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

Perry Nuclear Power Plant
Docket No. 50-440
Request for Exemption
from 10 CFR 70.24

Gentlemen:

Pursuant to the requirements of 10 CFR 70.14(a) and 70.24(d), an exemption from the requirements of 10 CFR 70.24, "Criticality Accident Requirements" is hereby requested for the Perry Nuclear Power Plant (PNPP), Unit 1. The 70.24 exemption being requested is similar to the one previously granted within PNPP's Special Nuclear Material (SNM) license.

Attachment 1 contains a discussion of the basis for reinstating this exemption. Attachment 2 contains a discussion on the design features and conditions to preclude criticality in areas where fuel is handled or stored. Attachment 3 is a copy of the Special Nuclear Materials License (SNM-1928) issued to PNPP on March 7, 1985. A Technical Specification change is also being submitted (see letter PY-CEI/NRR-1388 L, dated February 28, 1992) for removing the criticality monitors from Specification 3.3.7.1, "Radiation Monitoring Instrumentation."

If you have any questions, please feel free to call.

Sincerely,

Michael D. Lyster

MDL:RAL:ss

Attachment

cc: NRC Project Manager
NRC Resident Inspector Office
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State of Ohio

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INTRODUCTION

For reasons similar to those that previously provided the basis for an Exemption to 10 CFR 70.24 (granted in the March 1985 Special Nuclear Material (SNM) license for this facility), this letter requests a new exemption to the requirements of 10 CFR 70.24, "Criticality Accident Requirements". The previous Section 70.24 exemption is considered to have expired with the SNM license[1] [upon receipt of the Operating License (OL)] since the exemption was not specifically reissued at the time of OL issuance. It is our understanding that NRC Staff in the Office of General Counsel and the Office of Nuclear Material Safety and Safeguards take the position that unless an exemption granted under a 10 CFR Part 70 license is explicitly incorporated into the subsequently granted 10 CFR Part 50 operating license, that the exemption expires with the issuance of the Part 50 license. Although there may be precedent to the contrary,[2] it is our understanding that the SNM license (and thus the 70.24 exemption) for Unit 1 of the Perry Nuclear Power Plant (PNPP) is considered to have expired. Therefore, an exemption is requested to obtain formal relief from the requirements of 10 CFR 70.24.

CEI believes that a criticality monitoring system was not, and is still not, necessary for the PNPP. During review of our SNM license the NRC concurred, provided certain license conditions were included within the SNM license. We propose to reinstate the same former SNM license conditions (those dealing with criticality concerns in the new fuel storage vaults) as procedural commitments. A discussion about the rationale behind these commitments is given in Attachment 2.

Exemptions from the requirements of Section 70.24 have been, and are, typically granted to Part 50 licensees. As fairly recent examples, the Texas Utilities Electric Company (Comanche Peak) and the Illinois Power Company (Clinton Power Station) have both been granted exemptions. This exemption request is similar to an exemption proposed by Northeast Utilities for the Haddam Neck Plant and Units 1, 2 and 3 of Millstone Nuclear Power Station.[3]

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(1) See the SNM License No. SNM-1928, Docket No. 70-2968, (issued to PNPP Unit 1 on March 7, 1985). See also the low power Operating License No. NPF-45, Docket No. 50-440 (issued to PNPP Unit 1 on March 18, 1986).

(2) On May 11, 1988, the NRC issued a letter to the Tennessee Valley Authority (TVA) (see letter from R.A. Hermann (NRC) to S.A. White (TVA), "Criticality Monitoring") wherein the Staff considered the previously issued Part 70 exemptions for Browns Ferry to remain in effect "even though the specific provisions of the Part 70 licenses were not incorporated into the Part 50 license." The NRC's letter suggests that informal relief may be available, but gives no justification for their position.

(3) See letter from E.J. Mroczka (Northeast Utility Company) dated March 12, 1991 to the U.S. Nuclear Regulatory Commission; "Haddam Neck Plant, Millstone Nuclear Power Station, Units 1, 2 and 3 - Requests for Exemption from 10 CFR 70.24(a)."

I. REGULATORY REQUIREMENTS

10 CFR 70.24 contains several principal requirements that are applicable to Unit 1 of the Perry Nuclear Power Plant. These Section 70.24 requirements are summarized as:

> [1] Each licensee ... shall maintain in each area in which such licensed special nuclear material is handled, used, or stored, a monitoring system meeting the requirements of either paragraph (a)(1) or (a)(2), as appropriate, and using gamma- or neutron-sensitive radiation detectors which will energize clearly audible alarm signals if accidental criticality occurs. This section is not intended to require underwater monitoring when special nuclear material is handled or stored beneath water shielding...[4]
>
> [2] The licensee shall maintain emergency procedures for each area in which this licensed special nuclear material is handled, used, or stored to ensure that all personnel withdraw to an area of safety upon the sounding of the alarm ..[5]
>
> [3] The licensee shall retain a copy of current procedures for each area as a record for as long as licensed special nuclear material is handled, used, or stored in the area. The licensee shall retain any superseded portion of the procedures for three years after the portion is superseded.[6]

Section 70.24(d) anticipates that licensees may request relief from these requirements and allows licensees to apply for an exemption from Section 70.24, in whole or in part, if good cause is shown. The language supporting the regulation implies that where a licensee determines that design and/or procedural safeguards ensure against conditions of accidental criticality, compliance with Section 70.24 would not serve the underlying purpose of the regulation and that this constitutes good cause to apply for relief - in this case through an exemption. CEI believes that good cause exists for three reasons: (1) an exemption from Section 70.24 was previously granted in the SNM license; (2) since issuance of the Operating License, there have been no changes in the use, storage, or handling of SNM that have created new conditions in which compliance with Section 70.24 would be necessary; and (3) the design of the fuel storage pools/racks together with the associated procedural controls preclude inadvertant criticality.

