REED COLLEGE *Portland, Oregon 97202*

REACTOR FACILITY

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

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

The Reed Reactor Facility hereby requests an amendment to its Technical Specification. The amendment would change the wording to allow using a different installed nuclear instrument for an interlock. The old instrument reads in counts per second and the new instrument (Sorrento FC-10 Fission Chamber with a NLW-1000 Logarithmic Wide Range Meter) reads in percent power, although it actually measures counts. This change does not reduce the margin of safety of the facility. The interlocks section would be changed as follows:

OLD TABLE II

MINIMUM INTERLOCKS

Action Prevented

1. Control element withdrawal with less than two induced counts per second on the startup channel.
2. Simultaneous manual withdrawal of two control elements.

NEW TABLE II

MINIMUM INTERLOCKS

Action Prevented

1. Control element withdrawal with power level below the equivalent of two neutron induced counts per second.
2. Simultaneous manual withdrawal of two control elements.

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Revised edition, dated September 17, 1998. Checked with NRC License Authority File for accuracy. Includes Change No. 1 issued July 28, 1969, Change No. 2 issued October 3, 1972, Change No. 3 issued August 22, 1973, change No. 4 issued January 17, 1974, change No. 6 issued September 17, 1998, and change No. 7 issued January 31, 2003.

TECHNICAL SPECIFICATIONS FOR THE REED COLLEGE TRIGA MARK I REACTOR

DATE: July 2, 1968

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 operations) 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.

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). (Amended by Change No. 6)

B. Site

The minimum distance from the center of the reactor pool to the boundary of the exclusion area shall be 250 feet.

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 120 °F. (Note: 48.9°C)

2. The pool water shall be sampled for conductivity at least weekly . Conductivity averaged over a month shall not exceed 2 micromhos per centimeter. (Amended by Change No. 6)

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 (1) replacement of single individual elements with in core irradiation facilities or control rods; (2) two separated experiment positions in the D through E rings, each occupying a maximum of three fuel element positions. (Amended by Change No. 3) The reflector (excluding experiments and experimental facilities) shall be water or a combination of graphite and water .

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 1/5 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. (Amended by Changes No. 1, No. 4, and No. 6)

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 elements 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. (Amended by Change No. 6)

2. The control elements 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 elements in the cold condition, without xenon, with the most reactive of the operable control elements withdrawn shall be 0.4% delta k/k.

4. The maximum rate of reactivity insertion associated with movement of a standard rod shall be no greater than 0.12% delta k/k sec.

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

6. The type and minimum number of interlocks which shall be operable for reactor operation are shown in T able 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 element 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.

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 provide a signal which actuates an audible alarm. During short periods of repair to this monitor (up to one week), reactor operations may continue while a detector capable of displaying gamma dose rate is utilized as a temporary substitute. (Amended by Change No. 6)

2. A continuous air monitor with readout and audible alarm shall be operable in the reactor room when the reactor is operating.

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 and fuel devices shall be stored in an array which will permit sufficient natural convection cooling such that the fuel element or fuel device temperature will not exceed design values.

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. (Amended by Change No. 6)

2. A Radiation 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 faculty members and 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. (Amended by Change No. 2)

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. (Amended by Change No. 2) It shall review all experiments of the following types:

   (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 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 Committee shall establish written procedures regarding quorums, subcommittees, review of experiments and operations and others as appropriate.

4. Any additions, modifications, or maintenance to the core and its associated support structure, the pool structure, and 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 areas radiation monitors and air particulate monitors.

   (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 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. (Amended by Change No. 6)

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 by the Reactor Operations Committee.

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 130°F 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 (Amended by addition of entire section by Change No. 2)

In addition to the requirements of applicable regulations and in no way substituting therefor, 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 therefor;
   (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

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 element withdrawal with power below the equivalent of two neutron induced counts per second. (Amended by Change No. 7).
2. Simultaneous manual withdrawal of two control elements.