Nuclear Reactor Laboratory
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THE UNIVERSITY OF
ARIZONA®
TUCSON ARIZONA

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May 20, 2010

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

10 CFR 50

Subject: Possession Only License for the University of Arizona Research Reactor,
Facility License No. R-52, Docket No. 50-113

This letter requests a 'possession only' revision to our current operating license and submits revised Technical Specifications. Please delete the words "use, and operate" from the following part of our license:

> "Pursuant to Section 104c of the Act and 10 CFR 50 "Domestic Licensing of Production and Utilization Facilities," to possess, ~~use, and operate~~ the facility at the designated location in Tucson, Arizona, in accordance with the procedures and limitations set forth in this license."

The University of Arizona's current reactor operating license expires on May 22, 2010. On or before midnight on May 22 we will:

- Cease reactor operations,
- Partially unload fuel from Arizona Research Reactor so that it contains insufficient fissile material present in the reactor to attain criticality under optimum available conditions of moderation and reflection,
- Maintain the reactor in a "secured" condition per the definition of Reactor Secured part (a),
- Continue our possession of the nuclear fuel,
- Maintain our surveillance activities, and
- Maintain the facility, including the storage, control and maintenance of the spent fuel, in a safe condition until the defueling is completed.

By prior agreement, the DOE through its Reactor Fuel Assistance Program will assist in defueling our nuclear reactor following the end of operations.

I declare under penalty of perjury that the foregoing is true and correct. Executed on May 20, 2010.

John G. Williams

John G. Williams, Director
University of Arizona Research Reactor

Attachments
Amendment 19 Technical Specifications, University of Arizona Research Reactor
Amendment 19 Technical Specifications, University of Arizona Research Reactor-annotated

A020
NRR

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TECHNICAL SPECIFICATIONS

FOR THE

UNIVERSITY OF ARIZONA

TRIGA RESEARCH REACTOR

FACILITY LICENSE R-52

Amendment 19

This document includes the Technical Specifications and the bases for the Technical Specifications. The bases provide the technical support for the individual Technical Specifications and are included for information purposes only. The bases are not part of the Technical Specifications and they do not constitute limitations or requirements to which the licensee must adhere.

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1.0 DEFINITIONS

Channel - A channel is a combination of sensors, electronic circuits, and output devices connected by the appropriate communications network in order to measure and display the value of a parameter.

Channel Calibration - A channel calibration is an adjustment of a channel such that its output corresponds with acceptable accuracy to known values of the parameter which the channel measures. Calibration shall encompass the entire channel, including equipment, actuation, alarm, or trip and shall include a Channel Test.

Channel Check - A channel check is a qualitative verification of acceptable performance by observation of channel behavior. The verification shall include comparison of the channel output with previous readings or performance or with other independent channels or systems measuring the same variable, whenever possible.

Channel Test - A channel test is the introduction of a signal into the channel for verification that it is operable.

Cold Critical - The reactor is in the cold critical condition when it is critical with the fuel and bulk water temperatures the same (~20°C).

Decommissioning Activities – Decommissioning activities are the physical dismantlement or permanent removal from service of systems and components described in the SAR. Decommissioning activities, however, do not include the removal of fuel.

Experiment - An experiment is any device or material, not normally part of the reactor, which is introduced into the reactor for the purpose of exposure to radiation, or any operation which is designed to investigate non-routine reactor characteristics.

Experimental Facilities - Experimental facilities are the thermal column, pneumatic transfer systems, central thimble, rotary specimen rack, beam tube, and the in-core facilities.

Limiting Conditions for Operation - Limiting Conditions for Operation (LCO) are administratively established constraints on equipment and operational characteristics which shall be adhered to during operation of the reactor.

Limiting Decommissioning Conditions - Limiting Decommissioning Conditions (LDC) are administratively established constraints on equipment and operational characteristics which shall be adhered to during decommissioning activities.

Limiting Safety System Setting (LSSS) - The LSSS is the actuating level for automatic protective devices related to those variables having significant safety functions.

Manual Mode - The reactor is in the manual mode when the reactor mode selection switch is in the manual or automatic position. In this mode, reactor power is held constant or is changed on periods of approximately one second or longer.

Measured Value - The Measured Value is the value of a parameter as it appears on the output of a channel.

Movable Experiment - An experiment is movable when it is intended that all or part of the experiment may be moved in or near the core or into and out of the reactor while the reactor is operating.

Operable - Operable means a component or system is capable of performing its intended function.

Operating - Operating means a component or system is performing its intended function.

Pulse Mode - The reactor is in the pulse mode when the reactor mode selection switch is in the pulse position. In this mode, reactor power may be increased on periods less than one second by motion of the transient control rod.

Reactivity Worth of an Experiment - The reactivity worth of an experiment is the maximum value of the reactivity change that would occur as a result of planned changes or credible malfunctions that alter experiment position or configuration.

Reactor Committee - The group of persons at the University who are assigned responsibility for review and audit of facility operation and review of changes and experiments in accordance with 10 CFR 50.59.

Reactor Operating - The reactor is operating whenever it is not secured or shutdown.

Reactor Safety Systems - Reactor Safety Systems are those systems, including associated input channels, which are designed to initiate automatic reactor protection or to provide information for initiation of manual protective action.

Reactor Secured - The reactor is secured when:

a. It contains insufficient fissile material or moderator present in the reactor, adjacent experiments or control rods, to attain criticality under optimum available conditions of moderation and reflection, or

b. 1. The minimum number of neutron absorbing control rods are fully inserted or other safety devices are in shutdown position, as required by technical specifications, and

   2. The console key switch is in the off position and the key is removed from the lock, and

   3. No work is in progress involving core fuel, core structure, installed control rods, or control rod drives unless they are physically decoupled from the control rods, and

   4. No experiments in or near the reactor are being moved or serviced that have, on movement, a reactivity worth of one dollar or more.

Reactor Shutdown - The reactor is in a shutdown condition when sufficient control rods are inserted to assure that it is subcritical by at least $1.00 of reactivity.

Reportable Occurrence - A Reportable Occurrence is any of the following which occurs during reactor operation:

a. Operation with actual safety-system settings for required systems less conservative than the limiting safety-system settings specified in Technical Specification 2.2.

b. Operation in violation of limiting conditions for operation established in the Technical Specifications.

c. A reactor safety system component malfunction which renders or could render the reactor safety system incapable of performing its intended safety function unless the malfunction or condition is discovered during maintenance tests or periods of reactor shutdown.

d. Any unanticipated or uncontrolled change in reactivity greater than one dollar.

e. Abnormal and significant degradation in reactor fuel, cladding, or coolant boundary which could result in exceeding of prescribed radiation exposure or release limits.

f. An observed inadequacy in the implementation of either administrative or procedural controls which could result in operation of the reactor outside the limiting conditions for operation.

g. Release of radioactivity from the site above limits specified in 10CFR20.

Control Rod - A control rod is a device fabricated from neutron absorbing material or fuel which is used to establish neutron flux changes and to compensate for routine reactivity losses. A control rod may be coupled to its drive unit allowing it to perform a safety function when the coupling is disengaged.

Transient Rod - The transient rod is a control rod with scram capabilities that is capable of providing rapid reactivity insertion to produce a pulse.

Safety Limit - A Safety Limit is a limit on an important process variable which is found to be necessary to reasonably protect the integrity of certain of the physical barriers which guard against the uncontrolled release of radioactivity. The principal physical barrier is the fuel element cladding.

Secured Experiment - A Secured Experiment is any experiment, experimental facility, or component of an experiment that is held in a stationary position relative to the reactor by mechanical means. The restraining forces must be substantially greater than those to which the experiment might be subjected by hydraulic, pneumatic, buoyant, or other forces which are normal to the operating environment of the experiment, or by forces which can arise as the result of credible malfunctions.

Shall, Should, and May - The word "shall" is used to denote a requirement, the word "should" denotes a recommendation, and the word "may" denotes permission, neither a requirement nor a recommendation.

Shutdown Margin - Shutdown Margin is the reactivity existing when the most reactive control rod is fully withdrawn from the core and the other control rods are fully inserted into the core.

Time Interval - The average over any extended period for each surveillance time item shall be the normal surveillance time; e.g., for a two-year interval, the average shall not exceed two years.

a. Biennially - at two-year intervals (interval not to exceed 30 months)

b. Annually - at one-year intervals (interval not to exceed 15 months)

c. Semiannually - at 6-month intervals (interval not to exceed seven and one-half months)

d. Quarterly - at 3-month intervals (interval not to exceed four months)

e. Monthly - at one-month intervals (interval not to exceed six weeks)

f. Weekly - at seven-day intervals (interval not to exceed ten days)

g. Daily - (must be done during the calendar day)

Any extension of these intervals shall be occasional and for a valid reason shall not affect the average as defined.

Untried Experiment - An untried experiment is any experiment not previously performed in this reactor.

2.0 SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

2.1 Safety Limit - Fuel Temperature

Applicability
This specification applies to the reactor fuel temperature

Objective
The objective is to define a fuel temperature below which it can be predicted with confidence that no damage to the fuel elements will occur.

Specification
The temperature of the fuel shall not exceed 1000°C under any conditions of operation.

Basis
The recommended limiting design basis parameter for TRIGA fuel is the fuel temperature. A fuel temperature safety limit of 1150°C for stainless-steel-clad U-$ZrH_{1.65}$ TRIGA fuel is recommended as a design value to preclude the loss of clad integrity when the clad temperature is below 500°C (Simnad, GA Report E-117-833, The U-Zr H Alloy: Its Properties and Use in TRIGA Fuel, Feb. 1980, p. 4-1). The criterion for assuring the integrity of a TRIGA fuel element at the University of Arizona is that the fuel temperature be maintained below 1000°C, which is well below the recommended value. It has been shown by analysis and by measurements on other TRIGA reactors that a power level of 1000 kW corresponds to a peak fuel temperature of approximately 400°C. Pulsing with a reactivity input of $3.25 will give a peak fuel temperature of approximately 460°C.

The LSSS become inapplicable, once reactor operations have permanently ceased. Delete this section.

3.0 LIMITING CONDITIONS FOR OPERATION AND LIMITING DECOMMISSIONING CONDITIONS

3.1 Reactivity Limits

Applicability
These specifications apply to the reactivity condition of the reactor.

Objective
The objective is to assure that the reactor shall be shut down at all times and to assure that the safety limit will not be exceeded.

Specifications
The reactor shall not be operated.

3.2 Reactor Instrumentation

Applicability
This specification applies to the information which must be available during fuel movement and during decommissioning activities.

Objective
The objective is to require that sufficient information is available to the operator to assure safe movement of fuel and decommissioning.

Specification
Reactor fuel shall not be moved and decommissioning activities shall not be conducted unless the measuring channels described in the following table are operable and the information is available in the control room:

MEASURING CHANNEL	MINIMUM NUMBER OPERABLE	ACTIVITY IN WHICH REQUIRED
wide-range log power level (startup count rate)	1	fuel movement
reactor period	1	fuel movement
area radiation monitors	2	fuel movement and decommissioning activities
particulate air radiation monitor	1	fuel movement and decommissioning activities
reactor water activity monitor	1	fuel movement

Bases
The wide range log power and reactor period channels assure that indications of subcritical reactor power level changes are available during fuel movement.

The radiation monitors provide information to operating personnel of radiation above a preset level so that there will be sufficient time to evacuate the facility or take action to prevent the release of radioactivity to the surroundings.

3.3 Ventilation System

Applicability
This specification applies to the operation of the reactor facility ventilation system.

Objective
The objective is to assure that the ventilation system is in operation to mitigate the consequences of the possible release of radioactive materials.

