

UNIVERSITY of MISSOURI

RESEARCH REACTOR CENTER

September 15, 2015

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

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

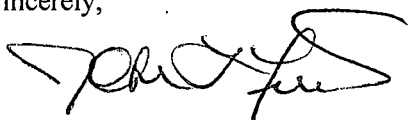
SUBJECT: Request for a Copy of the Emergency Plan in Support of the Renewal of Amended Facility License No. R-103 for the University of Missouri-Columbia Research Reactor (TAC No. ME1580)

On August 31, 2006, the University of Missouri-Columbia Research Reactor (MURR) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) to renew Amended Facility Operating License No. R-103.

On September 14, 2015, as part of the NRC's review of MURR's renewal request, the NRC requested a copy of the Emergency Plan (EP). Enclosed is a copy of the current MURR EP.

If there are questions regarding this response, please contact me at (573) 882-5319 or FruitsJ@missouri.edu. I declare under penalty of perjury that the foregoing is true and correct.

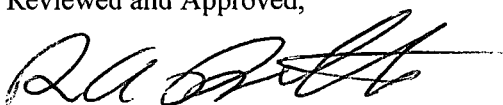
Sincerely,



John L. Fruits
Reactor Manager

ENDORSEMENT:

Reviewed and Approved,



Ralph A. Butler, P.E.
Director

Enclosed:

1. Emergency Plan for the University of Missouri Research Reactor (through Revision No. 17)

xc: Reactor Advisory Committee
Reactor Safety Subcommittee
Dr. Garnett S. Stokes, Provost
Dr. Henry C. Foley, Senior Vice Chancellor for Research
Mr. Alexander Adams, U.S. Nuclear Regulatory Commission
Mr. Geoffrey Wertz, U.S. Nuclear Regulatory Commission
Mr. Johnny Eads, U.S. Nuclear Regulatory Commission

State of Missouri
County of Boone

Subscribed and sworn to before me this
15 day of September 2015

Jacqueline L. Bohm
Jacqueline L. Bohm, Notary Public

My Commission Expires: March 26, 2019

JACQUELINE L. BOHM
Notary Public-Notary Seal
STATE OF MISSOURI
Commissioned for Howard County
My Commission Expires: March 26, 2019
Commission # 15634308





**UNIVERSITY OF MISSOURI-COLUMBIA
RESEARCH REACTOR (MURR)**

EMERGENCY PLAN

Amended Facility License No. R-103

Docket No. 50-186

Original Printing: August 12, 1982

Reprinted: December 8, 1989

M U R R
EMERGENCY PLAN--August 12, 1982
Reprinted December 8, 1989
(includes Revision 1 through 5)

<u>Revision No.</u>	<u>Date Filed</u>	<u>Revision No.</u>	<u>Date Filed</u>
<u>6</u>	<u>1/26/92</u>	<u> </u>	<u> </u>
<u>7</u>	<u>1/11/94</u>	<u> </u>	<u> </u>
<u>8</u>	<u>12/16/94</u>	<u> </u>	<u> </u>
<u>9</u>	<u>1/3/96</u>	<u> </u>	<u> </u>
<u>10</u>	<u>1/3/96</u>	<u> </u>	<u> </u>
<u>11</u>	<u>11/5/96</u>	<u> </u>	<u> </u>
<u>12</u>	<u>02/04/00</u>	<u> </u>	<u> </u>
<u>13</u>	<u>5-Nov-04</u>	<u> </u>	<u> </u>
<u>14</u>	<u>14-NOV-05 ^{KAN}</u>	<u> </u>	<u> </u>
<u>15</u>	<u>4-24-⁰⁷06 smv</u>	<u> </u>	<u> </u>
<u>16</u>	<u>4-17-12</u>	<u> </u>	<u> </u>
<u>17</u>	<u>10-17-14</u>	<u> </u>	<u> </u>
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25.....	4/13/07
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Appendix A (title page)	Original *
A-1	10/17/14
Appendix B (title page).....	Original *
B-1.....	3/19/04
B-2.....	3/19/04

* Original page as written in the August 12, 1982, submittal to the NRC; these pages have no revision dates on them.

