REED COLLEGE *Portland, Oregon 97202*

REACTOR FACILITY

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

June 18, 2009

Docket: 50-288
Subject: Request for Technical Specification Amendment
Attachment: RRR Technical Specifications

Attached please find Amendment 8 to the Reed Research Reactor Technical Specification, along with a safety evaluation. This change is designed to clear up some ambiguities and to eliminate antiquated or inapplicable information. This does not make any substantive changes to the Technical Specifications and does not reduce their safety or effectiveness.

Generic Changes

Moved revision date information to the end. Added current revision date to front. Changed the format of the revision information in the text.

Changed font to Times New Roman.

Standardized on "control rods" from "control elements" since both were used.

Specific Paragraphs

A.1 Shutdown

Corrected typographical error by changing "operations" to "operation."

B. Site

Changed the definition of the site boundary to be 250 feet from the center of the core to rather than the center the pool to be consistent with other documents and for clarity. The center of the core is approximately 30 inches from the center of the pool.

D. Reactor Pool and Bridge

Updated to modern units and rounded temperature limit in conservative direction.

E. Reactor Core

1. Removed the option of experiments occupying more than one fuel element location since RRR does not have that capability.
2. Changed "1/5" to "20%" for stylistic reasons.

4020
NRR

3203 SE Woodstock Blvd., Portland, OR 97202-8199 *503-777-7222 Fax: 503-777-7274 reactor@reed.edu*

F. Control and Safety Systems

4. Removed the word "standard" since RRR only has standard control rods.

9.b. Clarified what the ventilation system interlocks are.

G. Radiation Monitoring

1. Clarified the wording.

2. Clarified that the monitor must be measuring the air in or from the reactor room rather than the physical location of the monitor.

H. Fuel Storage

2. Removed "fuel devices" which is not applicable to RRR.

I. Administrative Requirements

Added the health physicist to the Radiation Safety Committee in addition to the Reactor Operations Committee.

Changed the name of the Radiation Safety Committee to the Reactor Safety Committee to avoid confusion with the Reed Campus Radiation Safety Committee.

Clarified that faculty member may be on Radiation Safety Committee, but doesn't need to be.

4. Corrected punctuation and grammar.

5. Corrected spelling and changed to be consistent with G.2.

J. Experiments

3. Specified that the proposed experiment must have a written procedure.

3. Specified that the Reactor Operations Committee must approve the experiments, not just review them.

8. Updated to modern units.

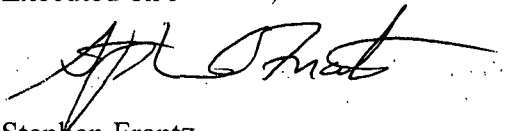
TABLE I

Clarified that the setpoint may be lower than 110%.

Please contact us if you have any questions. Thank you.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on June 18, 2009.



Stephen Frantz

TECHNICAL SPECIFICATIONS FOR THE REED COLLEGE TRIGA MARK I REACTOR

ORIGINAL DATE: July 2, 1968
REVISION DATE: June 8, 2009

The dimensions, measurement, and other numerical values given in these specifications may differ from measured values owing to normal construction and manufacturing tolerances, or normal accuracy of instrumentation.

A. Definitions

1. Shutdown

The reactor, with fixed experiments in place, shall be considered to be shut down (not in operation) whenever all of the following conditions have been met: (a) the console key switch is in the "off" position and the key is removed from the console and under the control of a licensed operator (or stored in a locked storage area); (b) sufficient control rods are inserted so as to assure the reactor is subcritical by a margin greater than 0.7% delta k/k cold, without xenon; (c) no work is in progress involving fuel handling or refueling operations or maintenance of its control mechanisms. *(Change 8)*

2. Steady State Mode

Steady-state mode shall mean operation of the reactor at power levels not to exceed 250 kilowatts utilizing the scrams in Table I and the interlocks in Table II. However, for the purpose of testing the 110% full power safety circuits, an exception shall be made to allow the reactor to be operated at power levels not to exceed 287.5 kilowatts during the testing period.

3. Operable

A system or component shall be considered operable when it is capable of performing its intended functions in its normal manner.

4. Experiment

Experiment shall mean:

(a) Any apparatus, device, or material installed in the core or experimental facilities (except for underwater lights, fuel element storage racks and the like) which is not a normal part of these facilities.

(b) Any operation designed to measure reactor parameters or characteristics.

5. Experimental Facilities

Experimental facilities shall mean rotary specimen rack, vertical tubes, pneumatic transfer systems, central thimble, and in-pool irradiation facilities.

