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DOCKET NO. 70-3027

APPLICANTS: Public Service Company of New Hampshire (PSNH)
The United Illuminating Company
Massachusetts Municipal Wholesale Electric Company
New England Power Company
Central Maine Power Company
The Connecticut Light and Power Company
Canal Electric Company
Montaup Electric Company
Bangor Hydro-Electric Company
New Hampshire Electric Cooperative, Inc.
Central Vermont Public Service Corporation
Maine Public Service Company
Fitchburg Gas and Electric Light Company
Vermont Electric Generation and Transmission Cooperative
Taunton Municipal Lighting Plant
Hudson Light and Power Department

FACILITY: Seabrook Station, Unit 1

SUBJECT: SAFETY EVALUATION REPORT - REVIEW OF APPLICATION DATED
AUGUST 1, 1985, AND ITS SUPPLEMENT DATED OCTOBER 24, 1985, FOR A
SPECIAL NUCLEAR MATERIALS LICENSE

I. INTRODUCTION

A. General

By application dated August 1, 1985, and its supplement dated October 24, 1985, PSNH acting on its own behalf and as agent for the applicants listed above, requested authorization to receive, inspect, possess, and store enriched uranium contained in fresh fuel assemblies. In addition, PSNH requested authorization to receive, inspect, possess, and use other radioactive materials in the form of irradiation test capsules containing U-238 and Np-237, incore fission chambers and excore detectors containing uranium enriched in U-235, and sources containing Pu-238, Pu-239, U-235, and U-238. The materials are for eventual use in Seabrook Station, Unit 1.

The materials license was requested to allow early receipt of the fuel for the purpose of inspection and preparation of the fuel for reactor loading. The materials license will automatically terminate upon issuance of the Part 50 license.

B. Fuel Assembly Design

The finished fuel assemblies for Seabrook Station, Unit 1, will be supplied by the Westinghouse Electric Corporation. Each fuel assembly contains 264 fuel rods, 24 Zircaloy-4 control rod guide thimbles, and 1 Zircaloy-4 instrumentation thimble. The fuel rods, guide thimbles, and

instrumentation thimble are spaced in a 17 x 17 array and supported by inconel grid assemblies located along the length of the fuel assembly. Table 1 gives general fuel parameters that describe the fuel which will eventually be used in Seabrook Station, Unit 1.

TABLE 1
SEABROOK STATION - UNIT 1

General Fuel Data

<u>Fuel Assembly Data</u>	<u>Inches</u>
Overall Length	160
Nominal Active Fuel Length	144.0
Fuel Rod Pitch	0.496
Rod Array	17 x 17
Rods Per Assembly	264
<u>Fuel Rod Data</u>	
Fuel Pellet Material	UO ₂
Outside Diameter	0.374
Cladding Thickness	0.0225
Cladding Inside Diameter	0.329
Fuel Pellet Immersion Density (% theoretical)	95.0
Fuel Pellet Diameter	0.3225

C. Location Description

Seabrook Station, Unit 1, is a PWR located near the northern boundary of the town of Seabrook, Rockingham County, New Hampshire. Construction permit CPPR-135 was issued by the Nuclear Regulatory Commission (NRC) in July 1976.

II. AUTHORIZED ACTIVITIES

A. Enriched Uranium Fuel Assemblies

This license will authorize the receipt, possession, inspection, and storage of 199 finished fuel assemblies with a maximum enrichment of 3.55 w/o in U-235. Fuel assemblies will be stored in their shipping containers, new fuel storage vault, and spent fuel pool.

PSNH also requests authorization to repackage any assembly, if necessary, for delivery to a carrier. It should be noted that the license does not authorize insertion of a fuel assembly into the reactor vessel.

B. Irradiation Test Capsules

The license will authorize the receipt, possession, inspection, and use of six test capsules which will contain uranium and neptunium as

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dosimeters. The Uranium-238 concentration in each capsule will be 4.0×10 microcuries and the Neptunium-237 concentration in each capsule will be 12.1 microcuries.

