Research Reactor Center
University of Missouri-Columbia

Research Park
Columbia, MO 65211

PHONE (573) 882-4211
FAX (573) 882-6360

February 28, 2005

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

REFERENCE: Docket 50-186
University of Missouri-Columbia Research Reactor
Amended Facility License R-103

SUBJECT: University of Missouri Research Reactor
2004 Reactor Operations Annual Report

I have enclosed one copy of the Reactor Operations Annual Report for the University of Missouri Research Reactor. The reporting period covers January 1, 2004 through December 31, 2004.

This document is submitted to the U.S. Nuclear Regulatory Commission in accordance with the University of Missouri Research Reactor Technical Specification 6.1.h (4).

If you have any questions regarding the contents of this report, please contact me at (573) 882-5276.

Sincerely,

Les Foyto
Reactor Manager

ENDORSEMENT:
Reviewed and Approved

Walt Meyer for Ralph A. Butler

Ralph A. Butler, P.E.
Director

Enclosure

cc: Mr. Alexander Adams, U.S. NRC
Mr. Craig Bassett, U.S. NRC

A020
A001

UNIVERSITY OF MISSOURI

UNIVERSITY OF MISSOURI RESEARCH REACTOR

REACTOR OPERATIONS ANNUAL REPORT

January 1, 2004 – December 31, 2004

RESEARCH REACTOR FACILITY

UNIVERSITY OF MISSOURI

RESEARCH REACTOR FACILITY

REACTOR OPERATIONS ANNUAL REPORT

January 1, 2004 through December 31, 2004

Compiled by the Research Reactor Staff

Submitted February 2005 by:

Leslie P. Foyto
Reactor Manager

Reviewed and Approved by:

Ralph A. Butler, PE
Director

UNIVERSITY OF MISSOURI – COLUMBIA
RESEARCH REACTOR

REACTOR OPERATIONS ANNUAL REPORT

January 1, 2004 through December 31, 2004

INTRODUCTION

The University of Missouri Research Reactor (MURR) is a multi-disciplinary research and education facility providing a broad range of analytical, materials science, and irradiation services to the research community and the commercial sector. Scientific programs include research in archaeometry, epidemiology, health physics, human and animal nutrition, nuclear medicine, radiation effects, radioisotope studies, radiotherapy, and nuclear engineering; and research techniques including neutron activation analysis, neutron and gamma-ray scattering, and neutron interferometry. The heart of this facility is a pressurized, reflected, open pool-type, light water moderated and cooled, heterogenous reactor designed for operation at a maximum steady state power level of 10 Megawatts thermal – the highest powered University-owned research reactor in the world.

The Reactor Operations Annual Report presents a summary of reactor operating experience for calendar year 2004. Included within this report are changes to MURR procedures, revisions to the Hazards Summary Report, facility modifications, new tests and experiments, reactor physics activities, and environmental and health physics data.

This Report is being submitted to the U.S. Nuclear Regulatory Commission to meet the administrative requirements of MURR Technical Specification 6.1.h (4).

ACKNOWLEDGMENTS

The success of MURR and these scientific programs is due to the dedication and hard work of many individuals and organizations. Included within this group are: the University administration; the governing officials of the State of Missouri; the Missouri State Police; the City of Columbia Police Department; the Missouri University Police Department; our Regulators; those who have provided funding including the Department of Energy (DOE) and the Department of Homeland Security; the Researchers; the Students; the Columbia Fire Department; the Campus Facilities organization; members of the National Organization of Test, Research, and Training Reactors; and many others who have made, and will continue to make, key contributions to our overall success. To these individuals and organizations, the staff of MURR wishes to extend its fondest appreciation.

Senior Management wishes to thank all of its staff members for their continuing efforts in accomplishing MURR's mission of providing quality nuclear services and products. The ongoing success of the Corrective Action Program, Safety Conscious Work Environment, Renewal and Relicensing activities, Administrative 50.59 Evaluations, and Work Control is due to their hard work, dedication, and positive attitude toward these programs. They are the reason why MURR represents a major research and education resource for the University, the State of Missouri, and the nation. It is a facility which enhances the international reputation of the University, and provides the catalyst for MU to be the leader in the education of future generations of scientists, engineers and technicians engaged in nuclear science applications.

Reactor Operations Management also wishes to commend the six individuals who received their Reactor Operator or Senior Reactor Operator certifications from the U.S. Nuclear Regulatory Commission. These individuals participated in a rigorous training program of classroom seminars, self-study, and on-the-job training. The results of this training are confident, well-versed, decisive individuals capable of performing the duties of licensed operators during normal and abnormal situations.

TABLE OF CONTENTS

SECTION I

REACTOR OPERATIONS SUMMARY

January 1, 2004 through December 31, 2004

The following table and discussion summarize reactor operations during the period from January 1, 2004 through December 31, 2004.

Date	Full Power Hours	Megawatt Days	Full Power % of Total Time	Full Power % of Scheduled*
Jan 2004	687.81	286.70	92.45	103.54
Feb 2004	615.65	256.62	91.61	102.61
Mar 2004	660.93	275.52	88.83	99.49
Apr 2004	646.22	269.33	89.75	100.53
May 2004	662.55	276.22	89.05	99.74
Jun 2004	641.69	267.53	89.12	99.83
Jul 2004	681.52	284.05	91.60	102.59
Aug 2004	669.83	279.36	90.03	100.83
Sep 2004	644.10	268.46	89.46	100.20
Oct 2004	662.82	276.30	89.09	99.78
Nov 2004	648.06	270.14	90.01	100.82
Dec 2004	682.70	284.56	91.76	102.77
Total for the Year	**7903.88**	**3294.79**	**90.23 %**	**101.06 %**

*MURR is scheduled to average at least 150 hours of full power operation per week. Total time is the number of hours in the month listed or the year.

January 2004

The reactor operated continuously in January with the following exceptions: four shutdowns for scheduled maintenance and/or refueling, and one unscheduled shutdown.

On January 16, a reactor scram was manually initiated when the control room operators observed no discernable increase in pressurizer liquid level with the primary coolant charging pump P533 operating. The charging pump had automatically started in response to a pressurizer low liquid level signal generated by level controller 936. The low liquid level condition was a result of normal operating system losses. Investigation revealed that coolant charging pump suction valve 515C had been left in the shut position after a routine preventative maintenance task had been completed; thereby isolating the charging pump from its suction source of makeup water. This resulted in a deviation from Technical Specification 3.10.b, which states, "The reactor shall not be operated unless the reactor makeup water system is operable and connected to a source of at least 2,000 gallons of primary grade water." With valve 515C in the shut position, the reactor makeup water system was in a degraded state and not considered operable. Pressurizer liquid level and pressure were within their normal operating ranges at the time of shutdown. A valve line-up checksheet was performed of the pressurizer system to ensure that no other valves were out-of-position and a Standing Order was issued prior to reactor startup that requires valve line-up checksheets to be performed on all

systems as part of equipment post maintenance testing. The reactor was subsequently refueled and returned to 10 MW operation. Licensee Event Report No. 04-01, providing a detailed description of this event and the corrective actions taken, was submitted within the Technical Specification thirty-day time requirement.

Major maintenance items for the month included: completing Modification Record 01-3, Addendum 2, "Relocation of TE-980A and TE-980B Temperature Transmitters."

February 2004

The reactor operated continuously in February with the following exceptions: four shutdowns for scheduled maintenance and/or refueling, and one unscheduled shutdown.

On February 5, a reactor scram was manually initiated when Nuclear Instrumentation (NI) Drawer No. 1 local plasma bar graph meter indications failed - remote analog meter indications on the reactor control console remained operable. After the shutdown, the drawer's automatic scram and rod run-in functions were tested and found to meet operability requirements; thus verifying that the loss of local meter indications did not affect the safety functions of the drawer. The spare NI drawer, which had been previously upgraded with LCD meter units, was installed and the drawer's functions were tested and found to meet operability requirements. The reactor was subsequently refueled and returned to 10 MW operation. The front panel level and period display units for the removed NI drawer will be upgraded in the future from plasma bar graphs to LCD meter units. This is an on-going modification to upgrade all of the Gamma-Metrics NI drawer local meters.

Major maintenance items for the month included: removing the X and MH-X fuel storage baskets and installing a new X fuel storage basket; performing a 1/M criticality measurement of the new X fuel storage basket to verify a K_{eff} of less than the Technical Specification limit of 0.9; removing the Y and MH-Y fuel storage baskets and installing a new Y fuel storage basket; replacing the NMC Model RAK stack monitor iodine channel chart motor; and loading new pool coolant system de-ionization bed 'B.'

March 2004

The reactor operated continuously in March with the following exceptions: four shutdowns for scheduled maintenance and/or refueling, and two unscheduled shutdowns.

On March 9, a reactor scram was manually initiated when the control room operators observed a faster than normal lowering of pressurizer liquid level after startup. Upon investigation, it was discovered that the water loss was through the sealing surfaces of the reactor pressure vessel top flange and vessel cover and into the reactor pool. The reactor pressure vessel cover is unbolted and removed during core refuelings. A fexitallic gasket provides the pressure seal between the vessel cover and vessel top flange. It was determined that the flexitallic gasket was damaged and the vessel cover appeared to have been unevenly tightened after refueling. The gasket was replaced and the reactor was subsequently refueled and returned to 10 MW operation.

On March 29, a reactor scram was automatically initiated when Rod Control power fuse 2F4 opened during a demonstration of the Automatic Shim Control circuit. The circuit was activated for training purposes just prior to the normally scheduled weekly shutdown. The 10-amp fuse blew just as the regulating blade had inserted to the 20% withdrawn position and the Automatic Shim Control circuit engaged. During the maintenance day activities, the rod control system was inspected and tested with no apparent cause discovered. The fuse was replaced and the reactor was returned to 10 MW operation after conclusion of the maintenance day.