EMERGENCY PLAN

UNIVERSITY OF MISSOURI RESEARCH REACTOR

1.0 INTRODUCTION

This emergency plan applies to the University of Missouri Research Reactor Facility (MURR). MURR is licensed pursuant to Title 10 Code of Federal Regulations, Chapter 1, Part 50, as a research and utilization reactor (class 104), Facility Operating License No. R-103, (Docket No. 50-186). Additionally, the MURR has a Byproduct Materials License, No. 24-00513-39.

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.

The plan contains a description of the elements of advance planning to cope with emergency situations connected with the operation of MURR and the conduct of experiments at MURR. The plan focuses primarily on handling of situations that may cause or may threaten to cause radiological hazards affecting the health and safety of University of Missouri staff or the public. It outlines the objectives to be met by the emergency procedures and defines the authority and responsibilities to achieve these objectives. Unusual or

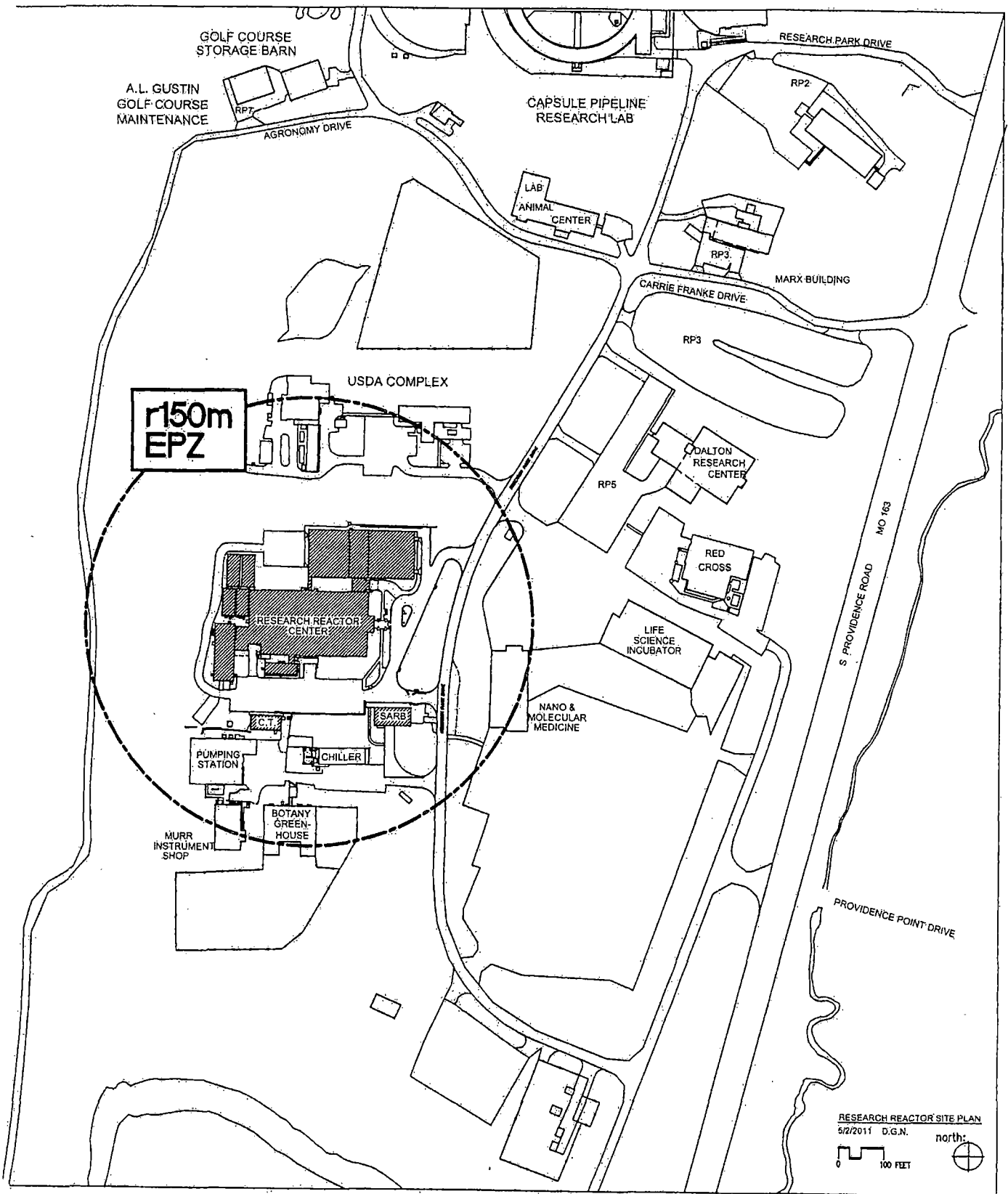


Figure I
2

Rev. 3/30/12

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 Planing for Research and Test Reactors, March 1982, and ANSI/ANS-15.16, Emergency Planning for Research Reactors draft II, November 29, 1981.

2.0 ORGANIZATION CONTROL OF EMERGENCIES

2.1 Emergency Director

The Emergency Director shall be responsible for the overall direction in the event of an emergency. The persons authorized to assume the Emergency Director responsibilities are the Facility Director, the Chief Operating Officer, the Reactor Manager (or Acting Reactor Manager), an Assistant Reactor Manager, and the Lead Senior Reactor Operator. In the event all of these persons are absent from the Facility during an emergency, the responsibility will be assumed by the next senior licensed operator.

The Lead Senior Reactor Operator will normally be the initial Emergency Director as outlined in Section 4.1, Activation of the Facility Emergency Organization. The duties of Emergency Director may be assumed by any of the above-mentioned individuals upon their arrival at the facility, and be passed from one individual to another, but only after being thoroughly briefed on the emergency and the action taken.