Specification
Fuel shall not be moved and decommissioning activities shall not be conducted unless the facility ventilation system is operable with a minimum air withdrawal rate of 500 cfm.

Basis
It is shown in The Safety Analysis Report that operation of the ventilation system reduces doses in the reactor facility in the event of a TRIGA fuel element failure.

4.0 SURVEILLANCE REQUIREMENTS

4.1 Fuel

Applicability
This specification applies to the surveillance requirements for the fuel elements.

Objective
The objective is to assure that the dimensions of the fuel elements remain within acceptable limits.

Specifications
a. All fuel elements shall be removed from the core and visually inspected for evidence of deterioration of cladding, (including at least corrosion, erosion, wear, cracking, and weld integrity) at least once every five years.

b. A fuel element indicating an elongation greater than 1/4 inch over its original length or a lateral bending greater than 1/16 inch over its original bending shall be considered to be damaged and shall be recorded as such in the fuel inventory logs.

Basis
The most severe stresses induced in the fuel elements result from pulse operation with high reactivity input, during which differential expansion between the fuel and the cladding occurs and the pressure of the gases within the elements increases sharply. The above limits on the allowable distortion of a fuel element correspond to strains that are considerably lower than the strain expected to cause rupture of a fuel element.

4.2 Control Rods

Applicability
This specification applies to the surveillance requirements for the control rods.

Objective
The objective is to assure the integrity of the fuel-followed control rods.

Specification
a. The fuel-followed control rods shall be visually inspected for deterioration biennially.

Basis
The visual inspection of the fuel-followed control rods is made to determine whether the control rods are preserving the integrity of fuel.

4.3 Radiation Monitoring Equipment

Applicability
This specification applies to the radiation monitoring equipment required by Section 3.2 of these specifications.

Objective
The objective is to assure that the radiation monitoring equipment is operating and to verify the appropriate alarm settings.

Specification

a. The alarm set points for the radiation monitoring instrumentation shall be verified prior to fuel movement or conduct of decommissioning activities, on each day when they are performed.

b. The radiation monitoring equipment shall be calibrated annually.

Basis
Verification of the alarm set points of radiation monitoring instrumentation will assure that sufficient information to provide protection against radiation exposure is available.

4.4 Maintenance

Applicability
This specification applies to the surveillance requirements following maintenance of a control or safety system.

Objective
The objective is to assure that a system is operable before being used after maintenance has been performed.

Specification

a. Following maintenance or modification of a control or safety system or component, it shall be verified that the system is operable prior to its return to service. A system shall not be considered operable until after it is successfully tested.

b. Any additions, modifications, or maintenance to the ventilation system, the core and its associated support structure, the pool or its penetrations, the pool coolant system, the rod drive mechanism, or the reactor safety system shall be made and tested in accordance with the specifications to which the systems were originally designed and fabricated or to specifications approved by the Reactor Committee.

c. A licensed reactor operator shall be present during maintenance of the reactor control and safety system.

Basis
This specification relates to changes in reactor systems which could directly affect the safety of the reactor. Changes or replacements to these systems which meet the original design specifications are considered to meet the presently accepted operating criteria.

4.5 Pool Water Conductivity

Applicability
This specific action applies to surveillance of pool water conductivity.

Objective
The objective is to assure that pool water mineral content is maintained at an acceptable level.

Specification
The conductivity of bulk coolant water shall be verified to be within specified limits at least monthly.

Basis
Based on experience, in which pool water conductivity changes slowly with time, observation at these intervals provides acceptable surveillance of conductivity to assure that accelerated fuel clad corrosion does not occur.

5.0 DESIGN FEATURES

5.1 Reactor Fuel

Applicability
This specification applies to the fuel elements stored in the reactor pool.

Objective
The objective is to assure that the fuel elements are of such a design and fabricated in such a manner as to permit their use with a high degree of reliability with respect to their mechanical integrity.

Specifications

a. Standard Fuel Element: The standard fuel element shall be of the TRIGA type and shall contain uranium-zirconium hydride, clad in 0.020 inch of 304 stainless steel. It shall contain a maximum of 9.0 weight percent uranium which has a maximum enrichment less than 20 percent. There shall be 1.55 to 1.80 hydrogen atoms to 1.0 zirconium atom.

b. Loading: With the exception of one fuel-followed control element (the "regulating rod") no fuel elements shall be placed within the B- or C- rings of the core.

Basis
This type of fuel element has a long history of successful use in TRIGA reactors.
Specification b ensures that the fuel stored within the core structure cannot attain a value of k_{eff} greater than 0.9.

5.2 Reactor Building and Decommissioning Site

Applicability
This specification applies to the facility which houses the reactor and the residual facility and site to which the Decommissioning Plan applies.

Objective
The objective is to assure that provisions are made to restrict the radioactivity released into the environment.

Specifications

a. The reactor shall be housed in a closed room of a facility designed to restrict leakage.

b. The free volume of the reactor room shall be at least 6,000 cubic feet.

c. All air or other gases exhausted from the reactor room during decommissioning activities shall be released at a minimum of 12 feet above ground level.

d. The reactor facility shall be equipped with a ventilation system capable of exhausting air or other gases from the reactor room from a stack at a minimum of 50 feet above ground level under emergency conditions.

e. During decommissioning activities within the reactor room, openings to the room other than those designed for exhaust air and gases shall be closed except for required access and when materials prepared for shipment are being removed.

f. During decommissioning activities outside the reactor room, components that are to be removed shall be enclosed in a manner designed to restrict leakage and to restrict access, before being dismantled.

Basis
In order that the movement of air can be controlled, the facility contains no windows that can be opened. Under emergency conditions the room air is exhausted through a filter and discharged through a stack at a minimum of 50 feet above ground to provide dilution.

Specification f. applies only to equipment described in the SAR which is outside the reactor room: parts of the water purification system and the cooling system. All other decommissioning activities will be confined to the footprint described in SAR section IVa, designated as a controlled access area.

5.3 Fuel Storage

Applicability
This specification applies to the storage of reactor fuel at times when it is not in the reactor core.

Objective
The objective is to assure that fuel which is being stored will not become supercritical and will not reach unsafe temperatures.

Specifications
a. All fuel elements shall be stored in a geometrical array where the value of k_{eff} is less than 0.9 for all conditions of moderation and reflection using light water.

b. Irradiated fuel elements and fueled devices shall be stored in an array which will permit sufficient natural convection cooling by water or air such that the fuel element or fueled device temperature will not exceed 800°C.

Basis
Specification 5.3a assures that unplanned criticality will not occur in fuel storage racks.

Specification 5.3b is based on a fuel temperature limit of 950°C to assure fuel clad integrity when the clad temperatures can equal the fuel temperature (Simnad, G. A. Report E-117-833, February 1980, p.4-1)

6.0 ADMINISTRATIVE CONTROLS

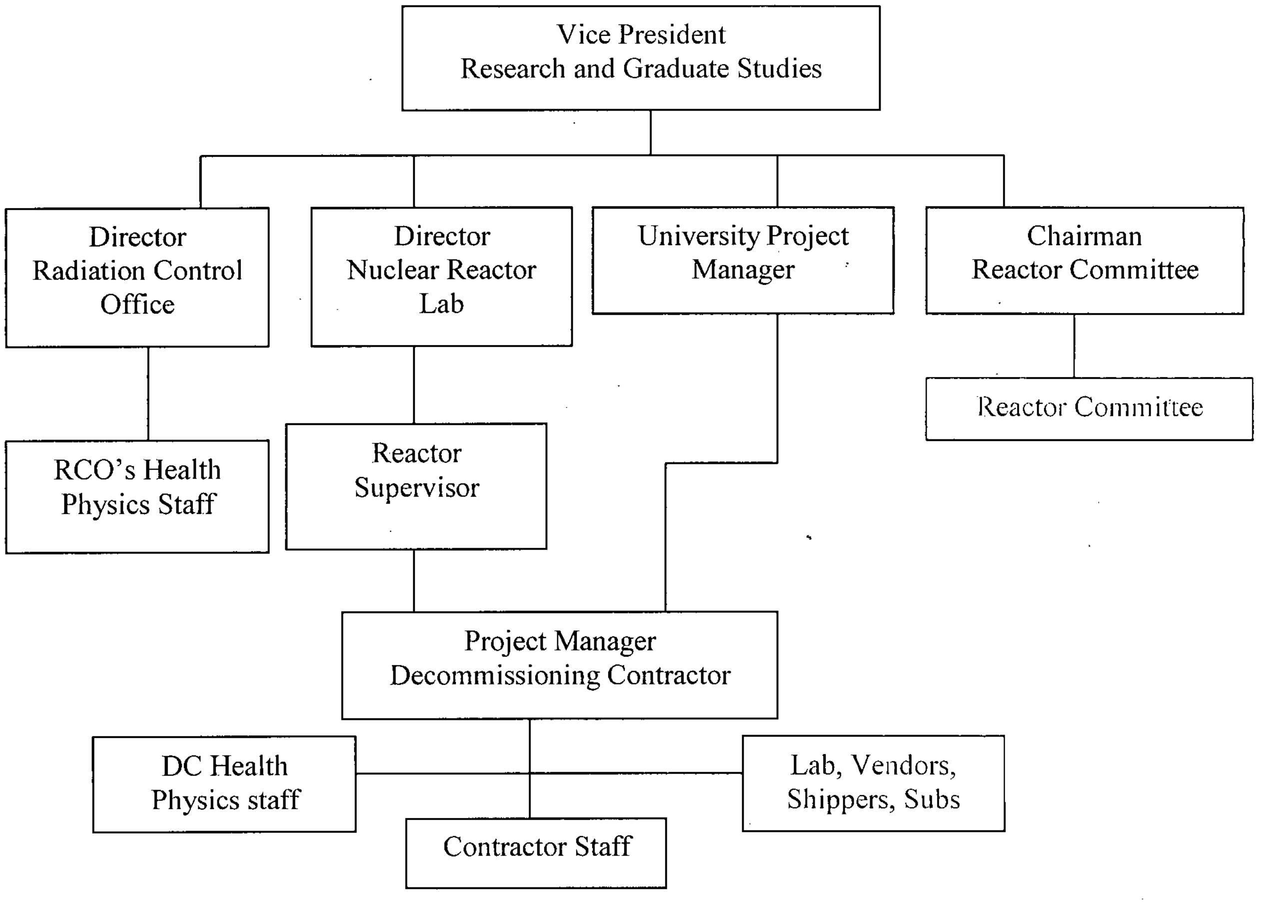
6.1 Organization

a. The reactor facility shall be maintained by the Nuclear Reactor Laboratory (NRL) at the University of Arizona. The Nuclear Reactor Laboratory Director shall report to the Vice President for Research and Graduate Studies at the University of Arizona as shown in the diagram below.

