Engineering Supervisor has a BS degree in engineering and a minimum of 4 years of professional level experience of which 2 years are in nuclear power plants. He is qualified to fulfill his responsibilities under the requested license.

The Manager, Health Physics/Chemistry, has a BS degree in science or engineering and a minimum of 5 years' experience in applied radiation protection. The Supervisor, Health Physics, has at least 5 years' experience in the principles and practices of

radiation protection. All the radiation protection personnel meet the minimum qualifications set forth in Regulatory Guide 1.8.

C. Administrative Procedures

The development of the fuel handling/storage procedures is performed by the reactor engineering staff. These procedures are reviewed and approved by the Plant Operating Committee (POC). The POC is chaired by the Plant Manager and consists of the various plant staff department heads: Operations, Maintenance, Technical, Health Physics/Chemistry, Operational QA, and Safety Engineering.

Administrative controls are covered under sections of the Plant Procedures Manual which govern the Plant Health Physics Program. These procedures include receipt, storage, and inventory control of radioactive material, personnel monitoring, establishing and posting controlled areas, operation of portable survey instruments, and radiation work permits. Contamination controls are provided by issuing radiation work permits governing work and access to the fuel handling and storage areas. In order to assure that operations personnel understand the health and safety aspects of their activities, it is recommended Condition No. 11 (Condition Nos. 9 and 10 are related to authorized use and authorized place of use, respectively) be added to require training in the procedures (including the health and safety aspects) for the receipt, handling, and storage of fuel assemblies and operational neutron sources, prior to their receipt.

D. Training

The application incorporates the educational experience and technical qualifications for onsite radiation control personnel and of the Technical Department Manager and Reactor Engineering Supervisor (responsible for the adminstrative controls for fuel handling and storage). Their training related to their functional responsibilities is also included. The staff has concluded that the applicant's radiation safety, fuel, neutron detector, and source handling program and personnel are adequate to allow them to reasonably carry out the activities for which a license is requested.

VI. Nuclear Criticality Safety

The fuel assemblies will be stored in their shipping containers in the contingency storage area (if necessary) and in the reactor building before fuel assembly removal, in the new fuel storage vault in the dry state, and in the spent fuel pool in the dry or the wet state. The new fuel storage vault can accommodate 240 fuel assemblies. The spent fuel storage racks have a capacity for 2658 fuel assemblies. In both the new

fuel vault and the spent fuel storage racks spaces between fuel storage positions are designed so that it is not possible to insert a fuel assembly in any position within the rack array not intended for fuel.

The fuel assembly racks in the new fuel storage vault are designed so the center-to-center spacing between assemblies within a row is 6.535 inches and 11.875 inches between assemblies in adjacent rows. There are 24 rows of assemblies with 10 assemblies per row. While fuel is being inserted or removed, the fuel will be protected by temporary metal covers over each row of new fuel and no more than one (1) row will be exposed at any one time during the fuel transfer into or out of the new fuel storage vault to minimize the number of fuel assemblies that may be exposed to water in the event water was used to fight a fire in the area. If the fuel is to be stored in the vault long term, concrete slab covers with rubber seals on the edge will be placed over the vault to provide a water-tight seal. The staff has determined that it is not possible to have an inadvertent criticality accident with no more than one (1) row of assemblies uncovered, independent of the degree of water moderation or reflection. If the entire array were flooded with full density water, the maximum k_{eff} of the array would be 0.879 ± .004.

The applicant plans to wrap the fuel assemblies in polyethylene sheeting open at the bottoms, to protect them from the environment while in storage. The opening at the bottom of the sheeting would prevent the assemblies from becoming internally moderated with water while the spaces between assemblies would be occupied only with air. This might occur if the bottoms of the sheeting were closed, the storage area flooded, the area then drained, and the water retained in the plastic bags. This added precaution taken by the applicant to prevent such a situation will be represented in Condition No. 12 which requires the fuel assemblies to be stored in such a manner that would allow water to drain freely from within the assemblies in the event of flooding and subsequent draining of a storage area. It is the staff's opinion that with this condition, the applicant has established reasonable and satisfactory precautions to avoid accidental criticality.

The fuel assemblies in the racks in the spent fuel pool are spaced on 6.50-inch centers. The spent fuel storage racks consist of fuel storage cells which have 0.125-inches-thick square stainless steel tubes (6.00 inches I.D.) with B_4C plates between them. The B_4C plates have a density of 1.5 g/cm^3 and have a B-10 loading of 0.0959 g/cm^2. The applicant has a quality assurance program starting with the certification of the analysis of each B_4C powder lot used in the plate fabrication and continuing with the manufacture of the plates, their installation in the spent fuel racks, and the surveillance program to assure the presence of the specified B_4C during use of the storage racks. The staff determined the maximum k_∞ for an infinite array of fuel assemblies in the spent fuel pool to be 0.831 ± .005 at the optimum degree of water moderation within and between assemblies. Therefore, any size array of fuel assemblies in the spent fuel pool is safe from inadvertent criticality.

The fuel assemblies may be stored in their shipping containers (inner metal container inside outer wooden container). WPPSS requests authorization to store fuel assemblies in this combination of containers in arrays up to six (6) wide by five (5) high. The safety of an infinite array stacked five high was confirmed in a memorandum from C. R. Marotta to R. H. Odegaarden dated April 12, 1977. WPPSS also requests authorization to store the assemblies in their inner metal containers only when the containers are stacked in arrays up to six (6) wide by four (4) high. The staff has confirmed the safety of the latter when it issued Amendment No. 5 to License No. SNM-1097 dated June 6, 1978, Docket No. 70-1113. Accordingly, the authorization for stacking the shipping containers as discussed is recommended as Conditions 13 and 14.