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(4) 10 CFR 70.24(a)

(5) 10 CFR 70.24(a)(3)

(6) Id.

In addition to a showing of good cause pursuant to Section 70.24(d), a request for an exemption from Section 70.24 may be granted only if the request also satisfies the requirements of 10 CFR 70.14(a).[7]

For the reasons given below, CEI believes that the requests for exemption from the requirements of Section 70.24 for the facility are authorized under Section 70.14(a).

II. JUSTIFICATION FOR GRANTING THE EXEMPTION REQUEST

The specific requirements for granting exemptions from Part 70 regulations are set forth in 10 CFR 70.14(a). Under Section 70.14(a) the Commission is authorized to grant an exemption upon a demonstration that the exemption: (a) is authorized by law, (b) will not endanger life or property or the common defense and security; and (c) is in the public interest. The following justifications address each of these requirements and demonstrate that the Commission should grant the requested exemption.

A. The Exemption Request Is Authorized By Law

The Commission's authority to grant requests for exemptions from its regulations has existed since 1956[8]. The particular authority to grant exemptions from the requirements of Part 70 was codified as 10 CFR 70.14 in 1972. See 37 Federal Register 5745, 5749 (March 21, 1972). In addition, this exemption is itself authorized by law as Section 70.24(d) explicitly recognizes that an exemption may be granted to these requirements. It is consistent with the regulatory scheme established by the NRC and is not prohibited by any statutory authority. Therefore, an exemption request is explicitly authorized under NRC regulations.

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(7) Although the PNPP facility is under a Part 50 license, the exemption requests need not be submitted pursuant to 10 CFR 50.12(a) since relief is not being sought from any Part 50 requirements. See 50 Federal Register 50764, 50775 (Dec. 12, 1985) (Statements of Consideration issued with the latest revision of Section 50.12(a) -- "Exemptions from the provisions of each part of the regulations must be evaluated and granted under the exemption provisions contained in that part.") However, when the NRC last revised Section 50.12(a) they declined to revise similar regulations, e.g., Section 70.14(a), since "the majority of exemption situations arise in the context of 10 CFR Part 50 requirements. . ." See 50 Federal Register at 50775. Notwithstanding, the NRC's rationale suggests that the guidance for requesting exemptions from Part 50 requirements is also applicable to Part 70 requirements.

(8) See 50 Federal Register at 50766-67 supra Footnote 7, citing U.S. v. Allegheny-Ludlum Steel, 406 U.S. 742, 755 (1972); WAIT Radio v. F.C.C., 418 F.2d 1153, 1157 (D.C. Cir. 1969); and Alabama Power Co. v. Costle, 636 F.2d 323, 357 (D.D. Cir. 1979).

B. The Exemption Request will Not Endanger Life or Property Or the Common Defense and Security

An exemption request will not endanger life or property or the common defense and security if it can be shown that the request meets the statutory standard of adequate protection to the health and safety of the public[9].

Furthermore, to ensure the common defense and security are not endangered, the exemption request must demonstrate that the loss or diversion of SNM is precluded.[10] For the reasons stated below, the granting of the requested exemption will not affect any of these matters, and, thus, the granting is consistent with the common defense and security.

In light of these standards, we describe below how the use, storage, and handling of SNM at the Perry Nuclear Power Plant provides adequate protection to the health and safety of the public, and precludes against loss or diversion of SNM. In particular, we focus on the following points: fuel storage/handling system design, Technical Specification requirements, procedural (or administrative) controls, and existing accident analyses.

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(9) See 50 Federal Register at 50767-68, supra Footnote 7. In discussing the "not endanger" terminology in the original language of Section 50.12(a), the NRC concluded that this criterion was "never intended to embody any special standards for exemptions that differed from the statutory standards that licensees must provide adequate protection to the health and safety of the public and be in accord with the common defense and security." Id. at 50678. Since Section 70.14(a) still employs the "not endanger" language but does not offer any definitive guidance for its application, we conclude that the guidance offered under Section 50.12(a) is applicable for Part 70 exemptions.

(10) See Siegel v. A.E.C., 400 F.2d 778, 784 (D.C. Cir. 1968). See also Florida Power & Light Co. (Turkey Point Nuclear Generating Station, Units 3 and 4), 4 A.E.C. 9, 12 (1967); and Long Island Lighting Co. (Shoreham Nuclear Power Station, Unit 1), LBP-84-45, 20 N.R.C. 1343, 1400 (1984) (citing Siegel and Florida Power). The Commission's Statement of Considerations in support of the exemption rule noted with approval the explanation of this standard. There, the term "common defense and security" refers principally to the safeguarding of special nuclear material, the absence of foreign control over the applicant, the protection of restricted data, and the availability of special nuclear material for defense needs.