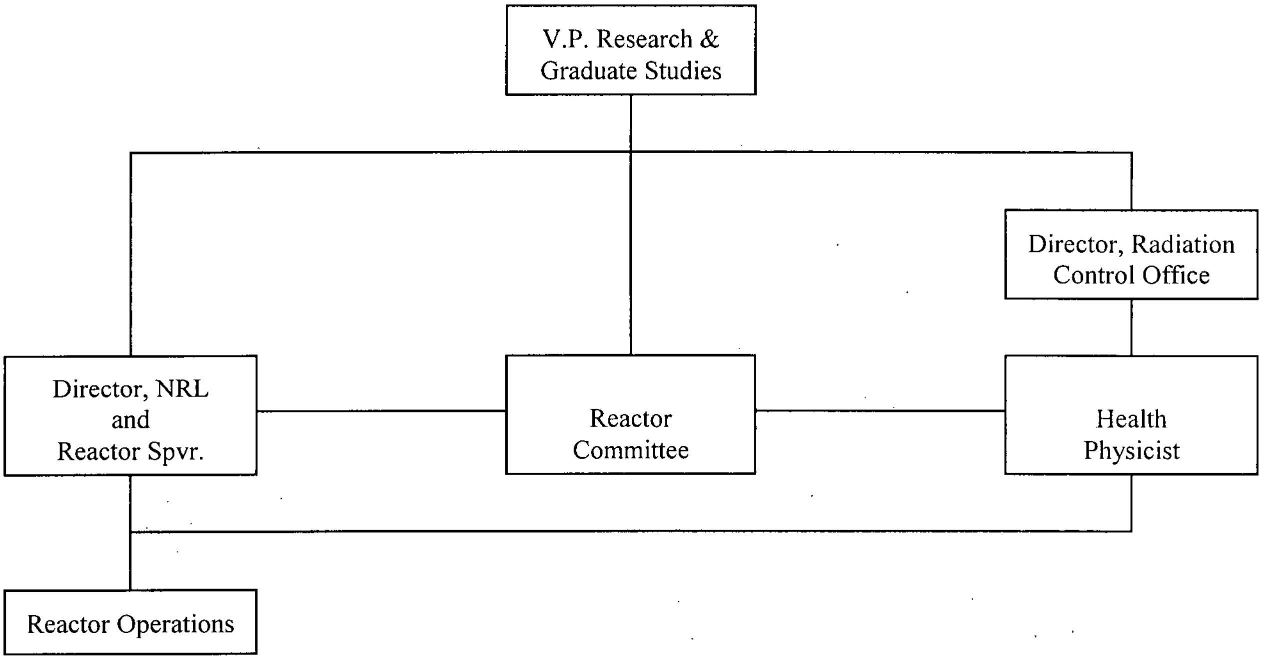
b. The reactor facility shall be under the supervision of a licensed senior operator for the reactor. He shall be responsible for assuring that all operations are conducted in a safe manner and within the limits prescribed by applicable federal regulations, by the facility license, and by the provisions of the Reactor Committee.

c. There shall be a Health Physicist responsible for assuring the safety of reactor operations from the standpoint of radiation protection.

d. An NRC-licensed operator must be present in the control room when the key switch is on. An operator and one other person authorized by the Reactor Supervisor must be present in the Reactor Laboratory whenever the reactor is not shut down.



The above organizational chart from our Decommissioning Plan replaces the organizational chart below when decommissioning activities commence. Until then, the following chart remains applicable.


V.P. Research &
Graduate Studies
Director, Radiation
Control Office
Director, NRL
and
Reactor Spvr.
Reactor
Committee
Health
Physicist
Reactor Operations

6.2 Review

a. There shall be a Reactor Committee which shall review reactor operations and decommissioning activities to assure that the facility is maintained in a manner consistent with public safety and within the terms of the facility license.

b. The responsibility of the Committee includes, but is not limited to, the following:
   1. Review and approval of experiments utilizing the reactor facilities;
   2. Review and approval of all proposed changes to the facility, procedures, and Technical Specifications;
   3. Determination of whether a proposed change, test, or experiment would constitute a license amendment pursuant to 10 CFR 50.59(c)(2) as outlined in UARR 165;
   4. Review and approval of all proposed changes to the Decommissioning Plan, provided such changes meet the specifications listed in 7.2
   5. Review of the operation and operational records of the facility;
   6. Review of abnormal performance of plant equipment and operating anomalies; and
   7. Review of unusual or abnormal occurrences and incidents which are reportable under 10 CFR 20 and 10 CFR 50.
   8. Review and audit of the retraining and requalification program for the operating staff.
   9. Biennial audit of the Emergency Plan.

c. The Committee shall be composed of at least five members, and shall include a health physicist and members competent in the field of reactor operations, radiation science, or reactor engineering. The membership of the Committee shall be such as to maintain a high level degree of technical proficiency.

d. The Committee shall establish a written charter defining such matters as the authority of the Committee, review and audit functions, and other such administrative provisions as are required for effective functioning of the Committee. Minutes of all meetings of the Committee shall be kept and submitted to committee members and to the Vice President for Research and Graduate Studies in a timely manner.

e. A quorum of the Committee shall consist of not less than three members of the Committee and shall include the chairman or his designee.

f. The Committee shall meet at least quarterly.

6.3 Operations

a. Operating Procedures

Written procedures, reviewed and approved by the Reactor Committee, shall be in effect and followed for the following items. The procedures shall be adequate to assure the safety of the reactor, but should not preclude the use of independent judgment and action should the situation require such.

1. Startup, operation, and shutdown of the reactor.

2. Installation or removal of fuel elements, control rods, experiments, and experimental facilities.

3. Actions to be taken to correct specific and foreseen potential malfunctions of systems or components, including responses to alarms, suspected primary coolant system leaks, and abnormal reactivity changes.

4. Emergency conditions involving potential or actual release of radioactivity, including provisions for evacuation, re-entry, recovery, and medical support.

5. Maintenance procedures which could have an effect on reactor safety.

6. Periodic surveillance of reactor instrumentation and safety system, area monitors and continuous air monitors.

7. Decommissioning activities

Substantive changes to the above procedures shall be made only with the approval of the Reactor Committee. Temporary changes to the procedures that do not change their original intent may be made with the approval of the Reactor Laboratory Director. All such temporary changes to procedures shall be documented and subsequently reviewed by the Reactor Committee.

b. ALARA Program

A program shall be established to assure that radiation exposures and releases are kept as low as reasonably achievable.

6.4 Action to be Taken in the Event a Safety Limit is Exceeded

In the event a safety limit is exceeded, or thought to have been exceeded:

a. The reactor shall be shut down and reactor operation shall not be resumed until authorized by the NRC.

b. An immediate report of the occurrence shall be made to the Chairman of the Reactor Committee and reports shall be made to the NRC in accordance with Section 6.7 of these specifications.

c. A report shall be made which shall include an analysis of the causes and extent of possible resultant damage, efficiency of corrective action, and recommendations for measures to prevent or reduce the probability of recurrence. This report shall be submitted to the Reactor Committee for review, and a similar report submitted to the NRC when authorization to resume operation of the reactor is requested.

6.5 Action to be Taken in the Event of a Reportable Occurrence

In the event of a Reportable Occurrence, the following action shall be taken:

a. The Reactor Laboratory Director shall be notified and corrective action taken prior to resumption of the operation involved.

b. A report shall be made which shall include an analysis of the cause of the occurrence, efficacy of corrective action and recommendations for measures to prevent or reduce the probability of reoccurrence. This report shall be submitted to the Reactor Committee for review.

c. A report shall be submitted to the NRC in accordance with Section 6.7 of these specifications.

6.6 Plant Operating Records

In addition to the requirements of applicable regulations, and in no way substituting therefore, records and logs of the following items shall be prepared and retained for a period of at least 5 years (except as otherwise specified in the Commission's regulations);

a. Normal plant operation (but not including supporting documents such as checklists, and recorder charts, which shall be maintained for a period of at least one year);

b. Principal maintenance activities;

c. Reportable Occurrences;

d. Equipment and component surveillance activities required by the Technical Specification;

e. Experiments performed with the reactor;

Logs and records of the following items shall be prepared and retained for the life of the facility.

f. Gaseous and liquid radioactive effluents released to the environs;

g. Off-site environmental monitoring surveys;

h. Fuel inventories and transfers;

i. Facility radiation and contamination surveys;

j. Radiation exposures for all personnel;

k. Updated, corrected, and as-built drawings of the facility; and

l. Decommissioning activities

6.7 Reporting Requirements

In addition to the requirements of applicable regulations, and in no way substituting therefore, reports shall be made to the NRC as follows:

a. A report within 24 hours by telephone and telegraph or telefax (FAX) to the responsible NRC organization as listed in the Emergency Kit and posted as deemed necessary by the Reactor Committee of:

   1. Any accidental off-site release of radioactivity above limits permitted by 10 CFR 20, whether or not the release resulted in property damage, personal injury, or exposure;

   2. Any violation of a Safety Limit; and

   3. Any reportable occurrences as defined in Section 1.0 (Reportable Occurrence) of these specifications in writing.

b. A written report within ten days to the U. S. Nuclear Regulatory Commission, Attn: Document Control Desk, Washington D.C. 20555, with a copy to the responsible NRC facility inspector of:

   1. Any significant variation of measured values from a corresponding predicted value of previously measured value of safety-connected operating characteristics occurring during operation of the reactor;

   2. Incidents or conditions relating to operation of the facility which prevented or could have prevented the performance of engineered safety features as described in these specifications;

   3. Any reportable occurrences as defined in Section 1.0 of these specifications; and

   4. Any violation of a Safety Limit.

   5. Any accidental off-site release of radioactivity above limits permitted by 10 CFR 20, whether or not the release resulted in property damage, personal injury, or exposure.

c. A written report within 30 days to the U.S. Nuclear Regulatory Commission, Attn: Document Control Desk, Washington D.C. 20555, with a copy to the responsible NRC facility inspector of:

   1. Any substantial variance from performance specifications contained in these specifications or in the Safety Analysis Report;

   2. Any significant change in the transient or accident analysis as described in the Safety Analysis Report;

3. Any changes in facility organization; and

4. Any observed inadequacies in the implementation of administrative or procedural controls.

d. A written report within 60 days after completion of startup testing of the reactor to the U. S. Nuclear Regulatory Commission, Attn: Document Control Desk, Washington D.C. 20555, with a copy to the responsible NRC facility inspector of:

   1. An evaluation of facility performance to date in comparison with design predictions and specifications; and

   2. A reassessment of the safety analysis submitted with the license application in light of measured operating characteristics when such measurements indicate that there may be substantial variance from prior analysis.

e. A written annual report within 60 days following the 30th of June each year to the U.S. Nuclear Regulatory Commission, Attn: Document Control Desk, Washington D. C. 20555, with a copy to the responsible NRC facility inspector of:

   1. A brief narrative summary of (1) operating experience (including experiments performed), (2) changes in facility design, performance characteristics, and operating procedures related to reactor safety and occurring during the reporting period, and (3) results of surveillance tests and inspections;

   2. Tabulation of the energy output (in megawatt days) of the reactor, amount of pulse operation, hours reactor was critical, and the cumulative total energy output since initial criticality;

   3. The number of emergency shutdowns and inadvertent scrams, including reasons therefore;

   4. Discussion of the major maintenance operations performed during the period, including the effect, if any, on the safety of the operation of the reactor, and the reasons for any corrective maintenance required;

   5. A brief description including a summary of the safety evaluations of changes in the facility or in procedures and of tests and experiments carried out pursuant to Section 50.59 of 10 CFR Part 50;

   6. A summary of the nature and amount of radioactive effluents released or discharged to the environs beyond the effective control of the licensee as measured at or prior to the point of such release or discharge;

Liquid Waste (summarized on a monthly basis)

(a) Radioactivity discharged during the reporting period.

(1) Total radioactivity released (in curies).

(2) The limiting concentrations (10CFR20, Appendix B) used and the isotopic composition if greater than 1×10^{-7} microcuries/cc for fission and activation products.

(3) Total radioactivity (in curies), released by nuclide, during the reporting period, based on representative isotopic analysis.

(4) Average concentration at point of release (in microcuries /cc) during the reporting period.

(b) Total volume (in gallons) of effluent water (including diluent) during periods of release.

Gaseous Waste (summarized on a monthly basis)

(a) Radioactivity discharged during the reporting period (in curies) for:

(1) Gases.

(2) Particulates with half lives greater than eight days.

(b) The limiting concentrations (10CFR20, Appendix B) used and the estimated activity (in curies) discharged during the reporting period, by nuclide, for all gases and particulates based on representative isotopic analysis.

Solid Waste

(a) The total amount of solid waste packaged (in cubic feet).