Major maintenance items for the month included: performing a 1/M criticality measurement of the new Y fuel storage basket to verify a K_{eff} of less than the Technical Specification limit of 0.9; completing Modification Record 91-3, Addendum 1, "Replacement of the Existing X, Y, MH-X, and MH-Y Fuel Storage Baskets with New X and Y Baskets;" replacing the inner and outer containment airlock door signal cabling; replacing room 114 exhaust ventilation HEPA filters; and replacing a pillow-block bearing on the building ventilation supply fan SF-1.

April 2004

The reactor operated continuously in April with the following exceptions: three shutdowns for scheduled maintenance and/or refueling, and one unscheduled shutdown.

On April 12, a reactor scram was automatically initiated when Rod Control supply power fuse 2F4 opened during a demonstration of the Automatic Shim Control circuit. The circuit was activated for training purposes just prior to the normally scheduled weekly shutdown. The 10-amp fuse blew just as the regulating blade had inserted to the 20% withdrawn position and the Automatic Shim Control circuit engaged. During the maintenance day activities, the rod control system was inspected and tested with no apparent cause discovered. The fuse was replaced and the reactor was returned to 10 MW operation after conclusion of the maintenance day. After careful review of the system prints, it was determined that both rod insertion and rod withdrawal power can be applied to the control rod drive motor simultaneously, thereby creating a potential overcurrent condition. In this instance and again on March 29, a control rod was being withdrawn when the circuit activated and fuse 2F4 opened. The operators have been instructed to secure all shimming evolutions prior to initiating the Automatic Shim Control circuit for training.

Major maintenance items for the month included: repairing the Domestic Cold Water cooling water line to the primary coolant system pumps; replacing a windgate in the pneumatic tube system; removing secondary coolant system distribution valve S-22 for refurbishment; replacing the local readout module in the secondary coolant system radiation monitor; completing Modification Record 04-1, "Replace the General Electric Measurement and Control Type 551 Reactor Pressure Transmitter PT-943 with a Rosemount Model 1151;" reinstalling refurbished secondary coolant system distribution valve S-21; replacing NMC Model RAK stack monitor blower motor thermal overloads; and completing the biennial changeout of Control Blade "B" Offset Mechanism.

May 2004

The reactor operated continuously in May with the following exceptions: four shutdowns for scheduled maintenance and/or refueling, and two unscheduled shutdowns.

On May 3, the reactor was manually shutdown to adjust Nuclear Instrumentation Channel 4 indication. The indication was reading low and the gain potentiometer for Signal Processor Drawer No. 1 was at its maximum setting. The resistance value of switch SW1, which is the course gain adjustment, was adjusted to bring the gain potentiometer to the middle of its operating range. The reactor was subsequently returned to 10 MW operation.

On May 17, a rod run-in was automatically initiated when a six-inch sample holder was removed from the graphite reflector region. The sample holder was being removed in order to activate the Automatic Shim Control circuit for training purposes just prior to the normally scheduled weekly shutdown. The sample holder was removed with the regulating blade at a height just above the Automatic Shim Control circuit set point of 20 % withdrawn (5.2 inches). The introduction of positive reactivity prompted by the removal of the sample holder caused the regulating blade to insert to the 10% withdrawn position and initiate the rod run-in. The reactor was returned to 10 MW operation after conclusion of the maintenance day.

Major maintenance items for the month included: replacing the heaters for the thermal overloads in the NMC Model RAK stack monitor motor; reinstalling refurbished secondary coolant system flow distribution valve S-22; repairing a Domestic Cold Water leak downstream of the secondary coolant system makeup water flow meter; completing Modification Record 01-5, Addendum 1, "Replace Secondary Coolant Flow Transmitters FT-912P and FT-912Q;" replacing the building ventilation supply fan SF-1 shaft and bearings; and completing Compliance Procedure No. 26, "Containment Building Compliance Test."

June 2004

The reactor operated continuously in June with the following exceptions: four shutdowns for scheduled maintenance and refueling, and two unscheduled shutdowns.

On June 3, the reactor was manually shutdown due to a sample scheduling error, which resulted in the incorrect sample being removed on the previous maintenance day. After the shutdown, the correct sample was pulled. The reactor was subsequently refueled and returned to 10 MW operation.

On June 16, the reactor was manually scrammed when it was discovered that the inner airlock door positioning chain had come off its sprocket due to a loose setscrew. Containment integrity was never lost since the outer airlock door remained closed and the seal inflated. The reactor was secured, and the inner airlock door set screw was replaced with a locking style set screw. The reactor was subsequently refueled and returned to 10 MW operation. The outer airlock door set screw was replaced with a locking style set screw during the next maintenance day.

Major maintenance items for the month included: reinstalling refurbished secondary coolant system flow distribution valve S-19; replacing the Domestic Cold Water cooling water line to the primary coolant system pumps; removing the X fuel storage basket for inspection; placing an epoxy-based patch on the secondary coolant side of primary coolant system heat exchanger 503A; and loading new pool coolant system de-ionization bed 'F.'

July 2004

The reactor operated continuously in July with the following exceptions: four shutdowns for scheduled maintenance and/or refueling. There were no unscheduled shutdowns this month.

Major maintenance items for the month included: completing Compliance Procedure No. 31, "Calibration of the Eberline Radiation Stack Monitor;" replacing the in-line secondary coolant system pH probe; relocating the Automatic Shim Control circuit as per Modification Record 04-4; completing Modification Record 95-1, Addendum 1F, "Gamma-Metrics Nuclear Instrumentation Gain Potentiometer R27 Replacement;" and removing the X fuel storage basket frame for inspection.

August 2004

The reactor operated continuously in August with the following exceptions: five shutdowns for scheduled maintenance and/or refueling, and one unscheduled shutdown. NRC regional inspector arrived at MURR for annual Reactor Operations' inspection. Three reactor startups were performed for NRC operator licensing examinations.

On August 28, a reactor scram was automatically initiated when pool reflector differential pressure decreased below Pressure Transmitter 917 (PT-917) scram set point. PT-917 monitors differential pressure across the reactor pool reflector region, thus serving as a back-up to the pool low flow scram. The low differential pressure condition was created when multiple material irradiation sample holders were removed from the graphite reflector region concurrently during a sample handling evolution. The reactor was subsequently refueled and returned to 10 MW operation. On August 30, during the next scheduled maintenance day, a calibration check of PT-917 was performed in accordance with Compliance Procedure No. 5. Data collected indicated that transmitter calibration was just out-of-specification low in the normal operating band – high and low calibration points were in specification (Note: These are calibration data points and not Technical Specification Limiting Conditions of Operation). After verifying that the scram set point was in specification, the transmitter was spanned and all data points were in calibration. This transmitter does not have a history of any drifting problems but it will be closely monitored.

Major maintenance items for the month included: re-installing the X fuel storage basket frame, Beryllium ring storage plate and X fuel storage basket; replacing the sightglass on the secondary coolant system acid addition day tank; spanning the Reflector Differential Pressure Transmitter PT-917 during calibration; and physically adjusting nuclear instrumentation channel No. 6 drywell.

September 2004

The reactor operated continuously in September with the following exceptions: four shutdowns for scheduled maintenance and/or refueling, and one unscheduled shutdown.

On September 25, a reactor scram was automatically initiated when meter indications on Nuclear Instrumentation (NI) Signal Processor Drawer No. 1 pegged high, thus causing a reactor safety system trip. Troubleshooting efforts revealed a breakdown in the insulation of the signal cabling near the fission chamber detector located in the reactor pool. This type of failure is typical of NI detector cabling that has been in operation over two years. The fission detector and its associated cabling were replaced and the drawer was verified to be operable. The reactor was subsequently refueled and returned to 10 MW operation.

Major maintenance items for the month included: replacing Nuclear Instrumentation Signal Processor Drawer No. 1 power range isolator; performing a backflush on the secondary coolant side of the pool coolant system heat exchanger 521; completing Modification Record 04-4, "Relocation of Automatic Shim Control Circuit for Reactor Console Modification;" completing Modification Record 88-11, Addendum 1, "Upgrade of Uninterruptible Power Supply (UPS) Alternate Source;" replacing the cabling and fission chamber detector for Nuclear Instrumentation Signal Processor Drawer No. 1; and completing Compliance Procedure No. 29, "Calibration of the NMC Model RAK Stack Monitor."

October 2004

The reactor operated continuously in October with the following exceptions: four shutdowns for scheduled maintenance and refueling, and one unscheduled shutdown. Received notification from the NRC that three new Reactor Operator and three new Senior Reactor Operator licenses had been issued.

On October 8, the reactor was manually shutdown when a loss of Domestic Cold Water (DCW) supply occurred at the facility. As part of the Cooling Tower Electrical Upgrade Project, trench work was being performed in order to install a new underground primary duct bank. While a backhoe was attempting to remove a large piece of concrete from the trench, the concrete inadvertently hit an exposed section of PVC piping, causing a break in the DCW supply line. The reactor was shutdown and DCW supply to the facility was isolated. Repairs were performed and the supply line was flushed and placed back in service. The reactor was subsequently refueled and returned to 10 MW operation.

Major maintenance items for the month included: replacing Room 299 400-amp branch feeder breaker; performing a backflush on the secondary coolant side of pool coolant system heat exchanger 521; replacing the wiring for secondary coolant system pump SP-3 from the supply breaker to its motor; and completing the biennial changeout of Control Blade "D" Offset Mechanism.

November 2004

The reactor operated continuously in November with the following exceptions: five shutdowns for scheduled maintenance and/or refueling. There were no unscheduled shutdowns this month.

Major maintenance items for the month included: replacing the fast speed contactors for building exhaust ventilation fans EF-13 and EF-14; completing Modification Record 03-3, "Installation of a Facility Fire Detection/Suppression System;" replacing a radiator hose on the 275-kW emergency diesel generator; performing a backflush on the secondary coolant side of pool coolant system heat exchanger 521; rebuilding primary coolant system demineralizer outlet valve 527F air actuator; replacing the fission chamber detector for Nuclear Instrumentation Signal Processor Drawer No. 1; and loading new pool coolant system de-ionization bed 'W.'