1. Use of SNM

SNM is present principally in the form of nuclear fuel. However, other quantities of SNM are used, or may be used (and stored), at the facility in the form of fissile material incorporated into incore nuclear instrumentation [source range monitors (SRMs), intermediate range monitors (IRMs), local power range monitors (LPRMs)], and into Health Physics (HP) sources. The amount of SNM contained in the nuclear instrumentation is small - significantly less than the quantities specified in Section 70.24(a). The small quantity of SNM present in the nuclear instrumentation and the form in which the SNM is maintained (a very thin coating sprayed on the inside of the sealed fission chamber contained at the end of each monitor) precludes inadvertent criticality.

The amount of SNM contained in the HP sources is also much less than an amount that could achieve criticality and is also less than the amounts specified in 70.24(a). This SNM is used for Health Physics instrument calibrations and is kept separate (under their procedural control) from SNM in the form of fuel or nuclear instrumentation used in the reactor.

Pursuant to Section 70.24(c), the facility is exempt from Section 70.24(b) for SNM "used or to be used in the reactor".

Thus, the focus of this exemption request is directed only toward the requirements of 70.24(a) with respect to irradiated and unirradiated nuclear fuel.

Inadvertent or accidental criticality in the reactor vessel is precluded through compliance with the facility Technical Specifications which include reactivity control requirements (e.g., shutdown margin demonstrations, limits on control rod movements), instrumentation requirements (e.g., reactor power and radiation monitors), and controls on refueling operations[11]. In addition, the Operator's continuous attention directed toward instruments monitoring behavior of the nuclear fuel in the reactor assures that the facility is operated in such a manner as to preclude inadvertent criticality. Finally, since access to the fuel in the reactor vessel is not physically possible while in use and is procedurally controlled during refueling (see Section II.B.3), there are no concerns associated with loss or diversion of the fuel.

Therefore, the requirements of Section 70.24 are not necessary for SNM in the form of nuclear fuel while used in the reactor vessel, and thus, granting these exemptions will not endanger life or property or the common defense and security.

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(11) See, e.g., Technical Specification Sections 3/4.1, "Reactivity Control Systems"; 3/4.3.1, "Reactor Protection System Instrumentation" and 3/4.9 "Refueling Operations".

2. Storage of SNM

SNM as nuclear fuel is stored in the fuel preparation and storage pool and the spent fuel pool (hereafter both referred to as the spent fuel pool) in the Fuel Handling Building. Temporary storage of fuel during refueling operations is provided by racks in the upper containment pool within the Containment Building. Both of these locations provide for storage of unirradiated (new) fuel or irradiated (spent) fuel under water. The new fuel storage vaults are also located within the Fuel Handling Building and can provide dry storage for unirradiated fuel. A summary is presented below and a detailed discussion of criticality controls/analysis and proposed commitments is presented in Attachment 2.

The spent fuel pool is primarily used to store irradiated fuel under water after its discharge from the reactor. It also may be used to store new fuel. The pool is designed to store the fuel in a geometric array that together with the neutron absorber material in the high density storage racks precludes criticality. Analysis demonstrates that the k_{eff} is maintained less than or equal to the Technical Specification and design limit of 0.95, even in the event of a fuel handling accident.[12 and 13]

The racks within the upper containment pool are used to temporarily store irradiated and unirradiated fuel under water during refueling operations. These racks are designed to store the fuel in a geometric array that precludes criticality. Analysis demonstrates that the k_{eff} is maintained less than or equal to the Technical Specification and design limit of 0.95, even in the event of a fuel handling accident.[12 and 13]

The new fuel storage vaults can be used to store new fuel in a dry condition upon arrival on site prior to loading in the reactor. The new fuel storage vaults are designed to store unirradiated (new) fuel in a geometric array that precludes criticality under dry or flooded conditions. Analysis demonstrates that the design limit on k_{eff} of 0.95 is not exceeded under these conditions, even in the event of a fuel handling accident.[14] Under conditions of optimum moderation (foam, small droplets, spray, or fogging) with all storage locations filled, the racks in the new fuel storage vaults

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(12) See PNPP Unit 1 Updated Safety Analysis Report (USAR), Section 9.1.2.

(13) See Technical Specification Section 3/4.9, "Refueling Operations" and/or 5.6.1 "Fuel Storage - Criticality".

(14) See PNPP Unit 1 USAR, Section 9.1.1.

may not maintain a k_{eff} of 0.98 or less. This optimum moderation condition is precluded when each new fuel storage vault has its solid two piece cover installed, and, during storage or movement of fuel accidental criticality can be precluded by spacing the fuel bundles such that a criticality event is impossible, or administrative controls could be used to preclude entry of sources of optimum moderation into the new fuel storage area. Many other plants use administrative controls to prevent introduction of optimum moderation into new fuel storage areas.

