PDR
70-687

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December 5, 1980

Director of Nuclear Material
Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Request for Exemption Pertaining to 10 CFR, Part 70.24(a)

Dear Sir:

A Region 1 NRC inspector in a September 4, 1980 inspection report questioned the compliance of our criticality monitoring program with respect to 10 CFR 70.24. In our November 5, 1980 response, we stated our position that all the requirements are satisfied, but that an exemption would be requested for those parts of our operation where the requirement is inappropriate. The following information addresses that subject along with two other subjects raised in the inspection.

Since SNM-639 authorizes greater than 700 g of enriched uranium 235 at our Sterling Forest facility, 10 CFR 70.24(a) requires a criticality monitoring system "in each area in which such licensed special nuclear material is handled, used, or stored". Due to factors discussed in the safety evaluation below, criticality monitoring is only appropriate in that portion of the facility where material is in solution form. An exemption is therefore requested for areas where material is handled, used, or stored in dry oxide form.

Attached is a document entitled "A. Hot Laboratory Monitoring System." This document updates and replaces in its entirety a document by the same title attached to our June 13, 1973 submittal. This document provides an up-to-date description of the monitoring system.

Exemption Requested

It is requested that the existing Condition 9 of License SNM-639 be amended by including reference to this letter, making Condition 9 in its entirety read:

"9. The special nuclear material is for use in accordance with the statements, representations and conditions specified in the licensee's applications dated April 28 and May 21, 1969; November 5, 1970; February 8, June 13, June 29, and August 13, 1973, May 28, 1974; February 11, 1975; August 12, 1976; May 3, October 13, and November 17, 1978; June 2, November 26, and December 5, 1980."

It is furthermore requested that the existing Condition 13 of License SNM-639 be amended by adding a second exempt condition, making Condition 13 in its entirety read:

> "13. Pursuant to paragraph 70.14(a) of Title 10, Code of Federal Regulations, Part 70, the licensee is hereby exempt from the requirements of Subparagraph 70.24(a) with respect to special nuclear material held under this license and being used (1) in hot cells as described in his letter dated June 29, 1973, or (2) in areas where material is allowed only in the form of dry oxide or assay samples, as described in his letter dated December 5, 1980."

Safety Evaluation

Section 9 of Materials and Plant Protection Amendment, MPP-3, to license SNM-639 restricts the quantity of unirradiated enriched uranium in the facility to less than 5,000 g U-235. The single parameter limit for nuclear criticality safety (ANSI Standard N16.1-1975, Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors) is as follows:

* 760 g U-235 for uniform aqueous solutions reflected by an effectively infinite thickness of water.

* 20,100 g U-235 for metal units reflected by an effectively infinite thickness of water. Nuclear Safety Guide, TID-7016, Revision 2, shows that the subcritical spherical mass is approximately the same whether the material is in the form of metal or dry oxide.

Various physical limitations and administrative controls restrict the quantity of special nuclear material in any defined area of the facility to a small fraction of the facility limit. However, if the entire 5000 g quantity of unirradiated special nuclear material for which the site is licensed were in oxide form in one location, it would still be significantly less than the single parameter limit. All areas where material is handled, used, or stored are above grade, so that flooding and dissolution are not credible events. It is, therefore, reasonable to grant an exemption for the criticality monitoring requirements of 70.24(a) for those areas where special nuclear material is only allowed in an oxide form.

The fact that Section 9.1 of License SNM-639, as referenced above, refers to unirradiated material does not change this conclusion. Material in the facility is in one of the following forms:

FORM	LICENSING CONSIDERATION
Liquid material in plating process.	Subject to 10 CFR 70.24(a) requirements.
Dry oxide or assay samples.	Subject of this exemption request.
Targets in the reactor or transfer canal.	Under water and not subject to 10 CFR 70.24(a).
Material in process in the hot cells.	Considered by the existing Condition 13 of SNM-639.
Material packaged for transportation.	Packaged per Part 71, and therefore not subject to 10 CFR 70.24(a).

