



December 1995

The reactor operated continuously in December with the following exceptions: four shutdowns for scheduled maintenance and refueling; four unscheduled shutdowns.

On December 26, a spurious wide range monitor (nuclear instrument channel #4) high power rod run-in occurred during a normal startup. Reactor power was less than 50 kW at the time. No actual high power condition was indicated on any instrumentation. The rod run-in was reset and observation of all instrumentation indicated no abnormalities. A reactor startup was subsequently completed and the reactor returned to normal operation.

On December 27, a manual rod run-in was initiated by the Shift Supervisor when he suspected that the regulating blade was not operating properly. Electronics technicians discovered a bad bearing and a missing pin in the gearbox input shaft coupling. The bearing and pin were replaced and the regulating blade was tested satisfactorily and returned to normal operation. A Licensee Event Report was written regarding this failure. The Technical Specification definition of "operable" leaves any degraded condition of the regulating blade a technical specification violation.

On December 30, a spurious reactor loop high temperature scram occurred. No actual reactor high temperature was indicated on any instrumentation; all reactor loop temperatures indicated normal at the time. The scram source isolation monitor indicated a green leg primary high temperature scram from RTD 980A or B--even though operators observed normal temperature on the 980 A & B indications. The scram most likely was the result of a momentary dimming of the filaments in one of the 980 trip unit bulbs. The 980 A/B trip units utilize a photo transistor switch that provides a trip if the light source intensity decreases or is intermittent. Electronics technicians replaced the bulbs in each of the photo trip units. A satisfactory compliance check on 980A and 980B was completed and no further problems of this type have occurred.

During the subsequent startup the Shift Supervisor initiated a manual rod run-in, while the reactor was subcritical, after noting small fluctuations (1-3%) in the wide range monitor (channel #4) indication. Electronics technicians reseated the wide range monitor drawer voltage regulator and picoammeter modules, and removed and cleaned the range switch. The drawer was returned to service and no further problems of this type have occurred.

Major maintenance items for the month included: removing the 6D wedge and installing 6C wedge in the graphite reflector position #6; replacing pool flow (detector) element 921A; removing 50 plates from the pool heat exchanger; replacing the uninterruptible power supply (UPS) battery bank; replacing the secondary water make-up float valve; replacing a bearing and a roll pin in the gearbox input drive shaft coupling of the regulating blade; replacing the photo trip unit bulbs in primary temperature indications 980A & 980B.

## UNSCHEDULED SHUTDOWNS

<u>Date</u>	<u>Number</u>	<u>Type</u>	<u>Cause</u>
12/26/95	1042	Rod run-in	Spurious channel #4 high power
12/27/95	1043	Manual rod run-in	Regulating blade drive mechanism in degraded operating condition
12/30/95	1044	Scram	Spurious reactor loop high temperature
12/31/95	1045	Manual rod run-in	Spurious channel #4 fluctuations

## OPERATION SUMMARY

HOURS OPERATED THIS PERIOD	670
TOTAL HOURS OPERATED	192,919
HOURS AT FULL POWER THIS PERIOD	667
TOTAL HOURS AT FULL POWER	189,921
INTEGRATED POWER THIS PERIOD	278 MWD
TOTAL INTEGRATED POWER	73,281 MWD

## MAINTENANCE ACTIVITIES

12/4/95	Refueled - removed core 95-52, loaded core 95-53. Removed the 6D wedge and installed the 6C wedge in the graphite reflector position #6.
12/11/95	Refueled - removed core 95-53, loaded core 95-54. Replaced pool flow (detector) element 921A. Removed 50 plates from the pool heat exchanger.
12/18/95	Refueled - removed core 95-54, loaded core 95-55. Replaced the UPS battery bank.
12/26/95	Refueled - removed core 95-55, loaded core 95-56. Replaced the secondary water make-up float valve.
12/27/95	Refueled - removed core 95-56, loaded core 95-57. Replaced a bearing and a pin the gearbox input shaft coupling of the regulating blade.
12/30/95	Refueled - removed core 95-57, loaded core 95-58. Replaced the photo trip unit bulbs in primary temperature indications 980A and 980B.



UNIVERSITY OF MISSOURI-COLUMBIA

Research Park  
Columbia, Missouri 65211  
Telephone (314) 882-4211  
FAX (314) 882-3443

L. C. File

December 18, 1995

Cynthia D. Pederson, Director  
Division of Nuclear Materials Safety  
U.S. Nuclear Regulatory Commission, Region III  
801 Warrenville Road  
Lisle, Illinois 60532-4351

Subject: Extension of the Implementation Date for the Procedures Replacing the Current CAL-RIII-95-004 Control Governing the Activities in Room 267.

Ref: University of Missouri letter to NRC-Director Cynthia D. Pederson dated November 17, 1995

Dear Ms. Pederson:

In our November 17, 1995 letter, we listed on page 3 new controls that would be in place December 18, 1995 to replace the controls given in the CAL-RIII-95-004 (CAL). The implementation of these new controls is being delayed. We will continue to operate in compliance with the commitments as given in the CAL until the new procedures are implemented. The delay will allow time to incorporate suggested changes to the draft procedures. We need to make the revisions and review the procedures again before implementing them. This review may take longer due to the holiday period; however, the new controls will be implemented before January 18, 1996.

The proper control of MURR irradiated by-product material in Room 267 can be validated easily in an inspection under the control and documentation procedures being used and the new procedures will maintain this capability. If there are any questions, please call Charles McKibben (314-882-5204) or John Ernst (314-882-5226).

Sincerely,

J. Charles McKibben  
Associate Director

xc: J. McCormick  
J. Rhyne  
J. Ernst  
S. Gunn



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UNIVERSITY OF MISSOURI-COLUMBIA

Research Reactor Center

Research Park  
Columbia, Missouri 65211  
Telephone (314) 882-4211  
FAX (314) 882-3443

December 20, 1995

Director of Nuclear Reactor Regulation  
U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Mail Station P1-37  
Washington, DC 20555

Reference: Docket 50-186  
University of Missouri Research Reactor  
License R-103

Subject: Notification of changes to the University of Missouri Research Reactor  
(MURR) Emergency Plan as required by NRC Memoranda and Orders  
CLI-95-01, CLI-95-08, CLI-95-11 and CLI-95-17.