December 2004

The reactor operated continuously in December with the following exceptions: five shutdowns for scheduled maintenance and/or refueling, and one unscheduled shutdown.

On December 20, a Nuclear Instrumentation (NI) Channel 6 High Power Rod Run-In occurred during a reactor startup. The operator had attempted to place the reactor in automatic control at 10 MW with Channel 6 indication too close to the high power rod run-in set point of 114%. The Wide Range channel, the NI channel that provides the output signal for automatic reactor control, was indicating approximately 15% lower than Channel 6 indication. The reactor was shutdown and checks of Channel 6 were performed to verify proper operability. Actual power, as recorded by the remaining NIs and displayed by the real-time power calculator, was less than 10 MW at time of the rod run-in. The reactor was subsequently returned to 10 MW operation. The operators involved were coached on the importance of being conservative on the approach to 10 MW and placing the reactor in automatic control during this sensitive transient period.

Major maintenance items for the month included: replacing the primary coolant system demineralizer inlet filters; replacing the pool coolant system skimmer filters; replacing the local "jog/stop" switch for secondary coolant system pump SP-1; realigning the emergency air compressor motor and pulley assembly; replacing the NMC model RAK stack monitor blower starter contactor; completing Modification Record 75-16, Addendum 2, "Relocation of the Reactor Safety System Monitoring Circuit Panel;" and replacing cooling tower fan CF-3 control circuit fuse.

SECTION II

MURR PROCEDURES

January 1, 2004 through December 31, 2004

As required by administrative Technical Specification 6.1.h (4), this section of the annual report includes a summary of procedure changes. These procedure changes were reviewed by the Reactor Manager or Reactor Health Physics Manager and others to assure compliance with the requirements of 10 CFR 50.59. These procedure changes were also reviewed by the Reactor Procedure Review Subcommittee of the Reactor Advisory Committee to meet the requirements of Technical Specification 6.1.c (1).

A. CHANGES TO REACTOR OPERATIONS PROCEDURES

As required by the MURR Technical Specifications, the Reactor Manager reviewed the Reactor Operations Procedures and found them to be adequate for the safe and reliable operation of the facility.

There were 55 new and revised Reactor Operations procedures, forms and operator aids issued. The majority of the revisions were strictly format or editorial in nature. The following is a list of the new and revised procedures, forms and operator aids:

Number	Name	Rev.	Revision Date	Notes
AP-RO-110	Conduct of Operations	3	6/2/04	
AP-RO-130	Crane Operation	0	3/15/04	
EX-RO-105	Reactor Irradiation Experiments	4	11/19/04	
OP-RO-100	Main Air System	3	6/2/04	
OP-RO-100	Main Air System	4	11/1/04	
OP-RO-101	Instrument Air System	3	4/26/04	
OP-RO-210	Reactor Startup - Normal	4	6/2/04	
OP-RO-211	Reactor Startup - Hot	3	8/5/04	
OP-RO-220	Reactor Shutdown or Power Reduction	3	8/5/04	
OP-RO-230	Changing Reactor Power Level	2	8/5/04	
OP-RO-250	In-Pool Fuel Handling	5	3/15/04	
OP-RO-310	Nuclear Instrumentation - Signal Processor #1	3	6/2/04	
OP-RO-311	Nuclear Instrumentation - Signal Processor #2	3	6/2/04	
OP-RO-312	Nuclear Instrumentation Power Range Monitor - Channel 6	4	6/2/04	
OP-RO-330	Nuclear Instrumentation - Wide Range Monitor	3	6/2/04	
OP-RO-340	Nuclear Instrumentation Adjustment	3	6/2/04	
OP-RO-350	Reactor Power Calculator Flow Potentiometer Adjustment	2	8/5/04	
OP-RO-410	Primary Coolant System	4	4/26/04	
OP-RO-460	Pool Coolant System - Two Pump Operation	4	6/28/04	
OP-RO-461	Pool Coolant System - One Pump Operation	3	6/28/04	
OP-RO-465	Pool Level Control - Skimmer System	3	4/26/04	
OP-RO-466	Pool Level Control - Pool Coolant System	3	4/26/04	

Number	Name	Rev.	Revision Date	Notes
OP-RO-480	Secondary Coolant System	5	11/19/04	
OP-RO-510	Nitrogen System	3	2/17/04	
OP-RO-510	Nitrogen System	4	9/24/04	
OP-RO-515	Emergency Air System	3	11/1/04	
OP-RO-516	Valve Operation Air System	3	7/12/04	
OP-RO-530	Demineralized Water Supply System	3	7/12/04	
OP-RO-530	Demineralized Water Supply System	4	11/19/04	
OP-RO-531	Primary and Pool Sample Station	3	7/12/04	
OP-RO-532	Drain Collection System	3	6/28/04	
OP-RO-555	Fire Protection System	0	11/1/04	
OP-RO-710	Radiation Monitoring - Area Monitors	2	9/24/04	
OP-RO-720	Radiation Monitoring - Stack Monitor Operational Check	3	8/5/04	
OP-RO-730	Building Exhaust System Fans	6	6/28/04	
OP-RO-741	Waste Tank System Operation	5	4/26/04	
RM-RO-400	Waste Tank System Filter Replacement	3	4/26/04	
RM-RO-405	Reactor Demineralizer System	4	8/5/04	
RP-RO-100	Fuel Movement	2	1/21/04	
RP-RO-100	Fuel Movement	3	3/15/04	
RP-RO-200	Measurement of Differential Worth of a Shim Blade, RTP-11(D)	0	7/29/04	Replaced RTP 11-D
RP-RO-201	Measurement of Total Reactivity Worth of Flux Trap Loadings, RTP-17(B)	0	7/29/04	Replaced RTP-17-B
SM-RO-300	Control Console And Instrument Panel-Securing Power	4	8/5/04	
SM-RO-620	Control Blade Bubble Leak Test	1	11/19/04	
FM-08	Fuel Movement Sheet	4	1/21/04	
FM-08	Fuel Movement Sheet	5	3/15/04	
FM-11	Reactor Shutdown Checksheet	1	1/21/04	
FM-16	Primary-Pool Coolant Water Analysis	3	4/26/04	
OA-3	Beamport and Pool Overflow Loop Seals	1	4/26/04	
OA-3	Beamport and Pool Overflow Loop Seals	2	11/19/04	
OA-4	Valve Operation Air Compressor	2	11/19/04	
OA-5	Emergency Air Compressor	2	11/19/04	
OA-7	Receiving Bulk Chemicals	1	9/24/04	
REP-RO-100	Reactor Emergency Procedures	1	3/15/04	
REP-RO-100	Reactor Emergency Procedures	2	6/2/04	

B. CHANGES TO THE MURR SITE EMERGENCY PROCEDURES AND FACILITY EMERGENCY PROCEDURES

As required by the MURR Technical Specifications, the Reactor Manager reviewed the Emergency Plan Implementing Procedures and found them to be adequate for the safe and reliable operation of the facility.

As part of the ongoing effort to rewrite and reformat MURR procedures in accordance with the MURR Procedure Writer's Guide, the Emergency Plan Implementing Procedures were revised and reformatted in their entirety with 41 new procedures, forms and operator aids issued. The following is a list of the new procedures, forms and operator aids:

Number	Name	Rev.	Revision Date	Notes
EP-RO-001	Definitions	0	4/8/04	Replaced FEP-10
EP-RO-002	Emergency Responsibilities	0	4/8/04	
EP-RO-002	Emergency Responsibilities	1	7/14/04	
EP-RO-003	Emergency Preparedness Training	0	4/8/04	Replaced SEP-7
EP-RO-004	Fire	0	4/8/04	Replaced FEP-6
EP-RO-005	Medical Emergency	0	4/8/04	Replaced FEP-7
EP-RO-006	Radiological Emergency	0	4/8/04	Replaced SEP-2
EP-RO-007	Severe Natural Phenomenon	0	4/8/04	
EP-RO-008	Threat To Security	0	4/8/04	Replaced FEP-9
EP-RO-009	Notification of Unusual Event	0	4/8/04	
EP-RO-010	Alert	0	4/8/04	
EP-RO-011	Site Area Emergency	0	4/8/04	
EP-RO-012	Reactor Isolation	0	4/8/04	Replaced FEP-4
EP-RO-013	Facility Evacuation	0	4/8/04	Replaced FEP-5
EP-RO-014	EPZ and Site Area Evacuations	0	4/8/04	
EP-RO-015	Emergency Notifications	0	4/8/04	Replaced SEP-1
EP-RO-016	Public Information	0	4/8/04	Replaced FEP-8
EP-RO-017	Emergency Air Sampling	0	4/8/04	Replaced SEP-3
EP-RO-018	Emergency Radiation Exposure	0	4/8/04	Replaced SEP-4
EP-RO-018	Emergency Radiation Exposure	1	7/14/04	
EP-RO-019	Emergency Dosimeters	0	4/8/04	Replaced SEP-5
EP-RO-020	Emergency Equipment Maintenance	0	4/8/04	Replaced SEP-6
FM-100	Emergency Declaration	0	4/8/04	
FM-101	FEO Management	0	4/8/04	
FM-102	Emergency Event Log	0	4/8/04	
FM-103	Facility Status	0	4/8/04	
FM-104	Emergency Call List	0	4/8/04	
FM-105	Initial/Follow-up Emergency Message	0	4/8/04	
FM-106	Log of Personnel Released From Site	0	4/8/04	
FM-110	Fire Flowchart	0	4/8/04	
FM-111	Medical Flowchart	0	4/8/04	
FM-112	Radiological Flowchart	0	4/8/04	
FM-113	Severe Natural Phenomenon Flowchart	0	4/8/04	

Number	Name	Rev.	Revision Date	Notes
FM-114	Security Flowchart	0	4/8/04	
FM-115	Plant Conditions Flowchart	0	4/8/04	
FM-116	Classification Flowchart	0	4/8/04	
FM-117	Reactor Isolation Flowchart	0	4/8/04	
FM-118	Evacuation Flowchart	0	4/8/04	
OA-09	Combined Emergency Flowcharts	0	4/8/04	
OA-10	Fire Extinguisher Locations and Types	0	4/8/04	
OA-20	Emergency Equipment	0	4/8/04	

C. CHANGES TO HEALTH PHYSICS PROCEDURES, BYPRODUCT MATERIAL SHIPPING PROCEDURES, and PREPARATION OF BYPRODUCT MATERIAL FOR SHIPPING PROCEDURES

As required by the MURR Technical Specifications, the Reactor Health Physics Manager reviewed the procedures for radioactive materials handling, shipping, and preparation for shipping of byproduct materials.

