12 CONDUCT OF OPERATIONS

12.1 ORGANIZATON

This chapter describes and discusses the Conduct of Operations at the University of Texas TRIGA. The Conduct of Operations involves the administrative aspects of facility operations, the facility emergency plan, the security plan, the Reactor Operator selection and requalification plan, and environmental reports. License is used in Chapter 12 in reference to reactor operators and senior reactors subject to 10CFR50.55 requirements.

12.1.1 Structure

12.1.1.1 University Administration

Fig. 12.1 illustrates the organizational structure that is applied to the management and operation of the University of Texas and the reactor facility. Responsibility for the safe operation of the reactor facility is a function of the management structure of Fig. 12.1[1]. These responsibilities include safeguarding the public and staff from undue radiation exposures and adherence to license or other operation constraints. Functional organization separates the responsibilities of academic functions and business functions. The office of the President administers these activities and other activities through several vice presidents.

12.1.1.2 NETL Facility Administration

The facility administrative structure is shown in Fig. 12.2. Facility operation staff is an organization of a director and at least four full time equivalent persons. This staff of four provides for basic operation requirements. Four typical staff positions consist of an associate director, a reactor supervisor, a reactor operator, and a health physicist. One or more of the listed positions may also include duties typical of a research scientist. The reactor supervisor, health physicist, and one other position are to be full time. One full time equivalent position may consist of several part-time persons such as assistants, technicians and secretaries. Faculty, students, and researchers supplement the organization. Titles for staff positions are descriptive and may vary from actual designations. Descriptions of key components of the organization follow.