Enclosed are the December 20, 1995, revisions to the Emergency Plan for the  
University of Missouri Research Reactor (MURR). These changes were required by  
NRC Memoranda and Orders CLI-95-01 dated February 28, 1995; CLI-95-08 dated  
June 22, 1995; CLI-95-11 dated August 22, 1995; and CLI-95-17 dated December 14,  
1995.

We agree with the NRC determination in CLI-92-11 that the site boundary is the  
critical distance from the MURR to consider off-site consequences to classify a Site  
Area Emergency. We do not agree with the determination in CLI-95-11 that the  
critical distance from MURR to consider off-site consequences for an Alert  
classification is some arbitrary distance from MURR (150 meters) within the MURR  
site boundary. RTM-93, pp. A-32 and A-33, clearly tie both classifications to off-site  
consequences (i.e., the site boundary).

Nevertheless, we are willing to incorporate the requirements of the above Memoranda  
& Orders, understanding that NRC response criteria for research reactors and  
materials licenses may vary slightly.



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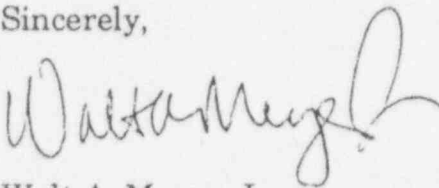
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CLI-95-11 requires a protective evacuation to beyond 150 meters for a fire involving TRUMP-S materials. This distance is beyond MURR's current EPZ which was based on the generic EPZ size (100 meters) prescribed in ANSI-ANS-15.16, Emergency Planning for Research Reactors and in NUREG-0849, Standard Review Plan for Review and Evaluation of Emergency Plans for Research and Test Reactors. This distance is also beyond the 100 meter protective action distance recommended in NUREG-1140, pp. 103 and 104, for an accident involving five times more material than evaluated in CLI-95-01. We are, however, changing our EPZ to 150 meters for additional conservatism and consistency between research reactor and materials license facility response criteria. We believe our emergency plan will be more effective with the same EPZ for reactor emergencies as the EPZ specified for the Materials License accident evaluated in CLI-95-01.

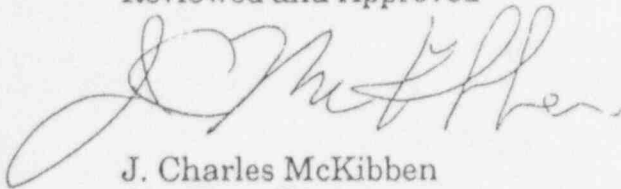
If you have any questions please contact me or J. Charles McKibben at (314) 882-4211.

Sincerely,



Walt A. Meyer, Jr.  
Reactor Manager

ENDORSEMENT:  
Reviewed and Approved



J. Charles McKibben  
Associate Director

enclosure

xc w/encl: Regional Administrator, U.S. NRC, Region III  
T. Reidinger, U.S. NRC, Region III

*Christine M. Errante 12/21/95*

CHRISTINE M. ERRANTE Notary Public - Notary Seal STATE OF MISSOURI Boone County My Commission Expires: April 14, 1999
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## 1.0 INTRODUCTION

MURR is a 10 MW pressurized water moderated pool type reactor with the reactor located in a containment building. It is located on a University of Missouri owned low population density 550-acre tract of land in Columbia, Missouri (Figure I). MURR provides research, education and service to the four campuses of the University of Missouri, other universities, government, and industry.

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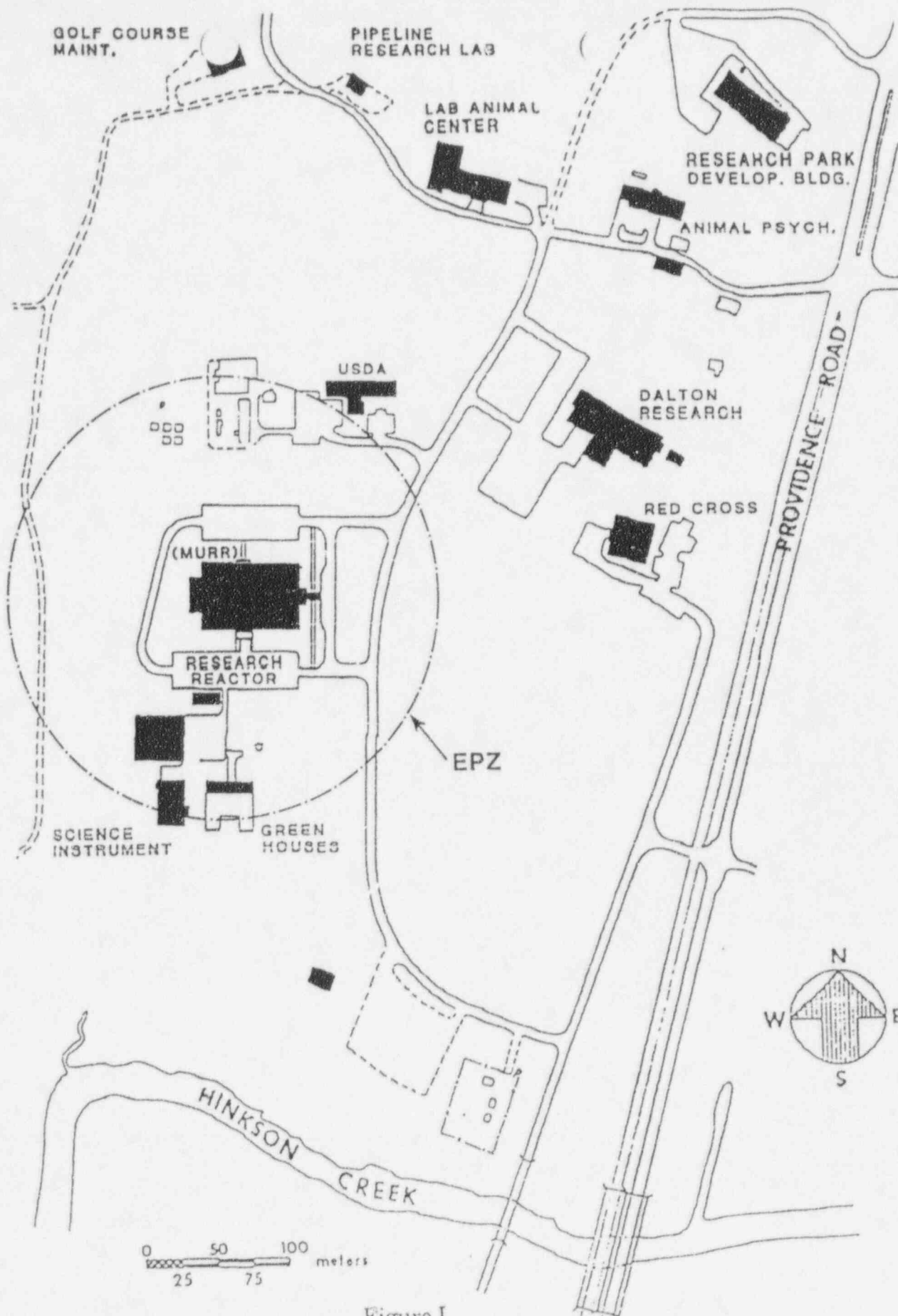


Figure I



unanticipated conditions in an emergency may prevent carrying out certain actions described in this plan or may require different types of actions than those described.