There were 125 new and revised health physics, radioactive materials shipping, and preparation for shipping procedures and forms issued. The majority of the revisions were strictly format or editorial in nature. The following is a list of the new and revised procedures and forms:

Number	Name	Rev.	Revision Date	Notes
AP-HP-105	Radiation Work Permit	3	4/1/04	
AP-HP-110	Controlled Special Exposures	3	11/1/04	
AP-HP-117	MURR Initial Radiation Worker Training Program	4	4/1/04	
AP-HP-117	MURR Initial Radiation Worker Training Program	5	4/23/04	
AP-HP-120	Beamport Area	1	3/16/04	
AP-HP-121	Isotope Closet	1	4/1/04	
AP-HP-122	Material License Projects Quarterly Review	2	6/28/04	
AP-HP-123	Visitor Dosimetry - Reception Desk	2	8/13/04	
AP-HP-129	Hot Cell Control	2	3/16/04	
AP-HP-130	Reactor License Projects Annual Review	0	10/12/04	
AP-HP-150	Source Calibration	2	4/14/04	
AP-PSO-001	Preparation of Radioactive Materials for Shipping	1	4/23/04	
AP-SH-001	Administrative Procedure	1	4/22/04	
AP-SH-001	Administrative Procedure	2	9/13/04	
BPB-SH-001	NeoRx 2R Shipping Container Leak Check	2	4/22/04	
BPB-SH-001	NeoRx 2R Shipping Container Leak Check	3	11/19/04	
BPB-SH-002	20WC-1 Packaging and Shipment of Type B Non-Waste Radioactive Material	3	4/22/04	Replaced SP-SH-002
BPB-SH-002	20WC-1 Packaging and Shipment of Type B Non-Waste Radioactive Material	4	11/19/04	
BPB-SH-003	DOT 20WC-1 Receipt and Preparation	1	4/22/04	

Number	Name	Rev.	Revision Date	Notes
BPB-SH-005	DOT 6M Packaging and Shipment of Type B Non-Waste Radioactive Material	1	4/22/04	Replaced SAS-00010
BPB-SH-005	DOT 6M Packaging and Shipment of Type B Non-Waste Radioactive Material	2	11/19/04	
BPB-SH-006	20WC-1 Packaging and Shipment of Type B Non-Waste Radioactive Material	0	8/27/03	Obsolete 4/22/04
BPB-SH-008	Type B(U) F-327 Series Packaging and Shipment of Type B Non-Waste Radioactive Material	1	4/22/04	Replaced SAS-00013
BPB-SH-008	Type B(U) F-327 Series Packaging and Shipment of Type B Non-Waste Radioactive Material	2	11/19/04	
BPB-SH-009	GB/0924BP/B(U) Packaging and Shipment of Type B(U) Non-Waste Radioactive Material (Amersham)	0	4/22/04	Replaced SAS-00008
BP-SH-004	Packing and Shipment of Type A Non-Waste Radioactive Material	2	8/18/03	Obsolete 4/22/04
BP-SH-007	F-327 Packaging and Shipment of Type A Non-Waste Radioactive Material	0	4/22/04	
BP-SH-010	Packaging and Shipment of Non-Waste Radioactive Materials in Excepted Packages	0	9/27/04	
BP-SH-011	Shipment of Non-Waste USA DOT 7A Type A (Gemstone) Radioactive Material Package	0	9/27/04	
BP-SH-036	Packaging of Non-Waste Radioactive Material Using MURR MODEL 1100	0	4/22/04	Replaced SP-SH-004
BP-SH-037	Packaging of Non-Waste Radioactive Material Using MURR MODEL 1220	0	4/22/04	Replaced SP-SH-004
BP-SH-038	Packaging of Non-Waste Radioactive Material Using MURR MODEL 1300	0	4/22/04	Replaced SP-SH-004
BR-RRD-205	Lutetium Chloride Batch Record	1	4/27/04	
BR-RRD-205	Lutetium Chloride Batch Record	2	9/27/04	
FM-151	Control Checksheet for Non-Waste USA DOT 7A Type A (Gemstone) Radioactive Material Package	0	9/27/04	
FM-151	Control Checksheet for Non-Waste USA DOT 7A Type A (Gemstone) Radioactive Material Package	1	10/11/04	
FM-27	In-House Radioactive Shipping Request	3	4/22/04	
FM-35	Control Checksheet for Type B USA DOT 20WC-1 Radioactive Materials Shipment	5	6/11/04	
FM-35	Control Checksheet for Type B USA DOT 20WC-1 Radioactive Materials Shipment	6	10/11/04	
FM-35	Control Checksheet for Type B USA DOT 20WC-1 Radioactive Materials Shipment	7	10/28/04	
FM-36	Control Checksheet for USA DOT 7A- MURR Model 1100 Series	3	4/22/04	
FM-36	Control Checksheet for USA DOT 7A- MURR Model 1100 Series	4	6/11/04	
FM-36	Control Checksheet for USA DOT 7A- MURR Model 1100 Series	5	10/11/04	
FM-37	Control Checksheet for USA DOT 7A -MURR Model 1220 Series	3	4/22/04	

Number	Name	Rev.	Revision Date	Notes
FM-37	Control Checksheet for USA DOT 7A -MURR Model 1220 Series	4	6/11/04	
FM-37	Control Checksheet for USA DOT 7A -MURR Model 1220 Series	5	10/11/2004	
FM-38	Control Checksheet for USA DOT 7A MURR Model 1300 Series	3	4/22/04	
FM-38	Control Checksheet for USA DOT 7A MURR Model 1300 Series	4	6/11/04	
FM-38	Control Checksheet for USA DOT 7A MURR Model 1300 Series	5	10/11/04	
FM-39	Control Checksheet for Excepted Package Radioactive Materials Shipment	3	6/11/04	
FM-39	Control Checksheet for Excepted Package Radioactive Materials Shipment	4	9/13/04	
FM-39	Control Checksheet for Excepted Package Radioactive Materials Shipment	5	10/11/04	
FM-44	Request for Radioisotope Shipment	4	4/22/04	
FM-74	Control Checksheet for Type B USA DOT 6M Radioactive Materials Shipment	2	6/11/04	
FM-74	Control Checksheet for Type B USA DOT 6M Radioactive Materials Shipment	3	10/11/04	
FM-74	Control Checksheet for Type B USA DOT 6M Radioactive Materials Shipment	4	10/28/04	
FM-75	Control Checksheet for Type B(U) F-327 Series Radioactive Materials Shipment	2	6/11/04	
FM-75	Control Checksheet for Type B(U) F-327 Series Radioactive Materials Shipment	3	10/11/04	
FM-77	Control Checksheet for GB/0924BP/B(U) Radioactive Materials Shipment	0	4/26/04	
FM-77	Control Checksheet for GB/0924BP/B(U) Radioactive Materials Shipment	1	6/11/04	
FM-77	Control Checksheet for GB/0924BP/B(U) Radioactive Materials Shipment	2	10/11/04	
FM-78	Lutetium Chloride Radiation Protection Data Sheet A	1	4/27/04	
FM-78	Lutetium Chloride Radiation Protection Data Sheet A	2	9/27/04	
FM-79	Lutetium Chloride Radiation Protection Data Sheet B	1	4/27/04	
FM-79	Lutetium Chloride Radiation Protection Data Sheet B	2	9/27/04	
FM-89	Control Checksheet for Type A F-327 Series Radioactive Material Shipment	0	4/26/04	
FM-89	Control Checksheet for Type A F-327 Series Radioactive Material Shipment	1	6/11/04	
FM-89	Control Checksheet for Type A F-327 Series Radioactive Material Shipment	2	10/11/2004	
GMP-PRC-112	Holmium Chloride Process Setup in HC-03	1	12/9/03	Obsolete 7/15/04