[1] "Standard for Administrative Controls" ANSI/ANS - 15.18 1979

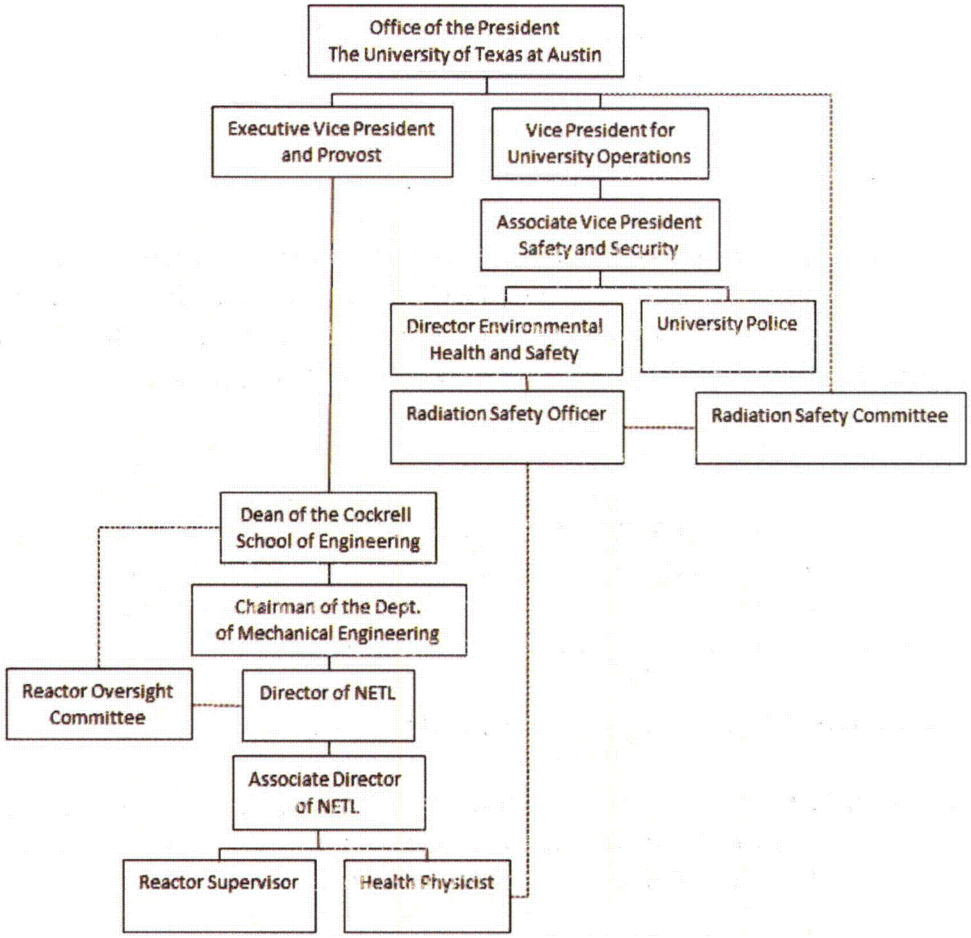

Figure 12.1, University Administration

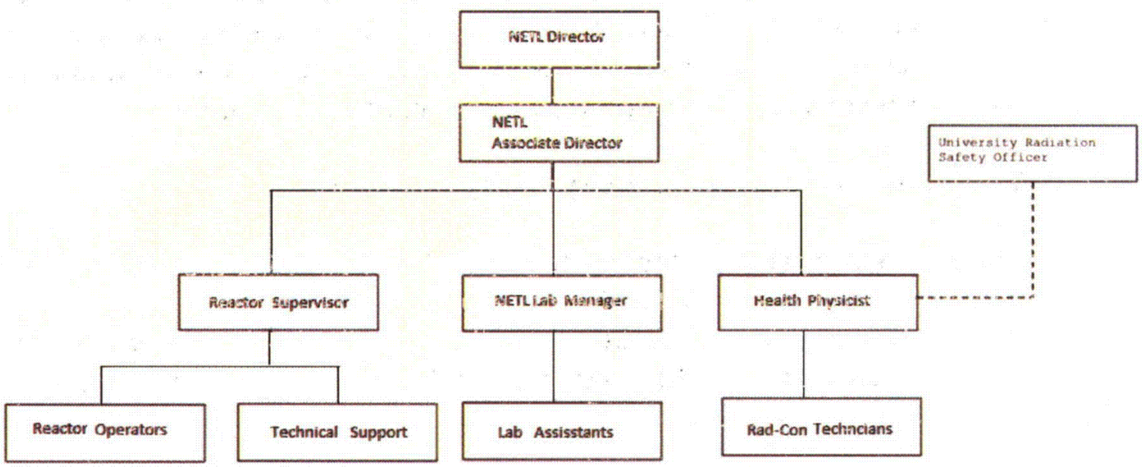

Figure 12.2, NETL Facility Administration

12.1.2 Responsibility

12.1.2.1 Executive Vice President and Provost

Research and academic educational programs are administered through the Office of the Executive Vice President and Provost. Separate officers assist with the administration of research activities and academic affairs with functions delegated to the Dean of the Cockrell School of Engineering and Chairman of the Mechanical Engineering Department.

12.1.2.2. Vice President for University Operations

University operations activities are administered through the Office of the Vice President for Operations. This office is responsible for multiple operational functions of the University including university support programs, human resources, campus safety and security, campus real estate, and campus planning and facilities management.

12.1.2.3 Associate Vice President Campus Safety and Security

The associate vice president for campus safety and security oversees multiple aspects of safety and security on campus including environmental health and safety, campus police, parking and transportation, fire prevention, and emergency preparedness.

12.1.2.4 Director of Nuclear Engineering Teaching Laboratory

Nuclear Engineering Teaching Laboratory programs are directed by a senior classified staff member or faculty member. The director oversees strategic guidance of the Nuclear Engineering Teaching Laboratory including aspects of facility operations, research, and service work. The director must interact with senior University of Texas at Austin management regarding issues related to the Nuclear Engineering Teaching Laboratory.

12.1.2.5 Associate Director of Nuclear Engineering Laboratory

The Associate Director performs the day to day duties of directing the activities of the facility. The Associate Director is knowledgeable of regulatory requirements, license conditions, and standard operating practices. The associate director will also be involved in soliciting and carrying out research utilizing the reactor and other specialized equipment at the Nuclear Engineering Teaching Laboratory.

12.1.2.6 Reactor Oversight Committee

The Reactor Oversight Committee is established through the Office of the Dean of the Cockrell School of Engineering of The University of Texas at Austin. Broad responsibilities of the committee include the evaluation, review, and approval of facility standards for safe operation.