C. Incore Fission Detectors

The license will authorize the receipt, possession, inspection, and use of 25 subminiature fission chambers. Each detector contains ≤ 2.7 milligrams of U_3O_8 enriched to 93% w/o U-235.

D. Excore Detectors

The license will authorize the receipt, possession, inspection, and use of five excore detectors. Each detector has two fission chambers each containing ≤ 4 grams U-235.

E. Other Special Nuclear Materials

The license will authorize the receipt, possession, inspection, and use of 100 microcuries of Pu-238, 100 microcuries of Pu-239, 200 microcuries of U-235, and 300 microcuries of U-238 for calibration or chemical analysis.

III. SCOPE OF REVIEW

The staff's safety review of the PSNH request for a materials license included an evaluation of Seabrook Station's organization, administration, nuclear criticality safety, radiation protection, and fire protection programs.

During the course of the review, discussions were held with the NRR Project Manager, the Senior Resident Inspector, and PSNH staff members.

The evaluation of the "Seabrook Station Physical Security Plan for the Protection of Nuclear Material of Low Strategic Significance," was made by the Safeguards Material Licensing and International Activities Branch, Division of Safeguards, Office of Nuclear Material Safety and Safeguards.

IV. POSSESSION LIMITS

Conditions 6, 7, and 8 of this license will specify the type, form, and quantity of material that PSNH may possess under this license and shall read as follows:

6. <u>Material</u>	7. <u>Form</u>	8. <u>Quantity</u>
A. Uranium enriched in U-235 isotope	A. In unirradiated fuel assemblies	A. 3,300 kg of U-235 in uranium enriched to no more than 3.55 w/o U-235

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B. Uranium-238 Neptunium-237	B. Irradiation test capsules	B. 25.0×10^{-3} microcuries U-238, 75.0 microcuries Np-237
C. Uranium enriched in U-235 isotope	C. Incore fission detectors	C. 70 milligrams of uranium enriched to 93% w/o U-235.
D. Uranium enriched in U-235 isotope	D. Excore detectors	D. 50 grams of uranium at any enrichment
E. Pu-238, Pu-239, U-235, U-238	E. Any Form	E. 100 microcuries Pu-238 100 microcuries Pu-239 200 microcuries U-235 300 microcuries U-238

V. ORGANIZATION

A. Nuclear Criticality Safety and Radiation Protection Responsibilities

1. Station Manager

The Station Manager has ultimate responsibility for the control and surveillance of all special nuclear materials on the plant site.

2. Reactor Engineering Supervisor

The Reactor Engineering Supervisor is responsible for ensuring that qualified personnel perform special nuclear materials' operations at the plant site in accordance with approved procedures. These operations include the transferring and shipping of special nuclear materials at Seabrook Station, Unit 1. In addition, the Reactor Engineering Supervisor is responsible for fuel movement sequences, accountability, storage, and inspection.

3. Nuclear Quality Manager

The Nuclear Quality Manager has overall responsibility for ensuring that the Seabrook Operational Quality Assurance Program is effectively implemented by all organizations performing work on safety-related systems.

4. Health Physics Department Supervisor

The Health Physics Department Supervisor is responsible for administering Seabrook Station's radiation protection program. He is responsible for ensuring compliance with applicable federal and state radiation protection regulations.

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B. Minimum Qualifications

The qualifications of the Reactor Engineering Supervisor, Nuclear Quality Manager, and the Health Physics Department Supervisor have been reviewed and the staff finds that they meet the minimum qualifications specified in Regulatory Guide 1.8, "Personnel Selection and Training" and/or ANSI/ANS 3.1-1978, "Selection, Qualification and Training of Personnel for Nuclear Power Plants." However, PSNH did not state the minimum qualifications for the Station Manager. Therefore, the staff recommends that Condition 11 be added to clearly specify the minimum technical qualifications for the above position.

Condition 11. The minimum technical qualifications for the Station Manager shall be in accordance with Section 4.2.1, "Plant Manager," ANSI/ANS 3.1-1978.

