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March 11, 1992

Director of Nuclear Reactor Regulation
US Nuclear Regulatory Commission
Mail Station P1-137
Washington, DC 20555

REFERENCE: Document 50-186
University of Missouri Research Reactor
License R-103

SUBJECT: Report as required by Technical Specification 6.1.h(2) regarding:
(a) operation of a fueled experiment with the experiment's direct radiation monitor out of service for source calibration check and,
(b) surveillance (calibration) interval for radiation monitors that exceeded Technical Specification 5.4.a requirements.

INTRODUCTION

On February 11, 1992, the University of Missouri Research Reactor (MURR) operated a fueled experiment for approximately six hours with a radiation monitor, part of the Area Radiation Monitor System (ARMS), required by Technical Specifications 3.6.c not operational. In analyzing this situation, it was realized that four of the new ARMS detectors were scheduled on an annual calibration frequency and therefore not calibrated at the semiannual interval required by Technical Specifications 5.4.a.

DESCRIPTION

The MURR operated until February 18, 1991 with an ARMS of 1960's vintage built by Tracerlab, Inc. In upgrading the reactor instrumentation, a new Eberline Model RMS II ARMS was installed to replace the old Tracerlab system. The function of other instrumentation including the fission product monitor, the secondary monitor, the back-up door air plenum monitor, and the film irradiation facility monitor were also included in the new ARMS. On February 18, 1991 after an extended testing period, MURR placed the new ARMS in service.

During an NRC "Team" Inspection March 6-10, 1989, a concern was expressed about the lack of traceability to NIST (formerly NBS) standards for the calibration of the ARMS monitors and instrumentation. In response to this concern, the Health Physics Group developed a new calibration methodology for the new ARMS which is traceable to a NIST standard. The new calibration procedure for a channel requires removal of the detector module and the

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indication/alarm module. These are taken to the building where Campus Health Physics have their J. L. Shepard Cs-137 calibration source to perform the check. This provides a calibration traceable to a NIST standard. The new ARMS can be calibrated in this fashion since the signal from the detector module to the indication/alarm module is not dependent on the length of cable between the two modules.

Because of this new requirement of removing the detector and electronic module, the Electronics Technicians and Health Physics Group who perform the source calibration checks of the ARMS changed the interval between surveillances on their maintenance procedures from semi-annual to annual. They were not aware of the Technical Specification requirements for surveillance frequency for the reactor bridge monitor and the reactor exhaust plenum monitor. These particular monitors are considered reactor instrumentation as per Technical Specification 3.4.a.

As reactor instrumentation, they are required to meet the semi-annual calibration interval specified in Technical Specification 5.4.a. This Technical Specification applies to surveillance of the reactor instrumentation system, which includes the radiation monitors for the reactor bridge and the reactor building exhaust air plenum. Technical Specification 5.4.a. states: "All instruments, as required by these specifications, shall be calibrated on semiannual intervals." Contrary to this requirement, the calibration of these radiation monitors had been changed to an annual frequency when the new ARMS was placed in service February 18, 1991.

The MURR ARMS incorporates two reactor bridge monitors and two reactor exhaust plenum monitors for redundancy (one of each type is required by Technical Specifications). These monitors were calibrated in January and February of 1991, shortly before the system was placed in operation on February 18, 1991. By Technical Specification 5.4.a and the definition of semi-annual in Technical Specification 1.2 (interval + 2 months), the reactor bridge and reactor exhaust plenum monitors should have been source calibration checked at the latest in September and October of 1991. Instead, since the maintenance procedure had been changed to indicate an annual calibration interval, the source calibration checks were completed in February 1992.

One of the ARMS monitors calibrated in February 1992 was for the film irradiator facility at MURR, a fueled experiment (see attached Figure 1) used to irradiate polycarbonate film. The film passes between two pairs of fission plates and is irradiated by the fission products to make ionization tracks through the film. Fueled experiments with iodine inventories greater than 1.5 curies or strontium-90 greater than 5 millicuries are required to be vented to the exhaust stack system through HEPA and charcoal filters which are continuously monitored for an increase in radiation levels (Technical Specification 3.6.o).

At 0915 on February 11, 1992, the film irradiator fueled experiment was placed in operation. Later that day at 1330, an Electronics Technician requested and received permission from the Control Room Operators to pull the Area Radiation Monitor for the film irradiator experiment along with several beamport floor area monitors for scheduled source calibration checks. The radiation monitor for the film irradiator experiment was pulled at this time for its calibration check.