The Emergency Director shall have the following direct responsibilities:

1. Responsibility to identify and classify the emergency.
2. Responsibility for terminating an emergency and initiating recovery action.
3. Responsibility for authorizing volunteer emergency workers to incur radiation exposure in excess of normal occupational limits.

He should delegate the following specific responsibilities when the designated individual is present, or in their absence, he may delegate these responsibilities to any individual who has sufficient experience and knowledge to handle the responsibility.

1. MU News Bureau be delegated the responsibility for relating necessary information about the emergency situation to the news media and the public.

2. Health Physics Manager be delegated the responsibility for radiological assessments including onsite and offsite which includes determining radiation and contamination levels, and relaying this information to the Emergency Director. Health Physics Manager will use this information to determine where isolation is required and has the responsibility for supervision of access to isolated areas to minimize the spread of contamination and exposure of individuals.
3. Reactor Manager be delegated the responsibility for recovery operations.

2.2 Emergency Coordinator

The Emergency Coordinator shall be appointed by the Emergency Director to assist him as required and to ensure a record of the events during and following the emergency is maintained. The duties of the Emergency Coordinator may be assumed by any of the individuals indicated by the line of succession for the Emergency Director in Section 2.1.

The Emergency Coordinator shall have the following direct responsibilities:

1. Evaluating the need for evacuation activities.
2. Accountability of personnel following a facility or area evacuation.
3. Maintaining a roster of all personnel released from the site by the Emergency Director.