C. Training

Training is conducted to ensure that all operations personnel are familiar with the design features, engineered safeguards, and fuel handling procedures. Prior to receipt of fuel, operations personnel involved in fuel handling activities will receive training using a dummy fuel assembly. In addition, all personnel involved with fuel handling and storage operations will have appropriate health physics training. The Training Manager is responsible for developing and implementing Seabrook Station's training program.

The staff has concluded that, based on PSNH's radiation safety and fuel handling training programs, PSNH can responsibly carryout the activities for which a license is requested.

D. Administrative Procedures

Administrative procedures for the control and handling of nuclear fuel are reviewed and approved by the Station Operation Review Committee (SORC). SORC composition and qualifications are per Seabrook Station, Unit 1, Technical Specification 6.5.1. The qualifications of SORC members must meet or exceed those required by Section 4 of ANSI/ANS 3.1-1978. Final approval of these procedures, based on the recommendations of the SORC, is by the Seabrook Station Manager.

VI. NUCLEAR CRITICALITY SAFETY

PSNH requests authorization to store fuel assemblies in their shipping containers, the new fuel storage vault, and spent fuel pool.

A. Fuel Handling

In order to ensure that all fuel handling equipment is ready to safely handle the fresh fuel assemblies, PSNH has stated that all required fuel handling equipment and storage facilities will be inspected and preoperationally tested prior to receipt of new fuel.

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PSNH's application states that no more than two assemblies will be out of their shipping container or designated storage location at one time. Calculations have indicated that two assemblies could be made critical at optimum conditions of water moderation and reflection; however, one assembly separated from another assembly by 12 inches of spacing cannot be made critical under any conditions. Therefore, the staff recommends the following license condition limiting the number of fuel assemblies out of storage and the minimum distance from all other fuel:

Condition 12a. No more than two fuel assemblies shall be out of approved shipping containers or fuel assembly storage racks at any one time.

b. PSNH shall maintain a minimum edge-to-edge distance of 12 inches:

1. Between the above two fuel assemblies,
2. Between fuel assemblies (out of storage) and the shipping container array, and
3. Between fuel assemblies (out of storage) and the storage rack arrays.

B. Shipping Containers

The fresh fuel assemblies may be temporarily stored in shipping containers in the rail bay and the new fuel shipping container area of the Fuel Storage Building. The shipping containers are authorized for use in accordance with Certificate of Compliance No. 5450. The Certificate of Compliance authorizes the shipment of as many as 60 containers filled with unirradiated fuel assemblies in a single Class III shipment independent of spacing or the degree of water moderation and reflection. PSNH did not describe the storage of more than 60 loaded shipping containers, therefore, the staff recommends that the following condition be added to the license limiting the number of loaded shipping containers onsite at one time:

Condition 13. No more than 60 loaded shipping containers shall be allowed onsite at any one time.

PSNH has indicated that if storage areas (rail bay and new fuel shipping container) for the shipping containers become unavailable, a temporary holding area will be established outside. The staff recommends that the following license condition be added to preclude the use of the outside holding area as a long-term storage facility for the shipping containers:

Condition 14. No shipping container shall be outside for more than 72 hours from time of receipt onsite.

C. New Fuel Storage Vault

The new fuel storage vault has a capacity for 90 assemblies arranged in a 5 x 18 array. The fuel assemblies are stored in storage cells (formed by steel tubing) with inner dimensions of 9-inches square and walls which are 0.093-inches thick. Each storage cell is separated from an adjacent cell by minimum 21 inches center-to-center spacing. The racks are engineered so that it is not possible to insert assemblies in other than their designated locations.

Although the new fuel storage racks have capacity for 90 assemblies, PSNH has stated that only 12 assemblies will be stored in a checkerboard pattern in the new fuel storage vault. In addition, eight removable steel plates covering the new fuel storage vault are present to limit the amount of water moderation and protect the fuel from the environment.