However, during the review process for the Special Nuclear Materials license it was determined that additional controls for the new fuel storage vaults would be implemented to preclude inadvertant criticality. The NRC Staff imposed a license condition (see Attachment 3, License Condition 21) to store new fuel assemblies in alternate rows and columns. As described in the NRC's Safety Evaluation Report (SER) that accompanied the SNM License[15], arrays of fuel assemblies in this configuration cannot be made critical regardless of the density of water moderation, including the case of optimum moderator density. A commitment is therefore being made that the same controls as were contained in the SNM condition [which required development of a documented fuel assembly storage plan that shows the storage location (in alternate rows and columns) for each fuel assembly] will be incorporated into plant procedures. Another commitment is also being incorporated into plant procedures to implement requirements like those in SNM License Condition 22 regarding draining of water from plastic wrapping material used around the new fuel assemblies (see Attachment 2 for additional details on these commitments). Upon implementation, exactly the same situation will apply as when the SNM license was issued.

Furthermore, it should be noted that a criticality monitoring system does not ensure against the loss or diversion of SNM material; consequently, the absence of such a system does not affect the capability of PNPP to ensure SNM is safeguarded.

Therefore, with the addition of the above commitments for criticality control within the new fuel vaults (similar conditions were in the Special Nuclear Material license) the requirements of Section 70.24 are not necessary for the SNM stored in the spent fuel pool, upper containment pool or new fuel storage vaults, and thus, granting this exemption will not endanger life or property or the common defense and security.

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(15) See letter from W. T. Crow (USNRC) to M. R. Edelman (CEI) dated March 7, 1985; reference contained on page 9 of the SER.

3. Handling of SNM

Unirradiated and irradiated fuel is moved to and from the reactor vessel, upper containment pool racks and the spent fuel pool racks to accommodate refueling operations. Unirradiated fuel when stored in the new fuel storage vaults is transferred from the new fuel storage vaults to the spent fuel pool for eventual transfer to the reactor vessel. In all cases, fuel movements are procedurally controlled and designed to preclude conditions involving criticality concerns. Moreover, previous accident analyses have demonstrated that a fuel handling accident (i.e., a dropped fuel assembly) will not create conditions which exceed design specifications.[16] In addition, the Technical Specifications specifically address refueling operations and limit the handling of fuel to ensure against an inadvertant criticality and to preclude certain movements over the spent fuel pool and the reactor vessel.[17]

While movement of nuclear fuel presents a potential opportunity for its loss or diversion, the existing procedural controls discussed above in Section II.B.2 also ensure SNM handling is authorized and monitored. Similarly, the absence of a criticality monitoring system does not affect the capability of PNPP to ensure SNM is safeguarded.

Therefore, the requirements of Section 70.24 are not necessary for the handling of SNM, and thus, granting these exemptions will not endanger life or property or the common defense and security.

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(16) See PNPP Unit 1 USAR, Sections 9.1.2.3.1, 9.1.2.3.2, 15.7.4 and 15.7.6.

(17) See Technical Specification Section 3/4.9 "Refueling Operations".

C. The Exemption Request Is In The Public Interest

The NRC has not provided specific detailed guidance on how to apply the "public interest" standard under Section 70.14(a). However, in a 1985 amendment to Section 50.12(a), see 50 Federal Register 50764 (December 12, 1985), the NRC deleted the "public interest" standard in favor of defining the "special circumstances" that justify requesting an exemption from the NRC regulations. At the same time, the NRC implied that Section 70.14(a) was not revised to be consistent with Section 50.12(a) only because the NRC did not envision frequent use of Section 70.14(a).[18] Consequently, it seems reasonable to apply the "special circumstances" articulated in Section 50.12(a) in lieu of the "public interest" criterion of Section 70.14(a).

Among the special circumstances identified in Section 50.12(a)(2), two are relevant to these exemption requests:[19]

> (ii) Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule: [or]
>
> (iii) Compliance would result in ... other costs that are significantly in excess of those contemplated when the regulation was adopted, or that are significantly in excess of those incurred by others similarly situated.

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(18) Specifically, the NRC commented as follows on the need for consistent exemption language throughout its regulations:

> The Commission has considered the need to revise other parts of its regulations to correspond to the criteria in 50.12(a). Because the majority of exemption situations arise in the context of 10 CFR Part 50 requirements, the Commission has determined that revisions to other parts of the regulations are not necessary at this time.

50 Federal Register at 50775.

(19) Section 50.12(a)(2) identifies six special circumstances that can be used to justify requesting an exemption; however, an exemption does not require that all six circumstances be justified. CEI has reviewed this exemption request against the criteria in Section 50.12(a)(2) and concluded that only items (ii) and (iii) as reprinted above, are applicable to PNPP Unit 1 in this instance.

Each of these items are reviewed in turn below:

1. Application of 10 CFR 70.24 would not serve the underlying purpose of the rule [regulation] or is not necessary to achieve the underlying purpose of the rule [regulation].

The explicit language of Section 70.24 does not identify the purpose(s) for requiring a criticality monitoring system and the associated emergency procedures. However, the regulatory history underlying this requirement indicates that:

> The following amendments [i.e., Section 70.24] to these regulations [i.e., Part 70] is [sic] designed to assure that all licensees who are authorized to possess special nuclear material in amounts which may produce conditions of accidental criticality have in operation adequate alarm systems and emergency plans to evacuate personnel.

23 Federal Register 8747 (November 11, 1958) (emphasis added). Based on this language, the NRC's purpose for promulgating Section 70.24 appears to be to ensure that licensees are aware of, and take appropriate response to, conditions of accidental criticality.