Many terms that are unique to MURR or that have particular connotations in the context of this emergency plan are defined in Section 9.

This plan was written to conform with 10CFR50, Appendix E, following the guidance provided by Revision I to Regulatory Guide 2.6 (for comment) Emergency Planning for Research and Test Reactors, March 1982, and ANSI/ANS-15.16, Emergency Planning for Research Reactors draft II, November 29, 1981. **Revisions of the plan have been made to accommodate criteria specific to Materials License Emergency Response as required by NRC Memoranda and Orders CLI-95-01 (Feb. 28, 1995); CLI-95-08 (June 22, 1995); and CLI-95-11 (Aug. 22, 1995).**

### 3.0 CLASSIFICATION OF EMERGENCY CONDITIONS

#### 3.1 Bases for Emergency Classifications

MURR's EPZ is based on ANS 15.16 (Table II) **as modified by the NRC evaluation of a worst-case TRUMP-S materials accident in Memorandum & Order CLI-95-01 dated Feb. 28, 1995.** It is the area bounded by a 150 meter radius from the MURR exhaust stack which lies completely within the site boundary. There are no credible accidents identified for the MURR facility that would result in radiological effluents exceeding PAG at EPZ boundary or exceeding **Alert** action levels listed in Table I at the site boundary.

However, the emergency plan describes three standardized classes of emergency situations grouping the accidents according to the severity of off-site radiological consequences: (1) Notification of Unusual Events, (2) Alert; and (3) Site Area Emergency. The latter **classification is** included to be conservative and to provide for consultation with off-site authorities and handling of information for the public through off-site authorities.

MURR recognizes emergencies of lesser consequences than the Notification of Unusual Events classification. These include physical occurrences within the facility requiring Facility Emergency Organization response. The initial assessment should indicate that it is unlikely that an off-site hazard will be created. Protective evacuations or isolations of certain areas within the facility may be necessary.

Response to these emergencies of lesser consequence than the Notification of Unusual Events classification are detailed in MURR Standard Operating Procedures. They are based on the recognition of immediate need for on-site staff to implement emergency measures to provide aid to affected persons or to mitigate the consequences of damage to equipment; coupled with assessing radiological monitors to determine if the possibility of a more serious emergency is present. Procedures will be written for other identifiable emergencies as the need is recognized.

### 3.2 Notification of Unusual Events

A Notification of Unusual Events condition may exist as a result of either man-made events or natural phenomena that can be recognized as creating a hazard potential that was previously nonexistent. There is usually time available to take precautionary and corrective steps to prevent the escalation of an accident or to reduce the consequences should it occur. No releases of radioactive material requiring off-site responses are expected. Although the situation may not have caused damage to the reactor, it may warrant the immediate shutdown of the reactor or the interruption of non-essential routine functions.

Situations that may lead to this class include:

1. Threats to or breaches of security, such as bomb threats or civil disturbances directed toward the reactor.
2. Severe natural phenomena such as earthquakes, tornadoes, etc.
3. Facility emergencies, such as prolonged fires **not involving TRUMP-S materials (americium, neptunium, plutonium)** or significant fuel damage indicated by high coolant fission product activity. ]

### 3.3 Alert

An Alert condition may exist when an accident within the MURR facility requires notification and response of the emergency organization to a serious radiological hazard. Substantial modification of reactor operating status is a high probable corrective action. Protective evacuations **of all public and non-emergency personnel to outside the EPZ shall be performed.** ]  
Isolation of certain areas within the site boundary will be necessary. Situations that may lead to this class include:

1. A fuel handling accident outside the core which releases significant radioactive materials to containment.
2. Significant releases of radioactive materials as a result of experiment failures.

(

fuel cladding or of fueled experiments when primary and  
boundaries exist to reduce releases.

leases of radioactive material as a result of fire ]

IMP-S materials (americium, neptunium, ]

].

Emergency condition may exist when events such as major  
has occurred with actual or eminent failure of primary system  
containment integrity. Monitoring at the site boundary should be  
the need for off-site protective actions. Protective  
and the nearest site boundary (400 m) shall be ]

### 5.2.2 Assessment Actions

Containment, laboratory building and site boundary airborne radioactivity and radiation levels shall be determined by stack monitor, area radiation monitors and portable monitoring equipment by members of the Emergency Organization. The Emergency Director shall use this information and Table I to determine that the emergency is appropriately classified.

### 5.2.3 Corrective Actions

A reactor shutdown shall be considered by the Emergency Director. Physical barriers to contain the radioactivity shall be maintained or implemented where necessary. Installed cleanup systems may be used to reduce the release of radioactive material. Specific corrective actions shall be provided in the implementing procedure for this emergency class.

### 5.2.4 Specific Protective Actions

The Protective Actions shall be provided in the implementing procedure for this emergency class and shall include **protective evacuation of all public and non-emergency personnel to outside the EPZ.**

### 5.2.5 Subsequent Actions

Notifications that an Alert has occurred shall be made to the NRC, American Nuclear Insurers (ANI) and the State Emergency Management Agency (SEMA) as specified in Site Emergency Procedures (SEP-3) for Alerts.

## 5.3 Site Area Emergency

### 5.3.1 Emergency Action Levels

The Emergency Director shall determine if a Site Area Emergency condition exists and shall respond to the emergency by implementing the appropriate procedures (Appendix B). Site Area Emergency would exist if one of the conditions listed in Table I existed.