The Dean shall appoint at least three members to the Committee that represent a broad spectrum of expertise appropriate to reactor technology. The committee will meet at least twice each calendar year or more frequently as circumstances warrant. The Reactor Oversight Committee shall be consulted by the Nuclear Engineering Teaching Laboratory concerning unusual or exceptional actions that affect administration of the reactor program.

12.1.2.7 Radiation Safety Officer

A Radiation Safety Officer acts as the delegated authority of the Radiation Safety Committee in the daily implementation of policies and practices regarding the safe use of radioisotopes and sources of radiation as determined by the Radiation Safety Committee. The Radiation Safety Program is administered through the University Environmental Health and Safety division. The responsibilities of the Radiation Safety Officer are outlined in The University of Texas at Austin Manual of Radiation Safety.

12.1.2.8 Radiation Safety Committee

The Radiation Safety Committee is established through the Office of the President of The University of Texas at Austin. Responsibilities of the committee are broad and include all policies and practices regarding the license, purchase, shipment, use, monitoring, disposal, and transfer of radioisotopes or sources of ionizing radiation at The University of Texas at Austin.

The President shall appoint at least three members to the Committee and appoint one as Chairperson. The Committee will meet at least once each year on a called basis or as required to approve formally applications to use radioactive materials. The Radiation Safety Committee shall be consulted by the University Safety Office concerning any unusual or exceptional action that affects the administration of the Radiation Safety Program.

12.1.2.9 Reactor Supervisor

Whenever the reactor is not secured, the reactor shall be (1) under the direction of or (2) operated by a (USNRC licensed) Senior Operator, designated as Reactor Supervisor; activities of reactor operators with USNRC licenses will be subject to the direction of a person with a USNRC senior operator license. Prior to operations, the Reactor Supervisor shall ensure conditions and limitations of the license, Technical Specifications, and experiment approvals (as applicable) are met for the intended operation. The reactor supervisor shall assess facility conditions and perform or direct performance of appropriate procedures during normal, routine situations.

Therefore, the Reactor Supervisor is to be knowledgeable of regulatory requirements, license conditions, and standard operating practices.

In addition to direction for conducting normal operations, the Reactor Supervisor will function to provide expertise for reactor operations in non-routine situations. The reactor supervisor shall assess facility conditions and select appropriate response procedures during abnormal and emergency situations. All activities that require the presence of licensed operators will also require the presence in the facility complex of a second person capable of performing prescribed written instructions. The Reactor Supervisor may act as the second person. The Supervisor may be on call if cognizant of reactor operations and capable of arriving at the facility within thirty minutes.

(1) The Reactor Supervisor shall directly supervise:

a. All fuel element or control rod relocations or installations within the reactor core region, and initial startup subsequent and approach to power.

b. Relocation or installation of any experiment in the core region with a reactivity worth of greater than one dollar, and subsequent initial startup and approach to power.

c. Recovery from an unscheduled shutdown or significant power reductions,

a. Any initial startup and approach to power following modifications to reactor safety or control rod drive systems.

(2) The Reactor Supervisor will provide direction for, or respond to, situations requiring activation of the Emergency Plan.

(3) In an emergency, the Reactor Supervisor is authorized to direct or perform a reasonable course of action that departs from a license condition or a Technical Specification (contained in a license issued under this part) when this action is immediately needed to protect the public health and safety, and no action consistent with license conditions and technical specifications that can provide adequate or equivalent protection is immediately apparent[2].

Since the UT TRIGA may be operated several times each working day supporting multiple experiment programs, control room supervisory inspections and tours may be more useful in

[2] 10CFR50.54(x)

promoting a healthy conduct of operations than monitoring routine startups. The Reactor Supervisor should consider whether direct supervision of routine operations would be counterproductive to fostering a heightened sense of awareness in non-routine activities. The Reactor Supervisor should consider the experience of Reactor Operators performing the operation.