Number	Name	Rev.	Revision Date	Notes
GMP-PRC-113	Holmium Chloride Production in HC-03	1	12/9/03	Obsolete 7/15/04
GMP-PRC-114	Quartz Vial Preparation	4	8/30/04	
GMP-PRC-115	Holmium Chloride Process Setup in HC-02 a/b	1	3/24/04	
GMP-PRC-115	Holmium Chloride Process Setup in HC-02 a/b	2	8/18/04	
GMP-PRC-115	Holmium Chloride Process Setup in HC-02 a/b	3	11/23/04	
GMP-PRC-116	Holmium Chloride Production in HC-02 a/b	1	3/24/04	
GMP-PRC-116	Holmium Chloride Production in HC-02 a/b	2	8/18/04	
GMP-PRC-116	Holmium Chloride Production in HC-02 a/b	3	11/23/04	
HC-PSO-002	Hot Cell Preparation of Radioactive Material for Shipment	2	4/23/04	
HC-PSO-002	Hot Cell Preparation of Radioactive Material for Shipment	3	9/24/04	
HC-PSO-003	Hot Laboratory Preparation of Radioactive Material for Shipment	1	4/23/04	
HC-PSO-003	Hot Laboratory Preparation of Radioactive Material for Shipment	2	9/24/04	
HC-PSO-005	Hot Cell Loading of Host Cans	2	4/23/04	
IC-HP-300	Calibration - Radiation Survey Instruments	2	2/17/04	
IC-HP-310	Calibration - Eberline Ping 1a Stack Monitor - Particulate Channel	2	1/23/04	
IC-HP-311	Calibration - Eberline Ping 1a Stack Monitor - Iodine Channel	2	1/23/04	
IC-HP-312	Calibration - Eberline Ping 1a Stack Monitor - Gas Channel	2	1/23/04	
IC-HP-319	Calibration - NMC Model RAK Monitor - Particulate Channel	2	3/16/04	
IC-HP-320	Calibration - NMC Model RAK Monitor - Iodine Channel	2	3/16/04	
IC-HP-321	Calibration - NMC Model RAK Monitor - Gas Channel	2	3/16/04	
IC-HP-330	Calibration - Canberra Model 2404 Swipe Counter	2	7/23/04	Obsolete 9/3/04
IC-HP-331	Calibration - Tennelec LB-5100 Alpha/Beta	3	4/1/04	
IC-HP-333	Eberline BC-4 Beta Swipe Counter-Calibration	2	1/23/04	
IC-HP-335	Calibration - Portal Monitor Gamma-60 - S/N 900644	5	4/1/04	
IC-HP-337	Calibration - Portal Monitor Gamma-60 - S/N 1010 and 1011	4	4/14/04	
IC-HP-341	Calibration -High Resolution Gamma Spectroscopy Systems	1	1/23/04	
IC-HP-343	Calibration - Sodium Iodide Detector	2	4/1/04	
IC-HP-347	Calibration - Protean Model WPC 9550 Alpha-Beta Swipe Counter	3	7/23/04	
OP-HP-220	Tritium Bioassay	2	5/14/04	
OP-HP-221	Environmental Sample - Analysis	2	2/17/04	
OP-HP-224	Spent Fuel Shipping Cask Air Sample Analysis	1	5/14/04	
OP-HP-225	Operation - Canberra Model 2404 Swipe Counter	1	8/4/03	Obsolete 9/3/04

Number	Name	Rev.	Revision Date	Notes
OP-HP-227	Tennelec LB-5100 Alpha/Beta - Operation	2	3/16/04	
OP-HP-230	Eberline BC-4 Beta Swipe Counter - Operation	2	1/23/04	
OP-HP-348	Operation - Protean WPC-9550 Swipe Counter	1	1/23/04	
OP-HP-350	Eberline Model Ping 1A - Filter Change	2	4/1/04	
OP-HP-352	Particulate and Iodine Filter - Analysis	1	1/23/04	
OP-HP-353	Waste Tank Sample - Analysis	1	2/17/04	
QA-SH-002	Sodium Iodide Spectral Analysis for Excepted, Exempt, License-to-License, Type A, or Type B Radioactive Materials Shipments	0	9/13/04	
RM-HP-100	Stack Monitor Preventive Maintenance - NMC Model RAK	2	3/16/04	
RM-HP-101	Stack Monitor Preventative Maintenance - Eberline Ping 1A	1	10/12/04	
RP-HP-110	Survey and Decontamination of Returned Shipping Container	2	4/1/04	
RP-HP-130	Receipt of New Fuel Elements	2	4/1/04	
RP-HP-135	Room 114 Entry - Self Monitored	1	4/14/04	
RP-HP-137	Handling Radioactive Material in the Reactor Pool	2	9/24/04	
RP-HP-139	Beamport Radiation Level Monitoring During Reactor Startup	1	5/14/04	
SP-SH-004	Packing and Shipment of Type A Non-Waste Radioactive Material	1	6/6/02	Obsolete 4/22/04
SV-HP-110	Environmental Sampling	2	5/14/04	
SV-HP-117	Secondary Coolant and Sump Water - Sampling and Analysis	2	4/1/04	
SV-HP-121	Building Exhaust Stack Effluent - Ar-41 Monitoring	1	4/1/04	
SV-HP-131	Emergency Analysis of Environmental Samples For Callaway Nuclear Plant	1	1/23/04	
WMB-SH-005	Shipment of Type B Radioactive Waste Using Chem-Nuclear System 1-13G Cask	2	6/28/04	
WM-SH-100	Radioactive Waste - Preparation and Storage	2	4/22/04	
WM-SH-105	Radioactive Waste Processing	1	5/14/04	
WM-SH-200	Exclusive Use Shipment of LSA or SCO Radioactive Waste Utilizing a Broker	3	5/14/04	
WM-SH-300	MURR Exclusive Use Shipment of LSA or SCO Radioactive Waste	1	7/14/04	

SECTION III

REVISIONS TO THE HAZARDS SUMMARY REPORT

January 1, 2004 through December 31, 2004

These changes were approved by the Reactor Manager and reviewed by licensed staff and members of the Reactor Safety Subcommittee and have been determined not to involve a change to the Technical Specifications. These changes have all been reviewed in accordance with 10 CFR 50.59.

HAZARDS SUMMARY REPORT (ORIGINAL JULY 1, 1965)

Original HSR, page 7-4, Section 7.1.4 (as revised by the 1972-73, 1989-90, and 2002 Reactor Operations Annual Reports):

Add: The following to the end of the list:
"(15) Fire Protection System"

Original HSR, page 7-17, Section 7.2.4 (as revised by the 1995 Reactor Operations Annual Report):

Delete: Entire section, which states:
"Fire Control System

The Research Reactor Facility has eleven fire hose cabinets strategically located throughout the building. The hose cabinets are connected to a dry fire system which connects to three siamese fittings located outside the building, one each at the north, west and south entries. Fire hydrants are located outside the building in a vicinity near the external siamese connections to facilitate connecting a pumper truck between the hydrants and the hose connections on the building."

Replace with: "Fire Protection System

The MURR fire protection system is designed to protect the facility and staff, and to mitigate any property loss in the event of a fire. The system provides two primary functions: (1) detection, which affords an early warning of an actual or potential fire condition by a combination of heat, smoke, and remote manual devices, and (2) suppression, which incorporates a normal sprinkler system with a pre-action system that is used in areas with sensitive electronic equipment, and a deluge, non-freezing system used in the cooling tower. It should be noted that fire protection is not required to accomplish a safe shut down of the reactor or to maintain a safe shutdown condition.

The fire detection system is a combination of thermal, photoelectronic, and ionization-type sensors, flow switches, and manual pull stations. A central control station, located in room 204, and a repeater station, located in the reactor control room, monitors each system component. These stations will annunciate an alarm if any component is not in its normal condition.

The fire suppression system is a combination of many types of systems: a deluge system used in the cooling tower; a pre-action system used in areas that contain highly sensitive electronic equipment; a dry fire main system used in the reactor containment building; a traditional sprinkler system used throughout the rest of the laboratory building; and a damper isolation system for the facility ventilation exhaust system. The containment building fire suppression system consists of three fire hose cabinets connected to a dry fire main. Cross-connecting it to the rest of the facility's wet system by a manual isolation valve located in the laboratory basement can flood this system.

The fire protection system receives a virtually unlimited supply of water from the combination University fire and domestic cold water main. Four (4) siamese or storz hose fittings are also connected to the MURR fire main. These fittings are located outside the facility and they facilitate connecting a pumper truck between the fittings and fire hydrants, which are located in the vicinity of the hose fittings, thus providing an additional water supply path to the fire main. In addition, fire extinguishers are strategically located throughout the facility.

The fire protection system is powered from the emergency electrical distribution system (ELP-2). The system also has a self-contained 24-hour battery backup."

Original HSR, pages 9-5 through 9-7, Table 9.1 (as revised by 1981-82, 1995, and 2001 Reactor Operations Annual Reports):

Delete:	"25	Temperature Readout		Digital"
Replace with:	"25	Auto Shim Engaged		Light"
Delete:	"59	Automatic Shim Circuit	N/A	N/A"
Replace with:	"59	Intercom	N/A	N/A"
Delete:	"60	Temperature Readout	N/A	24 Position"

Original HSR, Figure 5.1, Piping & Instrument Diagram (as revised by the 1972-73, 1973-74, 1994, 1996, 2001, 2002, and 2003 Reactor Operations Annual Reports):

Replace with: Updated Figure 5.1, Piping & Instrument Diagram (MURR Dwg No. 156, Sheet 1 of 1, dated 11/16/04)

Original HSR, Figure 9.2, Control Console Layout (as revised by 1995 and 2001 Reactor Operations Annual Reports):

Replace with: Updated Figure 9.2, Control Console Layout (dated 6/29/04)

Original HSR, Figure 9.3, Instrument Panel Layout (as revised by 1995 and 2001 Reactor Operations Annual Report):

Replace with: Updated Figure 9.3, Instrument Cabinet (MURR Dwg No. 74, Sheet 12 of 12, dated 1/26/05)

ADDENDUM 1 - HAZARDS SUMMARY REPORT (FEBRUARY 1966)

HSR, Addendum 1, page 24, Section 3.8, paragraph 4, fourth item (as revised by the 1989-90 and 2002 Reactor Operations Annual Reports):

Add: The following bolded words to the first sentence: "...nitrogen station, **fire protection system,** and the evacuation alarms."