### 5.3.1 Emergency Action Levels - Cont'd

Site Area Emergency conditions may require evacuation of non-essential personnel to beyond the site boundary, and shall require providing emergency notification and status information to off-site organizations and the public. ]

### 5.3.2 Assessment Actions

Containment, laboratory building and site boundary airborne radioactivity and radiation levels shall be determined by stack monitor, area radiation monitors and portable monitoring equipment by members of the emergency organization. The Emergency Director shall use this information and Table I to determine release and contamination magnitudes and to estimate projected exposures to on-site and off-site population.

### 5.3.3 Corrective Actions

The reactor shall be shutdown. Physical barriers to contain the radioactivity shall be maintained or implemented where necessary. Installed cleanup systems may be used to reduce the release of radioactive material. Specific corrective actions shall be provided in the implementing procedure for this emergency class.

### 5.3.4 Specific Protective Actions

The Protective Actions shall be provided in the implementing procedure for this emergency class and **shall include evacuation of public and non-emergency personnel from the area bounded by 400 m radius (the nearest site boundary) from the MURR exhaust stack.** ] ] ]

### 5.3.5 Subsequent Actions

Notifications that a Site Area Emergency has occurred shall be made to the NRC, American Nuclear Insurers (ANI), and the State Emergency Management Agency (SEMA), as specified in Site Emergency Procedure (SEP-4) for Site Area Emergencies.



9.8 Emergency Planning Zone (EPZ)

Area for which emergency planning is performed to assure that prompt and effective actions can be taken to protect the public in the event of an accident. MURR's EPZ is the area bounded by a 150 meter radius from the MURR exhaust stack and lies completely within the site boundary.

9.9 Emergency Procedures

Emergency procedures are the documented instructions that detail the implementation actions and methods required to achieve the objectives of this emergency plan.

9.10 MURR

University of Missouri Research Reactor located in Columbia, Missouri.

9.11 Nearest Site Boundary

The site boundary east-southeast of the MURR exhaust stack that represents the shortest distance between the exhaust stack and any site boundary for emergency planning purposes (approximately 400 meters).

9.12 Offsite

The geographic area that is beyond the site boundary.

9.13 Onsite

The part of the University of Missouri owned and controlled grounds that lie within the following site boundaries: south of Stadium Boulevard; west of Route K (Providence Road); north of Hinkson Creek; east of the former MKT railroad bed. The University of Missouri owned and controlled grounds extend beyond these boundaries but are not included in our definition of "on-site".

9.19 Site Boundary

The site boundary is that boundary listed in the on-site definition, not having restrictive barriers, surrounding the operations boundary wherein the reactor administrator may directly initiate emergency activities. The area within the site boundary may be frequented by people unacquainted with the reactor operations.

9.20 Shall, Should and May

The word "shall" is used to denote a requirement; the word "should" to denote a recommendation; and the word "may" to denote permission, neither a requirement nor a recommendation.

9.21 Standard Operating Procedures (SOP)

There are Standard Operating Procedures for Reactor Operations, Health Physics, and Reactor Chemistry which contain detailed procedures for carrying out their respective responsibilities in handling routine and emergency events.

9.22 Surveillance Team

The person or person appointed by the Emergency Coordinator to ensure that all personnel have evacuated the facility or a specific part of the facility. In the event of a Reactor Isolation or Facility Evacuation, the Duty Operators will perform the surveillance team function in the containment building as per FEP-1, Facility Evacuation, and FEP-2, Reactor Isolation.

9.23 TRUMP-S Materials

Transuranic isotopes listed on the MURR Materials License #24-00513-39 for use in TRUMP-S experiments. This includes americium-241, plutonium-239/240, and neptunium-237 in use in the Alpha Lab or being transferred into or out of the Alpha Lab. It does not include material stored in containment either as waste or raw material.

9.24 UMHC - University of Missouri Hospital and Clinics

A 405 bed hospital located within a five minute drive from MURR.

TABLE I  
EMERGENCY CLASSES

<u>Emergency Class</u>	<u>Action Levels</u>	<u>Purpose</u>
Notification of Unusual Events	1) Report or observation of severe natural phenomenon.	1) To assure the first step in any response later found to be necessary has been carried out;
	2) Threats to or breaches of security.	
	3) Concentration of airborne radioactivity at the stack monitor exceeding 20,000 AEC* averaged over 24 hours.	2) bring operating staff handling of unusual events information.
	4) The projected concentration of airborne radiological effluents at the distance corresponding to the nearest site boundary exceeding 15 mrem whole body accumulated in 24 hours.	3) provide systematic handling of unusual events information.
	5) Prolonged fire or explosion within the facility <b>that does not involve TRUMP-S materials (americium, neptunium, plutonium).</b>	] ] ] ]
	6) Other plant conditions exist that warrant assuring emergency personnel are available to respond to an emergency to prevent exposures of 1 rem whole body or 5 rem thyroid to the public or staff.	

\*AEC-Air Effluent Concentration, 10CFR20, Appendix B, Table 2, Column 1.

TABLE I (Cont'd)  
EMERGENCY CLASSES

<u>Emergency Class</u>	<u>Action Levels</u>	<u>Purpose</u>
Alert	<ol style="list-style-type: none"> <li>1) Concentration of airborne radioactivity at the stack monitor exceeding 100,000 AEC* averaged over 24 hours.</li> <li>2) The projected concentration of airborne radiological effluent at the distance corresponding to the nearest site boundary exceeding 75 mrem whole body accumulated in 24 hours.</li> <li>3) Radiation levels at the distance corresponding to the nearest site boundary of 20 mrem/hr for 1 hour whole body or 100 mrem thyroid dose.</li> <li>4) Loss of physical control of the facility.</li> <li>5) Fire in which up to 3 grams of TRUMP-S materials (americium, neptunium, plutonium) are involved.</li> <li>6) Other plant conditions exist with a level of significance of a major failure of fuel cladding but primary and containment boundaries exist to reduce releases.</li> </ol>	<ol style="list-style-type: none"> <li>1) Assure that emergency organization is ready to respond if situation becomes more serious;</li> <li>2) to perform confirmatory radiation monitoring;</li> <li>3) provide communications link to offsite authority.</li> </ol>

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\*AEC-Air Effluent Concentration, 10CFR20, Appendix B, Table 2, Column 1.