(b) The total activity involved (in curies).

(c) The dates of transfer or shipment and disposition

7. A summary of radiation exposures received by facility personnel and visitors, including dates and time of significant exposures, and a summary of the results of radiation and contamination surveys performed within the facility; and

8. A description of any environmental surveys performed outside the facility.

6.8 Review of Experiments

a. All proposed new experiments utilizing the reactor shall be evaluated by the experimenter and the Reactor Committee. The evaluation shall be reviewed by a licensed Senior Operator of the facility (and the Health Physicist when appropriate) to assure compliance with the provisions of the utilization license, the Technical Specifications, 10 CFR 20, and the requirements of 10 CFR 50.59. If, in his judgment, the experiment meets with the above provisions and does not constitute a threat to the integrity of the reactor, he shall submit it to the Reactor Supervisor for scheduling or to the Reactor Committee for final approval as indicated in Section 6.2 above. When pertinent, the evaluation shall include:

1. The reactivity worth of the experiment;

2. The integrity of the experiment, including the effects of changes in temperature, pressure, or chemical composition;

3. Any physical or chemical interaction that could occur with the reactor components; and

4. Any radiation hazard that may result from the activation of materials or from external beams.

5. A determination that for the maximum planned or inadvertent pulse, no credible mechanism exists which could cause the experiment to fail.

b. Prior to performing an experiment not previously performed in the reactor, it shall be reviewed and approved in writing by the Reactor Committee. This review shall consider the following information:

1. The purpose of the experiment;

2. A procedure for the performance of the experiment; and

3. The evaluation approved by a licensed Senior Operator.

c. For the irradiation of materials, the applicant shall submit an "Irradiation Request" to the Reactor Supervisor. This request shall contain information on the target material including the amount, chemical form, and packaging. For routine irradiations (which do not contain known explosive materials and which do not constitute a significant threat to the integrity of the reactor or to the safety of individuals) the approval for the Reactor Committee may be made by the Reactor Supervisor.

d. In evaluating experiments, the following assumptions should be used for the purpose of determining whether failure of the experiment would cause the appropriate limits of 10 CFR 20 to be exceeded:

1. If the possibility exists that airborne concentrations of radioactive gases or aerosols may be released within the facility, 100 percent of the gases or aerosols will escape;

2. If the effluent exhausts through a filter installation designed for greater than 99 percent efficiency for 0.3 micron particles, 10% of the particulates will escape; and

3. For a material whose boiling point is above 130°F and where vapors formed by boiling this material could escape only through a column of water above the core, 10% of these vapors will escape.

7.0 DECOMMISSIONING PLAN

7.1 Incorporation of the Decommissioning Plan

The license is amended to approve the Decommissioning Plan described in the licensee's application dated May 22, 2009, as supplemented by the licensee's letter of March 26, 2010, and authorizes inclusion of the Decommissioning Plan as a supplement to the Safety Analysis Report pursuant to 10 CFR 50.82(b)(5).

7.2 Changes to the Decommissioning Plan

The licensee may make changes to the decommissioning plan without prior approval provided the proposed changes do not:

(i) Require Commission approval pursuant to 10 CFR 50.59;

(ii) Use a statistical test other than the Sign test or Wilcoxon Rank Sum test for evaluation of the final status survey;

(iii) Increase the radioactivity level, relative to the applicable derived concentration guideline level, at which an investigation occurs;

(iv) Reduce the coverage requirements for scan measurements;

(v) Decrease an area classification (i.e., impacted to unimpacted; Class 1 to Class 2; Class 2 to Class 3; or Class 1 to Class 3);

(vi) Increase the Type I decision error;

(vii) Increase the derived concentration guideline levels and related minimum detectable concentrations (for both scan and fixed measurement methods); and

(viii) Result in significant environmental impacts not previously reviewed.

7.3 Characterization Report

A completed radiological characterization report shall be submitted to NRC review and approval prior to initiating decommissioning activities. The characterization report will include information required in NUREG-1575, Sections 2.4 and 5.3; and NUREG-1757, Volume 2, Section 4.2) to allow NRC staff to verify that the University has adequately characterized the radiological condition of the site.

7.4 Final Status Survey Plan

The University shall provide NRC with a Final Status Survey Plan prior to conduct of license termination surveys. The Plan will be developed in accordance requirements in NUREG 1575 (MARSSIM); NUREG-1537, Part 1, Appendix 17.1, Section A; and NUREG-1757, Volume 2, Chapter 4.

7.5 Release Criteria

The University shall use the release criteria specified in the Decommissioning Plan and as amended in the letter dated March 26, 2010. The University shall submit a revised license condition for review and approval by the NRC if alternative release criteria are developed for release of the NRL.

TECHNICAL SPECIFICATIONS

FOR THE

UNIVERSITY OF ARIZONA

TRIGA RESEARCH REACTOR

FACILITY LICENSE R-52

Amendment 19

This document includes the Technical Specifications and the bases for the Technical Specifications. The bases provide the technical support for the individual Technical Specifications and are included for information purposes only. The bases are not part of the Technical Specifications and they do not constitute limitations or requirements to which the licensee must adhere.

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1.0 DEFINITIONS

DEFINITIONS remain unaffected, with the addition of Decommissioning Activities and Limiting Decommissioning Conditions.

Channel - A channel is a combination of sensors, electronic circuits, and output devices connected by the appropriate communications network in order to measure and display the value of a parameter.

Channel Calibration - A channel calibration is an adjustment of a channel such that its output corresponds with acceptable accuracy to known values of the parameter which the channel measures. Calibration shall encompass the entire channel, including equipment, actuation, alarm, or trip and shall include a Channel Test.

Channel Check - A channel check is a qualitative verification of acceptable performance by observation of channel behavior. The verification shall include comparison of the channel output with previous readings or performance or with other independent channels or systems measuring the same variable, whenever possible.

Channel Test - A channel test is the introduction of a signal into the channel for verification that it is operable.

Cold Critical - The reactor is in the cold critical condition when it is critical with the fuel and bulk water temperatures the same (~20°C).

Decommissioning Activities – Decommissioning activities are the physical dismantlement or permanent removal from service of systems and components described in the SAR. Decommissioning activities, however, do not include the removal of fuel.

Experiment - An experiment is any device or material, not normally part of the reactor, which is introduced into the reactor for the purpose of exposure to radiation, or any operation which is designed to investigate non-routine reactor characteristics.

Experimental Facilities - Experimental facilities are the thermal column, pneumatic transfer systems, central thimble, rotary specimen rack, beam tube, and the in-core facilities.

Limiting Conditions for Operation - Limiting Conditions for Operation (LCO) are administratively established constraints on equipment and operational characteristics which shall be adhered to during operation of the reactor.

Limiting Decommissioning Conditions - Limiting Decommissioning Conditions (LDC) are administratively established constraints on equipment and operational characteristics which shall be adhered to during decommissioning activities.

DEFINITIONS remain unaffected, with the addition of Decommissioning Activities and Limiting Decommissioning Conditions.

Limiting Safety System Setting (LSSS) - The LSSS is the actuating level for automatic protective devices related to those variables having significant safety functions.

Manual Mode - The reactor is in the manual mode when the reactor mode selection switch is in the manual or automatic position. In this mode, reactor power is held constant or is changed on periods of approximately one second or longer.

Measured Value - The Measured Value is the value of a parameter as it appears on the output of a channel.

Movable Experiment - An experiment is movable when it is intended that all or part of the experiment may be moved in or near the core or into and out of the reactor while the reactor is operating.

Operable - Operable means a component or system is capable of performing its intended function.

Operating - Operating means a component or system is performing its intended function.

Pulse Mode - The reactor is in the pulse mode when the reactor mode selection switch is in the pulse position. In this mode, reactor power may be increased on periods less than one second by motion of the transient control rod.

Reactivity Worth of an Experiment - The reactivity worth of an experiment is the maximum value of the reactivity change that would occur as a result of planned changes or credible malfunctions that alter experiment position or configuration.

Reactor Committee - The group of persons at the University who are assigned responsibility for review and audit of facility operation and review of changes and experiments in accordance with 10 CFR 50.59.

Reactor Operating - The reactor is operating whenever it is not secured or shutdown.

Reactor Safety Systems - Reactor Safety Systems are those systems, including associated input channels, which are designed to initiate automatic reactor protection or to provide information for initiation of manual protective action.

Reactor Secured - The reactor is secured when:

a. It contains insufficient fissile material or moderator present in the reactor, adjacent experiments or control rods, to attain criticality under optimum available conditions of moderation and reflection, or

b. 1. The minimum number of neutron absorbing control rods are fully inserted or other safety devices are in shutdown position, as required by technical specifications, and

   2. The console key switch is in the off position and the key is removed from the lock, and

   3. No work is in progress involving core fuel, core structure, installed control rods, or control rod drives unless they are physically decoupled from the control rods, and

   4. No experiments in or near the reactor are being moved or serviced that have, on movement, a reactivity worth of one dollar or more.

Reactor Shutdown - The reactor is in a shutdown condition when sufficient control rods are inserted to assure that it is subcritical by at least $1.00 of reactivity.

Reportable Occurrence - A Reportable Occurrence is any of the following which occurs during reactor operation:

a. Operation with actual safety-system settings for required systems less conservative than the limiting safety-system settings specified in Technical Specification 2.2.

b. Operation in violation of limiting conditions for operation established in the Technical Specifications.

c. A reactor safety system component malfunction which renders or could render the reactor safety system incapable of performing its intended safety function unless the malfunction or condition is discovered during maintenance tests or periods of reactor shutdown.

d. Any unanticipated or uncontrolled change in reactivity greater than one dollar.

DEFINITIONS remain unaffected, with the addition of Decommissioning Activities and Limiting Decommissioning Conditions.

e. Abnormal and significant degradation in reactor fuel, cladding, or coolant boundary which could result in exceeding of prescribed radiation exposure or release limits.

f. An observed inadequacy in the implementation of either administrative or procedural controls which could result in operation of the reactor outside the limiting conditions for operation.

g. Release of radioactivity from the site above limits specified in 10CFR20.

Control Rod - A control rod is a device fabricated from neutron absorbing material or fuel which is used to establish neutron flux changes and to compensate for routine reactivity losses. A control rod may be coupled to its drive unit allowing it to perform a safety function when the coupling is disengaged.

Transient Rod - The transient rod is a control rod with scram capabilities that is capable of providing rapid reactivity insertion to produce a pulse.

Safety Limit - A Safety Limit is a limit on an important process variable which is found to be necessary to reasonably protect the integrity of certain of the physical barriers which guard against the uncontrolled release of radioactivity. The principal physical barrier is the fuel element cladding.

Secured Experiment - A Secured Experiment is any experiment, experimental facility, or component of an experiment that is held in a stationary position relative to the reactor by mechanical means. The restraining forces must be substantially greater than those to which the experiment might be subjected by hydraulic, pneumatic, buoyant, or other forces which are normal to the operating environment of the experiment, or by forces which can arise as the result of credible malfunctions.

Shall, Should, and May - The word "shall" is used to denote a requirement, the word "should" denotes a recommendation, and the word "may" denotes permission, neither a requirement nor a recommendation.

Shutdown Margin - Shutdown Margin is the reactivity existing when the most reactive control rod is fully withdrawn from the core and the other control rods are fully inserted into the core.

DEFINITIONS remain unaffected, with the addition of Decommissioning Activities and Limiting Decommissioning Conditions.