2.3 Emergency Organization

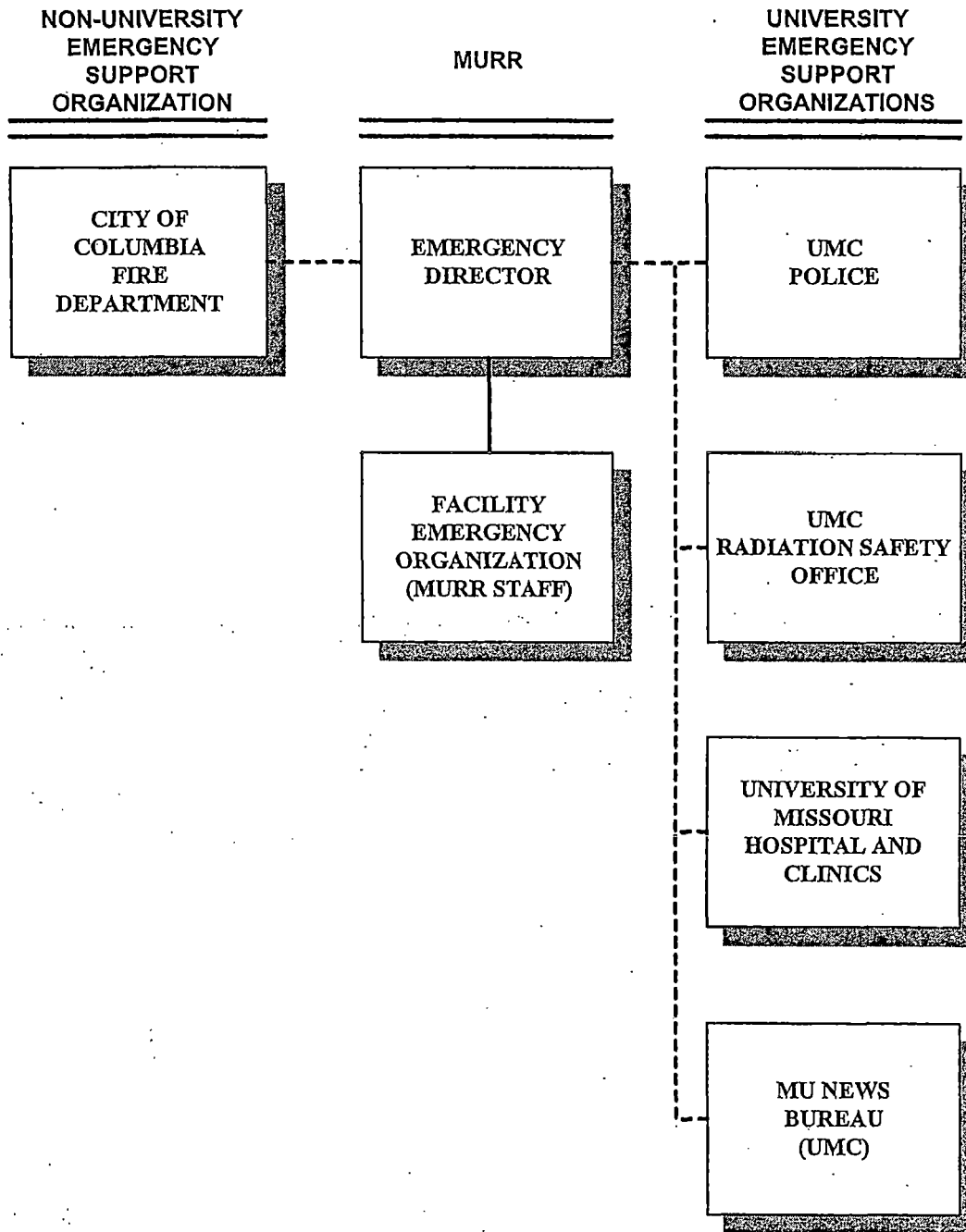
The Emergency Organization (Figure II) consists of two groups: (1) the Facility Emergency Organization, and (2) the Emergency Support Organizations.

The Facility Emergency Organization consists of MURR staff in the Director's Office, Reactor Operations, Health Physics and select staff members, based upon their expertise, who are on-site at the time of the emergency or that may be called in to assist as required. Other MURR staff members may be asked to assist as needed.

The Emergency Support Organizations are those organizations which may be called upon for specific assistance based on the type of emergency. These Emergency Support Organizations are all composed of University of Missouri staff except for the City of Columbia Fire Department which will provide fire fighting and life saving support. The University of Missouri Emergency Support Organizations are the UMC Radiation Safety Office to assist with radiological assessment, UMC Police to control access to the site area, University of Missouri Hospital and Clinics to handle medical emergencies, and the MU News Bureau to provide information to public and off-site authorities.