6. Reactor Safety Circuits

Reactor safety circuits shall mean those circuits, including their associated input circuits, which are designed to initiate a reactor scram.

7. Surveillance Periods

The term weekly means once each week (interval not to exceed ten days); bimonthly means once every two months (interval not to exceed eleven weeks); semi-annually means every six months (interval not to exceed thirty-two weeks); annually means once each year (interval not to exceed sixty-five weeks); and biennially means once every two years (interval not to exceed one hundred and thirty weeks). *(Change 6)*

B. Site

The minimum distance from the center of the reactor core to the boundary of the exclusion area shall be 250 feet. *(Change 8)*

C. Reactor Building

1. The reactor shall be housed in a closed room designed to restrict leakage. The minimum free volume in the reactor room shall be 12,000 cubic feet.
2. All air or other gas exhausted from the reactor room and from associated experimental facilities during the reactor operation shall be released to the environment at a minimum of 12 feet above ground level.

D. Reactor Pool and Bridge

1. The reactor core shall be cooled by natural convective water flow. Corrective action shall be taken if during reactor operation the pool water is less than 16 feet above the top grid plate. The bulk pool temperature shall be monitored while the reactor is in operation and the reactor shall be shut down if the temperature exceeds 48°C. *(Change 8)*
2. The pool water shall be sampled for conductivity at least weekly. Conductivity averaged over a month shall not exceed 2 microSiemens per centimeter. *(Changes 6, 8)*

E. Reactor Core

1. The core shall be an assembly of TRIGA Mark I aluminum clad and/or stainless-steel clad fuel-moderator elements arranged in a close-packed array except for replacement of single individual elements with in-core irradiation facilities or control rods. The reflector (excluding experiments and experimental facilities) shall be water or a combination of graphite and water. *(Changes 3, 8)*
2. The maximum available excess reactivity above cold, critical, without xenon, shall be 2.25% delta k/k with experiments in place.
3. Each standard fuel element shall be visually inspected at least once every ten years. At least 20% of all the fuel elements of the core shall be inspected biennially. If indication of apparent deterioration or distortion is found, the fuel element(s) shall be removed from the core. *(Changes 1, 4, 6, 8)*
4. Any fuel element which exhibits a clad break as indicated by a measurable release of fission products shall be located and removed from service before resumption of routine reactor operation.

F. Control and Safety Systems

1. The control rods shall have scram capability and the poison section shall contain borated graphite, B_4C powder, or boron and its compounds in solid form as a poison in an aluminum or stainless steel clad. *(Change 6)*

2. The control rods shall be visually inspected at least once every two years. If indication of significant distortion or deterioration is found, the element(s) will be replaced.

3. The minimum shutdown margin (with fixed experiments in place) provided by operable control rods in the cold condition, without xenon, with the most reactive of the operable control rods withdrawn shall be 0.4% delta k/k.

4. The maximum rate of reactivity insertion associated with movement of a control rod shall be no greater than 0.12% delta k/k sec. *(Change 8)*

5. The type and minimum number of safety circuits which shall be operable for reactor operation are shown in Table I.

6. The type and minimum number of interlocks which shall be operable for reactor operation are shown in Table II.

7. The reactor instrumentation channels and safety circuits as listed in Table I shall be verified to be operable at least once each day the reactor is operated unless the operation extends continuously beyond one day, in which case their operability need only be verified prior to beginning the extended operation.

8. Following maintenance or modification of the control or safety systems, it shall be verified that the affected system is operable before reactor operation is resumed.

9. The tests listed below shall be performed at least once semi-annually, with the exception that if the reactor is operating continuously, the tests shall be performed after the first shutdown if this occurs more than six months after the previous tests:
   a. Verification that all control rod drop times are less than one second. If drop time is found to be greater than this, the element shall not be considered operable.
   b. A functional test of the ventilation system interlocks. Ventilation exhaust from the reactor room will shift to a filtered exhaust upon a manual signal or on high radioactivity of the air in the reactor room. *(Change 8)*

10. The linear power level channel shall be calibrated at least annually by thermal power calibration.

G. Radiation Monitoring

1. The radiation levels within the reactor room shall be monitored by at least one area radiation monitor during reactor operation or when work is done on or around the reactor core or experimental facilities. The monitor shall have a readout and an audible alarm. It

may be replaced for up to one week for repairs by a detector capable of displaying gamma dose rate. *(Changes 6, 8)*

2. A continuous air monitor with readout and audible alarm shall be operable and monitoring the air in or from the reactor room when the reactor is operating. *(Change 8)*

3. The alarm set points for the above radiation monitoring instrumentation shall be verified at least once a week. This instrumentation shall be calibrated at least once a year.