Electronics Technicians reported to the control room at 1715, the end of their normal work day, that only two of four modules were completely calibrated. Control Room Operators did not

request that either of the calibrated modules be placed in service as the radiation monitor for the film irradiator fueled experiment.

Later that evening, the Shift Supervisor of the night shift, which starts at 1830, called me (the Reactor Manager) after shift turnover to discuss the film irradiator fueled experiment operating without the direct radiation monitor for its exhaust filter bank. The Shift Supervisor recommended securing the experiment; I concurred and the experiment was secured at 1915.

The film irradiator fueled experiment therefore ran for a period of 5 hours 45 minutes with its direct radiation monitor out of service for its scheduled source calibration check. This is in violation of MURR Technical Specification 3.6.o. The fueled experiment should have been secured while the radiation monitor was out of service. It was while investigating the cause of this Technical Specification violation that it was learned that the calibration frequency of four detectors (two are required by Technical Specification 3.4.a.) in the ARMS was not in compliance with Technical Specification 5.4.a.

ANALYSIS

The basis for Technical Specification 5.4.a states: "Semiannual calibration of the reactor instrumentation system channels will assure that long-term drift of the channels will be corrected." Review of the reactor console logs from February 1991 to February 1992 showed that the indications for the reactor bridge and reactor exhaust plenum monitors, which monitor a relatively constant background when the reactor is at 10MW power level, did not experience noticeable drift. Additionally, the Technical Specification 5.4.b monthly requirement to response check these monitors was accomplished on a weekly basis as part of the reactor startup checksheet.

Historically, the scheduling of calibrations for radiation detection equipment has been done by the Electronics Technicians and the Health Physics Group as part of their preventive maintenance program. Records indicate that all the semiannual calibration requirements for the Tracerlab ARMS had been met. The error in calibration interval was introduced when Electronics Technicians and the Health Physics Group prepared the new calibration procedures for the Eberline RMS II. The fact that these new calibration procedures were not reviewed for Technical Specification compliance indicates an area of weakness in implementation of management control for surveillance of the ARMS equipment. These procedures should have been reviewed by the Reactor Manager and the Procedures Review Subcommittee of the Reactor Advisory Committee.

Prior to the installation of the Eberline RMS II, extensive review of the Hazards Summary and the safety system compliance checks associated with the ARMS was performed. The necessary modifications to the Hazards Summary Report were identified and reported in the 1990-1991 Annual Report to the Nuclear Regulatory Commission as required by Technical Specification 6.1.h(4). The compliance check procedures for the safety system functions associated with the ARMS (Reactor Isolation and Scram) were rewritten. Discussions between the Electronics Technicians, the Health Physics Group, and me about how to schedule the ARMS calibrations were held. A decision was reached that the calibrations for the reactor bridge and reactor exhaust plenum monitors, which can initiate a Reactor Isolation, must be accomplished on shutdown days when containment integrity is not required. The failure to specify the semiannual calibration

interval for these same radiation monitors during these discussions indicate a weakness in implementing the necessary management control for the ARMS.

A similar weakness resulted in Control Room Operators and Electronics Technicians removing instrumentation, required by Technical Specification for operation of an experiment, to perform the new calibration checks and not being sensitive to the operational limitations it put on them. Since these calibration checks had previously been done with the detectors in place, the new maintenance procedures should have stressed the fact that the instrument channels would be taken out of service to accomplish the calibration checks.

The film irradiator facility is a fueled experiment that has been operational since 1979. MURR requested amendments to License R-103 by letter dated February 15, 1977, in order to conduct fueled experiments with fission product inventories greater than had been previously authorized. This was authorized by Amendment No. 8 to MURR License R-103 in February 24, 1978. The film irradiator fueled experiment was approved for routine operation following extensive testing by the Reactor Manager on November 28, 1979.

In developing the basis for the Safety Evaluation to support Amendment No. 8, the Nuclear Regulatory Commission (NRC) posed ten questions to MURR staff in a letter dated August 4, 1977. Question 8 of this letter requests details of the monitors which would detect the failure of a fueled experiment. MURR's responses to question 8 were contained in a letter to NRC dated September 23, 1977. In this letter MURR proposed that fueled experiments containing inventories of radioiodine isotopes 131 through 135 greater than 1.5 curies and strontium-90 greater than 5 millicuries will be vented to the exhaust stack system through particulate and halogen filters which would be continuously monitored for increase in radiation level. This proposal for a direct radiation monitor for fueled experiments was incorporated into Technical Specifications as 3.6.o. It was also stated (page 16) that these "monitors will have a high level trip with visual and audible alarms both locally and in the reactor control room. These individual fueled experiment monitors will serve as a **back-up** to the MURR exhaust stack monitor which will provide the most sensitive quantitative indication of any fission product release."