This language also seems to imply that where a licensee determines that design and/or procedural safeguards ensure against conditions of accidental criticality, compliance with Section 70.24 would not serve the underlying purpose of the regulation. This implication is supported by Section C.1 of Regulatory Guide 8.12, "Criticality Accident Alarm Systems," Rev. 2 (October 1988) and its value/impact statement which states:

> Section 70.24 of 10 CFR Part 70 requires alarm coverage "in each area in which such licensed special nuclear material is handled, used or stored...," whereas paragraph 4.2.1 of the standard states that the need for criticality alarms shall be evaluated for such areas. If such an evaluation does not determine that a potential for criticality exists, as for example where the quantities or form of special nuclear material make criticality practically impossible or where geometric spacing is used to preclude criticality, such as in some storage spaces for unirradiated nuclear power plant fuel, it is appropriate to request an exemption from 70.24. [Emphasis added.]
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> As indicated in Regulatory Position 1, a request for an exemption to the requirements of 10 CFR 70.24, "Criticality Accident Requirements," of 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material," is appropriate when there is no real possibility of a criticality, for example in situations where geometric spacing is used to preclude criticality,... [Emphasis added.]

As discussed in Section II.B, the design of and safety analyses for the reactor vessel, spent fuel pools, upper containment pool and new fuel storage vaults, as well as the associated (and proposed) administrative controls and Technical Specification requirements, ensure that conditions of accidental criticality are precluded. Therefore, continued application of Section 70.24 to the PNPP facility would not serve and is not necessary to achieve the underlying purpose of this regulation.

Based on these findings, special circumstances exist which justify the granting of the exemption request using the guidance of Section 50.12(a). Consequently, the exemption request is in the public interest and should be granted pursuant to Section 70.14(a).

2. Compliance with Section 70.24 would result in ... other costs significantly in excess of those contemplated when this regulation was adopted, and that are significantly in excess of those incurred by others.

A criticality accident monitoring system requires a considerable expenditure of resources involved in operation and maintenance of the system for the life of the facility. Since an accidental criticality monitoring system is not required by Section 70.24, this expenditure could otherwise be put to better use improving the operation of the plant. On balance, therefore, CEI concludes that compliance with Section 70.24 would result in undue hardship and other costs that are significantly in excess of those likely contemplated when this regulation was adopted.

It is our understanding that exemptions from the requirements of Section 70.24 have been, and are typically granted to Part 50 licensees. As a recent example, Texas Utilities Electric Company (TUEC) was granted an exemption from Section 70.24 prior to the conversion of their construction permit to an operating license at the Comanche Peak facility.[20] Therefore, CEI concludes that since Unit 1 of the Perry Nuclear Power Plant is not dissimilar from other facilities granted such an exemption, compliance with Section 70.24 would create an undue hardship and other costs significantly in excess of those incurred by others similarly situated.

III. CONCLUSION

Because an exemption from the requirements of 10 CFR 70.24 for PNPP Unit 1 is authorized by law, will not endanger life or property or the common defense and security, is in the public interest, and is requested for good cause, we respectfully submit that, in accordance with the requirements of 10 CFR 70.14(a) and 70.24(d), the NRC should grant the requested exemption.

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(20) See letter from William J. Cahill, Jr. (TUEC) to the NRC dated June 30, 1989 ("Application for Exemption from 10 CFR 70.24"), and letter from Christopher I. Grimes (NRC) to W.J. Cahill, Jr., dated November 6, 1989. ("Environmental Assessment and Finding of No Significant Impact--Exemption from the Requirements of 10 CFR 70.24 Concerning Criticality Monitors)".

Criticality Controls and Analysis for Each Fuel Storage Location

Two kinds of spent fuel storage racks are used for storing spent (irradiated) fuel: those achieving subcriticality by spacing in a loose packed geometric array, and those using a neutron absorber to achieve subcriticality in a close packed or dense geometric array. The low density fuel storage racks (furnished by General Electric) are used in the containment. The high density fuel storage racks (furnished by Programmed and Remote Systems Corporation (PAR)) are used in the spent fuel pools in the fuel handling and storage area of the Intermediate Building (hereafter called the Fuel Handling Building).

For new (unirradiated) fuel storage, the new fuel is either loaded directly into the spent fuel pool or the new fuel can be stored dry in the new fuel storage vaults in the Fuel Handling Building. The new fuel storage vaults utilize the same low density fuel storage rack design (furnished by General Electric) as those in containment.

For each type of fuel storage rack/pool location, the nuclear design and criticality safety evaluation is presented in the following Updated Safety Analysis Report (USAR) section:

Pool Location (Rack Type)	Safety Evaluation-Nuclear Design USAR Section	Criticality Control USAR Section
1. Upper Containment Pool (GE Racks)	9.1.2.1.3	9.1.2.3.1
2. Fuel Preparation and Storage Pool and Spent Fuel Pool (PAR Racks)	9.1.2.1.4	9.1.2.3.2
3. New Fuel Storage Vaults (GE Racks)	9.1.1.1.2	9.1.1.3.1

A. Criticality Control - Fuel Preparation and Storage Pool and the Spent Fuel Pool (PAR Racks)

Arrays of high density spent fuel storage racks are provided in the fuel preparation and storage pool, and in the spent fuel pool located in the Fuel Handling Building. As mentioned previously, these racks are designed and furnished by Programmed and Remote Systems Corporation. The high density storage racks use neutron absorber and structural material in a densely packed, square array of storage spaces to achieve subcriticality.