H. Fuel Storage

1. All fuel elements or fueled devices shall be rigidly supported during storage in a safe geometry (k_{eff} less than 0.8 under all conditions of moderation).

2. Irradiated fuel elements shall be stored in an array which will permit sufficient natural convection cooling such that the fuel element temperature will not exceed design values. *(Change 8)*

I. Administrative Requirements

1. The facility shall be under the direct control of the Facility Director. He or she shall be responsible to the President of Reed College for safe operation and maintenance of the reactor and its associated equipment. The Director's staff shall include a reactor supervisor, senior reactor operators, and reactor operators. The Director (or appointee) shall review and approve all experiments and experimental procedures prior to their use in the reactor. The Director shall enforce rules for the protection of personnel against radiation. *(Change 6)*

2. A Reactor Safety Committee shall review and approve safety standards associated with operation and use of the facility. It shall report directly to the President of Reed College. Its membership shall consist of a qualified health physicist, as well as faculty, staff, and/or individuals from outside organizations not connected with operation of the reactor facility. It shall meet at least twice yearly to review safety aspects of facility operation. *(Changes 2, 8)*

3. A Reactor Operations Committee shall be composed of a minimum of four members of the faculty and facility staff, including the reactor supervisor and a qualified health physicist. It shall review facility operations at least twice yearly and shall meet as required to review all questions of safety of operation and scheduling of work of a non-routine nature. It shall review all experiments of the following types: *(Change 2)*

   (a) Any experiment involving fissionable material.

   (b) Any new experiment of a type not previously reviewed by the committee.

   (c) Any experiment involving a change of core configuration or change in equipment associated with the reactor.

   The Reactor Operations Committee shall be responsible for determining whether a proposed change, test or experiment would constitute an unreviewed safety question or a change in technical specifications. The Reactor Operations Committee shall establish

written procedures regarding quorums, subcommittees, review of experiments and operations and others as appropriate. *(Change 8)*

4. Any additions, modifications, or maintenance to the core and its associated support structure, the pool structure, rod drive mechanisms, or the reactor safety system shall be made and tested in accordance with the specifications to which the systems or components were originally designed and fabricated, or to specifications approved by the Reactor Operations Committee as suitable and not involving an unreviewed safety question. The reactor shall not be placed in operation until the affected system has been verified to be operable.

5. Written instructions shall be in effect for, but not limited to:
   (a) Checkout and calibration of reactor operating instrumentation and control, control rod drives, and area radiation monitor and air monitor. *(Change 8)*
   (b) Reactor startup, routine operation and reactor shutdown.
   (c) Emergency and abnormal conditions, including evacuations, reentry and recovery.
   (d) Fuel loading or unloading.
   (e) Control rod removal and replacement.
   (f) Maintenance operations which may affect reactor safety.

J. Experiments

1. Prior to performing any new reactor experiment, the proposed experiment shall have a written proposed experimental procedure to be evaluated by a person or persons appointed by the Facility Director to be responsible for reactor safety. The Director shall consider the experiment in terms of its effect on reactor operation and the possibility and consequences of its failure, including, where significant, consideration of chemical reactions, physical integrity, design life, proper cooling, interaction with core components, and reactivity effects. The Director shall determine whether, in his or her judgment, the experiment by virtue of its nature and/or design does not constitute a significant threat to the integrity of the core or to the safety of personnel. Following a favorable determination and prior to conducting an experiment, the Director must sign an authorization form containing the basis for the favorable determination. *(Changes 6, 8)*

2. No experiment shall be performed if failure of such experiment could lead to a failure of a fuel element or of other experiments and these associated failures could result in a measurable increase in reactivity or a measurable release of radioactivity.

3. No new experiment shall be performed until the proposed experimental procedure for that experiment or type of experiment has been reviewed and approved by the Reactor Operations Committee. *(Change 8)*

4. The following limitations on reactivity shall apply to all experiments:
   (a) The reactivity worth of any individual in-core experiment shall not exceed $1.35;

(b) The total reactivity worth of in-core experiments shall not exceed $2.00. This includes the potential reactivity which might result from experimental malfunction, experiment flooding or voiding and removal or insertion of experiments;

(c) Experiments having reactivity worths greater than $1.00 shall be securely located or fastened to prevent inadvertent movement during reactor operations.

5. Experiments containing materials corrosive to reactor components, compounds highly reactive with water, and liquid fissionable materials shall be doubly encapsulated.