12.1.2.10 Health Physicist

Radiological safety of the Nuclear Engineering Teaching Laboratory is monitored by a health physicist, who will be knowledgeable of the facility radiological hazards. Responsibilities of the health physicist will include calibration of radiation detection instruments, measurements of radiation levels, control of radioactive contamination, maintenance of radiation records, and assistance with other facility monitoring activities.

Activities of the health physicist will depend on two conditions. One condition will be the normal operation responsibilities determined by the director of the facility. A second condition will be communications specified by the radiation safety officer. This combination of responsibility and communication provides for safety program implementation by the director, but establishes independent review. The health physicist's activities will meet the requirements of the director and the policies of an independent university safety organization.

12.1.2.11 Laboratory Manager

Laboratory operations and research support is provide by a designated Laboratory Manager. The function is typically combined with the Health Physicist position.

12.1.2.12 Reactor Operators

Reactor operators (and senior reactor operators) are licensed by the USNRC to operate the UT TREIGA II nuclear research reactor. University staff and/or students may be employed as reactor operators.

12.1.2.13 Technical Support

Staff positions supporting various aspects of facility operations are assigned as required.

12.1.2.14 Radiological Controls Technicians

Radiological Controls Technicians are supervised by the Health Physicist to perform radiological controls and monitoring functions. Radiological Controls Technicians are generally supported as Undergraduate Research Assistant positions.

12.1.2.15 Laboratory Assistants

Laboratory Assistants are supervised by the Laboratory Manager to perform laboratory operations and analysis. Laboratory Assistants are generally supported as Undergraduate Research Assistant positions.

12.1.3 Staffing

Operation of the reactor and activities associated with the reactor, control system, instrument system, radiation monitoring system, and engineered safety features will be the function of staff personnel with the appropriate training and certification[3].

Whenever the reactor is not secured, the reactor shall be under the direction of a (USNRC licensed) Senior Operator who is designated as Reactor Supervisor. The Supervisor may be on call if capable of arriving at the facility within thirty minutes and cognizant of reactor operations. The Reactor Supervisor shall directly supervise:

d. All fuel element or control rod relocations or installations within the reactor core region, and subsequent initial startup and approach to power.

e. Relocation or installation of any experiment in the core region with a reactivity worth of greater than one dollar, and subsequent initial startup and approach to power.

f. Recovery from an unscheduled shutdown or significant power reductions,

g. All initial startup and approach to power following modifications to reactor safety or control rod drive systems.

Whenever the reactor is not secured, a (USNRC licensed) Reactor Operator (or Senior Reactor Operator) who meets requirements of the Operator Requalification Program shall be at the reactor control console, and directly responsible for control manipulations. All activities that require the presence of licensed operators will also require the presence in the facility complex of a second person capable of performing prescribed written instructions.

Only the Reactor Operator at the controls or personnel authorized by, and under direct supervision of, the Reactor Operator at the controls shall manipulate the controls. Whenever

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[3] "Selection and Training of Personnel for Research Reactors", ANSI/ANS -15.4 - 1970 (N380)

the reactor is not secured, operation of equipment that has the potential to affect reactivity or power level shall be manipulated only with the knowledge and consent of the Reactor Operator at the controls. The Reactor Operator at the controls may authorize persons to manipulate reactivity controls who are training either as (1) a student enrolled in academic or industry course making use of the reactor, (2) to qualify for an operator license, or (3) in accordance the approved Reactor Operator requalification program.

Whenever the reactor is not secured, a second person (i.e., in addition to the reactor operator at the control console) capable of initiating the Reactor Emergency Plan will be present in the NETL building. Unexpected absence of this second person for greater than two hours will be acceptable if immediate action is taken to obtain a replacement.

Staffing required for performing experiments with the reactor will be determined by a classification system specified for the experiments. Requirements will range from the presence of a certified operator for some routine experiments to the presence of a senior operator and the experimenter for other less routine experiments.

12.1.4 Selection and Training of Personnel

12.1.4.1 Qualifications

Personnel associated with the research reactor facility[4] shall have a combination of academic training, experience, skills, and health commensurate with the responsibility to provide reasonable assurance that decisions and actions during all normal and abnormal conditions will be such that the facility and reactor are operated in a safe manner.