The high density storage racks are designed so that the center-to-center spacing between fuel assemblies within a rack is 6.625 inches and 0.375 inches between assemblies in adjacent locations. The fuel preparation and storage pool contains storage for 1620 fuel assemblies and the spent fuel pool contains storage for 2400 fuel assemblies. Arrays of fuel assemblies in this geometry would be supercritical without neutron poisons in the array. Therefore, square neutron absorber canisters have been built into the racks arranged in a checkerboard fashion: this produces one Boral (B_4C in an Al composite matrix) plate between adjacent pairs of fuel assemblies. The neutron absorber canisters contain concentric squares of stainless steel (SS) 304 with Boral plates sandwiched between the SS 304 on all four sides. There is one B_4C plate between every pair of fuel assemblies.

The design of the high dens y storage racks provides for a subcritical multiplicatior factor (k_{eff}) for both normal and abnormal storage conditions. For normal and abnormal conditions, k_{eff} is equal to or less than 0.95. Normal conditions exist when the high density storage racks are located in the pool and are covered with a normal depth of water (about 28 feet above the stored fuel) for radiation shielding and with the maximum number of fuel assemblies or bundles in their design storage positions. The spent fuel is covered with water at all times by a minimum depth required to provide sufficient shielding (the design and licensing basis is a minimum of 23 feet). An abnormal condition may result from accidental dropping of equipment or damage caused by the horizontal movement of fuel handling equipment without first disengaging the fuel from the hoisting equipment. To meet the requirements of General Design Criterion 62, a neutron absorber (sealed inside the rack's structure) and geometry are employed to ensure that k_{eff} will not exceed 0.95 under all normal and abnormal storage conditions. The PNPP Unit 1 Technical Specifications, Section 5.6.1.a: Fuel Storage - Criticality, require that the k_{eff} be maintained below 0.95.

B. Criticality Control - Upper Containment Pool (GE Racks)

The upper containment pool (for each Unit) contains 19 sets of racks which may contain up to 190 fuel assemblies. The design of the upper containment pool fuel storage racks provides for a subcritical multiplication factor for both normal and abnormal storage conditions equal to or less than 0.95. Normal conditions exist when the fuel storage racks are located in the pool and are covered with a normal depth of water (about 27 feet above the stored fuel) for radiation shielding and with the maximum number of fuel assemblies or bundles in their design storage position. The spent fuel is covered with water at all times by a minimum depth required to provide sufficient shielding (the design and licensing basis is a minimum of 23 feet). An abnormal condition may result from accidental dropping of equipment or damage caused by the horizontal movement of fuel handling equipment without first disengaging the fuel from the hoisting equipment. To meet the requirements of

General Design Criterion 62, geometrically safe configurations of fuel stored in the fuel array are employed to assure that k_{eff} is less than or equal to 0.95 due to overmoderation. The PNPP Unit 1 Technical Specifications, Section 5.6.1.a: Fuel Storage - Criticality, require that the k_{eff} be maintained below 0.95. Section 5.6.1 also prohibits storage of spent fuel in the upper containment pool during Operational Conditions 1 and 2.

C. Criticality Control - New Fuel Storage Vaults (GE Racks)

There are two new fuel storage vaults each containing 18 sets of racks with 10 fuel assembly locations per rack (for a total of 360 fuel assembly locations in the two vaults). The new fuel storage vaults are designed for the dry storage of new (unirradiated) fuel.

The new fuel storage racks in the new fuel storage vaults are designed so that the center-to-center spacing between the 10 fuel assembly locations within a rack module is 7.00 inches, and 12.00 inches between those in adjacent racks (rows).

The calculations of k_{eff} are based on the geometrical arrangements of the fuel array and subcriticality does not depend on the presence of neutron absorbing materials. The arrangement of fuel assemblies in the new fuel storage racks within the new fuel storage vaults results in k_{eff} below 0.95 in a dry condition or completely flooded with water which has a density of 1 g/cc. To meet the requirements of General Design Criterion 62, it has been demonstrated analytically that the geometrically-safe configuration of fuel stored in the new fuel storage array will ensure that k_{eff} will not exceed 0.95 if fuel is stored in the dry condition or if the abnormal condition of flooding (water with a density of 1 g/cc) occurs. In the dry condition, k_{eff} is maintained $\leq$0.95 due to undermoderation. In the flooded condition, the geometry of the new fuel storage array assures the k_{eff} will remain $\leq$0.95 due to overmoderation.

under conditions of optimum moderation (foam, small droplets, spray, or fogging), with all storage locations filled, the racks are not designed to maintain a k_{eff} of 0.98 or less. The condition of optimum moderation is precluded when each of the two new fuel storage vaults has its solid two piece cover installed. The additional administrative controls described below are used to preclude retention of moderator in the vault area, and controls are also placed on spacing in the vault areas. The floor of the vault is sloped to a drain to remove any water introduced into the vault. The requirements of General Design Criterion 62, "Prevention of Criticality in Fuel Storage and Handling" are satisfied by the vault design and administrative controls.