During the 5 hours 45 minutes on February 11, 1992 that the film irradiator fueled experiment operated without its direct radiation monitor, the primary indication of a fission product release, the exhaust stack monitor, was in continuous operation. Any fission product release would have been detected by the exhaust stack monitor which detects, measures and records airborne radioactivity in the form of particulates, iodine and gases separately and continuously.

Therefore the operation of the film irradiator experiment on February 11, 1992 for a period of 5 hours 45 minutes indicated a deficiency in management control but did not represent a hazard to the health and safety of the public.

CORRECTIVE ACTIONS

The immediate corrective action on February 11, 1992 was to secure the film irradiator fueled experiment until its radiation monitor was calibration checked and returned to service. The following day before the film irradiator experiment was allowed to resume operation, a Standing Order was issued by the Reactor Manager to amplify the requirements of Technical Specification 3.6.o. The Standing Order states the radiation monitor for the film irradiator

experiment will be verified operable before permitting an experiment startup and that any time the radiation monitor for that experiment is not operable (either due to failure or being out of service for calibration) the film irradiator experiment will be red tagged secured.

To further assure compliance with Technical Specification 3.6.o, the operating procedures for the film irradiator experiment have been changed to ensure that its radiation monitor is verified operable prior to experiment startup. The remote module (in the control room) will be marked with a red name tag (similar to the monitors that are considered reactor instrumentation) to indicate that it has a safety related significance.

The preventative maintenance procedure for the ARMS System has been changed to reflect that when the film irradiator ARMS is removed, the film irradiator equipment will be shut down and red tagged off. These preventive maintenance procedures for the ARMS are being incorporated into the Reactor Operations Compliance Check System. The Compliance Check System has an extensive scheduling and tracking system for Technical Specification compliance relating to reactor instrumentation and the reactor safety system. This system is composed of compliance procedures which are approved by the Reactor Manager and reviewed by the Procedures Review Subcommittee (PRSC) of the Reactor Advisory Committee. Any changes to these procedures are also reviewed by the PRSC as well as by all licensed operators as part of the requalification program.

The scheduling of preventive maintenance for the ARMS has already been moved to the Reactor Operations Compliance Check tracking system. The Reactor Manager and licensed operators on staff are determining if any other Technical Specification surveillance requirements are not currently in the Compliance Check tracking system. As part of this determination, the scheduling of the preventive maintenance for the exhaust stack monitor has also been moved to the Reactor Operations Compliance Check tracking system, even though review of records indicates that specified surveillance requirements for the stack monitor have been met.