The potential for the unirradiated inventory of U-235 interacting with irradiated material has been evaluated. Unirradiated material is separated from the irradiated material by four feet of concrete or a greater thickness of water. Unirradiated material is therefore de-coupled from irradiated material.

Liquid material in the plating process is confined to the second floor of the Hot Lab where criticality monitoring is provided. The only personnel access and egress points are a remote indoor stairwell and emergency exits to the outdoors. In addition to being physically separated by walls and structures, the remote means of access to the facility is such that material will not be inadvertently taken to other areas of the facility. The physical layout and assembly process provide a high degree of assurance that material in solution form will not leave the designated, monitored area and enter those areas restricted to SNM in dry oxide form.

The requested amendment also seeks an exemption from criticality monitoring in those areas where assay samples are processed. If numerous assay vials are placed on a laboratory counter in a closely packed array, the single parameter limit of 4.6 cm thickness for an infinite aqueous slab applies per ANSI N16.1-1975. Typically, assay samples are dispersed in small quantities per vial in an array that is much less reactive than the infinite slab. There is no need or incentive to have a major portion of the licensed inventory tied up in assay samples, as would be the case if the 760 g single parameter limit were approached. Assay samples, by their nature, require a total of only a few grams in the lab. It is, therefore, reasonable to include assay samples in the exemption, regardless of the physical form.

Designation of New Storage Area

MBA 3 of the facility is Reactor Operations. Prior to placing a finished target in the reactor it is welded in a secondary encapsulation. This step is done in the machine shop by one of the MBA 3 custodians. The shop has recently been posted as a location where special nuclear material is authorized in quantities of up to 300 grams in oxide form. Material is only kept in this area while the targets are being encapsulated; there is no extended storage. While undergoing this process, the material remains on the inventory of the storage cabinet from which it was taken and to which it will be returned.

Alpha Contamination

Statements were made in submittals dated April 28, 1969 and again on November 5, 1970 to the effect that when handling unencapsulated special nuclear material, floor clean-up would commence upon finding alpha contamination in excess of 100 dpm per 100 cm^2 of floor area. Experience over the past decade has shown this criteria to be overly conservative and unduly restrictive.

Work with SNM is conducted daily in the target plating laboratory. Even with frequent cleaning it is not practical to maintain removable alpha contamination levels below 100 dpm per 100 cm^2. The following criteria is proposed to supercede all previous statements regarding alpha contamination:

Alpha Surface Contamination Limits for Controlled Areas

Removable Surface Contamination Threshhold in dpm Above Background	Action to be Taken by Health Physics when either Average or Maximum Smear Results are Exceeded
30 dpm avg/75 dpm max	Inform Supervisor.
300 dpm avg/750 dpm max	Post area, requiring protective clothing, and inform Supervisor.
1500 dpm avg/3750 dpm max	Post area, requiring protective clothing, and inform Supervisor of need for immediate clean-up.

Note 1. Wipe samples over a 100 cm^2 area shall be taken each working day and analyzed for alpha contamination in areas where unencapsulated alpha emitters are being handled.

Note 2. The maximum dpm value is determined from the highest single smear. The dpm average is the average dpm of the smears taken in a particular area.

The above criteria are part of the Agreement State license for the facility. It is demonstrated to be adequate in that the continuous air sampling performed in these laboratories has never detected significant airborne uranium originating from floor contamination.

Pursuant to 10CFR 170.31, a check in the amount of $1400.00 is attached for processing this amendment.

If we can be of assistance to you in your review, please feel free to call.

Yours very truly,

Marcus H. Voth

Marcus H. Voth
Manager, Nuclear Operation

cc: George H. Smith, Chief
Fuel Facility & Materials Safety Branch
Region 1, U.S. Nuclear Regulatory Commission

Att.

A. HOT LABORATORY MONITORING SYSTEM

The Health Physics Supervisor is responsible for all phases of Health Physics. He supervises the activities of Health Physics technicians.