6. Explosive materials shall not be irradiated in the reactor.

7. Experiment materials, except fuel materials, which could off-gas, sublime, volatilize or produce aerosols under (a) normal operating conditions of the experiment or reactor, (b) credible accident conditions in the reactor, or (c) possible accident conditions in the experiment shall be limited in activity such that if 100% of the gaseous activity or radioactive aerosols produced escaped to the reactor room or the atmosphere, the airborne concentration of radioactivity averaged over a year would not exceed the limits of Appendix B of 10 CFR Part 20.

8. The following assumptions shall be used in calculations regarding experiments:

   (a) If the effluent from an experiment facility exhausts through a holdup tank which closes automatically on high radiation level, 10% of the gaseous activity or aerosols produced will escape.

   (b) If the effluent from an experiment facility exhausts through a filter installation designed for greater than 99% efficiency for 0.3-micron particles, 10% of the aerosols produced will escape.

   (c) For materials whose boiling point is above 55°C and where vapors formed by boiling this material could escape only through an undisturbed column of water above the core, 10% of these vapors will escape.

9. Each fueled experiment shall be controlled such that the total inventory of iodine isotopes 131 through 135 in the experiment is no greater than 1.5 curies and the maximum strontium-90 inventory is no greater than 5 millicuries.

10. If a capsule fails and releases material which could damage the reactor fuel or structure by corrosion or other means, physical inspection shall be performed to determine the consequences and need for corrective action. The results of the inspection and corrective action taken shall be reviewed by the Facility Director and determined to be satisfactory before operation of the reactor is resumed.

K. Plant Operating Records *(Change 2)*

In addition to the requirements of applicable regulations and in no way substituting therefore, records and logs of the following items, as a minimum, shall be kept in a manner convenient for review and shall be retained as indicated:

1. Records to be retained for a period of at least five (5) years:

   (a) reactor operations, including unscheduled shutdowns;
   (b) principal maintenance activities and the reasons therefore;
   (c) shipments of radioactive materials;
   (d) equipment and components surveillance activities;
   (e) experiments performed with the reactor.

2. Records to be retained for the life of the facility:

   (a) gaseous and liquid radioactive waste released to the environs;
   (b) off-site environmental monitoring surveys;
   (c) facility radiation and contamination surveys;
   (d) fuel inventories and transfers;
   (e) updated, corrected and as-built facility drawings.

TABLE I
MAXIMUM REACTOR SAFETY SYSTEM SCRAMS
(Change 8)

Originating Channel	Set Point
1. Linear	≤110% of full power
2. Percent Power	≤110% of full power
3. Scram button on console	Manual

TABLE II
MINIMUM INTERLOCKS

Action Prevented

1. Control rod withdrawal without a neutron induced signal on a reactor instrument channel. *(Change 7)*

2. Simultaneous manual withdrawal of two control rods.

Revision History

Change 1 issued July 28, 1969.
Change 2 issued October 3, 1972.
Change 3 issued August 22, 1973.
Change 4 issued January 17, 1974.
Change 5 was not issued.
Change 6 issued September 17, 1998.
Change 7 issued March 11, 2003.
Change 8 issued June 8, 2009.

62A 10CFR50.59 Screen Form 62A

Screen Number: 09-06 Date: 06/12/09

Description:

Amendment Number 8 to Technical Specification.

Yes	No		
√		1.	Does the proposed change, test, or experiment (activity) require a change to the Technical Specifications?
	√	2.	Does the proposed activity involve a change to a structure, system, or component (SSC) that adversely affects an Updated Final Safety Analysis Report (UFSAR) described design function?
	√	3.	Does the proposed activity involve a change to a procedure that adversely affects an UFSAR design function are performed or controlled?
	√	4.	Does the proposed activity involve revising or replacing an UFSAR described evaluation methodology that is used in establishing the design basis or used in the safety analysis?
	√	5.	Does the proposed activity involve a test or experiment not described in the UFSAR where an SSC is utilized or controlled in a manner that is outside the reference bounds of the design for that SSC or is inconsistent with the analysis of descriptions in the UFSAR?
	√	6.	Does the proposed activity present a hazard of another sort (fire, safety, ALARA, etc.)?

If 1 is "yes", then a license amendment must be submitted to the NRC.

If 2, 3, 4, 5, or 6 are "yes", then perform a full 10CFR50.59 analysis.

Vanessa Hulyk
Associate Director Signature

12 June 2009
Date

Director Signature

6-12-09
Date

This involves an amendment to the Technical Specification so it automatically requires a full evaluation with SOP 62B.

62B 10CFR50.59 Evaluation Form 62B

Screen Number: 09-06 Date: 06/12/09

Description:

Amendment Number 8 to Technical Specification.