In the application, PSNH did not state the administrative controls to be used to assure that fuel stored in the new fuel storage vault is in its proper location. The staff recommends the following license condition be added:

Condition 15. New fuel assemblies may be stored in the new fuel storage vault subject to the following conditions:

- a. The maximum U-235 enrichment shall be 3.55 w/o.
- b. The maximum number of fuel assemblies that shall be stored in the new fuel storage area shall be 12.
- c. The fuel assemblies shall be stored dry in a checkerboard pattern.
- d. The Reactor Engineering Department Supervisor or equivalent qualified designee shall verify correct fuel assembly location after insertion into the assigned storage location in accordance with a prepared written procedure approved by the Station Manager.

The checkerboard pattern, the storage of only 12 assemblies, and the 21 inches minimum center-to-center spacing effectively isolate assemblies stored in the new fuel storage vault from one another. Therefore, based on the proposed conditions for storage and PSNH's fuel storage array, criticality safety of the new fuel storage vault is assured.

D. Spent Fuel Pool

Fuel assemblies in the spent fuel pool are spaced on 10.35-inch centers. The storage cells are 8.90-inches square and are made of 0.090-inch thick stainless steel. Subcriticality of the racks is maintained by the presence of neutron poison sheets (Boroflex) securely positioned on all four sides of each cell. The staff has reviewed PSNH's quality assurance program to ensure that the neutron meets design specifications and is encapsulated securely to each storage cell. The quality assurance program was found to be adequate.

PSNH conducted a criticality safety analysis for the spent fuel pool based on the following conditions: the fuel assemblies contain unirradiated fuel at a uniform 3.50 U-235 enrichment, the array of assemblies is infinite in the lateral extent, and at full water density. Based on these conditions and using 123 energy group cross-section library and KENO IV code for reactivity determination, PSNH determined that fresh fuel stored in the spent fuel pool would have a maximum k-effective of less than 0.95.

An independent nuclear criticality safety analysis by the staff indicates the k-effective of an infinite array of fuel assemblies at an enrichment of 3.55 w/o U-235 is 0.91 at full water density (optimum moderation). Therefore, the storage of fresh fuel in the spent fuel pool is critically safe.

E. Exemption from Criticality Alarm Requirements

PSNH has requested, pursuant to 10 CFR 70.24(d), an exemption from the provisions of 10 CFR 70.24. Because the fuel assemblies are handled as discrete items, stored with controlled engineered spacing under dry conditions, and the inherent features associated with unirradiated fuel containing uranium enriched to less than 5 percent in the U-235 isotope when no fuel processing are to be performed, the possibility of accidental criticality during fuel handling and storage activities is remote. Therefore, the staff hereby determines that granting such an exemption will not endanger life or property. This exemption is authorized pursuant to 10 CFR 70.14. It is recommended that the exemption be identified as Condition 16.

Condition 16. PSNH is hereby exempted from the provisions of 10 CFR 70.24 insofar as this section applies to materials held under this license.

VII. RADIATION SAFETY

Since most of the radioactive materials requested, including fresh fuel assemblies, are sealed sources, the principal exposure pathway to an individual is via external radiation. For a low-enriched uranium fuel bundle ($\leq 4\%$ U-235 enrichment), the exposure rate at 1 foot from the surface is normally less than 1 mr/hr; therefore, it is estimated that the exposure level to workers from these sources would be less than 25 percent of the maximum permissible exposure specified in 10 CFR 20. All other special nuclear materials requested by PSNH will also present no threat to plant personnel or to the environment because of the small quantities of radioactive material involved.

PSNH is committed to establishing a program to maintain occupational exposures as low as reasonably achievable (ALARA). The responsibility for maintenance of safe radiological conditions and implementation of the Seabrook Station, Unit 1, radiation protection program is the Health Physics Department Supervisor.

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At Seabrook Station, Unit 1, all persons subject to radiation exposure will be issued thermoluminescent dosimeters (TLDs) and/or self reading pocket dosimeters (SRPD). TLDs are normally evaluated at monthly intervals. SRPDs are read out at the end of each day for exposure tracking purposes.