The MURR staff comprising the Facility Emergency Organization is of sufficient size to be able to man a continuous emergency response effort for as long as necessary. The specific actions to notify and mobilize the Facility Emergency Organization and the appropriate Emergency Support Organizations, including the current emergency notification list, shall be in the procedures used during emergencies.

FIGURE II
EMERGENCY ORGANIZATION CHART



3.0 CLASSIFICATION OF EMERGENCY CONDITIONS

3.1 Bases for Emergency Classifications

The radius of MURR's EPZ is greater than the value listed in Table 2 of ANSI/ANS 15.16 for research reactors authorized to operate at a power level of 10 MW. 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. Several natural phenomena such as earthquakes, tornadoes, etc.
3. Facility emergencies, such as prolonged fires 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.

3.3 Alert - Cont'd

3. Severe failure of fuel cladding or of fueled experiments when primary and containment boundaries exist to reduce releases.

3.4 Site Area Emergency

A Site Area Emergency condition may exist when events such as major damage to fuel has occurred with actual or imminent failure of primary system integrity and containment integrity. Monitoring at the site boundary should be conducted to assess the need for off-site protective actions. Protective evacuations to beyond the nearest site boundary (400 m) shall be performed.

4.0 ACTIVATION OF EMERGENCY ORGANIZATION

The activation of the Emergency Organization will be staged with the immediate activation of the Facility Emergency Organization, followed by the activation of Emergency Support Organizations as required.

4.1 Activation of the Facility Emergency Organization

The **Lead Senior Reactor Operator** or individual authorized to assume the Emergency Director position shall carry out the Activation of Facility Emergency Organization Procedure when he determines there are conditions exceeding the emergency action levels or if he feels conditions warrant activating the Facility Emergency Organization. The onsite Emergency Organization shall be activated to handle facility emergencies detailed in either the MURR Standard Operating Procedures or the Emergency Plan.

4.2 Activation of Emergency Support Organizations

The Emergency Support Organizations listed in Section 2.0 of the Emergency Plan provide diverse support capabilities which the Emergency Director shall call upon as detailed in the emergency procedures.

5.0 EMERGENCY RESPONSE

This section contains specific emergency response measures for each emergency class identified in Section 4 of the MURR Emergency Plan as well as certain Protective Actions common to all classes.

5.0.1 Protective Actions for All Classes

The Protective Actions for all classifications are based upon a PAG of 1 rem dose equivalent for whole body and 5 rem dose equivalent thyroid to members of the general public and MURR staff onsite.

Accountability of personnel following a facility or area evacuation shall be done by a surveillance team that will check the facility or area clear of personnel before the teams' evacuation.

Medical assistance shall be provided for persons with bodily injury requiring more than first aid.

The Emergency Director may authorize personnel voluntary whole body exposure up to 75 rem dose equivalent per individual for life-saving actions and up to 25 rem dose equivalent exposure per individual to save vital reactor equipment or to prevent exposures to members of the general public in excess of the PAGs.]

5.1 NOTIFICATION OF UNUSUAL EVENTS

5.1.1 Emergency Action Levels

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

5.1.2 Assessment Actions

During emergencies involving airborne radioactivity, containment, laboratory building and site boundary airborne radioactivity levels shall be determined by the 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.

5.1.3 Corrective Actions

A reactor shutdown should 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.

5.1.4 Specific Protective Actions

The Protective Actions shall be provided in the implementing procedure for this emergency class and may include evacuation of a room or small part of the MURR facility.

5.1.5 Subsequent Actions

Notifications that an UNUSUAL EVENT has occurred shall be made to the NRC, American Nuclear Insurers (ANI) and the State Emergency Management Agency (SEMA) as specified in EP-RO-015, "Emergency Notifications."