Does the proposed change, test, or experiment (activity):

Yes	No		
___	√	1.	Result in more than a minimal increase in the frequency of occurrence of an accident previously evaluated in the Updated Final Safety Analysis Report (UFSAR)?
___	√	2.	Result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety previously evaluated in the UFSAR?
___	√	3.	Result in more than a minimal increase in the consequences of an accident previously evaluated in the UFSAR?
___	√	4.	Result in more than a minimal increase in the consequences of a malfunction of an SSC important to safety previously evaluated in the UFSAR?
___	√	5.	Create a possibility for an accident of a different type than any previously evaluated in the UFSAR?
___	√	6.	Create a possibility for a malfunction of an SSC important to safety with a different result than any previously evaluated in the UFSAR?
___	√	7.	Result in a design basis limit for a fission product barrier as described in the UFSAR being exceeded or altered?
___	√	8.	Result in a departure from a method of evaluation described in the UFSAR used in establishing the design bases or in the safety analyses?

Attach a written evaluation of each of the above questions.

If any answer is "yes", then a license amendment must be submitted to the NRC.

Director Signature — Date: 6-12-09

ROC/RSC Chair — Date: 6-17-09

Amendment 8 to the Reed Research Reactor (RRR) Technical Specification (TS)

Generic Changes

Moved revision date information to the end. Added current revision date to front. Changed the format of the revision information in the text. Changed font to Times New Roman. Standardized on "control rods" from "control elements" since both were used.

The generic changes have no safety significance since they are entirely stylistic.

Specific Paragraphs

A.1 Shutdown Corrected typographical error by changing "operations" to "operation."

The change to Section A has no safety significance since it corrects a typographical error.

B. Site Changed the definition of the site boundary to be 250 feet from the center of the core to rather than the center the pool to be consistent with other documents and for clarity. The center of the core is approximately 30 inches from the center of the pool.

The change to Section B has minimal safety significance. It corrects a discrepancy between RRR Emergency Plan and TS on where to place the origin of the 250-foot circle. This harmonizes the two and produces a change of 2.5 feet out of 250 feet.

D. Reactor Pool and Bridge Updated to modern units and rounded temperature limit in conservative direction.

The changes to Section D have no safety significance since they only changes the units. The conductivity was changed from micromhos to microSiemens. In changing the temperature units, we rounded down from 48.9°C to 48°C.

E. Reactor Core 1. Removed the option of experiments occupying more than one fuel element location since RRR does not have that capability. 2. Changed "1/5" to "20%" for stylistic reasons.

The changes to Section E have no safety significance since they eliminate an option that has never been applicable to RRR, and make a stylistic change.

F. Control and Safety Systems 4. Removed the word "standard" since RRR only has standard control rods. 9.b. Clarified what the ventilation system interlocks are.

The change to Section F has no safety significance since it actually tightens the requirements. Previously the interlocks were undefined. The wording change is stylistic.

G. Radiation Monitoring

1. Clarified the wording.
2. Clarified that the monitor must be measuring the air in or from the reactor room rather than the physical location of the monitor.

The changes to Section G have minimal safety significance since they correct the wording to match the existing situation. The actual location of the detector is not the intent. The intent is to monitor the air from the reactor room. Some of our air monitors are located outside the reactor room so that we can access their filters during an emergency. They sample the air coming from the reactor room, but are not physically inside the reactor room. This change reflects this reality.

H. Fuel Storage

2. Removed "fuel devices" which is not applicable to RRR.

The change to Section H has no safety significance since it removes language that is not applicable to RRR.

I. Administrative Requirements

Added the health physicist to the Radiation Safety Committee in addition to the Reactor Operations Committee.

Changed the name of the Radiation Safety Committee to the Reactor Safety Committee to avoid confusion with the Reed Campus Radiation Safety Committee.

Clarified that a faculty member may be on the Radiation Safety Committee but doesn't have to be.

4. Corrected punctuation and grammar.
5. Corrected spelling and changed to be consistent with G.2.

The change to Section I has minimal safety significance since it increases the health physicist coverage to both committee rather than just one. The other changes are minor or grammatical.

J. Experiments

3. Specified that the proposed experiment must have a written procedure.
3. Specified that the Reactor Operations Committee must approve the experiments, not just review them.
8. Updated to modern units.

The change to Section J has no safety significance since it specifies requirements that have always existed, but spells them out. It also changes from Fahrenheit to Celsius.

TABLE I

Clarified that the setpoint may be lower than 110%.

The change to Table I has no safety significance since it is stylistic.