HSR, Addendum 1, page 25a, Figure 3.8.1, Emergency Generator Load Diagram (as revised by the 1989-90 and 2002 Reactor Operations Annual Reports):

Replace with: Updated Figure 3.8.1, Electrical Distribution Elem. Diagram (MURR Dwg No. 2272, Sheet 1 of 1, dated 8/20/04)

HSR, Addendum 1, page 104, Figure 3.22.2, Ventilation Air Flow Diagram for the East Tower (as revised by 1995 Reactor Operations Annual Report):

Replace with: Updated Figure 3.22.2, MURR Supply Air Schematic (MURR Dwg No. 1125, Sheet 2 of 3, dated 10/25/04)

ADDENDUM 3 - HAZARDS SUMMARY REPORT (AUGUST 1972)

HSR, Addendum 3, page 20, Figure 2.2, Secondary Cooling System (as revised by the 1989-90, 1990-91, 1994, 1995, 2001, 2002, and 2003 Reactor Operations Annual Reports):

Replace with: Updated Figure 2.2, Secondary Cooling System (MURR Dwg No. 502, Sheet 1 of 1, dated 2/12/04)

HSR, Addendum 3, page 23a, Figure 2.3.a, Electrical Distribution (as revised by the 1989-90, 1990-91, 1995, 2001, 2002, and 2003 Reactor Operations Annual Reports):

Replace with: Updated Figure 2.3.a, Electrical Distribution (MURR Dwg No. 522, Sheet 1 of 3, dated 11/16/04)

HSR, Addendum 3, page 23b, Figure 2.3.b, Electrical Distribution (as revised by the 1995, 2001, 2002, and 2003 Reactor Operations Annual Reports):

Replace with: Updated Figure 2.3.b, Electrical Distribution (MURR Dwg No. 522, Sheet 2 of 3, dated 11/16/04)

HSR, Addendum 3, page 23c, Figure 2.3.c, Electrical Distribution:

Add new figure: Figure 2.3.c, Electrical Distribution (MURR Dwg No. 522, Sheet 3 of 3, dated 11/16/04)

ADDENDUM 4 - HAZARDS SUMMARY REPORT (OCTOBER 1973)

HSR, Addendum 4, page A-29, Figure A.2, Piping and Instrument Diagram (as revised by the 1995, 2001, 2002, and 2003 Reactor Operations Annual Reports):

Replace with: Updated Figure A.2, Piping & Instrument Diagram (MURR Dwg No. 156, Sheet 1 of 1, dated 11/16/04)

HSR, Addendum 4, page A-31a, Figure A.4.a, Reactor Control System - 10 MW (as revised by 1995 and 2001 Reactor Operations Annual Reports):

Replace with: Updated Figure A.4.a, Reactor Control System (MURR Dwg No. 42, Sheet 1 of 2, dated 10/13/04)

HSR, Addendum 4, page A-31b, Figure A.4.b, Reactor Control System - 10 MW (as revised by 1995 and 2001 Reactor Operations Annual Reports):

Replace with: Updated Figure A.4.b, Reactor Control System (MURR Dwg No. 42, Sheet 2 of 2, dated 7/14/04)

HSR, Addendum 4, page A-33a, Figure A.6.a, 10 MW Process Instrumentation Control & Interlock (as added by the 2001 Reactor Operations Annual Report):

Replace with: Updated Figure A.6.a, 10 MW Process Instrumentation Control & Interlock (MURR Dwg No. 41, Sheet 4 of 4, dated 5/18/04)

ADDENDUM 5 - HAZARDS SUMMARY REPORT (JANUARY 1974)

HSR, Addendum 5, page 4, Section 2.2, third paragraph, second item (as revised by the 1989-90 Reactor Operations Annual Report):

Add: The following bolded words to the first sentence: "...intercommunication system, **nitrogen station, fire protection system,** and the reactor evacuation and isolation alarms."

HSR, Addendum 5, page 12, Section 2.4.1 (as revised by the 1989-90 and 2002 Reactor Operations Annual Reports):

Add to end of list: "(15) Fire Protection System

Normal supply power would be lost to the fire detection system. However, the system is equipped with a battery backup that would provide power for the entire system for a period of twenty-four (24) hours. Additionally, fire protection is not required to accomplish a safe shut down of the reactor or to maintain a safe shutdown condition."

HSR, Addendum 5, page 15, Figure 2.1, Electrical Distribution (as revised by the 1989-90, 2001, 2002, and 2003 Reactor Operations Annual Reports):

Replace with: Updated Figure 2.1, Electrical Distribution (MURR Dwg No. 522, Sheet 1 of 3, dated 11/16/04)

SECTION IV

PLANT AND SYSTEM MODIFICATIONS

January 1, 2004 through December 31, 2004

For each facility modification described below, MURR has on file the safety evaluation as well as the documentation of review in accordance with 10 CFR 50.59.

Modification 75-16, Addendum 2:

Relocation of the Reactor Safety System Monitoring Circuit Panel

This addendum to modification record 75-16, "Portable White Rat for Safety System," documents the relocation of the reactor safety system monitoring circuit display panel from the right side of the control room Instrument Panel to the left side of the panel. This modification will allow the new Secondary Coolant Pump variable speed controller circuit control switches and meters, which are part of the Cooling Tower Electrical Upgrade Project (Modification Record 04-5), to be mounted on a panel in this freed position. This location was preferred since it is adjacent to the Secondary Coolant Flow and Temperature Chart Recorder.

Modification 88-11, Addendum 1:

Upgrade of the Uninterruptible Power Supply (UPS) Alternate Source

This addendum to modification record 88-11, "Reactor Control Power Upgrade," documents the upgrade in the load carrying capacity of the UPS Alternate Source. The alternate source, with a previous maximum load capacity of 50 amps, was undersized in relationship to the UPS. This modification upgraded the alternate source wiring to 125 amps and replaced the 15 kVA, 3 phase, 480-208/120V step-down transformer with a new low-impedance isolation transformer line conditioner. Installation of a combination transformer/line conditioner allowed the removal of the 2.5 kVA Elgar; a 40-year old line conditioner that had not been placed in service for over fifteen years. In addition to its unknown reliability and functional utility, transfer of supply power to the Elgar had to be performed while the reactor was shutdown and secured. Installation of a line conditioner on the alternate source should increase operational reliability and flexibility in that if a failure of the UPS would occur while the reactor is operating, the alternate source will provide regulated and filtered AC output voltage to the reactor Instrumentation and Control Systems without an interruption in power.

Modification 91-3, Addendum 1:

Replacement of the Existing X, Y, MH-X, and MH-Y Fuel Storage Baskets with New X and Y Baskets

This addendum to modification record 91-3, "Temporary Additional In-Pool Fuel Storage Baskets," documents the replacement of the X, Y, MH-X, and MH-Y fuel storage baskets with two new fuel baskets. The MH-X and MH-Y baskets were installed in 1991 as additional temporary fuel storage locations during a period when the facility was unable to ship fuel because two spent fuel shipping casks that were certified to transport MURR fuel were removed from service. The additional storage locations were needed to ensure that no interruption to MURR's operating schedule would be experienced. The MH-X and MH-Y baskets were designed and built for the MH1A shipping cask and were not intended for long-term everyday use that they had endured at MURR. The new baskets are designed and constructed for everyday use, similar to that of the original X, Y, and Z storage baskets.

Modification 95-1, Addendum 1F:

Gamma-Metrics Nuclear Instrumentation Gain Potentiometer R27 Replacement

This addendum to modification record 95-1, "Replacement of Nuclear Instruments," documents the replacement of the 20 K-ohm Gain Potentiometer R27 with a 50 K-ohm gain potentiometer in each Gamma-Metrics Nuclear Instrumentation (NI) drawer Squaring Amplifier. The 20 K-ohm potentiometer limited the NI adjustment range to approximately 15% at full power. If an adjustment was required outside of this range, the reactor had to be shutdown and the resistance value of switch SW1 changed. Replacement of the 20 K-ohm gain potentiometer with a 50 K-ohm potentiometer provides a greater adjustment range while operating.

Modification 01-3, Addendum 2:

Relocation of TE-980A and TE-980B Temperature Transmitters

This addendum to modification record 01-3, "Replacement of the 980A/B Temperature Transmitters, Meter Relay Units, and RTDs," documents the relocation of the Primary Coolant System Temperature Transmitters for TE-980A and TE-980B from their previous location in Room 114 - a high radiation area at operation - to immediately outside of its entrance. These transmitters, replaced in March 2001 because of their age and unavailability of replacement parts, had experienced periodic drifting/erratic behavior since their installation. This modification was in response to the Manufacturer's (Rosemount Nuclear) recommendation of relocating the transmitters to a lower radiation field. The manufacturer believed that the drifting/erratic behavior of the temperature instruments was attributed to the high radiation field that the transmitters were mounted in. Since relocation, the transmitters have not experienced any more problems.

Modification 01-5, Addendum 1:

Replace Secondary Coolant Flow Transmitters FT-912P and FT-912Q

This addendum to modification record 01-5, "Upgrade Secondary Coolant System Flow and Temperature Measurement System," documents the replacement of the Rosemount Model 1151DP4J22B1 differential pressure transmitters for Secondary Coolant Flow Transmitters FT-912P and FT-912Q with Rosemount Model 1151DP4E22B2 transmitters. The Rosemount Model 1151DP4J22B1 transmitters were unique in that they were the only Rosemount differential pressure transmitters at MURR that had the circuitry to perform the necessary square root function to determine flow built within the transmitter, and hence located in Room 114 (a high radiation area at operation). All other transmitters, which support process recorders that require a square root input, have the square root converters located in the reactor control room. FT-912P and FT-912Q had historically been problematic in that the "zero" and "span" settings routinely drifted, usually requiring adjustments during calibration. All other Rosemount Model 1151 transmitters in Room 114 had not experienced this same type of problem. A recent modification (Modification Record 01-3, Addendum 2) was performed in which the temperature transmitters for TE-980A and TE-980B were relocated from inside Room 114 to immediately outside its entrance. By relocating the temperature transmitters to a much lower radiation field, these instruments have not experienced any of the previous drifting problems. One of the many features of the Yokogawa Chart Recorder, which provides an indication of flow for FT-912P and FT-912Q, is the ability to take the square root of an input signal and provide a linear output signal; consequently no additional square root converters needed to be installed. Since replacement, the new transmitters have not experienced any more problems.