5.2 Alert

5.2.1 Emergency Action Levels

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

Alert conditions shall require providing emergency notification and status information to offsite organizations.

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 for 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 EP-RO-015, "Emergency Notifications."

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 radio-activity 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 EP-RO-015, "Emergency Notifications."

6.0 EMERGENCY FACILITIES AND EQUIPMENT

6.1 Emergency Control Center

The reactor control room or the facility lobby will normally become the Emergency Control Center when the Emergency Organization is activated. Should the situation require evacuation of the entire reactor building, the Emergency Control Center would be moved to the Research Park Development Building.

6.2 Assessment Facilities

The facility stack monitor and the reactor area monitoring system provide immediate indications for assessment of emergency conditions. Portable air sampling equipment and radiation survey meters are available for additional and more refined assessments of the emergency conditions. A fission product monitor provides a gross indication of coolant activity trends. Radiochemical analysis may be used for more accurate indication of coolant and other activities.

6.3 First Aid and Medical Facilities

First aid supplies are in an emergency locker and shall be maintained and inventoried and detailed in the Emergency Equipment Maintenance Procedure. Safety showers are installed in north and south hallways. Another shower is available in the men's restroom.

The University of Missouri Hospital and Clinics Emergency Action Plan provides for first aid, transportation, and appropriate medical assistance for persons involved in an emergency at MURR.

6.4 Decontamination Facilities

The normal decontamination facility consists of the shower in the men's restroom adjacent to the lobby (Emergency Control Center). Health Physics personnel will provide decontamination monitoring, supplies and assistance.

As part of contamination control during and following a radiological emergency, Health Physics personnel will survey all staff as per RP-HP-120, "Personnel Radioactive Contamination," prior to their release from the site by the Emergency Director.

Should an emergency require a facility evacuation or protective evacuation of the EPZ or other areas within the radius of the nearest site boundary, the Research Park Development Building (backup emergency control center) will become the contamination assessment and control facility. Facilities are available there for minor decontamination of personnel. Personnel requiring extensive decontamination will be sent to the UMH&C as outlined in the UMH&C Radiation Emergency Plan.

6.5 Communication Equipment

Provisions for communication by public telephone have been made with all Emergency Support Organizations. MURR has licensed walkie-talkie sets for constant communication between individuals at the Reactor Facility and as backup communication to the Research Park Development Building.

MURR has a paging system to announce emergency information to the Facility and to specific areas within the facility. Additionally, evacuation horns are available to signal a facility evacuation or a reactor containment evacuation.

Emergency notification rosters shall be posted in the Control Room, facility lobby, and in all controlled copies of the Emergency Plan Implementing Procedures Manual. The rosters shall include telephone numbers for required staff, University Emergency Support Organizations, Off-site Emergency Support Organization, and Emergency related State and Federal agencies.

6.6 Emergency Dosimetry

MURR staff responding to a radiological emergency will utilize their normally assigned dosimetry (PC, film badge and finger rings) and any added high range dosimetry deemed necessary by the Emergency Director.

Provisions for personnel dosimetry for off-site personnel responding to emergencies is contained in EP-RO-019, "Emergency Dosimeters."

7.0 RECOVERY

The Emergency Director may secure from the emergency when conditions are stable and less than the Emergency Action Levels for Notification of Unusual Event. The Recovery Organization will be the Emergency Organization. The Emergency Director shall assess the potential radiological affects to onsite and offsite personnel before returning access to portions of the facility that have been evaluated because of the emergency and the Emergency Organization shall determine the radiological conditions within these affected areas are safe before access to them is restored.

During recovery from each emergency with Notification of Unusual Events classification action levels or greater, procedures shall be written and approved for handling significant evolutions before they are performed.

8.0 MAINTAINING EMERGENCY PREPAREDNESS

The Reactor Manager is responsible for maintaining emergency preparedness.

8.1 Training

MURR staff and users annually receive training in radiation safety and emergency procedures. The UMC Police, UMC Radiation Safety Office, City of Columbia Fire Department, MU News Bureau, and University of Missouri Hospital and Clinics shall biennially be invited to train on their role in maintaining Emergency Preparedness. The procedure detailing the training requirements is EP-RO-003, "Emergency Preparedness Training."