TABLE I (Cont'd)  
EMERGENCY CLASSES

<u>Emergency Class</u>	<u>Action Levels</u>	<u>Purpose</u>
Site Area Emergency	1) Concentration of airborne radioactivity at the stack monitor exceeding 500,000 AEC* averaged over 24 hours.	1) Assure emergency organization manned;
	2) The projected concentration of airborne radiological effluent at the distance corresponding to the nearest site boundary exceeding 375 mrem whole body accumulated in 24 hours.	2) assure monitoring teams dispatched;
	3) Radiation levels at the distance corresponding to the nearest site boundary of 100 mrem/hr for 1 hour whole-body or 500 mrem thyroid dose.	3) provide communication with offsite authorities;
	4) <b>Fire in which more than 3 grams of TRUMP-S materials (americium, neptunium, plutonium) are involved.</b>	4) provide information to the public through offsite authorities.
	5) Other plant conditions exist with a level of significance of a major fuel damage and conditions that indicate actual or imminent failure of containment integrity and primary system integrity.	

\*AEC-Air Effluent Concentration, 10CFR20, Appendix B, Table 2, Column 1.

December 27, 1995

Gerald Brouder, Provost  
The Curators of the University  
of Missouri  
University of Missouri - Columbia  
Columbia, MO 65211

SUBJECT: CONFIRMATORY ACTION LETTER FOLLOWUP INSPECTION

Dear Dr. Brouder:

This refers to the special safety inspection conducted by Mark Mitchell of this office on November 1-3, 1995, with continuing review through November 27, 1995, of activities authorized by NRC License Nos. R-103 and 24-00513-36E, and to the discussion of our findings with Dr. John McCormick and other members of your staff at the conclusion of the inspection.

The enclosed copy of our inspection report identifies areas examined during the inspection. Within these areas, the inspection consisted of a selective examination of procedures and representative records, observations, and interviews with personnel.

One area of concern was identified regarding the handling of irradiated topaz. Specifically, irradiated topaz releasable for international shipment under 10 CFR Part 110, was given to a customer of the University for sorting, storage and/or preparation for shipment. Prior to the implementation of the actions listed in the University's amended letter of September 21, 1995, to NRC, the customer performed these functions independent of the University in a room that was leased from the Missouri University Research Reactor. This being the case, it appeared that the University was transferring irradiated topaz to an unauthorized individual (the customer). An October 6, 1995, Confirmatory Action Letter formalized our understanding of the actions you committed to take to ensure the irradiated topaz was properly controlled. These actions were reviewed during this inspection and it was determined that their implementation did not alleviate our concern that the byproduct material was being inappropriately transferred to the customer. A written response to this concern was received in a letter dated November 17, 1995. Acceptable interim measures were listed in the letter and were implemented to ensure the University had appropriate control of the irradiated topaz. In addition, acceptable long term control measures were proposed for future implementation. Therefore, no further reply to this concern is required.

No violations of NRC requirements were identified during the course of this inspection.

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G. Brouder

-2-

In accordance with 10 CFR 2.790 of the Commission's regulations, a copy of this letter, the enclosed report and its attachments will be placed in the NRC Public Document Room.

We will gladly discuss any questions you have concerning this inspection.

Sincerely,

Original Signed By  
James L. Caldwell for

Cynthia Pederson, Director  
Division of Nuclear Materials Safety

License Nos. R-103, 24-00513-36E  
Docket Nos. 050-186, 030-30162

Enclosure: Inspection Report Nos.:  
050-186/95004(DNMS); 24-00513-36E/95004(DNMS)

cc w/encl: Jim Ryhne, Director  
bcc w/encl: PUBLIC

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\* See Previous Concurrences

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U'd E-mail

December 27, 1995

Gerald Brouder, Provost  
The Curators of the University  
of Missouri  
University of Missouri - Columbia  
Columbia, MO 65211

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G. Brouder

-2-

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Sincerely,

Original Signed By  
James L. Caldwell for

Cynthia Pederson, Director  
Division of Nuclear Materials Safety

License Nos. R-103, 24-00513-36E  
Docket Nos. 050-186, 030-30162

Enclosure: Inspection Report Nos.:  
050-186/95004(DNMS); 24-00513-36E/95004(DNMS)

cc w/encl: Jim Ryhne, Director  
bcc w/encl: PUBLIC

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\* See Previous Concurrences

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G. Brouder

-2-

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Sincerely,

Cynthia Pederson, Director  
Division of Nuclear Materials Safety

License Nos. R-103, 24-00513-36E  
Docket Nos. 050-186, 030-30162

Enclosure: Inspection Report  
No. 050-186/95004(DNMS)

cc w/encl: Jim Ryhne, Director

bcc w/encl: PUBLIC

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DATE	12/20/95	for	12/20/95		12/20/95		12/ /95		12/ /95	

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U.S. NUCLEAR REGULATORY COMMISSION  
REGION III

Report Nos. 050-186/95004(DNMS); 24-00513-36E(DNMS)

Docket Nos. 050-186, 030-30162

License Nos. R-103, 24-00513-36E

Licensee: The Curators of the University of Missouri

Facility Name: Missouri University Research Reactor (MURR)

Inspection Conducted: November 1-3, 1995, with continuing review through  
November 27, 1995

Inspector:

TKozak for  
Mark W. Mitchell  
Radiation Specialist

12/27/95  
Date

Approved By:

TKozak  
Thomas J. Kozak, Chief  
Nuclear Materials Inspection  
Branch 2

12/27/95  
Date

Inspection Summary

Inspection on November 1 to 3, 1995 with continuing review through November 27, 1995 (Report Nos. 05-186/95004 (DNMS); 24-00513-36E/95004(DNMS))

Areas Inspected: This was a special unannounced safety inspection to assess the actions taken by the licensee in response to a Confirmatory Action Letter which was issued to the licensee on October 6, 1995.

Results: One unresolved item concerning the possible transfer of byproduct material to an unauthorized individual was identified. A written response concerning this issue was received in a letter dated November 17, 1995. Acceptable interim control measures were listed in the letter and were implemented to ensure the irradiated topaz was appropriately controlled. In addition, acceptable long term controls were proposed for future implementation.