1. Health Physics Training

All personnel working with radioactive material in the Hot Lab receive basic radiation safety training. This initial radiation safety instruction is supplemented by on-the-job training during each new operation.

2. Personnel Monitoring

All personnel working in the Hot Lab wear a film badge and two pocket ionization chambers. The pocket chambers are read daily and the film badges are evaluated bi-weekly by an approved commercial laboratory. Urinalyses on all Hot Lab personnel working with radioactive materials are made on a routine basis at least once each year. Additional samples will be taken as recommended by the Health Physics Supervisor.

3. Instruments and Equipment

All radiation detection and monitoring equipment is set and kept in proper operating condition.

a. Radiation Detection and Monitoring

Radiation detection instruments available for monitoring include at least 5 Ion Chamber survey meters with range up to 50,000 mr/hr, 2 Geiger Detectors with range up to 20 mr/hr, 1 Alpha Scintillation Counter, 1 End Window G.M. Counter with Sealer, and 1 Multichannel Analyzer with NaI Scintillation Detector.

Portable radiation detection equipment such as cutie-pies, G-M survey meters, and alpha detectors are located at various points in the area. A Hand and Foot Counter is near the main exit from the Hot Lab; it is used by visitors and personnel before leaving the building.

b. Area Monitors

Within the Hot Lab at various points, monitrons are provided to detect local increases in radiation levels and to give alarms. These monitors have audio and visual alarms at the local point and at the main monitron control panel in the operating area of the Hot Lab. (A similar system monitors SNM-639 material while in the reactor building, the main monitron control panel for that area being in the reactor control room.) Set points for the monitrons in occupied areas are normally set at 5 mr/hr to 10 mr/hr.

Two monitrons on the second floor of the Hot Lab are used for a criticality monitor pursuant to 10 CFR 70.24(a). All extremities of the area are within 120 feet of each of the monitors. The maximum intervening shielding is a six inch hollow concrete block wall. The high level alarm set points are set between 5 mr/hr and 20 mr/hr, providing capability to detect a criticality which generates radiation levels of 300 rems per hour one foot from the source. The location of intervening shielding has been evaluated to verify that a criticality of that magnitude at all possible locations will be detected. In the event of a criticality of this magnitude, both monitrons will trip and alarm. The simultaneous trip of these two monitrons will initiate an automatic evacuation alarm. Two channels are used rather than one to avoid false alarms caused by movement of radioactive material near a monitron. Each detector is designed to fail in the tripped condition. To clear a criticality monitor alarm which is known to be the result of other factors (e.g., monitron failure, equipment maintenance, or movement of radioactive material), the set points may be changed from those specified above if all special nuclear material is secured and operating personnel are vacated from the area.

c. Constant Air Monitors

Two constant air monitrons are located in the Hot Lab. The monitors can be set to draw air (via a vacuum pump) past filter paper at a flow rate ranging from 1 to 10 ft^3/min. A G-M tube is located above the filter paper and measured activities are continually recorded.

d. Stack Monitors

The exhaust air from both the Reactor and Hot Lab are continuously monitored for radioactive particulate matter and for gaseous activity. This monitor is equipped with a recorder and alarm circuits to indicate high activity or equipment failure. It is checked on a routine basis at least once a day. An accumulative weekly sample is analyzed for alpha activity.

e. Hot Lab Evacuation System

In the event of unexplained alarms from (a) two area monitors, (b) an area monitor and a constant air monitor, or (c) an area monitor and the stack monitor, the evacuation alarm will be sounded. This alarm is normally sounded manually by means of push buttons located throughout the facility. The alarm sounds from units located in every major area of the Hot Lab and is easily heard in all locations. All personnel are instructed in the use of the system.

The simultaneous trip of the two monitrons used to detect criticality on the second floor of the Hot Lab will initiate the evacuation alarm automatically.

f. Wipe Tests

Wipe tests are made of the floors daily and analyzed for beta, gamma, or alpha activity as appropriate. Wipe tests are done on all sealed sources semiannually. All equipment and materials require Health Physics' approval before being removed from a controlled area.