8.2 Drills

An annual on-site emergency drill shall be conducted as an action drill with each required emergency measure being executed as realistically as is reasonably possible, including the use of appropriate emergency equipment. At least every two years the drill shall contain provisions for coordination with emergency support personnel and should test, as a minimum, the communication links and notification procedures with the emergency support organizations.

The Reactor Manager shall provide critiques of all drills, including timely evaluation of observer comments and correction of identified deficiencies and procedures.

8.3 Plan Review and Update

The Emergency Plan and the Procedures that implement the Emergency Plan shall be annually reviewed and revised as necessary. The revisions will be reviewed and approved in accordance with MURR Technical Specification 6.1. Approved revisions will be distributed to manual holders in a timely fashion. The Reactor Manager

shall provide for any necessary retraining needed due to revision in the Emergency Plan or Associated Procedures.

8.4 Equipment Maintenance

The operational readiness of emergency equipment and supplies required by the Procedures that implement the Emergency Plan shall be maintained, calibrated, tested, and periodically inventoried as detailed in EP-RO-020, "Emergency Equipment Maintenance." The procedure shall cover detailed requirements such as the required inventory of emergency supplies (Anti-C's, shoe covers, etc.) to be maintained at designated readily accessible locations.

9.0 DEFINITIONS

9.1 Air Effluent Concentration (AEC) as listed in 10CFR20, Appendix B, Table 2, Column 1.]]

9.2 Annually]
At intervals not to exceed 15 months.

9.3 Biennially]
At intervals not to exceed 30 months.

9.4 Emergency]
An emergency is a condition which calls for immediate action, beyond the scope of normal operating procedures, to avoid an accident or to mitigate the consequences of one.

9.5 Emergency Action Levels]
Specific instrument readings, or observations; radiological dose or dose rates; or specific contamination levels of airborne, waterborne, or surface-deposited radioactive materials that may be used as thresholds for establishing emergency classes and initiating appropriate emergency measures.

9.6 Emergency Classes]
Emergency classes are classes of accidents grouped by severity level for which predetermined emergency measures should be taken or considered.

9.7 Emergency Plan]
The emergency plan is the document that provides the basis for actions to cope with an emergency. It outlines the objectives to be met by the emergency procedures and defines the authority and responsibilities to achieve such objectives.

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 the MU Recreation Trail; east of the MKT Nature and Fitness Trail. The University of Missouri owned and controlled grounds extend beyond these boundaries but are not included in our definition of "on-site".

9.14 Operations Boundary

The outside walls of the MURR building are the operations boundary. This area is where the MURR Director has direct authority over all activities. The area within this boundary shall have prearranged emergency procedures with evacuation routes known to personnel frequenting the area.

9.15 Protective Action Guides (PAG)

Projected radiological dose or dose commitment values to individuals that warrant protective action following a release of radioactive material. Protective actions would be warranted provided the reduction in individual dose expected to be achieved by carrying out the protective action is not offset by excessive risks to individual safety in taking the protective action. The projected dose does not include the dose that has unavoidably occurred prior to the assessment.

9.16 Reactor Containment Building

The concrete enclosure within the operations boundary housing the reactor core, pool and irradiated fuel storage facilities.

9.17 Research Park Development Building (RPDB)

The offices and laboratories for the UMC Radiation Safety Office are located in this building therefore it serves as a good backup emergency control center.

9.18 Research Reactor

A device designed to support a self-sustaining neutron chain reaction for research, developmental, educational, training, or experimental purposes, and which may have provisions for production of nonfissile radioisotopes.

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 and Health Physics which contain detailed procedures for carrying out their respective responsibilities in handling routine and emergency events.

9.22 Surveillance Team

The person or persons 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 while evacuating the containment building.