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## DETAILS

### 1.1 Persons Contacted

#### University of Missouri-Columbia

- \*John McCormick, Vice Provost for Research and Graduate Studies
- +James Rhyne, Director, MURR
- +\*Charles McKibben, Associate Director, MURR
- +\*Jim Schuh, Health Physicist, MURR
- +\*Steve Gunn, Service Manager, MURR
- +John Ernst, RSO, Health Physics Manager, MURR
- \*Matthew R. Sanford, Reactor Services Project Specialist
- \*Ronita Dinger, Information Specialist
- \*Tony Schoone, MURR Reactor Operations
- +Walt Meyer, Manager, MURR Reactor Operations
- +Bruce Hoskins, University Counsel
- +Kelly Mescher, University Counsel
- \*Clarence Jett, Internal Auditor, University of Missouri

#### Nuclear Regulatory Commission

- \*\*Cynthia Pederson, Director, Division of Nuclear Materials Safety(DNMS)
- \*\*Jim McCormick-Barger, Chief, Decommissioning Branch
- \*\*Bruce Berson, Regional Counsel, Region III
- \*\*Charles Weil, Enforcement Specialist, Region III
- \*\*Timothy Reidinger, Sr. Inspector, DNMS, Region III
- \*\*Seymour Weiss, NRR
- \*\*Marvin Mendonca, NRR
- \*\*George Pangburn, NMSS
- +\*Robert Marsh, Sr. Investigator, Region III Field Office
- +\*Harold Walker, Sr. Investigator, Region III Field Office
- +\*Mark Mitchell, Radiation Specialist

Additional technical, operational, and administrative personnel were contacted by the inspector during the course of the inspection.

- +Denotes those attending the entrance meeting on November 1, 1995.
- \*Denotes those attending the exit meeting on November 3, 1995.
- \*\*Denotes those attending the exit meeting on November 3, 1995 via teleconference.

### 1.2 Purpose of Inspection

This inspection was conducted to assess the licensee's actions taken as a result of the commitments made to the NRC in the amended letter of September 21, 1995 (Attachment 1) from Mr. S. Gunn, Manager of Service Applications, MURR, to Mr. R. Marsh, Senior Investigator, Chicago Field Office, NRC, and a subsequent Confirmatory Action Letter issued to the licensee on October 6, 1995 (Attachment 2).



The inspection was limited in scope and focused on security and accountability of byproduct material (irradiated topaz) which is stored and processed in Room 267 of the Missouri University Research Reactor facility (MURR). The inspection consisted of interviews with licensee personnel, a review of records and observations of activities conducted in Room 267.

### 1.3 Topaz Irradiation Program

The University of Missouri Research Reactor (MURR) is a research reactor located in an academic environment at the University of Missouri, Columbia, Missouri. In addition to the academic and research uses for the reactor, the licensee irradiates topaz for commercial distribution. The Service Applications Group is responsible for the topaz irradiation program. The Services Manager reports to the Director, MURR.

The University leased Room 267 of the MURR facility to a customer of the topaz program. Once the University had determined that the irradiated topaz was releasable for international shipment under 10 CFR Part 110, it was given to the customer in Room 267 for sorting, storage and/or preparation for shipment. Prior to the implementation of actions listed in the University's amended letter of September 21, 1995, to NRC, the customer signed a document listing the carat weight of the topaz that was received and processed the material independent of the University. Topaz with activity levels above the domestic limit in License No. 24-00513-36E was usually included in the material given to the customer.

When the customer was ready to make an international topaz shipment, the University was informed of the weight and contents of the packages that had been prepared for shipment. The University indicated that they did not perform an independent verification of the actual contents or weight of the packages. In addition, the MURR staff did not have an accurate inventory of the topaz in Room 267 up to September 20, 1995.

The circumstances surrounding the handling and shipping of irradiated topaz indicate that the University may have been transferring byproduct material to an unauthorized individual (the customer). This is an unresolved item (URI No. 050-186/95004-01; 24-00513-36E/95004-01). This concern was initially developed during an investigation September 19-21, 1995. A letter from the University to NRC, as amended on September 21, 1995, listed actions that would be taken to improve the University's control of irradiated topaz. An October 6, 1995, Confirmatory Action Letter (CAL) to the University formalized NRC's understanding of the actions planned to ensure the irradiated topaz was properly controlled.

One Unresolved Item was identified.

### 1.4 Confirmatory Action Item Review

A review of the actions taken by the licensee to meet the commitments

listed in the CAL was performed. The specific items outlined in the CAL and the licensee's actions are discussed below.

Item 1: Padlock the inner door to the dark room (Room 267) and place two keys to the room under the control of Mr. John Ernst or his designee and Mr. Matt Sanora or his designee.

Discussion: The licensee completed their commitment in this item on September 20, 1995. It appeared that key control was maintained at all times between September 20, 1995 and the date of the inspection. There appeared to be no opportunity for the keys to be duplicated prior to the transfer to the designated individuals. The padlock packages were opened from the manufacturer's packaging in the presence of the controlling individuals.

Item 2: Until further notice the University of Missouri Research Reactor (MURR) will have a MURR employee present in a supervisory role when any work is performed in this space.

Discussion: The space referred to in this item is Room 267. Starting on September 20, 1995, the licensee ensured a MURR employee was present at all times when the customer or employees of the customer were in the room. Through a review of recent shipments and interviews with personnel assigned to oversee activities in Room 267, it was determined that the individuals had no formal guidelines for their duties, kept no formal inventory or log of materials entering and leaving the room, and were not aware of the origin of packages shipped by the customer. One shipment contained eight packages, three of which did not originate from Room 267. However, the oversight personnel thought all of the material originated from Room 267. This indicated that the supervision of the activities in Room 267 was not effective in ensuring that the licensee was in positive control of the transfer of material into and out of the room. This area of concern was adequately addressed in a November 17, 1995, letter (Attachment 3) from the licensee and there are no further questions regarding the supervision of activities in Room 267.

Item 3: The licensee will conduct an audit of the material contained in the room under the direction of Mr. Jim Schuh.

Discussion: The licensee inventory found 26,049.8 carat weight of topaz that was not known to be in the room. The licensee determined that this material should have been in their vault as it was for other MURR customers. The material was apparently placed in the room without following the normal material transfer procedure. The inventory also initially revealed that approximately 1,000,000 carat weight of topaz

was not in the room as expected. Mr. Jett of the University's Internal Auditing Department was contacted to reconcile the inventory. Data transfer errors were found by Mr. Jett and once the reconciliation was complete, the physical inventory was within 3.37 percent of the expected value. This was considered by the licensee to be a reasonable agreement.