Time Interval - The average over any extended period for each surveillance time item shall be the normal surveillance time; e.g., for a two-year interval, the average shall not exceed two years.

a. Biennially - at two-year intervals (interval not to exceed 30 months)

b. Annually - at one-year intervals (interval not to exceed 15 months)

c. Semiannually - at 6-month intervals (interval not to exceed seven and one-half months)

d. Quarterly - at 3-month intervals (interval not to exceed four months)

e. Monthly - at one-month intervals (interval not to exceed six weeks)

f. Weekly - at seven-day intervals (interval not to exceed ten days)

g. Daily - (must be done during the calendar day)

Any extension of these intervals shall be occasional and for a valid reason shall not affect the average as defined.

Untried Experiment - An untried experiment is any experiment not previously performed in this reactor.

DEFINITIONS remain unaffected, with the addition of Decommissioning Activities and Limiting Decommissioning Conditions.

2.0 SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

2.1 Safety Limit - Fuel Temperature

Applicability
This specification applies to the reactor fuel temperature

Objective
The objective is to define a fuel temperature below which it can be predicted with confidence that no damage to the fuel elements will occur.

Specification
The temperature of the fuel shall not exceed 1000□C under any conditions of operation.

Basis
The recommended limiting design basis parameter for TRIGA fuel is the fuel temperature. A fuel temperature safety limit of 1150°C for stainless-steel-clad U-$ZrH_{1.65}$ TRIGA fuel is recommended as a design value to preclude the loss of clad integrity when the clad temperature is below 500°C (Simnad, GA Report E-117-833, The U-Zr H Alloy: Its Properties and Use in TRIGA Fuel, Feb. 1980, p. 4-1). The criterion for assuring the integrity of a TRIGA fuel element at the University of Arizona is that the fuel temperature be maintained below 1000°C, which is well below the recommended value. It has been shown by analysis and by measurements on other TRIGA reactors that a power level of 1000 kW corresponds to a peak fuel temperature of approximately 400°C. Pulsing with a reactivity input of $3.25 will give a peak fuel temperature of approximately 460°C.

The SAFETY LIMIT remains unaffected by our cessation of operations.

~~**2.2 Limiting Safety System Setting - Steady State Reactor Power Level**~~

~~Applicability~~
~~This specification applies to the reactor power level safety system setting for steady state operation.~~

~~Objective~~
~~The objective is to assure that the Safety Limit is not exceeded.~~

~~Specification~~
~~The setting for the power level scram in steady state operation shall be no greater than 110 kW.~~

~~Basis~~
~~Calculations and measurements show that at 110 kW, the peak fuel temperature in the core will be less than approximately 150□C which is well below the safety criterion of 1000□C and provides an ample safety margin to accommodate errors in measurement and anticipated operational transients.~~

The LSSS become inapplicable, once reactor operations have permanently ceased. Delete this section.

~~**2.3 Limiting Safety System Setting - Pulse Mode Reactor Power Level**~~

~~Applicability~~
~~This specification applies to the reactor power level safety system setting for pulse mode operation.~~

~~Objective~~
~~The objective is to assure that the fuel temperature specified by the Safety Limit is not exceeded in pulse mode operation.~~

~~Specification~~
~~The setting for the peak power level scram in pulse mode operation shall be no greater than 1100 MW.~~

~~Basis~~
~~Calculations and measurements show that at a peak power of 1100 MW in pulse mode operation, the peak fuel temperature in the core will be less than approximately 400°C. This provides an ample safety margin to accommodate errors in measurements and anticipated operational transients.~~

The LSSS become inapplicable, once reactor operations have permanently ceased. Delete this section.

3.0 LIMITING CONDITIONS FOR OPERATION AND LIMITING DECOMMISSIONING CONDITIONS

3.1 Reactivity Limits

Applicability
These specifications apply to the reactivity condition of the reactor~~, and the reactivity worths of control rods and experiments, and apply for all modes of reactor operation~~.

Objective
The objective is to assure that the reactor ~~can~~ shall be shut down at all times and to assure that the safety limit will not be exceeded.

Specifications
The reactor shall not be operated. ~~unless the following conditions exist:~~

~~a. The shutdown margin referred to the cold xenon-free condition is greater than $0.50 with the highest worth rod fully withdrawn and with the highest worth non-secured experiment in its most positive reactivity state.~~

~~b. Any experiment with a reactivity worth greater than $1.00 is secured so as to prevent unplanned reactivity removal from or insertion into the reactor;~~

~~c. The reactivity available to be inserted by the pulse rod is determined and is limited by a mechanical block to a maximum of $2.50.~~

~~d. The reactivity worth of an individual experiment is not more than $3.00;~~

~~e. The total of the absolute values of the reactivity worth of all experiments in the reactor is less than $5.00;~~

~~f. A ramp or oscillating rod placed in the reactor cannot add more than $1.00 of reactivity;~~

~~g. The drop time of each standard control rod from the fully withdrawn position to 90 percent of full reactivity insertion is less than one second; and~~

~~h. The neutron count rate on the startup channel is greater than one count per second.~~

Change the LCO Reactivity Limits Specifications to "The reactor shall not be operated," and delete the remainder of this section.

~~3.2 High Power Operation~~

~~Applicability~~
~~This specification applies to operation of the reactor at high steady-state power.~~

~~Objective~~
~~The objective is to prevent inadvertent pulse operation of the reactor while it is at a high power level.~~

~~Specification~~
~~The reactor shall not be operated in the steady-state mode at power levels above 10 kW unless, in addition to the conditions of Section 3.1, the transient rod is fully withdrawn to the limit of its limiting switch.~~

~~Basis~~
~~This specification is intended to prevent inadvertent pulse operation when the fuel temperature is above 50°C (corresponding to a power level of 10 kW) as measured in the B-ring. See Specification 3.3b.~~

The HIGH POWER OPERATION section becomes inapplicable, ~~once reactor~~once reactor operations have permanently ceased. Delete this section.

~~3.3 Pulse Operation~~ ~~Applicability~~ ~~These specifications apply to operation of the reactor in the pulse mode.~~ ~~Objective~~ ~~The objective is to prevent the fuel temperature safety limit from being exceeded during pulse mode operation.~~ ~~Specifications~~ ~~The reactor shall not be operated in the pulse mode unless, in addition to the requirements of Section 3.1, the following conditions exist:~~ ~~a. The transient rod is set such that the reactivity worth upon withdrawal is not greater than $2.50; and~~ ~~b. The temperature of the fuel immediately prior to the pulse is essentially in equilibrium with the bulk water temperature. This is controlled by limiting the reactor power prior to pulsing.~~ ~~Basis~~ ~~The specification 3.3a will maintain the maximum temperature of the fuel after a pulse below 400°C above the bulk pool temperature, and thus well below the 1000°C fuel safety criterion.~~	The PULSE OPERATION section becomes inapplicable, ~~once reactor~~once reactor operations have permanently ceased. Delete this section.

3.2~~3.4~~ Reactor Instrumentation

Applicability
This specification applies to the information which must be available ~~to the reactor operator during reactor operation~~ during fuel movement and during decommissioning activities.

Objective
The objective is to require that sufficient information is available to the operator to assure safe ~~operation of the reactor~~movement of fuel and decommissioning.

Specification
~~The reactor shall not be operated~~Reactor fuel shall not be moved- and decommissioning activities shall not be conducted unless the measuring channels described in the following table are operable and the information is available in the control room:

MEASURING CHANNEL	MINIMUM NUMBER OPERABLE	~~OPERATING MODE~~ ACTIVITY IN WHICH REQUIRED
~~reactor power level (linear)~~	~~1~~	~~steady state~~
wide-range log power level (startup count rate)	1	~~steady state~~fuel movement
reactor period	1	~~steady state~~fuel movement
~~reactor power level (high range)~~	~~1~~	~~pulse mode~~
~~reactor tank water temperature~~	~~1~~	~~all modes~~
area radiation monitors	2	~~all modes~~fuel movement and decommissioning activities
particulate air radiation monitor	1	fuel movement and decommissioning activities~~all modes~~
reactor water activity monitor	1	~~all modes~~fuel movement

Bases
The wide range log power and reactor period channels ~~neutron detectors~~ assure that indications ~~measurements~~ of ~~the~~ subcritical reactor power level changes are ~~adequately covered at both low and high ranges~~available during fuel movement.

The REACTOR INSTRUMENTATION section is modified for conditions after operations have permanently ceased. The wide-range log power level (startup count rate) meter and the reactor period meter remain operable with the reactor "secured" and with the console power "off." Delete the channels other than these two indicators and the radiation monitors.

The radiation monitors provide information to operating personnel of radiation above a preset level so that there will be sufficient time to evacuate the facility or take action to prevent the release of radioactivity to the surroundings.

The REACTOR INSTRUMENTATION section is modified for conditions after operations have permanently ceased. The wide-range log power level (startup count rate) meter and the reactor period meter remain operable with the reactor "secured" and with the console power "off." Delete the channels other than these two indicators and the radiation monitors.

~~3.5 Reactor Safety System~~

~~Applicability~~
~~This specification applies to the reactor safety system channels and interlocks.~~

~~Objective~~
~~The objective is to require the minimum number of reactor safety system channels and interlocks that must be operable in order to assure that the safety limits and the LCO's are not exceeded.~~

~~Specification~~
~~The reactor shall not be operated unless the safety system channels and interlocks described in the following tables are operable.~~

~~SAFETY SYSTEM OR MEASURING CHANNEL~~	~~MINIMUM NUMBER OPERABLE~~	~~FUNCTION~~	~~OPERATING MODE IN WHICH REQUIRED~~	~~SETPOINT~~
~~reactor power level~~	~~2~~	~~scram~~	~~steady state~~	~~not above 110 kw~~
~~reactor period~~	~~1~~	~~audible alarm~~	~~steady state~~	~~no shorter than 2 seconds~~
~~peak reactor power~~	~~1~~	~~scram~~	~~pulse mode~~	~~not above 1100 Mw~~
~~manual scram~~	~~1~~	~~scram~~	~~all modes~~	
~~pool water level~~	~~1~~	~~scram~~	~~all modes~~	~~not less than 14 feet of water above core~~
~~safety channel switched to "zero" or "calibrate"~~	~~2~~	~~scram~~	~~all modes~~	
~~timer after pulsing operation~~	~~1~~	~~scram~~	~~pulse mode~~	~~15 seconds or less~~
~~power failure~~	~~1~~	~~scram~~	~~all modes~~	~~loss of console power~~

The REACTOR SAFETY SYSTEM section becomes inapplicable, once reactor operations have permanently ceased. Delete this section.

~~Interlock~~	~~Minimum number operable~~	~~Operating mode in which function~~	~~Required~~
~~startup count rate interlock~~	~~1~~	~~prevent control rod withdrawal when neutron count rate is less than 1per second~~	~~reactor startup~~
~~transient rod interlock~~	~~1~~	~~prevent withdrawal of a transient rod when its shock absorber anvil is not fully inserted~~	~~steady state mode~~
~~simultaneous control rod withdrawal prohibit interlock~~	~~1~~	~~prevent simultaneous manual withdrawal of two control rods~~	~~all modes~~
~~reactor power level interlock~~	~~1~~	~~prevent transient rod withdrawal when power is greater than 10 kW~~	~~pulse mode~~

The REACTOR SAFETY SYSTEM section becomes inapplicable, once reactor operations have permanently ceased. Delete this section.

~~Bases~~

~~The power level scrams are provided in all modes of operation as protection against abnormally high fuel temperatures and to assure that the reactor operation stays within the licensed limits. The manual scram allows the operator to shut down the system if an unsafe or abnormal condition occurs. The reactor period alarm alerts the operator to potential rapid transient power changes so limiting actions may be taken. The pool water level scram assures that sufficient water shielding is above the core during reactor operation.~~

~~The interlocks which prevent the withdrawal of the transient rod in the steady state mode and when the power level is greater than 10 kW prevent inadvertent pulses. The interlock to prevent startup of the reactor with less than one neutron per second indicated on the startup channel assures that sufficient neutrons are available to provide indication on the measuring channels.~~

3.3~~3.6~~ Ventilation System

Applicability
This specification applies to the operation of the reactor facility ventilation system.