No more than three fuel assemblies will be outside their shipping containers or storage racks in any localized area and an edge-to-edge distance of at least 12 feet will be maintained between these localized groupings. This number cannot be made critical in any container geometry and is independent of the degree of water moderation and/or reflection. Accordingly, conditions 15 and 16 are recommended limiting the number of fuel assemblies in any localized area outside their shipping containers or storage racks to three and the minimum distance between groupings of 3 to 12 feet, respectively.

The applicant has requested, pursuant to 10 CFR 70.24(d), an exemption from the provisions of 10 CFR 70.24. Based on the applicant's demonstration of subcriticality under normal and accident conditions, good cause exists for exemption from the requirements of 10 CFR 70.24. Because of the inherent features associated with the storage and inspection of unirradiated fuel containing uranium enriched to less than 5% in the U-235 isotope when no fuel processing activities are to be performed, the staff hereby determines that granting such an exemption will not endanger life or property or the common defense and security, and is in the public interest. This exemption is authorized pursuant to 10 CFR 70.14. It is recommended that this exemption be identified as Condition 17.

VII. Radiation Safety

The Health Physics Supervisor is responsible for establishing administrative and technical controls for radiation protection, radiation exposure reduction, and for the subsequent administration of this program. He meets the criteria of Regulatory Guide 1.8 for "Personnel Selection and Training" for a Radiation Protection Manager.

WPPSS is committed, consistent with Recommendations of Regulatory Guide 8.8, to establish a program to maintain occupational and general public exposure to radiation As Low As Reasonably Achievable (ALARA).

Administrative controls are covered under sections of the Plant Procedures Manual which govern the Health Physics Program. The procedures include the receipt of radioactive material, personnel monitoring, establishing and posting controlled areas, operation of portable survey instruments, and radiation work permits.

Portable survey instrumentation will be calibrated at six (6)- month intervals and laboratory instruments will be calibrated at twelve (12)-month intervals.

The in-core neutron detectors will be stored in a fenced and locked storage area Warehouse 4 inside a controlled access area .

The operational neutron sources will be stored in their shielded containers in the spent fuel pool or the dryer/separator pit. The standard license condition regarding leak testing of sealed byproduct material sources is being added as Condition 18 in accordance with standard operating procedures. Shortly before fuel loading commences, the fuel pool or the dryer/separator pit will be flooded, the shielded shipping containers holding the sources unbolted, the sources installed in holders, transferred under water to the reactor, and installed in the reactor vessel. These operations are required prior to fuel loading to calibrate and test the source range monitors. Since these operations are performed in accordance with approved written procedures and are under health physics supervision, the staff has concluded the operations can be reasonably carried out with adequate protection of the operating personnel, the public and the environment.

VIII. Environmental Protection

The "Final Environmental Statement" related to the operation of WPPSS Unit No. 2, dated December 1981, has been prepared and issued by the NRC as NUREG-0812. Based on the environmental statement, implementation of the 10 CFR Part 70 license for the storage and handling of special nuclear and byproduct materials will have an insignificant effect on the environment.

IX. Fire Safety

The materials used in the construction of the fuel storage areas are concrete and steel. The presence of combustible materials in the fuel storage areas is minimized by administrative controls. Fire protection in the vicinity of the fuel storage areas consists of fire hoses and dry chemical extinguishers for manual use. Automatic fire detectors and manual fire alarm boxes are provided which alarm and annunciate in the Control Room. The staff has determined the fire protection measures provided are adequate for the facility.

X. Physical Protection

The WPPSS physical security plan has been reviewed. It is the staff's opinion the program described is adequate and meets the requirements of 10 CFR 73.67. The applicant was notified by the NRC by letter dated November 27, 1981, and by letter dated August 17, 1982, that his "Fuel Storage Physical Security Plan" and its modification, respectively, are approved as conditioned. It is recommended Condition 19 be added requiring the plan to be fully implemented by the date of fuel receipt.

XI. Conclusion

Based on the above statements, the staff believes that the proposed activities can be performed without undue risk to the health and safety of the public. It has been determined by the staff that the applicant fulfills the requirements of 10 CFR 70.23(a). Further, the issuance of this license is not a major Federal action significantly affecting the quality of the human environment and thus, pursuant to 10 CFR 51.5(d)(4), no environmental appraisal need be prepared.

XII. Recommendations

The staff recommends approval of the application and its supplements with the addition of the following conditions:

11. Operations personnel shall receive training in the procedures (including the health and safety aspects) for the receipt, handling, and storage of fuel assemblies and operational neutron sources, prior to their receipt.

12. Fuel assemblies shall be stored in such a manner that water would drain freely from the assemblies in the event of flooding and subsequent draining of the fuel storage area.

13. Fuel assemblies, when stored in their shipping containers (inner metal and outer wooden shipping containers), shall be limited to arrays stacked no more than five (5) high.

14. Fuel assemblies, when stored only in their metal shipping containers, shall be stacked no more than four (4) high.

15. No more than three (3) fuel assemblies shall be in a single localized area outside their shipping containers or storage racks at any one time.

16. The minimum edge-to-edge distance between groupings of three (3) fuel assemblies in a localized area and fuel assemblies in other localized areas or from those in shipping containers or in storage racks shall be at least 12 feet.

17. The licensee is hereby exempted from the provisions of 10 CFR 70.24 insofar as this section applies to material held under this license.

18. The licensee shall comply with the provisions of Annex A, "License Condition for Leak Testing Sealed Byproduct Material Sources."

19. The "Fuel Storage Security Plan" shall be fully implemented by the date of fuel receipt.

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