Modification 03-3:

Installation of a Facility Fire Detection/Suppression System

This modification record documents the installation of a new Fire Detection/Suppression System in the facility. The new system, as its name implies, provides two functions: (1) a Detection System that provides an early warning of an actual or potential fire condition by a combination of heat, smoke, and remote manual devices, and (2) a Suppression System that incorporates a normal sprinkler system with a pre-action system used in areas with sensitive electronic equipment, and a deluge, non-freezing system used in the Cooling Tower. All of these systems and devices combine to form a complete Fire Detection/Suppression System for MURR.

Modification 04-1:

Replace the General Electric Measurement and Control Type 551 Reactor Pressure Transmitter PT-943 with a Rosemount Model 1151

This modification record documents the replacement of the General Electric Measurement and Control (GE/MAC) Type 551 Pressure Transmitter for Reactor Pressure Transmitter PT-943 with a Rosemount Model 1151 Pressure Transmitter. Because of its age and the inability to purchase replacement parts, the GE/MAC Type 551 Pressure Transmitter had become obsolete. In addition to their known reliability, replacement of the GE/MAC transmitters with Rosemount Model 1151's will help standardize all reactor plant pressure transmitters.

Modification 04-4:

Relocation of Automatic Shim Control Circuit for Reactor Console Modification

This modification record documents the relocation of the Automatic Shim Control circuit from the sloping face section of the reactor control console to a panel behind the north most console access door. Relocation of this circuit freed up sufficient space that allowed the Master Control Switch, 1S1, to be relocated higher and away from the writing surface, thereby lessening the chance that 1S1 could inadvertently be bumped and cause a shutdown of the reactor. Additionally, the old Regulating Rod Position Indication panel was removed and a new panel, which only houses the regulating rod indicating lights and manual pushbuttons, was mounted in its place.

SECTION V

NEW TESTS AND EXPERIMENTS

January 1, 2004 through December 31, 2004

New tests or experiments developed during this period are as follows:

RUR 219, as amended: Ytterbium Metal and Oxide (Natural and Enriched)

Description: This amended RUR authorizes the irradiation of natural and enriched ytterbium metal and ytterbium oxide for use in research and development activities.

RUR 276, as amended: Natural Iridium

Description: This amended RUR authorizes the irradiation of natural iridium for use in research and development activities.

RUR 407: Enriched Calcium Carbonate

Description: This RUR authorizes the irradiation of enriched calcium carbide for use in research and development activities.

RUR 409, as amended: Xenon Targets – Modified Encapsulation Design

Description: This amended RUR authorizes the irradiation of xenon targets with a modified encapsulation design for use in research and development activities.

RUR 411: Enriched Gadolinium Nitrate

Description: This RUR authorizes the irradiation of enriched gadolinium nitrate for use in research and development activities.

Project Authorization RL-64: Irradiation of Electronic Components in the Thermal Column

Description: This Project Authorization authorizes the irradiation of electronic components in the thermal column port of the reactor.

Each of these tests or experiments has a written safety evaluation on file, and a 10 CFR 50.59 Screen if applicable, to assure that the test or experiment is safe and within the limits of the Technical Specifications. The safety evaluations have been reviewed by the Reactor Manager, Reactor Health Physics Manager, Assistant Reactor Manager-Physics, and the Reactor Safety Subcommittee. In the case of RL-64, the Isotope Use Subcommittee also reviewed the project.

SECTION VI

SPECIAL NUCLEAR MATERIAL AND REACTOR PHYSICS ACTIVITIES

January 1, 2004 through December 31, 2004

Inspections:

There was one NRC inspection which reviewed SNM activities. All records and activities were found to be in compliance with NRC rules and regulations. No violations were noted.

Reactor Characteristic Measurements:

Sixty (60) refueling evolutions were completed in 2004. Excess reactivity verification was performed for each refueling. The largest measured excess reactivity was 2.95%. MURR Technical Specification 3.1(f) requires that the excess reactivity be less than 9.8%.

Reactivity Measurements:

Ten (10) measurements were made to determine the reactivity worth of several samples that are irradiated in either the flux trap or reflector regions and that of the total flux trap loading.

Eight (8) differential blade-worth measurements and one primary coolant temperature coefficient measurement were also performed.

SECTION VII

RADIOACTIVE EFFLUENT

January 1, 2004 through December 31, 2004

TABLE 1
SANITARY SEWER EFFLUENT

January 1, 2004 through December 31, 2004

Descending Order of Activity Released for Nuclide Totals > 1.000E-05 Ci

Nuclide	Activity (Ci)
H-3	1.029E-01
S-35	1.345E-03
Lu-177	5.384E-04
Co-60	5.237E-04
Cr-51	1.476E-04
Ca-45	1.245E-04
Lu-177m	1.145E-04
I-131	2.621E-05
Tl-201*	1.885E-05
Zn-65	1.700E-05
Ag-110m	1.615E-05
Mn-54	1.591E-05
Cu-67	1.170E-05
Total H-3	1.029E-01
Total Other	1.086E-01

Sanitary Sewer Effluents are in compliance with 10 CFR 20.2003, "Disposal By Release Into Sanitary Sewerage."

*Tl-201 effluents comply with Missouri Department of Health, Division 10; Chapter 20 regulations.

TABLE 2
STACK EFFLUENT

January 1, 2004 through December 31, 2004

Ordered by % Technical Specification (TS) Limit

Isotope	Average Concentration µCi/ml	Total Release Ci	TS Limit Multiplier	% TS
Ar-41	2.85E-06	1.32E+03	350	81.5061
C-14	2.48E-11	1.13E-02	1	0.830
Co-60	3.97E-14	1.84E-05	1	0.0794
I-131	1.49E-13	6.89E-05	1	0.0743
H-3	1.88E-08	8.70E+00	350	0.0537
I-125	7.00E-14	3.25E-05	1	0.0233
Cd-109	1.16E-14	5.36E-06	1	0.0165
Ti-51	3.83E-11	1.78E-02	350	0.0110
W-188	1.78E-13	8.27E-05	1	0.0089
Sr-85	1.97E-14	9.11E-06	1	0.0010
Cs-137	1.50E-15	6.97E-07	1	0.0008
Sc-46	2.05E-15	9.50E-07	1	0.0007
Hf-181	2.75E-15	1.28E-06	1	0.0005
Se-75	3.50E-15	1.62E-06	1	0.0004
Os-191	7.84E-15	3.63E-06	1	0.0004
Ru-103	1.91E-15	8.84E-07	1	0.0002
I-133	4.51E-13	2.09E-04	350	0.0001
Xe-135m	1.74E-11	8.05E-03	350	0.0001
S-35	3.72E-15	1.72E-06	1	0.0001
Sn-113	9.05E-16	4.19E-07	1	0.0001
Hg-203	1.04E-15	4.81E-07	1	0.0001
As-77	2.37E-12	1.10E-03	350	0.0001
Co-58	6.39E-16	2.96E-07	1	0.0001
Be-7	1.81E-14	8.38E-06	1	0.0001

Note: C-14 activity is calculated based on the ratio of argon to nitrogen in the air and the (n,p) reaction cross sections for the activation of N-14 to C-14.

Isotopes observed at < 0.0001% TS limit are not listed.

Stack Flow Rate = 30,500 cfm

Stack effluent releases are in compliance with University of Missouri-Columbia Research Reactor, License R-103 Technical Specifications.

SECTION VIII

ENVIRONMENTAL MONITORING AND HEALTH PHYSICS SURVEYS

January 1, 2004 through December 31, 2004

Environmental samples are collected two times per year at eight (8) locations and analyzed for radioactivity. Soil and vegetation samples are taken at each location. Water samples are taken at three (3) of the eight (8) locations. Analytical results are shown in Tables 1 and 2.

Table 3 lists the radiation doses recorded by the environmental monitors deployed around MURR in 2004. All doses are about 25 mRem/year or less, except monitor numbers 9 and 15. These monitors are located near the loading dock where packages containing radioactive material are loaded on transport vehicles. The doses recorded by these monitors are considered to be the result of exposure to packages in transit. The environmental monitoring program confirms that no environmental impact exists from the operation of the MURR facility.

The number of radiation and contamination surveys performed each month is provided in Table 4.

TABLE 1

Summary of Environmental Set 65

May 2004

Detection Limits*

Matrix	Alpha	Beta	Gamma	Tritium
Water	1.82 pCi/L	10.19 pCi/L	288.16 pCi/L	3.76 pCi/mL of sample
Soil	1.49 pCi/g	10.06 pCi/g	1.32 pCi/g	N/A
Vegetation	3.65 pCi/g	19.73 pCi/g	2.84 pCi/g	3.81 pCi/mL of distillate

*Gamma and tritium analyses are based on wet weights while alpha and beta analyses are based on dry weights.

Activity Levels - Vegetation

Sample	Alpha (pCi/g)	Beta (pCi/g)	Gamma (pCi/g)	H-3 (pCi/mL)
1V65	< 3.65	< 19.73	< 2.84	< 3.81
2V65	< 3.65	31.54	< 2.84	< 3.81
3V65	< 3.65	21.92	< 2.84	< 3.81
4V65	< 3.65	29.94	< 2.84	< 3.81
5V65	< 3.65	24.06	< 2.84	< 3.81
6V65	< 3.65	20.32	< 2.84	< 3.81
7V65	< 3.65	24.06	< 2.84	< 3.81
10V65	< 3.65	22.99	< 2.84	< 3.81

TABLE 1 (Cont'd)

Summary of Environmental Set 65
May 2004

Activity Levels - Soil

Sample	Alpha (pCi/g)	Beta (pCi/g)	Gamma (pCi/g)
1S65	< 1.49	10.43	3.09
2S65	1.60	14.44	< 1.32
3S65	1.60	< 10.06	< 1.32
4S65	< 1.49	< 10.06	< 1.32
5S65	< 1.49	17.11	2.92
6S65	< 1.49	10.43	< 1.32
7S65	< 1.49	11.23	< 1.32
10S65	< 1.49	16.04	7.48

Activity Levels - Water

Sample	Alpha (pCi/L)	Beta (pCi/L)	Gamma (pCi/L)	H-3 (pCi/mL)
4W65	< 1.82	< 10.19	< 288.16	< 3.76
6W65	< 1.82	< 10.19	< 288.16	< 3.76
10W65	< 1.82	14.03	824.86	< 3.76

*Sample 10W65 was found to have gamma activity above MDA. Sample was counted on a HPGE detector and Tc-99m was identified as the only isotope above background levels. This isotope is routinely used for medical treatment and has historically been found at this sample location.