Objective
The objective is to assure that the ventilation system is in operation to mitigate the consequences of the possible release of radioactive materials ~~resulting from reactor operation~~.

Specification
~~The reactor shall not be operated~~Fuel shall not be moved and decommissioning activities shall not be conducted unless the facility ventilation system is ~~in operation~~operable with a minimum air withdrawal rate of 500 cfm~~,~~. ~~except for periods of time not to exceed two days to permit repairs to the system. During such periods of repair:~~

~~a. The reactor shall not be operated at power levels above 10 kW and;~~

~~b. The reactor shall not be operated with experiments in place whose failure could result in the release of radioactive gases or aerosols.~~

Basis
It is shown in The Safety Analysis Report that operation of the ventilation system reduces doses in the reactor facility ~~due to argon-41, and also~~ in the event of a TRIGA fuel element failure. ~~The specifications governing operation of the reactor while the ventilation system is undergoing repairs limit the generation of argon-41 and also reduce the probability of fuel element failure during such times.~~

The VENTILATION SYSTEM section applies to fuel movement and to decommissioning activities once our reactor operations have permanently ceased.

~~3.7 Experiments~~

~~Applicability~~
~~These specifications apply to experiments installed in the reactor and its experimental facilities.~~

~~Objective~~
~~The objective is to prevent damage to the reactor or excessive release of radioactive materials in the event of an experiment failure.~~

~~Specifications~~
~~The reactor shall not be operated unless the following conditions exist:~~

~~a. fueled experiments shall be limited such that the total inventory of iodine isotopes 131 through 135 in the experiment is not greater than 1.5 millicuries and the strontium-90 inventory is not greater than 5 millicuries;~~

~~b. experiments containing materials corrosive to reactor components, compounds highly reactive with water, potentially explosive materials, or liquid fissionable materials shall be doubly encapsulated; and~~

~~c. known explosive materials shall not be irradiated in the reactor in quantities greater than 25 milligrams. In addition, the pressure produced in the experiment container upon detonation of the explosive shall have been determined experimentally, or by calculations, to be less than the design pressure of the container.~~

~~Basis~~
~~The limits of Specification 3.7a prevent the dose in unrestricted areas resulting from experiment failure from exceeding 10 CFR Part 20 limits. Calculations for the SAR demonstrate that the maximum release in the event of a fuel element failure would not exceed 6.5 millicuries of iodine isotopes 131 through 135. Specifications 3.7b and 3.7c are provided to reduce the probability of damage to reactor components resulting from experiment failure.~~

The EXPERIMENTS section becomes inapplicable, once reactor operations have permanently ceased. Delete this section.

4.0 SURVEILLANCE REQUIREMENTS

4.1 Fuel

Applicability
This specification applies to the surveillance requirements for the fuel elements.

Objective
The objective is to assure that the dimensions of the fuel elements remain within acceptable limits.

Specifications

a. All fuel elements shall be removed from the core and visually inspected for evidence of deterioration of cladding, (including at least corrosion, erosion, wear, cracking, and weld integrity) at least once every five years.

~~b. The standard fuel elements shall be measured for length and bend at intervals separated by not more than 500 pulses of magnitude greater than $2.00 of reactivity.~~

~~c~~b. A fuel element indicating an elongation greater than 1/4 inch over its original length or a lateral bending greater than 1/16 inch over its original bending shall be considered to be damaged and shall ~~not be used in the core for further operation~~ be recorded as such in the fuel inventory logs.

~~d. Fuel elements in the B- and C- rings shall be measured for possible distortion in the event that there is indication that the Limiting Safety System Settings may have been exceeded.~~

Basis
The most severe stresses induced in the fuel elements result from pulse operation with high reactivity input, during which differential expansion between the fuel and the cladding occurs and the pressure of the gases within the elements increases sharply. The above limits on the allowable distortion of a fuel element correspond to strains that are considerably lower than the strain expected to cause rupture of a fuel element.

No change to the overall FUEL SURVEILLANCE section except delete Specifications (b) and (d) as we won't be pulsing or keeping fuel in the B- or C-rings.

4.2 Control Rods

Applicability
This specification applies to the surveillance requirements for the control rods.

Objective
The objective is to assure the ~~operability~~ integrity of the fuel-followed control rods.

We cannot accomplish all CONTROL ROD SURVEILLANCE once our operating license expires. Keep only Specification (c) for fuel followed rods and delete the remainder of this section.

Specification

~~a. The reactivity worth of each control rod shall be determined annually.~~

Cannot accomplish reactivity worth determination.

~~b. Control rod drop times shall be determined annually and after disassembly and reassembly of control rod drives or removal of control elements.~~

~~c~~a. The fuel-followed control rods shall be visually inspected for deterioration biennially.

~~d. On each day that pulse mode operation of the reactor is planned, a functional performance check of the transient (pulse) rod system shall be performed prior to pulse mode operation.~~

~~e. Semiannually, the transient (pulse) rod drive cylinder and the associated air supply system shall be inspected, cleaned and lubricated as necessary.~~

~~f. The maximum control rod reactivity insertion rates shall be determined annually.~~

Cannot accomplish.

Basis
~~The reactivity worth of the control rods is measured to assure that the required shutdown margin is available and to provide a means for determining the reactivity worths of experiments inserted in the core.~~ The visual inspection of the fuel-followed control rods ~~and measurement of their drop times are~~ is made to determine whether the control rods are ~~capable of performing their functions properly~~preserving the integrity of fuel.

~~4.3 Reactor Safety System~~ ~~Applicability~~ ~~The specification applies to the surveillance requirements for the measuring channels of the reactor safety system.~~ ~~Objective~~ ~~The objective is to assure that the safety system will remain operable and will prevent the fuel temperature safety limit from being exceeded.~~ ~~Specification~~ ~~a. A channel test of each of the reactor safety system channels required in the operating mode to be followed shall be performed prior to each day's operation or prior to each operation extending more than one day.~~ ~~b. A channel check of the power level measuring channels required in the operating mode to be followed shall be performed daily whenever the reactor is in operation.~~	We cannot accomplish all REACTOR SAFETY SYSTEM SURVEILLANCE, which is not applicable once our operations cease. Eliminate this entire REACTOR SAFETY SYSTEM SURVEILLANCE section.
~~c. A channel calibration by the calorimetric method shall be performed for the reactor power level measuring channels annually.~~ ~~Basis~~ ~~The daily tests and channel checks will assure that the safety channels are operable. The annual calibration and verifications will permit any long-term drift of the channels to be corrected.~~	Cannot accomplish

4.3~~4.4~~ Radiation Monitoring Equipment

Applicability

This specification applies to the radiation monitoring equipment required by Section 3.24 of these specifications.

Objective

The objective is to assure that the radiation monitoring equipment is operating and to verify the appropriate alarm settings.

Specification

a. The alarm set points for the radiation monitoring instrumentation shall be verified prior to ~~each day's run~~fuel movement or conduct of decommissioning activities, on each day when they are performed.

b. The radiation monitoring equipment shall be calibrated annually.

Basis

Verification of the alarm set points of radiation monitoring instrumentation will assure that sufficient information to provide protection against radiation exposure is available.

The RADIATION MONITORING EQUIPMENT SURVEILLANCE section applies to equipment required during fuel movement and decommissioning activities, after reactor operations have ceased.

4.~~5~~4 Maintenance

Applicability
This specification applies to the surveillance requirements following maintenance of a control or safety system.

Objective
The objective is to assure that a system is operable before being used after maintenance has been performed.

Specification

a. Following maintenance or modification of a control or safety system or component, it shall be verified that the system is operable prior to its return to service. A system shall not be considered operable until after it is successfully tested.

b. Any additions, modifications, or maintenance to the ventilation system, the core and its associated support structure, the pool or its penetrations, the pool coolant system, the rod drive mechanism, or the reactor safety system shall be made and tested in accordance with the specifications to which the systems were originally designed and fabricated or to specifications approved by the Reactor Committee.

c. A licensed reactor operator shall be present during maintenance of the reactor control and safety system.

Basis
This specification relates to changes in reactor systems which could directly affect the safety of the reactor. Changes or replacements to these systems which meet the original design specifications are considered to meet the presently accepted operating criteria.

The SURVEILLANCE FOLLOWING MAINTENANCE section remains unaffected once our operating license expires.

4.~~6~~5 Pool Water Conductivity

Applicability
This specific action applies to surveillance of pool water conductivity.

Objective
The objective is to assure that pool water mineral content is maintained at an acceptable level.

Specification
The conductivity of bulk coolant water shall be verified to be within specified limits at least monthly.

Basis
Based on experience, in which pool water conductivity changes slowly with time, observation at these intervals provides acceptable surveillance of conductivity to assure that accelerated fuel clad corrosion does not occur.

The POOL WATER CONDUCTIVITY SURVEILLANCE section remains unaffected once our operating license expires.

5.0 DESIGN FEATURES

5.1 Reactor Fuel

Applicability
This specification applies to the fuel elements ~~used~~ stored in the reactor ~~core~~pool.

Objective
The objective is to assure that the fuel elements are of such a design and fabricated in such a manner as to permit their use with a high degree of reliability with respect to their mechanical integrity.

Specifications

a. Standard Fuel Element: The standard fuel element shall be of the TRIGA type and shall contain uranium-zirconium hydride, clad in 0.020 inch of 304 stainless steel. It shall contain a maximum of 9.0 weight percent uranium which has a maximum enrichment less than 20 percent. There shall be 1.55 to 1.80 hydrogen atoms to 1.0 zirconium atom.

b. Loading: With the exception of one fuel-followed control element (the "regulating rod") no fuel elements shall be placed within the B- or C- rings of the core. ~~The elements shall be placed in a closely packed array except for experimental facilities or for positions occupied by control rods, elements fully loaded with graphite, a neutron-startup source, or single positions within the array filled with water.~~

Basis
This type of fuel element has a long history of successful use in TRIGA reactors.
Specification b ensures that the fuel stored within the core structure cannot attain a value of k_{eff} greater than ~~0.9~~ .0.9.

The REACTOR FUEL DESIGN FEATURES section is modified to reflect the use of core positions outside rings B and C for fuel storage.

5.2 Reactor Building and Decommissioning Site

Applicability

This specification applies to the facility which houses the reactor and the residual facility and site to which the Decommissioning Plan applies.

The REACTOR BUILDING SPECIFICATIONS section is modified to include the site to which the Decommissioning Plan applies

Objective

The objective is to assure that provisions are made to restrict the radioactivity released into the environment.

Specifications

a. The reactor shall be housed in a closed room of a facility designed to restrict leakage.

b. The free volume of the reactor room shall be at least 6,000 cubic feet.

c. All air or other gases exhausted from the reactor room during ~~reactor operation~~ decommissioning activities shall be released at a minimum of 12 feet above ground level.

d. The reactor facility shall be equipped with a ventilation system capable of exhausting air or other gases from the reactor room from a stack at a minimum of 50 feet above ground level under emergency conditions.

e. During decommissioning activities within the reactor room, openings to the room other than those designed for exhaust air and gases shall be closed except for required access and when materials prepared for shipment are being removed.

f. During decommissioning activities outside the reactor room, components that are to be removed shall be enclosed in a manner designed to restrict leakage and to restrict access, before being dismantled.

Basis

In order that the movement of air can be controlled, the facility contains no windows that can be opened. Under emergency conditions the room air is exhausted through a filter and discharged through a stack at a minimum of 50 feet above ground to provide dilution.