Storage of other radioactive materials (other than new fuel) will be in a locked controlled storage area. PSNH did not state the persons responsible for other special nuclear materials, therefore, the staff recommends that the following condition be added to the license:

Condition 17a. The irradiation test capsules and radioactive sources shall be used by or under the supervision of individuals designated by the Health Physics Department Supervisor or an equivalent qualified alternate.

b. The incore fission and excore detectors shall be used by or under the supervision of individuals designated by the Reactor Engineering Supervisor or an equivalent qualified alternate.

Annex A, "License Condition for Leak Testing Sealed Source Which Contains Alpha Emitters," has been adopted as a Branch Technical Position and will be incorporated as License Condition 18. Accordingly, Condition 18 shall read as follows:

Condition 18. PSNH shall comply with the provisions of Annex A, "License Condition for Leak Testing Sealed Source Which Contains Alpha Emitters."

Because of the low radiation exposure levels associated with the requested materials and activities and PSNH's radiation protection procedures, the staff has concluded that the requested operation can be carried out with adequate protection of the operating personnel.

VIII. ENVIRONMENTAL PROTECTION

The NRC has prepared an Environmental Assessment related to the proposed 10 CFR Part 70 Fuel Storage License for Seabrook Station, Unit 1. Based on this Assessment, a Finding of No Significant Impact has been issued and approved pursuant to 10 CFR Part 51. This Finding was published in the Federal Register on November 19, 1985.

IX. FIRE SAFETY

The materials used in the fuel handling and storage areas are steel and concrete. Administrative controls limit the combustible material in the storage areas.

The Fuel Storage Building has been provided with an ionization fire detection system, manual fire fighting equipment consisting of portable fire extinguishers, halon and dry chemicals, along with a standpipe and hose and reel system. Primary

method of fire control will be the use of dry chemical extinguishers. The hose and reel system using water as a suppressant will serve as a secondary method of fire control. The staff has determined that the fire protection measures taken by PSNH are adequate for the protection of the health and safety of the workers and the public.

X. PHYSICAL PROTECTION

The Division of Safeguards, NMSS, has reviewed PSNH's Physical Plan and has determined that it meets the requirements of 10 CFR 73.67. To ensure that the Physical Security Plan shall be fully implemented and remain in effect whenever fresh fuel is stored onsite, the staff recommends Condition 19 be added to the license.

Condition 19. PSNH shall maintain and fully implement all provisions of the Commission approved Physical Security Plan, including any changes that may be made pursuant to the authority of 10 CFR 70.32(e). The approved Physical Security Plan consists of PSNH's submitted Plan titled "Seabrook Station Physical Security Plan for the Protection of Nuclear Material of Low Strategic Significance," dated May 28, 1985. The Physical Security Plan identified by this condition shall be withheld from public disclosure pursuant to 10 CFR 2.790(d).

XI. CONCLUSION

1. After reviewing the application, and its supplement, the staff finds that:
 - a. PSNH meets the requirements of the Atomic Energy Act, as amended, and of the regulations of the Commission,
 - b. Issuance of the license would not be inimical to the common defense and security, and
 - c. Issuance of the license would not constitute an unreasonable risk to the health and safety of the public.
2. With the recommended license conditions, the NRC staff finds that:
 - a. PSNH is qualified by reason of training and experience to use the material for the purpose requested in accordance with regulations in 10 CFR 70.
 - b. PSNH's proposed equipment and facilities are adequate to protect health and minimize danger to life or property.
 - c. PSNH's proposed procedures to protect health and to minimize danger to life or property are adequate.

