5/9/97

UNIVERSITY OF MASSACHUSETTS LOWELL
RADIATION LABORATORY
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Non-Power Reactors and Decommissioning
Project Directorate
MS11B20
Division of Reactor Program Management
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Docket Number 50-223
License No. R-125

SUBJECT: RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

This reponds to your request dated March 21, 1997. The answers to the questions posed are enclosed.

A subject discussed by telephone was the provision of a backup radiation monitor in the access corridor. This monitor would be in addition to the fixed wall monitor with readout and alarm in the control room and display in the access corridor and the portable survey meter in the access corridor used for cave entry. A frisker-type Geiger-Mueller detector with a local alarm set at 10-20 mr/hr and positioned to respond to radiation from the cave door opening has been emplaced. This detector will be part of the radiation monitoring system until an in-cave monitor, suitable for the environmental and radiation conditions, is added to the gamma cave interlock and alarm system.

A020/1

William T. Hogan

William T. Hogan
Chancellor

Submitted under oath or affirmation per CFR 50.30(b)

DR. JEROME L. HOJNACKI
NOTARY PUBLIC
My Commission Expires Sept. 28, 2001

5/9/97
Jerome L. Hojnacki

Enclosure: As stated
cc w/ enclosures: See next page

020017

cc:

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1. The more important question from a safety standpoint is, "Can the minimum strength source being used be detected just outside the gamma cave door?" A test to ascertain the answer to this question was conducted on April 7, 1997. (data summary below) The gamma cave radiation monitor clearly detected the source presence. The portable survey meter did not respond until interlocks were defeated and the cave door cracked open. A rapid increase in detected radiation level was then noted. The door was only opened wide enough to place the detector in the opening.

Experimental observations:

4/7/97, Cobalt Rack 102 (one strip ,80 Ci) on window

| Reactor shut down | Gamma Cave Monitor | Door Survey Gamma Cave |
|---|---|---|
| No source | 0.04 mr/hr | 0 mr/hr |
| Rack 102 on window | 0.10 mr/hr | 0 mr/hr |
| Rack 102, door cracked | 3 1/2 mr/hr | 40-50mr/hr |
| Rack 102, door opened 4" | >20 mr/hr | 100 mr/hr |

Doses measured by fixed ion chambers in the cave for these conditions were: Inside door @ 5' from floor 8.2R in one hour and 3' from source window 112 R in one hour. Note that at these levels, the definition of "irradiator" of Part 36 no longer applies and the access controls of 10CFR 20.1601 apply.

2. The meter is checked for battery operation each time it is turned on, typically at the beginning of a work day and often for each cave entry, when the irradiation times are longer than tens of minutes. It is operationally checked prior to each gamma cave entry by observing the full scale response on the 0 - 5 mr/hr (lowest) scale to a $Co^{60}$ check source mounted on the wall just to the left of the gamma cave door. See SO-10 (enclosed).

3. The measures to prevent entry into the access corridor with a minimum cobalt 60 source in front of the gamma cave window are those that have long been in place. The operator who places the cobalt on the window then assures that the corridor radiation monitor trips high. This assures that the electrical interlocks are energized. If the source was not of sufficient strength, the operator is instructed (Standing Order 10, Para. 3.0) to lower the setpoint until the alarm and interlocks are engaged. These measures have been in place for many years.

The gamma cave and the reactor share the same pool, are part of the same facility, and have been operated under License R-125 since November 1981. The radiation monitoring system for the reactor is the same as the one for the gamma cave. The operability of the entire radiation monitoring system is determined prior to each reactor operation, weekly or more often (except school vacation periods).

This is done to satisfy Technical Specifications 3.4 and 4.3. Technical Specification 4.3 requires semi annual calibration; this includes all radiation sensors, including those for the gamma cave, since they are part of the reactor facility. These existing Technical Specifications meet or exceed any requirements of 10CFR 36. No further Technical Specifications are proposed.

4. Technical Specification 3.6 prohibits explosive materials and cryogenic liquids. Standing Order #1 further prohibited mercury, paraffin, loose boron, and flammable bottled gases. Standing Order #1 has been changed to prohibit pyrophoric materials, and oxidizers from the reactor building and flammable liquids from the vicinity of all reactor experimental facilities, including beam tubes, gamma cave, and hot cell. Quantities of flammable liquids at other locations will be limited to that needed for cleaning, lubricating, or painting of the facility. A copy of the revised SO 1 is enclosed. Note that NFPA Standard 801 does not define "organic liquids", but does define "flammable liquid".

5. The radiation dose rate in the source handling area does not exceed 0.02 millisievert per hour. The low alarm setpoint is 0.03 millisievert per hour and the high alarm/local alarm setpoint is 0.10 millisievert per hour for the bulk pool monitor over the handling area. However, the bulk pool detector is located 8" above the water surface in a region that traps argon gas, so the detector reaches 0.05 millisievert per hour during extended reactor operations. The operator handling cobalt is standing above this region in a well ventilated area where the radiation dose rates are those typical of the reactor building, 0.001-0.003 millisievert per hour.