Item 4: The licensee will ensure that no material is transferred into or out of this room until the inventory has been reconciled under the oversight of Clarence Jett of the University of Missouri Internal Auditing Department.

Discussion: It appears that no material left the Room 267 until Mr. Jett had reconciled the inventory.

Item 5: After the inventory is complete and until further notice, the licensee will ensure that a MURR employee supervises all material transfers into and out of the dark room (Room 267).

Discussion: As of the date of this inspection, a member of the MURR staff continued to be physically present in the room during all operations.

In summary, our review indicated that items 1, 3, 4, and 5 were adequately completed. However, the action taken for item 2 did not alleviate our concern that irradiated topaz was being inappropriately transferred to the customer. The need for positive control of the material was discussed at the exit meeting and, as agreed to at the meeting, a written response to this concern was received in a letter dated November 17, 1995. The letter was discussed with the licensee on November 27, 1995, to ensure the intent of the listed actions was mutually understood. Acceptable interim measures were listed in the letter and were implemented to ensure the University had appropriate control of the irradiated topaz. In addition, acceptable long term control measures were proposed for future implementation. The long term control measures will be reviewed during a future inspection.

#### 1.5 Exit Meeting

On November 3, 1995, an exit meeting was held with licensee personnel listed in Section 1 to discuss the preliminary findings of the inspection. The NRC expressed the concern that MURR did not have positive control of the topaz irradiated at MURR until it was shipped internationally in compliance with 10 CFR 110 or domestically under the requirements of NRC License No. 24-00513-36E for exempt distribution. The licensee agreed to respond to this concern in writing. The response was received on November 17, 1995 and was discussed with the licensee on November 27, 1995. It appeared that acceptable interim measures were implemented to enhance the control of topaz until the proposed procedures containing long term controls were developed.

# University of Missouri-Columbia

## Research Reactor Center

Research • Education • Service  
Columbia, MO 65211

phone (314) 882-5273

fax (314) 882-3443

Robert Marsh  
Senior Investigator  
U.S. Nuclear Regulatory Commission  
Office of Investigations  
Chicago Field Office

Amended September 20, 1995  
September 21, 1995

Dear Mr. Marsh

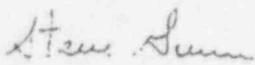
The following actions have been taken to address your concerns regarding our control of Radioactive Topaz in our Non-Licensed Accounts (NLA).

- (1) A padlock was purchased this date at Walmart and placed on the inner door to the dark room. Two keys exist, one under the control of John Ernst, or his designee, and one under the control of Matt Sanford or his designee.
- (2) Until further notice, the Licensee (MURR) will insure that a MURR employee is present in a supervisory role when any work is performed in this space.
- (3) An audit of the material contained in the room has been started under the direction and supervision of Jim Schuh.
- (4) No material will be transferred into or out of this room until the inventory has been reconciled.

*9/21/95 Clarence Jett of the University of Missouri Internal Auditing Department will oversee the reconciliation.*

- (5) Until further notice, the Licensee (MURR) will insure that a MURR employee supervises all material transfers into and out of this room.

Sincerely,



Steve Gunn  
Manager, Service Applications

CC: Jim Rhyne, Charlie McKibben, John Ernst, Walt Meyer, Steve Morris, Jim Schuh, Matt Sanford  
*9/21/95 Clarence Jett*

ATTACHMENT 1

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Ocotber 6, 1995

CAL No. RIII-95-004

The Curators of the University  
of Missouri  
ATTN: Jim Rhyne, Ph.D., Director  
Research Reactor Center  
Columbia, MO 65211

SUBJECT: CONFIRMATORY ACTION LETTER

Dear Dr. Rhyne:

This letter refers to NRC concerns with the control of radioactive topaz at your facility identified by Mr. R. Marsh during an investigation on September 19 and 20, 1995.

Pursuant to Mr. Steve Gunn's letter to Mr. Marsh dated September 20, 1995, as amended on September 21, 1995, it is our understanding that you will:

- (1) padlock the inner door to the dark room and place two keys to the room under the control of Mr. John Ernst or his designee and Mr. Matt Sanford or his designee,
- (2) until further notice, have a University of Missouri Research Reactor (MURR) employee present in a supervisory role when any work is performed in this space,
- (3) conduct an audit of the material contained in the room under the direction of Mr. Jim Schuh,
- (4) ensure no material is transferred into or out of this room until the inventory has been reconciled under the oversight of Clarence Jett of the University of Missouri Internal Auditing Department, and
- (5) once the inventory is complete and until further notice, ensure a MURR employee supervises all material transfers into and out of the dark room.

Pursuant to Section 182 of the Atomic Energy Act, 42 U.S.C. 2232, you are required to:

- 1) Notify me immediately if your understanding differs from that set forth above;

ATTACHMENT 2

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- 2) Notify me if for any reason you cannot complete the actions within the specified schedule and advise me in writing of your modified schedule in advance of the change; and
- 3) Notify me in writing when you have completed the actions addressed in this Confirmatory Action Letter.

Issuance of this Confirmatory Action Letter does not preclude issuance of an order formalizing the above commitments or requiring other actions on the part of the licensee; nor does it preclude the NRC from taking enforcement action for violations of NRC requirements that may have prompted the issuance of this letter. In addition, failure to take the actions addressed in this Confirmatory Action Letter may result in enforcement action.

The responses directed by this letter are not subject to the clearance procedures of the Office of Management and Budget as required by the Paperwork Reduction Act of 1980, Pub. L. No. 96-511.

In accordance with 10 CFR 2.790 of the NRC's "Rules of Practice," a copy of this letter, and your response will be placed in the NRC Public Document Room (PDR). To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be placed in the PDR without redaction. However, if you find it necessary to include such information, you should clearly indicate the specific information that you desire not to be placed in the PDR, and provide the legal basis to support your request for withholding the information from the public.