Specification f. applies only to equipment described in the SAR which is outside the reactor room: parts of the water purification system and the cooling system. All other decommissioning activities will be confined to the footprint described in SAR section IVa~~, designated~~, designated as ~~a controlled~~a ~~access~~controlled access area.

5.3 Fuel Storage

Applicability
This specification applies to the storage of reactor fuel at times when it is not in the reactor core.

Objective
The objective is to assure that fuel which is being stored will not become supercritical and will not reach unsafe temperatures.

Specifications

a. All fuel elements shall be stored in a geometrical array where the value of k_{eff} is less than 0.9 for all conditions of moderation and reflection using light water.

b. Irradiated fuel elements and fueled devices shall be stored in an array which will permit sufficient natural convection cooling by water or air such that the fuel element or fueled device temperature will not exceed 800°C.

Basis
Specification 5.3a assures that unplanned criticality will not occur in fuel storage racks.

Specification 5.3b is based on a fuel temperature limit of 950°C to assure fuel clad integrity when the clad temperatures can equal the fuel temperature (Simnad, G. A. Report E-117-833, February 1980, p.4-~~1)~~1)

The FUEL STORAGE SPECIFICATIONS section remains unaffected once our operating license expires.

6.0 ADMINISTRATIVE CONTROLS

6.1 Organization

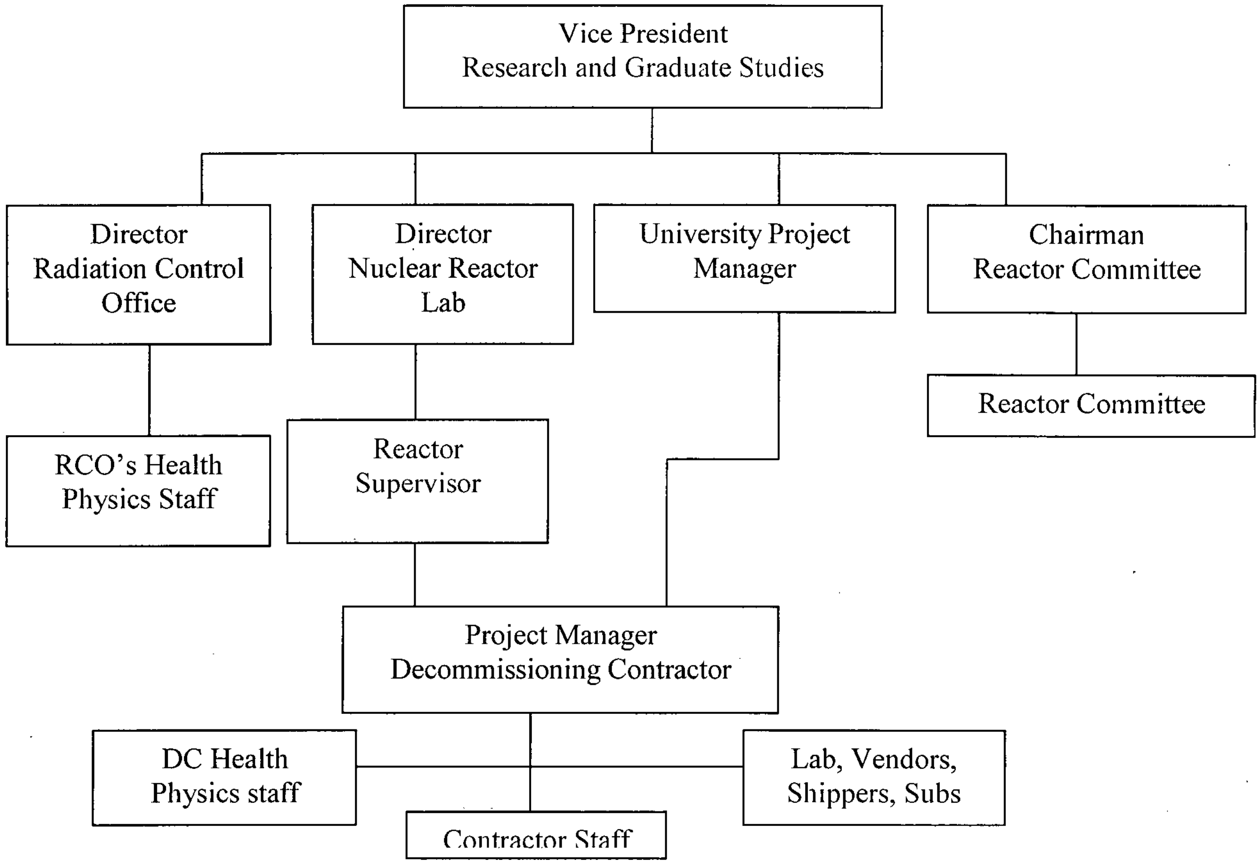
a. The reactor facility shall be maintained~~operated~~ by the Nuclear Reactor Laboratory (NRL) at the University of Arizona. The Nuclear Reactor Laboratory Director shall report to the Vice President for Research and Graduate Studies at the University of Arizona as shown in the diagram below.

b. The reactor facility shall be under the supervision of a licensed senior operator for the reactor. He shall be responsible for assuring that all operations are conducted in a safe manner and within the limits prescribed by applicable federal regulations, by the facility license, and by the provisions of the Reactor Committee.

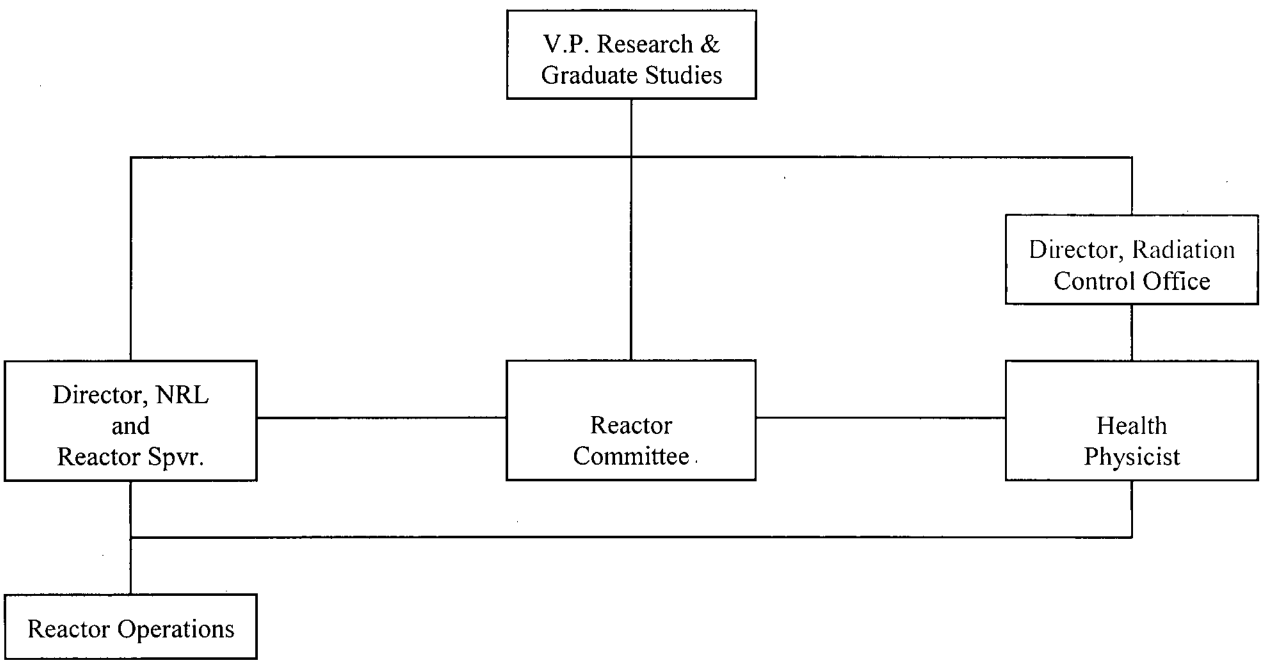
c. There shall be a Health Physicist responsible for assuring the safety of reactor operations from the standpoint of radiation protection.

d. An NRC-licensed operator must be present in the control room when the key switch is on. An operator and one other person authorized by the Reactor Supervisor must be present in the Reactor Laboratory whenever the reactor is not shut down.

The ADMINISTRATIVE CONTROLS ORGANIZATION section remains unaffected when our operations cease, but changes become applicable when we begin decommissioning activities.



The above organizational chart from our Decommissioning Plan replaces the organizational chart below when decommissioning activities commence. Until then, the following chart remains applicable.



6.2 Review

a. There shall be a Reactor Committee which shall review reactor operations and decommissioning activities to assure that the facility is ~~operated~~ maintained in a manner consistent with public safety and within the terms of the facility license.

b. The responsibility of the Committee includes, but is not limited to, the following:
   1. Review and approval of experiments utilizing the reactor facilities;

   2. Review and approval of all proposed changes to the facility, procedures, and Technical Specifications;

   3. Determination of whether a proposed change, test, or experiment would constitute a license amendment pursuant to 10 CFR 50.59(c)(2) as outlined in UARR 165;

   4. Review and approval of all proposed changes to the Decommissioning Plan, provided such changes meet the specifications listed in 7.2

   5. Review ~~of the~~of the operation and operational records of the facility;

   ~~5~~6. Review of abnormal performance of plant equipment and operating anomalies; and

   ~~6~~7. Review of unusual or abnormal occurrences and incidents which are reportable under 10 CFR 20 and 10 CFR 50.

   ~~7~~8. Review and audit of the retraining and requalification program for the operating staff.

   ~~8~~9. Biennial audit of the Emergency Plan.

c. The Committee shall be composed of at least five members, and shall include a health physicist and members competent in the field of reactor operations, radiation science, or reactor engineering. The membership of the Committee shall be such as to maintain a high level degree of technical proficiency.

The REVIEW section becomes applicable to decommissioning activities once our operations have ceased.

d. The Committee shall establish a written charter defining such matters as the authority of the Committee, review and audit functions, and other such administrative provisions as are required for effective functioning of the Committee. Minutes of all meetings of the Committee shall be kept and submitted to committee members and to the Vice President for Research and Graduate Studies in a timely manner.

e. A quorum of the Committee shall consist of not less than three members of the Committee and shall include the chairman or his designee.

f. The Committee shall meet at least quarterly.

The REVIEW section becomes applicable to decommissioning activities once our operations have ceased.

6.3 Operations

a. Operating Procedures

Written procedures, reviewed and approved by the Reactor Committee, shall be in effect and followed for the following items. The procedures shall be adequate to assure the safety of the reactor, but should not preclude the use of independent judgment and action should the situation require such.

1. Startup, operation, and shutdown of the reactor.

2. Installation or removal of fuel elements, control rods, experiments, and experimental facilities.

3. Actions to be taken to correct specific and foreseen potential malfunctions of systems or components, including responses to alarms, suspected primary coolant system leaks, and abnormal reactivity changes.

4. Emergency conditions involving potential or actual release of radioactivity, including provisions for evacuation, re-entry, recovery, and medical support.

5. Maintenance procedures which could have an effect on reactor safety.

6. Periodic surveillance of reactor instrumentation and safety system, area monitors and continuous air monitors.

7. Decommissioning activities

Substantive changes to the above procedures shall be made only with the approval of the Reactor Committee. Temporary changes to the procedures that do not change their original intent may be made with the approval of the Reactor Laboratory Director. All such temporary changes to procedures shall be documented and subsequently reviewed by the Reactor Committee.

b. ALARA Program

A program shall be established to assure that radiation exposures and releases are kept as low as reasonably achievable.

The OPERATIONS section remains unaffected once our operations cease, but become applicable also to decommissioning activities.