# STANDING ORDER #1

## MATERIALS PROHIBITED IN THE REACTOR CONTAINMENT BUILDING AND EXPERIMENTAL FACILITIES

The materials listed below are not to be brought into the reactor building Exceptions will be made only upon written approval of the Reactor Supervisor or the Chief Reactor Operator if such approval will not violate NRC regulations, Technical Specification limitations, or ULR Procedures.

Materials Prohibited: In-Containment

1. Any explosive material in any form (e.g., gun-powder, dynamite, TNT, nitroglycerin, PETN, etc.)

2. Mercury (in element form).

3. Paraffin (except for portable shielding for sources).

4. Boron in loose chemical form (borax, boric acid, etc.)

5. Flammable bottled gases (including oxygen).

6. Pyrophorics

The following exceptions are authorized.

1. Bottled oxygen when used in breathing apparatus and other emergency medical purposes. (This exception has no expiration date).

2 Proportional counter counting gas (90% argon, 10% methane) to be used with counters set up on third floor or basement.

3. Mercury thermometer used during temperature calibrations.

4. Small propane tanks used during heat shrinking of instruments.

Material Prohibited in or Near Experimental Facilities (Beam Tubes, Bayonets, Rabbits, Hot Cell, Gamma Cave)

These materials may not be used in or near experimental facilities without explicit hazards review by Reactor Safety Subcommittee and NRC if required.

1. Cryogenics

2. Oxidizers such as peroxides, and hypchlorites

3. Flammable organic liquids

4. Corrosive chemicals

An example list of the type of substances prohibited in or near experimental facilities is attached. The list is for example only; staff members are responsible for safe operation of experimental facilities . If there is a compelling desire to use a prohibited material in experiments, a complete hazards review and approval by the Reactor Safety Subcommittee and other appropriate University and regulatory bodies is required prior to use.

# EXAMPLE LIST OF SUBSTANCES PROHIBITED IN OR NEAR EXPERIMENTAL FACILITIES

1. Cryogenics
   - Liquid Nitrogen
   - Liquid Helium
   - Liquid Air

2. Oxidizers
   - Nitrates
   - Nitrites
   - Peroxides
   - Chlorites
   - Hypochlorites
   - Per Chlorates
   - Permanganates
   - Persulfates

3. Flammable Liquids
   Flashpoint below 140F(60C°) or having a vapor pressure not exceeding 40 PSI at 100F
   (National Fire Protection Association
   NFPA Fire Protection Handbook, 13th Edition)

Lee H. Bettenhausen 4/30/97
Lee H. Bettenhausen Date
Reactor Supervisor

# STANDING ORDER #10

## GAMMA CAVE OPERATION AND ALARM SETPOINTS

### 1.0. SETTING UP IRRADIATION

1.1 Obtain key to gamma cave entry barrier from control room (3rd floor).

1.2 Assure that the source handling tool is secured by its key lock and the wall mounted interlock light is green (3rd floor).

1.3 Prior to opening entry barrier, assure that all indications on the radiation monitor in the access corridor are green (1st floor).

1.4 Unlock entry barrier, pick up radiation survey meter with attached gamma cave padlock key from storage shelf. Make sure the survey meter is operational by performing battery and operational checks. Survey area. If exposure levels exceed 1.0 mR/hr determine source of exposure before proceeding. Unlock and open gamma cave door.

1.5 Set up experiment in gamma cave.

1.6 Clear gamma cave, assure all personnel are out, close and padlock gamma cave door. Return survey meter with attached key to storage shelf.

1.7 Clear access corridor, close entry barrier; assure that all barriers are properly closed as indicated by a yellow light on the radiation monitor in the access corridor.

1.8 Prior to unlocking the source handling tool key, assure that the wall mounted interlock light is green (3rd floor)

1.9 Unlock the source handling tool, note that the warning bell sounds, pick appropriate cobalt source(s) from storage rack, and place source on window of gamma cave. Assure that the radiation monitor channel Q in the control room has alarmed high. Adjust setpoint if necessary per Section 3.0

### 2.0. SECURING IRRADIATION

2.1 Upon completion of irradiation, remove cobalt from gamma cave window and return source(s) to storage rack.

2.2 Return source handling tool to its storage location and relock the key. In the control room, clear channel Q on the radiation monitor from its alarm condition, and obtain key to the entry barrier.

2.3 Follow steps 1.3, and 1.4.

2.4 Retrieve experiment from gamma cave, follow steps 1.6 and 1.7.

2.5 Return entry barrier key to control room.

### 3.0 ADJUSTING ALARM SETPOINT

The decay of the cobalt-60 source necessitates the constant review of the alarm setpoints used in the Gamma Cave Interlock System. Because of this review RF-4, in regard to Channel Q, reads "set alarm points as per current standing order".

Low Level Trip Value, mR/hr = 0.3
High Level Trip Value, mR/hr = 0.5

If the rack used is not of sufficient strength to reach these levels (i.e. Rack #158) the High Level Trip Value should be lowered so as to engage the interlock. This setpoint should be returned to its normal value prior to disengaging the interlock system.

Approved by: Lee H. Bettenhausen 3/24/97
Lee Bettenhausen, Reactor Supervisor

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