Sincerely,

Cynthia D. Pederson, Director  
Division of Nuclear Materials Safety

Docket No.: 030-30162  
License No.: 24-00513-36E

cc w/ltr dated 9/20/95: H. Thompson, OEDO  
J. Lieberman, OE  
J. Goldberg, OGC  
D. Cool, NMSS  
C. Jones, NMSS  
H. Miller, RIII  
State of Missouri, SLO





UNIVERSITY OF MISSOURI-COLUMBIA

November 17, 1995

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Cynthia D. Pederson, Director  
Division of Nuclear Materials Safety  
U.S. Nuclear Regulatory Commission, Region III  
801 Warrenville Road  
Lisle, Illinois 60532-4351

Subject: Reply to Confirmatory Action Letter CAL No. RIII-95-04 and Concerns Raised During Exit Interview November 3, 1995

Dear Ms. Pederson:

This letter is our notification to you that we have completed the actions addressed in your Confirmatory Action Letter CAL-RIII-95-004. Specifically:

- (1) On September 20, 1995, the inner door of Room 267 (Dark Room) was padlocked and the two keys were placed under the control of Mr. John Ernst or his designee and Mr. Matt Sanford or his designee.
- (2) Since September 20, 1995, a University of Missouri Research Reactor (MURR) employee has been present in a supervisory role when any work is performed in Room 267.
- (3) Conducted on the evening of September 20, 1995, an audit of the byproduct material contained in Room 267 was conducted under the direction of Mr. Jim Schuch.
- (4) The inventory was reconciled under the oversight of Mr. Clarence Jett of the University of Missouri Internal Auditing Department on September 21, 1995. No material was transferred into or out of Room 267 until September 22, 1995.
- (5) A University of Missouri Research Reactor employee has supervised all byproduct material transfers into and out of Room 267. The first transfer of byproduct material was a transfer into Room 267 on September 22, 1995. The first transfer out was a shipment on September 25, 1995.

During the investigation conducted on September 20-21, 1995, we understood Mr. Robert Marsh had major concerns about how we were handling the byproduct material in Room 267. We do not believe that the University violated any regulations regarding the possession and use of the byproduct material in Room 267. When we asked Mr. Marsh what NRC regulation he felt we were not in compliance with concerning Room 267, no specific answer was given. Therefore in an attempt to



COLUMBIA KANSAS CITY ROLLA ST. LOUIS

UNIVERSITY OF MISSOURI RESEARCH REACTOR

ATTACHMENT 3

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continue to meet appropriate program needs while alleviating nonspecific concerns, Mr. Steve Gunn committed to take the actions in his September 20, 1995 letter (amended September 21, 1995). MURR is in compliance with CAL-RIII-95-004.

Next, we wish to address the issues raised in the November 3, 1995 exit interview of the CAL compliance inspection. We understand that you are concerned that our supervision of non-University employees working with byproduct material is insufficient to preclude the possibility of unauthorized release in the United States. Specifically, that allowing non-University employees unrestricted access to byproduct topaz material in Room 267 and being involved jointly with MU employees in delivering the material to the carrier in St. Louis does not provide a sufficient barrier to prevent this topaz from being switched with nonbyproduct topaz. You suggest that this provides an opportunity for byproduct topaz to be released in the U.S. without going through the appropriate controls of an exempt gemstone license.

We have implemented the following controls to provide the barrier and documentation for inspection to validate that the byproduct topaz is only released in compliance with 10CFR regulations:

- (1) We have restricted the activities in Room 267 to storage, cleaning, heat treating and sorting of MURR irradiated byproduct material that has been approved by the Gemstone QA program for non-U.S. release. No nonbyproduct topaz will be allowed in Room 267.
- (2) All transfers into and out of the Room 267 are documented by MURR employees who log the date, type of transfer and mass of the transfer.
- (3) MURR employees will package all shipments of byproduct topaz leaving the Center after weighing and documenting the weights. The packages will be sealed and marked to clearly differentiate them from any other packages and make unauthorized opening easily detectable.
- (4) MURR employees will keep packages in their custody during the transfer to the air carrier and will obtain documentation of this transfer. Only MURR irradiated byproduct material will be allowed in these shipments.

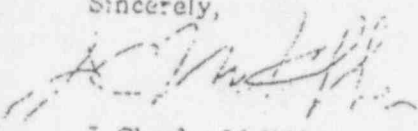
It is our position that properly trained radiation workers can be relied on to follow procedures and obey regulations. The gemstone material being handled in Room 267 has all been analyzed by an extensive QA program to ensure that each individual stone does not exceed a concentration of 74 Bq/g (2 mCi/g). In practice the concentrations are significantly below the 74 Bq/g limit. Small batches of gemstones having these very low radioactive concentrations can be surveyed with a typical GM survey instrument with no increase in count rate detected. We believe that the hazard level of byproduct material that has been certified to have a specific activity of less than 74 Bq/g including beta activity does not justify constant surveillance or physical search of trained personnel.

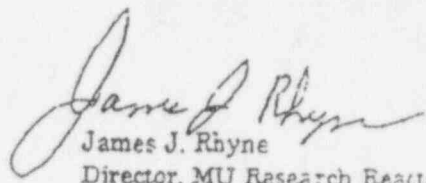
We propose implementing the following controls governing the activities in Room 267 to address the issues raised during the inspection November 1-3, 1995. These controls will be in place December 18, 1995 and will replace the controls given in the CAL-RIII-95-004:

- (1) Limit by procedure the activities in Room 267 to the storage, cleaning, heat treating, sorting and handling of byproduct material that has been certified for non-domestic release by the MURR Gemstone QA program.
- (2) By procedure, require that all transfers of byproduct material into and out of Room 267 will be supervised by a MURR employee.
- (3) By procedure, require that the date, type of transfer and mass of all transfers of byproduct material into and out of Room 267 be logged by a MURR employee.
- (4) By procedure, require that MURR employees perform or supervise the packaging of all topaz byproduct topaz leaving the center.
- (5) By procedure, require that shipments of byproduct material from Room 267 will be restricted to byproduct material only, and that MURR employees will keep the packages in their custody during transfer to the air carrier and will obtain documentation of this transfer.
- (6) Compliance with the control procedures will be documented by conducting an annual audit of the physical inventory and records of the material balance in Room 267.

These steps will enhance the level of control over byproduct material located in Room 267 of MURR. We believe that this enhanced level of control will address the issues you raised and more than adequately protect the public from any potential hazards associated with this byproduct material. No shipments of byproduct topaz have been made since the November 3, 1995 exit. We will make shipments as needed meeting the above policies, but do not anticipate shipping until after November 26, 1995. If there are any additional questions, please call John Ernst (314-882-5226) or Charles McKibben (314-882-5204).

Sincerely,

  
J. Charles McKibben  
Associate Director

  
James J. Rhyne  
Director, MU Research Reactor  
and Professor of Physics

cc: J. McCormick  
S. Weiss, NRC/NRR/ONDB  
J. Ernst