6.4 Action to be Taken in the Event a Safety Limit is Exceeded

In the event a safety limit is exceeded, or thought to have been exceeded:

a. The reactor shall be shut down and reactor operation shall not be resumed until authorized by the NRC.

b. An immediate report of the occurrence shall be made to the Chairman of the Reactor Committee and reports shall be made to the NRC in accordance with Section 6.7 of these specifications.

c. A report shall be made which shall include an analysis of the causes and extent of possible resultant damage, efficiency of corrective action, and recommendations for measures to prevent or reduce the probability of recurrence. This report shall be submitted to the Reactor Committee for review, and a similar report submitted to the NRC when authorization to resume operation of the reactor is requested.

The ACTION TO BE TAKEN IN THE EVENT A SAFETY LIMIT IS EXCEEDED section remains unaffected.

6.5 Action to be Taken in the Event of a Reportable Occurrence

In the event of a Reportable Occurrence, the following action shall be taken:

a. The Reactor Laboratory Director shall be notified and corrective action taken prior to resumption of the operation involved.

b. A report shall be made which shall include an analysis of the cause of the occurrence, efficacy of corrective action and recommendations for measures to prevent or reduce the probability of reoccurrence. This report shall be submitted to the Reactor Committee for review.

c. A report shall be submitted to the NRC in accordance with Section 6.7 of these specifications.

The ACTION TO BE TAKEN IN THE EVENT OF A REPORTABLE OCCURRENCE section remains unaffected.

6.6 Plant Operating Records

The PLANT OPERATING RECORDS section become applicable to decommissioning activities

In addition to the requirements of applicable regulations, and in no way substituting ~~therefor~~therefore, records and logs of the following items shall be prepared and retained for a period of at least 5 years (except as otherwise specified in the Commission's regulations);

a. Normal plant operation (but not including supporting documents such as checklists, and recorder charts, which shall be maintained for a period of at least one year);

b. Principal maintenance activities;

c. Reportable Occurrences;

d. Equipment and component surveillance activities required by the Technical Specification;

e. Experiments performed with the reactor;

Logs and records of the following items shall be prepared and retained for the life of the facility.

f. Gaseous and liquid radioactive effluents released to the environs;

g. Off-site environmental monitoring surveys;

h. Fuel inventories and transfers;

i. Facility radiation and contamination surveys;

j. Radiation exposures for all personnel; ~~and~~

k. Updated, corrected, and as-built drawings of the facility; and~~.~~

l. Decommissioning activities

6.7 Reporting Requirements

In addition to the requirements of applicable regulations, and in no way substituting ~~therefor~~therefore, reports shall be made to the NRC as follows:

a. A report within 24 hours by telephone and telegraph or telefax (FAX) to the responsible NRC organization as listed in the Emergency Kit and posted as deemed necessary by the Reactor Committee of:

   1. Any accidental off-site release of radioactivity above limits permitted by 10 CFR 20, whether or not the release resulted in property damage, personal injury, or exposure;

   2. Any violation of a Safety Limit; and

   3. Any reportable occurrences as defined in Section 1.0 (Reportable Occurrence) of these specifications in writing.

b. A written report within ten days to the U. S. Nuclear Regulatory Commission, Attn: Document Control Desk, Washington D.C. 20555, with a copy to the responsible NRC facility inspector of:

   1. Any significant variation of measured values from a corresponding predicted value of previously measured value of safety-connected operating characteristics occurring during operation of the reactor;

   2. Incidents or conditions relating to operation of the facility which prevented or could have prevented the performance of engineered safety features as described in these specifications;

   3. Any reportable occurrences as defined in Section 1.0 of these specifications; and

   4. Any violation of a Safety Limit.

   5. Any accidental off-site release of radioactivity above limits permitted by 10 CFR 20, whether or not the release resulted in property damage, personal injury, or exposure.

The REPORTING REQUIREMENTS section remains unaffected.

c. A written report within 30 days to the U.S. Nuclear Regulatory Commission, Attn: Document Control Desk, Washington D.C. 20555, with a copy to the responsible NRC facility inspector of:

1. Any substantial variance from performance specifications contained in these specifications or in the Safety Analysis Report;

2. Any significant change in the transient or accident analysis as described in the Safety Analysis Report;

3. Any changes in facility organization; and

4. Any observed inadequacies in the implementation of administrative or procedural controls.

d. A written report within 60 days after completion of startup testing of the reactor to the U. S. Nuclear Regulatory Commission, Attn: Document Control Desk, Washington D.C. 20555, with a copy to the responsible NRC facility inspector of:

1. An evaluation of facility performance to date in comparison with design predictions and specifications; and

2. A reassessment of the safety analysis submitted with the license application in light of measured operating characteristics when such measurements indicate that there may be substantial variance from prior analysis.

e. A written annual report within 60 days following the 30th of June each year to the U.S. Nuclear Regulatory Commission, Attn: Document Control Desk, Washington D. C. 20555, with a copy to the responsible NRC facility inspector of:

1. A brief narrative summary of (1) operating experience (including experiments performed), (2) changes in facility design, performance characteristics, and operating procedures related to reactor safety and occurring during the reporting period, and (3) results of surveillance tests and inspections;

The REPORTING REQUIREMENTS section remains unaffected.

2. Tabulation of the energy output (in megawatt days) of the reactor, amount of pulse operation, hours reactor was critical, and the cumulative total energy output since initial criticality;

3. The number of emergency shutdowns and inadvertent scrams, including reasons therefore;

4. Discussion of the major maintenance operations performed during the period, including the effect, if any, on the safety of the operation of the reactor, and the reasons for any corrective maintenance required;

5. A brief description including a summary of the safety evaluations of changes in the facility or in procedures and of tests and experiments carried out pursuant to Section 50.59 of 10 CFR Part 50;

The REPORTING REQUIREMENTS section remains unaffected.

6. A summary of the nature and amount of radioactive effluents released or discharged to the environs beyond the effective control of the licensee as measured at or prior to the point of such release or discharge;

The REPORTING REQUIREMENTS section remains unaffected.

<u>Liquid Waste</u> (summarized on a monthly basis)

(a) Radioactivity discharged during the reporting period.

(1) Total radioactivity released (in curies).

(2) The limiting concentrations (10CFR20, Appendix B) used and the isotopic composition if greater than 1×10^{-7} microcuries/cc for fission and activation products.

(3) Total radioactivity (in curies), released by nuclide, during the reporting period, based on representative isotopic analysis.

(4) Average concentration at point of release (in microcuries /cc) during the reporting period.

(b) Total volume (in gallons) of effluent water (including diluent) during periods of release.

<u>Gaseous Waste</u> (summarized on a monthly basis)

(a) Radioactivity discharged during the reporting period (in curies) for:

(1) Gases.

(2) Particulates with half lives greater than eight days.

(b) The limiting concentrations (10CFR20, Appendix B) used and the estimated activity (in curies) discharged during the reporting period, by nuclide, for all gases and particulates based on representative isotopic analysis.

Solid Waste

(a) The total amount of solid waste packaged (in cubic feet).

(b) The total activity involved (in curies).

(c) The dates of transfer or shipment and disposition

7. A summary of radiation exposures received by facility personnel and visitors, including dates and time of significant exposures, and a summary of the results of radiation and contamination surveys performed within the facility; and

8. A description of any environmental surveys performed outside the facility.

The REPORTING REQUIREMENTS section remains unaffected.

6.8 Review of Experiments

a. All proposed new experiments utilizing the reactor shall be evaluated by the experimenter and the Reactor Committee. The evaluation shall be reviewed by a licensed Senior Operator of the facility (and the Health Physicist when appropriate) to assure compliance with the provisions of the utilization license, the Technical Specifications, 10 CFR 20, and the requirements of 10 CFR 50.59. If, in his judgment, the experiment meets with the above provisions and does not constitute a threat to the integrity of the reactor, he shall submit it to the Reactor Supervisor for scheduling or to the Reactor Committee for final approval as indicated in Section 6.2 above. When pertinent, the evaluation shall include:

1. The reactivity worth of the experiment;
2. The integrity of the experiment, including the effects of changes in temperature, pressure, or chemical composition;
3. Any physical or chemical interaction that could occur with the reactor components; and
4. Any radiation hazard that may result from the activation of materials or from external beams.
5. A determination that for the maximum planned or inadvertent pulse, no credible mechanism exists which could cause the experiment to fail.

b. Prior to performing an experiment not previously performed in the reactor, it shall be reviewed and approved in writing by the Reactor Committee. This review shall consider the following information:

1. The purpose of the experiment;
2. A procedure for the performance of the experiment; and
3. The evaluation approved by a licensed Senior Operator.

The REVIEW OF EXPERIMENTS section remains unaffected.

c. For the irradiation of materials, the applicant shall submit an "Irradiation Request" to the Reactor Supervisor. This request shall contain information on the target material including the amount, chemical form, and packaging. For routine irradiations (which do not contain known explosive materials and which do not constitute a significant threat to the integrity of the reactor or to the safety of individuals) the approval for the Reactor Committee may be made by the Reactor Supervisor.

The REVIEW OF EXPERIMENTS section remains unaffected.

d. In evaluating experiments, the following assumptions should be used for the purpose of determining whether failure of the experiment would cause the appropriate limits of 10 CFR 20 to be exceeded:

1. If the possibility exists that airborne concentrations of radioactive gases or aerosols may be released within the facility, 100 percent of the gases or aerosols will escape;

2. If the effluent exhausts through a filter installation designed for greater than 99 percent efficiency for 0.3 micron particles, 10% of the particulates will escape; and

3. For a material whose boiling point is above 130□F and where vapors formed by boiling this material could escape only through a column of water above the core, 10% of these vapors will escape.

7.0 DECOMMISSIONING PLAN

7.1 Incorporation of the Decommissioning Plan

This is a new section

The license is amended to approve the Decommissioning Plan described in the licensee's application dated May 22, 2009, as supplemented by the licensee's letter of March 26, 2010, and authorizes inclusion of the Decommissioning Plan as a supplement to the Safety Analysis Report pursuant to 10 CFR 50.82(b)(5).

7.2 Changes to the Decommissioning Plan

The licensee may make changes to the decommissioning plan without prior approval provided the proposed changes do not:

(i) Require Commission approval pursuant to 10 CFR 50.59;

(ii) Use a statistical test other than the Sign test or Wilcoxon Rank Sum test for evaluation of the final status survey;

(iii) Increase the radioactivity level, relative to the applicable derived concentration guideline level, at which an investigation occurs;

(iv) Reduce the coverage requirements for scan measurements;

(v) Decrease an area classification (i.e., impacted to unimpacted; Class 1 to Class 2; Class 2 to Class 3; or Class 1 to Class 3);

(vi) Increase the Type I decision error;

(vii) Increase the derived concentration guideline levels and related minimum detectable concentrations (for both scan and fixed measurement methods); and

(viii) Result in significant environmental impacts not previously reviewed.

7.3 Characterization Report

This is a new section

A completed radiological characterization report shall be submitted to NRC review and approval prior to initiating decommissioning activities. The characterization report will include information required in NUREG-1575, Sections 2.4 and 5.3; and NUREG-1757, Volume 2, Section 4.2) to allow NRC staff to verify that the University has adequately characterized the radiological condition of the site.

7.4 Final Status Survey Plan

The University shall provide NRC with a Final Status Survey Plan prior to conduct of license termination surveys. The Plan will be developed in accordance requirements in NUREG 1575 (MARSSIM); NUREG-1537, Part 1, Appendix 17.1, Section A; and NUREG-1757, Volume 2, Chapter 4.

7.5 Release Criteria

The University shall use the release criteria specified in the Decommissioning Plan and as amended in the letter dated March 26, 2010. The University shall submit a revised license condition for review and approval by the NRC if alternative release criteria are developed for release of the NRL.