The new fuel storage vaults (when used) are only used during the limited time period between fuel receipt and refueling operations, a period of several weeks. During this period fuel shipments are received and new fuel is normally stored in the spent fuel pool for loading into the reactor. The new fuel storage vaults are not normally used (they have never yet been used at PNPP), and would only be used for temporary storage in special circumstances. During these limited periods of use of the vaults, the following administrative controls will be imposed by plant procedures:

a. When fuel handling activities are suspended the new fuel storage vault covers are reinstalled.

b. When new fuel bundles are stored in the new fuel storage vaults a Reactor Engineer ensures that the drain valves for the vaults are tagged open and there is no material in the vaults which could block the drains.

c. A Reactor Engineer ensures that the bundles are stored in such a manner that water can drain freely from the fuel assemblies in the event of flooding and subsequent draining of the new fuel storage vaults.

Fuel assemblies are shipped and may be stored with plastic wrappers around them to protect the fuel from the storage environment and to keep dust off of the fuel. During the development of the SNM License, the NRC Staff expressed the concern that if the fuel assemblies were covered and the storage area flooded and drained, the assemblies could become internally moderated with water (retained in the wrappers) while spaces between assemblies would be occupied only with air. Within the NRC's Safety Evaluation Report to the SNM license the Staff indicated that they believe that large arrays under these conditions could become critical. We indicated within the SNM license application that the fuel packaging, i.e., plastic wrappers, would not retain water around or within the assemblies. Although with the imposition of the spacing criteria described below an internally moderated bundle could not present a criticality concern, we recognize the Staff's concern and therefore, propose retention of the commitment in item c. above, which is the same as the former Condition 22 within the Special Nuclear Materials license.

Although the incorporation of the spacing criteria discussed below obviates the need for the administrative controls committed to above (vault covers in place, drain valve tagging and ensuring free drainage of water from the fuel assembly), they will nevertheless be put in place because they do not impose an excessive burden.

During the periods when fuel is being moved and/or placed into the new fuel storage vaults, the vault cover(s) will be removed. When the vault covers are removed accidental criticality can be precluded by spacing the fuel bundles such that a criticality event is impossible, or administrative controls could be used to preclude entry of sources of

optimum moderation (foam, small droplets, spray or fogging) into the vaults. These controls could include one or more of the following: fire protection personnel training; signs posted in the area; removal of only one of the two vault covers at a time; availability of non-water/foam based fire extinguishers in the area; control of combustibles storage in the immediate area; control of ignition sources in the immediate area, or use of solid stream nozzles on fire hoses in the area. Many plants use administrative controls to preclude such entry of sources of optimum moderation into new fuel storage vaults.

However, due to the low likelihood of a need to use the new fuel storage vaults prior to the time that the spent fuel pools are filled, the incorporation of these controls to preclude introduction of a moderator have been determined to be excessively burdensome to enforce.

Instead, to completely preclude any possibility of inadvertent criticality (even assuming the introduction of optimum moderation occurs) it is proposed to store the new fuel assemblies in the new fuel vaults in alternate rows and columns. This was discussed with the NRC Staff during application for the Special Nuclear Materials license and was added to the SNM license as License Condition 21 (see Attachment 3). Under these conditions, the center-to-center distance between fuel assemblies in a row would be 14 inches and that between assemblies in alternate columns would be 24 inches. As noted in the NRC's Safety Evaluation Report that accompanied the March 1985 SNM license, arrays of fuel assemblies in this configuration can not be made critical regardless of the density of water moderation between fuel assemblies or the degree of water reflection surrounding the arrays. Administrative controls will be used to prevent insertion of fuel assemblies in the eight storage locations immediately surrounding each fuel assembly. The approved location of each storage position will be verified after each fuel assembly is placed in its storage location, and there will be periodic inventories when the new fuel vaults are in use. A fuel transfer record specifies the storage location for each fuel assembly in the new fuel storage vaults. The following administrative controls will be imposed by plant procedures when the new fuel vaults are in use.

a. Prior to storing fresh fuel assemblies in the New Fuel Storage Vaults a documented fuel assembly storage plan indicating the specific storage location of each assembly shall be developed. The plan shall show that the fuel assemblies are stored only in alternate rows and columns and be approved by the Reactor Engineer.

b. A Reactor Engineer or a Senior Reactor Operator shall verify the authorized storage location at the completion of each fuel assembly transfer.

As described on page 10 within the Safety Evaluation Report for the Special Nuclear Materials license, the NRC Staff indicated "that with this condition, the applicant has established reasonable and satisfactory precautions to avoid an accidental criticality in the new fuel storage vaults."

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U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

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Attachment 3
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Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee		
1. Cleveland Electric Illuminating Company Duquesne Light Company Ohio Edison Company Pennsylvania Power Company 2. Toledo Edison Company P.O. Box 5000 Cleveland, Ohio 44101	3. License number	SNM-1928
	4. Expiration date	February 28, 1990, or*
	5. Docket or Reference No.	70-2968

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
A. Uranium enriched in the U-235 isotope	A. Reactor fuel assemblies	A. 2,602 kg of U-235 in uranium enriched to no more than 3.00 w/o in U-235
B. Antimony-124	B. Contained in sealed Sb-Be neutron sources	B. 42,000 Ci Sb-124
C. Uranium enriched in the U-235 isotope	C. Neutron detectors	C. 85 mg of U-235 in uranium enriched >20 w/o in U-235
D. Depleted uranium	D. Neutron detector storage cask	D. 95 kg depleted uranium

9. Authorized Use:

For receipt, possession, inspection, storage, and packaging of fuel for delivery to a carrier in accordance with statements, representations, and conditions specified in the licensee's application dated August 30, 1982, and its supplements dated September 30, 1982, May 27, 1983, May 30, August 22, November 15, 1984, January 7, and January 25, 1985.