XII. RECOMMENDATIONS

The staff recommends approval of the application, and its supplement subject to the following conditions which the staff finds are appropriate to protect or to minimize danger to life or property:

- Condition 11. The minimum technical qualifications for the Station Manager shall be in accordance with Section 4.2.1, "Plant Manager," ANSI/ANS 3.1-1978.
- Condition 12a. No more than two fuel assemblies shall be out of approved shipping containers or fuel assembly storage racks at any one time.
 - b. PSNH shall maintain a minimum edge-to-edge distance of 12 inches:
 - 1. Between the above two fuel assemblies,
 - 2. Between fuel assemblies (out of storage) and the shipping container array, and
 - 3. Between fuel assemblies (out of storage) and the storage rack arrays.
- Condition 13. No more than 60 loaded shipping containers shall be allowed onsite at any one time.
- Condition 14. No shipping container shall be outside for more than 72 hours from time of receipt onsite.
- Condition 15. New fuel assemblies may be stored in the new fuel storage vault subject to the following conditions:
 - a. The maximum U-235 enrichment shall be 3.55 w/o.
 - b. The maximum number of fuel assemblies that shall be stored in the new fuel storage area shall be 12.
 - c. The fuel assemblies shall be stored dry in a checkerboard pattern.
 - d. The Reactor Engineering Department Supervisor or equivalent qualified designee shall verify correct fuel assembly location after insertion into the assigned storage location in accordance with a prepared written procedure approved by the Station Manager.
- Condition 16. PSNH is hereby exempted from the provisions of 10 CFR 70.24 insofar as this section applies to materials held under this license.
- Condition 17a. The irradiation test capsules and radioactive sources shall be used by or under the supervision of individuals designated by the Health Physics Department Supervisor or an equivalent qualified alternate.

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- b. The incore fission and excore detectors shall be used by or under the supervision of individuals designated by the Reactor Engineering Supervisor or an equivalent qualified alternate.

Condition 18. PSNH shall comply with the provisions of Annex A, "License Condition for Leak Testing Sealed Source Which Contains Alpha Emitters."

Condition 19. PSNH shall maintain and fully implement all provisions of the Commission approved Physical Security Plan, including any changes that may be made pursuant to the authority of 10 CFR 70.32(e). The approved Physical Security Plan consists of PSNH's submitted Plan titled "Seabrook Station Physical Security Plan for the Protection of Nuclear Material of Low Strategic Significance," dated May 28, 1985. The Physical Security Plan identified by this condition shall be withheld from public disclosure pursuant to 10 CFR 2.790(d).

Original signed by:
Kishore Kodali

Kishore K. Kodali
Uranium Process Licensing Section
Uranium Fuel Licensing Branch
Division of Fuel Cycle and
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Original Signed By:
Approved by: W. T. Crow
W. T. Crow, Section Leader

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ANNEX A

LICENSE CONDITION FOR LEAK TESTING
SEALED SOURCE WHICH CONTAINS ALPHA EMITTER

- A. 1. Each sealed source containing licensed material shall be tested for leakage at intervals not to exceed six months. In the absence of a certificate from a transferor indicating that a test has been made within six months prior to the transfer, a sealed source received from another person shall not be put into use until tested.
2. The periodic leak test required by this condition does not apply to sealed sources that are stored and not being used. The sources shall be tested for leakage prior to any use or transfer to another person unless they have been leak tested within six months prior to the date of use or transfer.
- B. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. The test sample shall be taken from the sealed source or from the surfaces of the device in which the sealed source is permanently mounted or stored on which one might expect contamination to accumulate. Records of leak test results shall be kept in units of microcuries and maintained for inspection by the Commission.
- C. If the test reveals the presence of 0.005 microcurie or more of removable contamination, the licensee shall immediately withdraw the sealed source from use and shall cause it to be decontaminated and repaired by a person appropriately licensed to make such repairs or to be disposed of in accordance with the Commission regulations.

Within five days after determining that any source has leaked, the licensee shall file a report with the Division of Fuel Cycle and Material Safety, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, describing the source, the test results, the extent of contamination, the apparent or suspected cause of source failure, and the corrective action taken. A copy of the report shall be sent to the Administrator of the nearest NRC Regional Office having jurisdiction listed in Appendix D of Title 10, Code of Federal Regulations, Part 20.