TABLE 2

Summary of Environmental Set 66
October 2004

Detection Limits**

Matrix	Alpha	Beta	Gamma	Tritium
Water	0.72 pCi/L	4.50 pCi/L	200.82 pCi/L	4.08 pCi/mL of sample
Soil	0.88 pCi/g	2.35 pCi/g	0.71 pCi/g	N/A
Vegetation	1.44 pCi/g	3.93 pCi/g	1.69 pCi/g	4.02 pCi/mL of distillate

**Gamma and tritium analyses are based on wet weights while alpha and beta analyses are based on dry weights.

TABLE 2 (Cont'd)

Summary of Environmental Set 66
October 2004

Activity Levels - Vegetation

Sample	Alpha (pCi/g)	Beta (pCi/g)	Gamma (pCi/g)	H-3 (pCi/mL)
1V66	< 1.44	13.19	< 1.69	< 4.02
2V66	< 1.44	13.45	< 1.69	< 4.02
3V66	< 1.44	20.76	< 1.69	< 4.02
4V66	< 1.44	12.40	< 1.69	< 4.02
5V66	< 1.44	27.03	< 1.69	< 4.02
6V66	< 1.44	21.80	< 1.69	< 4.02
7V66	< 1.44	31.21	< 1.69	< 4.02
10V66	< 1.44	19.19	< 1.69	< 4.02

Activity Levels - Soil

Sample	Alpha (pCi/g)	Beta (pCi/g)	Gamma (pCi/g)
1S66	< 0.88	15.54	4.20
2S66	1.01	11.88	3.03
3S66	< 0.88	16.19	3.57
4S66	< 0.88	8.23	2.84
5S66	< 0.88	14.36	3.93
6S66	< 0.88	7.18	1.24
7S66	1.01	12.14	2.60
10S66	1.16	16.45	4.08

Activity Levels - Water

Sample	Alpha (pCi/L)	Beta (pCi/L)	Gamma (pCi/L)	H-3 (pCi/mL)
4W66	< 0.72	9.66	< 308.29	< 4.08
6W66	< 0.72	6.27	< 308.29	< 4.08
10W66	< 0.72	< 4.50	< 308.29	< 4.08

TABLE 3
Environmental TLD Summary

January 1, 2004 through December 31, 2004

Badge Number	Direction From MURR	Map Distance from MURR Stack (meters)	1st Qtr. 2004 Net mR	2nd Qtr. 2004 Net mR	3rd Qtr. 2004 Net mR	4th Qtr. 2004 Net mR	Total 2004 Net mR
1	Control	N/A	-1.4	0.2	-1.1	-0.7	-3.0
2	Control	N/A	-6.0	-0.4	-0.1	-0.4	-6.9
3	WSW	N/A	2.8	0.7	0.0	1.4	4.9
4	Spare	N/A	6.0	3.1	2.2	4.3	15.6
5	Spare	N/A	2.3	2.6	2.4	1.3	8.6
6	N	34	1.0	-0.2	1.9	-2.0	0.7
7	NE	57	2.0	1.1	-1.3	-0.4	1.4
8	SW	27	-6.8	-3.5	-0.9	0.8	-10.4
9	S	27	23.7	31.1	22.8	22.9	100.5
10	NE	149	-5.0	-7.1	0.7	-4.5	-15.9
11	NW	149	absent	-4.5	-5.6	-6.1	-16.2
12	ENE	301	8.3	0.9	2.5	2.2	13.9
13	NNE	316	-0.2	2.3	-1.4	-0.7	0.0
14	S	156	2.3	-0.4	0.5	0.3	2.7
15*	S	65	28.6	28.6	18.7	22.3	98.2
16	SE	107	-3.0	-6.5	-2.7	-4.0	-16.2
17	E	293	-3.7	-5.8	-1.5	-4.2	-15.2
18	NE	476	-2.1	-6.8	-3.0	-4.9	-16.8
19	NNE	606	-16.1	-12.4	-6.8	-7.7	-43.0
20	NE	907	-6.0	-10.0	-5.5	-8.1	-29.6
21	SE	236	1.3	-3.0	0.2	-3.0	-4.5
22	ESE	168	absent	-5.8	absent	-0.8	-6.6
23*	NW	110	8.8	-0.6	1.9	0.4	10.5
24	SSW	328	-5.3	-2.2	0.0	absent	-7.5
25	SSW	480	-1.9	-1.3	1.9	-2.2	-3.5
26	SW	301	-5.7	-4.6	0.4	-3.3	-13.2
27	WSW	141	-6.9	-11.1	-4.7	-8.1	-30.8
28**	WNW	210	absent	absent	absent	absent	0.0
29*	NW	255	9.0	9.0	1.4	-3.9	15.5
30	NNW	328	absent	-9.1	-0.9	-6.0	-16.0
31	NNW	671	-4.0	-2.9	-1.3	-0.8	-9.0
32	NNW	724	-6.4	-0.7	1.0	-3.0	-9.1
33	E	671	-8.3	absent	-3.9	-7.1	-19.3
34*	ENE	587	7.9	-9.7	-3.2	-8.9	-13.9
35	SSE	499	-4.2	-8.5	-4.5	-6.3	-23.5
36	SE	419	absent	-6.4	0.0	2.6	-3.8
37	NE	690	-4.5	-6.6	-2.1	-4.7	-17.9
38	NW	556	absent	-2.6	absent	-2.0	-4.6
39	W	491	absent	-9.2	0.0	-0.4	-9.6
40	N	514	-5.2	-6.1	1.3	-5.9	-15.9
41	NNE	137	-4.0	-10.0	-1.6	-7.4	-23.0
42	In Building	N/A	-2.1	1.1	-0.7	-0.4	-2.1
43	In Building	N/A	4.1	0.8	4.8	5.7	15.4
44	Spare	N/A	4.6	0.1	-13.5	2.1	-6.7
45	S	65	-3.5	-5.5	0.7	-1.4	-9.7

*TLD No. 23 and 34 left at site 4th quarter 2003 and 1st quarter 2004, total dose is divided between the two quarters. TLD No. 15 and 29 left at site 1st and 2nd quarter 2004, total dose divided between the two quarters.
**TLD No. 28 has been moved to a different tree at the same location to prevent it from being absent so often.

TABLE 4
Number of Facility Radiation and Contamination Surveys

January 1, 2004 through December 31, 2004

	Radiation	Surface Contamination*	Air Samples**	RWP's
January	57	57	63	4
February	44	44	62	6
March	58	58	64	4
April	57	56	63	7
May	54	52	60	4
June	75	73	66	5
July	40	39	60	6
August	62	62	61	5
September	42	42	46	7
October	53	52	56	5
November	44	44	55	4
December	59	59	64	5
TOTALS	**645**	**638**	**720**	**62**

* In addition, general building contamination surveys are conducted each normal work day.

** Air samples include stack Ar-41, containment Ar-41, sump entries, and hot cell entries.

Miscellaneous Notes

Rob Taylor was promoted to Health Physicist in August 2004.

Matt Ballew was promoted to Health Physics Technician II in February 2004.

During 2004, MURR shipped 828 cubic feet of low level radioactive waste.

SECTION IX

SUMMARY OF RADIATION EXPOSURES TO FACILITY STAFF, EXPERIMENTERS AND VISITORS

January 1, 2004 through December 31, 2004

TOTAL PERSONNEL DOSE (MREM) BY DOSIMETRY GROUP

Month	AC	DO	FSO	HC	RAG	IRR	NA	NS	OPS	PRO	RP	SH	SIL	Total
January	35	35	65	149	99	15	19	20	1117	103	69	50	40	1816
February	54	80	242	202	198	15	66	66	1824	174	86	83	64	3154
March	54	21	176	212	198	41	5	76	1332	102	75	50	117	2459
April	54	7	90	150	221	51	30	86	1489	90	106	64	54	2492
May	113	2	121	120	117	50	53	28	1307	89	56	58	59	2173
June	104	6	167	177	209	71	92	93	1756	66	105	63	57	2966
July	64	3	86	88	128	28	29	55	967	85	92	107	33	1765
August	35	5	55	125	137	76	7	124	1069	91	20	94	37	1875
September	17	15	35	125	163	71	8	40	1385	61	28	103	48	2099
October	7	5	29	232	250	38	10	31	1472	45	29	76	31	2255
November	5	8	29	165	103	59	18	12	1133	37	44	89	35	1737
December	17	0	211	138	121	62	14	22	1351	86	74	94	49	2239
Total to Date	559	187	1306	1883	1944	577	351	653	16202	1029	784	931	624	27030
Monthly Ave	47	16	109	157	162	48	29	54	1350	86	65	78	52	2253
Highest WB	22	34	107	83	81	48	19	35	133	48	33	76	103	
Highest EXT	450	50	2450	500	390	120	230	70	290	1520	958	480	270	

AC-Analytical Chemistry
DO-Director's Office
FSO-Shops
HC-Hot Cell
RAG-Health Physics
IRR-Irradiations
NA-Nuclear Analysis
NS-Neutron Scattering
OPS-Operations
PRO-Isotope Production
RP-Radiopharmaceutical
SH-Shipping
SIL-Silicon

WB=Whole Body EXT=Extremities

NOTE: Dosimetry services are provided by R.S. Landauer Jr. & Company (except self-reading dosimetry).

Analysis of personnel exposure levels indicates that exposures are significantly below the limits of 10 CFR 20.1201 and are generally maintained ALARA. Radiation workers who are not full time staff members have radiation exposures which are generally lower than full time radiation workers.