*Upon conversion of Construction Permit No. CPPR-148 to an operating license, whichever is earlier.

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SUPPLEMENTARY SHEET

License number: SNM-1928
Docket or Reference number: 70-2968

10. Authorized Place of Use:

The licensee's Perry Nuclear Power Plant, Unit 1, located in Lake County in northeast Ohio approximately 35 miles northeast of Cleveland, Ohio and approximately 21 miles southwest of Ashtabula, Ohio.

11. The minimum technical qualifications for the Perry Nuclear Power Plant (PNPP) Plant Technical Department Manager shall be in accordance with Section 4.2.4, "Technical Manager," of ANSI N18.1-1971.

12. The minimum technical qualifications for the Reactor Engineer shall be in accordance with Section 4.4.1, "Reactor Engineering and Physics," of ANSI N18.1-1971.

13. The minimum technical qualifications for the Training Supervisor shall be a Bachelor's Degree in Engineering or the Physical Sciences and be in accordance with the Section 4.6.2, "Staff Specialists", of ANSI N18.1-1971.

14. The minimum technical qualifications for the Plant Health Physicist shall be in accordance with the requirements for "Radiation Protection Manager" of Regulatory Guide 1.8, September 1975.

15. The following training program shall be completed by each individual prior to participation in the radiation safety and/or fuel handling programs:

    a. All radiation safety personnel shall be trained in radiation safety and in PNPP, Unit 1, radiation protection procedures related to the receipt, handling, and storage of fuel assemblies, neutron sources, neutron detectors, and depleted uranium prior to receipt of the special nuclear, byproduct, and/or source materials.

    b. All operations personnel involved in the receipt, handling, and/or storage of the above materials shall receive training in the related procedures including the health and safety aspects of the activities.

16. Fuel assemblies, when stored in their shipping containers, shall be stacked no more than three containers high.

17. No more than three fuel assemblies shall be outside their shipping containers or storage racks at any one time.

18. The minimum edge-to-edge distance between the group of three fuel assemblies and all other fuel assemblies shall be 12 inches.

19. Fuel assemblies shall not be stored in any fuel storage rack unless the fuel storage racks have been installed, inspected, and approved by CEI's Reactor Engineer.

20. All preoperational testing for systems associated with receipt, inspection, movement, and storage of fresh fuel shall have been completed.

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21. Prior to storing fresh fuel assemblies in the New Fuel Storage Vaults, the licensee shall:

    a. Develop a documented fuel assembly storage plan indicating the specific storage location of each assembly. The plan shall show that the fuel assemblies are stored only in alternate rows and columns and be approved by the Reactor Engineer or by the Plant Operations Review Committee (PORC).

    b. The Reactor Engineer or a licensed Senior Reactor Operator shall verify the authorized storage location at the completion of each fuel assembly transfer.

22. 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.

23. Prior to storing fresh fuel assemblies in the Containment Building Spent Fuel Storage Pool Racks (if not flooded), the licensee shall:

    a. Develop a documented fuel assembly storage plan indicating the specific storage location of each assembly. The plan shall show that the fuel assemblies are stored only in alternate rows and columns and be approved by the Reactor Engineer or by the Plant Operations Review Committee (PORC).

    b. The Reactor Engineer or a licensed Senior Reactor Operator shall verify the authorized storage location at the completion of each fuel assembly transfer.

24. The licensee shall confirm the presence of the Boral sheets in all design locations in the Spent Fuel Pool in the Fuel Handling Building prior to storing fresh fuel in adjacent cells in the racks in the Spent Fuel Pool.

25. The licensee is hereby exempted from the provisions of 10 CFR 70.24 insofar as this exemption applies to materials held under this license only.

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

27. The approved "Perry Nuclear Power Plant Interim Physical Security Plan" for the fixed sight and in-transit physical protection of special nuclear material of low-strategic significance shall be fully implemented by the date of fuel receipt and shall be in effect whenever fresh fuel is stored onsite. The approved Security Plan consists of the following documents:

    a. The "Perry Nuclear Power Plant Interim Physical Security Plan," submitted by Cleveland Electric Illuminating Company letter (PY-CEI/NMSS-0005 L) dated November 15, 1984;

    b. The "Revision 1 (dated February 6, 1985)" to the "Perry Nuclear Power Interim Physical Security Plan," submitted by Cleveland Electric Illuminating Company letter (PY-CEI/NMSS-0008 L) dated February 7, 1985; and

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c. The "Supplemental Physical Security Conditions for the Perry Nuclear Power Plant Interim Physical Security Plan," enclosed with the Commission letter from Willard B. Brown to the Cleveland Electric Illuminating Company dated February 20, 1985.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date: MAR 07 1985

By: [signature]

Division of Fuel Cycle and
Material Safety, NMSS
Washington, D.C. 20555