9.23 UMHC – University of Missouri Hospitals and Clinics

The closest hospital to the facility, 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 of 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.	
	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"> 1) Concentration of airborne radioactivity at the stack monitor exceeding 100,000 AEC* averaged over 24 hours. 2) The projected concentration of airborne radiological effluent at the distance corresponding to the nearest site boundary exceeding 75 mrem whole body accumulated in 24hours 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. 4) Loss of physical control of the facility. 5) 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. 	<ol style="list-style-type: none"> 1) Assure that emergency organization is ready to respond if situation becomes more serious; 2) to perform confirmatory radiation monitoring; 3) provide communications link to offsite authority.

* 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	<ol style="list-style-type: none"> 1) Concentration of airborne radioactivity at the stack monitor exceeding 500,000 AEC* averaged over 24 hours. 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 3) Radiation levels at the distance corresponding to the nearest site boundary of 100 mrem/hr for 1 hour whole-body of 500 mem thyroid dose. 4) 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. 	<ol style="list-style-type: none"> 1) Assure emergency organization manned; 2) assure monitoring teams dispatched; 3) provide communi-cation with offsite authorities; 4) provide information to the public through offsite authorities.

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

APPENDIX A

AGREEMENT LETTER



CITY OF COLUMBIA, MISSOURI

OFFICE OF CITY MANAGER

August 13, 2014

John L. Fruits, Reactor Manager
University of Missouri – Columbia
Research Park Drive
Columbia, MO 65211-3400

Dear Mr. Fruits,

This letter is to provide assurance that the City of Columbia Fire Department will respond to fires or other emergency situations should they occur at the research reactor. We understand that the research reactor staff will continue to conduct training sessions at least every two years for Fire Department personnel, including MURR facility orientation and review of selected health physics procedures specific to the MURR facility. The responsibility for maintaining and scheduling training for our Fire Department, which will participate in such training, will remain with the MURR staff.

Sincerely,

A handwritten signature in black ink that reads "Mike Matthes".

Mike Matthes
City Manager

Cc: Chuck Witt, Fire Chief

APPENDIX B

LIST OF IMPLEMENTING PROCEDURES

APPENDIX B
LIST OF IMPLEMENTING PROCEDURES

EP-RO-001	Definitions
EP-RO-002	Emergency Responsibilities
EP-RO-003	Emergency Preparedness Training
EP-RO-020	Emergency Equipment Maintenance
OA-020	Emergency Equipment
EP-RO-004	Fire
OA-010	Fire Extinguisher Locations and Types
EP-RO-005	Medical Emergency
EP-RO-006	Radiological Emergency
EP-RO-017	Emergency Air Sampling
EP-RO-018	Emergency Radiation Exposure
EP-RO-019	Emergency Dosimeters
EP-RO-007	Severe Natural Phenomenon
EP-RO-008	Threat to Security
EP-RO-011	Site Area Emergency
EP-RO-010	Alert
EP-RO-009	Notification of Unusual Event
EP-RO-012	Reactor Isolation
EP-RO-013	Facility Evacuation
EP-RO-014	EPZ and Site Area Evacuations
EP-RO-015	Emergency Notifications
EP-RO-016	Public Information

LIST OF IMPLEMENTING PROCEDURES
(CONT.)

FM-100	Emergency Declaration
FM-101	FEO Management
FM-102	Emergency Event Log
FM-103	Facility Status
FM-104	Emergency Call List
FM-105	Initial/Follow-Up Emergency Message
FM-106	Log of Personnel Released From Site
OA-009	Combined Emergency Flowcharts
FM-110	Fire Flowchart
FM-111	Medical Flowchart
FM-112	Radiological Flowchart
FM-113	Severe Natural Phenomenon Flowchart
FM-114	Security Flowchart
FM-115	Plant Conditions Flowchart
FM-116	Classification Flowchart
FM-117	Reactor Isolation Flowchart
FM-118	Evacuation Flowchart

University of Missouri-Columbia Hospital & Clinics Radiation
Emergency Plan, Annex Q

Reactor Operations Procedures

Regulatory Assurance Procedures