Sincerely,

Walter A. Meyer Jr
Reactor Manager

ENDORSEMENT:
Reviewed and Approved

J.Charles McKibben
Associate Director

3/11/92

CHRISTINE M. ERRANTE
NOTARY PUBLIC STATE OF MISSOURI
BOONE COUNTY
MY COMMISSION EXP. APR. 14,1995

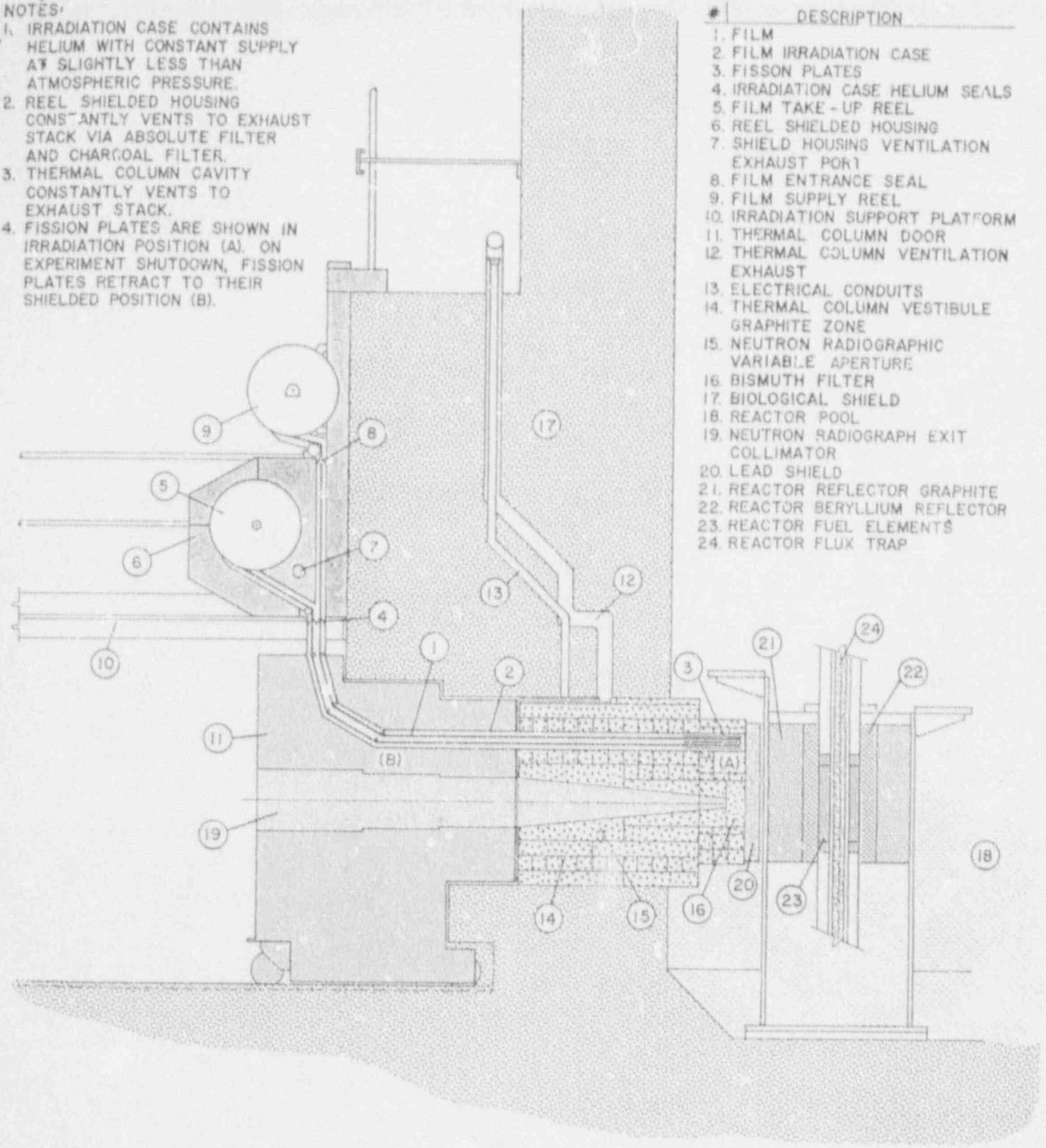
Attachment: Fig. 1

xc w/enc: Regional Administrator, NRC, Region III
Reactor Advisory Committee
Reactor Safety Committee

NOTES:

1. IRRADIATION CASE CONTAINS HELIUM WITH CONSTANT SUPPLY AT SLIGHTLY LESS THAN ATMOSPHERIC PRESSURE.
2. REEL SHIELDED HOUSING CONSTANTLY VENTS TO EXHAUST STACK VIA ABSOLUTE FILTER AND CHARCOAL FILTER.
3. THERMAL COLUMN CAVITY CONSTANTLY VENTS TO EXHAUST STACK.
4. FISSION PLATES ARE SHOWN IN IRRADIATION POSITION (A). ON EXPERIMENT SHUTDOWN, FISSION PLATES RETRACT TO THEIR SHIELDED POSITION (B).

#	DESCRIPTION
1.	FILM
2.	FILM IRRADIATION CASE
3.	FISSON PLATES
4.	IRRADIATION CASE HELIUM SEALS
5.	FILM TAKE-UP REEL
6.	REEL SHIELDED HOUSING
7.	SHIELD HOUSING VENTILATION EXHAUST PORT
8.	FILM ENTRANCE SEAL
9.	FILM SUPPLY REEL
10.	IRRADIATION SUPPORT PLATFORM
11.	THERMAL COLUMN DOOR
12.	THERMAL COLUMN VENTILATION EXHAUST
13.	ELECTRICAL CONDUITS
14.	THERMAL COLUMN VESTIBULE GRAPHITE ZONE
15.	NEUTRON RADIOGRAPHIC VARIABLE APERTURE
16.	BISMUTH FILTER
17.	BIOLOGICAL SHIELD
18.	REACTOR POOL
19.	NEUTRON RADIOGRAPH EXIT COLLIMATOR
20.	LEAD SHIELD
21.	REACTOR REFLECTOR GRAPHITE
22.	REACTOR BERYLLIUM REFLECTOR
23.	REACTOR FUEL ELEMENTS
24.	REACTOR FLUX TRAP



MURR THERMAL COLUMN DOOR FILM IRRADIATOR EXPERIMENT