12.1.4.2 Job Descriptions

Qualifications for University positions are incorporated in job descriptions, summarizing function and scope. The typical description includes title, duties, supervision, education, experience, equipment, working conditions, and other special requirements for the job position. Student employment is typically under the general description of Undergraduate or Graduate Research Assistant, with minimal specification to accommodate a wide range of jobs.

12.1.4.2.1 Facility Director

A combination of academic training and nuclear experience will fulfill the qualifications for the individual identified as the facility director. A total of six years' experience will be required. Academic training in engineering or science, with completion of a baccalaureate degree, may account for up to four of the six years' experience. The director is generally a faculty member with a Ph.D. in nuclear engineering or a related field.

[4] ANS/ANSI-15.4, op. cit.

12.1.4.2.2 Associate Director

A combination of academic training and nuclear experience will fulfill the qualifications for the individual identified as the facility director. Academic training in engineering or science, with operating and management experience at a research reactor is required. The Associate Director will be qualified by certification as a senior operator and is typically a person with at least one graduate degree in nuclear engineering or a related field.

12.1.4.2.3 Reactor Supervisor

A person with special training to supervise reactor operation and related functions will be designated as the reactor supervisor. The reactor supervisor will be qualified by certification as a senior operator as determined by the licensing agency. Additional academic or nuclear experience will be required as necessary for the supervisor to perform adequately the duties associated with facility activities. The supervisor is typically a person with at least one graduate degree in nuclear engineering or a related field.

12.1.4.2.4 Health Physicist

A person with a degree related to health, safety, or engineering, or sufficient experience that is appropriate to the job requirements will be assigned the position of health physicist. A degree in health physics or similar field of study and some experience is preferred. Certification is not a qualification, but work towards certification should be considered a requirement.

12.1.4.3.4 Laboratory Manager

Laboratory operations and research support id provide by a designated Laboratory Manager. The function is typically combined with the Health Physicist position.

12.1.2.12 Reactor Operators

Reactor operators (and senior reactor operators) are licensed by the USNRC to operate the UT TREIGA II nuclear research reactor. Training and requalification requirements are indicated below.

12.1.2.13 Technical Support

Staff positions supporting various aspects of facility operations are assigned as required. Selection, qualification and training are on a case by case basis.

12.1.2.14 Radiological Controls Technicians

Radiological Controls Technicians training is provided in the Radiation Protection Program.

12.1.2.15 Laboratory Assistants

Laboratory Assistants are supervised by the Laboratory Manager to perform laboratory operations and analysis, with specific training requirements related to job responsibilities. .

12.1.5 Radiation Safety

Protection of personnel and the general public against hazards of radioactivity and fire is established through the safety programs of the University Safety Office. Safety programs at the reactor facility supplement the university programs so that appropriate safety measures are established for the special characteristics of the facility[5] [6].

Safety programs are operated as a function of the Vice President for University Operations and include a radiation safety organization as presented in Fig. 12.1. Radiation protection at the reactor facility is the responsibility of the Reactor Supervisor, Health Physicist, or a designated senior operator in charge of operation activities. The person responsible for radiation protection at the reactor facility will have access to other individuals or groups responsible for Radiological safety at the University. Contact with the Radiation Safety Officer will occur on an as needed basis and contact with the Reactor Oversight Committee will occur on a periodic basis. Responsibility includes the authority to act on questions of radiation protection, the Acquisition of appropriate training for radiation protection and the reporting to management of problems associated with radiation protection. Radiological management policies and programs are described in Chapter 11.

12.2 REVIEW AND AUDIT ACTIVITES

The review and audit process is the responsibility of the Reactor Oversight Committee (ROC).

12.2.1 Composition and Qualifications

The ROC shall consist of at least three (3) members appointed by the Dean of the Cockrell School of Engineering that are knowledgeable in fields which relate to nuclear safety. The university radiological safety officer shall be a member or an ex-officio member. The committee will perform the functions of review and audit or designate a knowledgeable person for audit functions.

[5] "Radiological Control at Research Reactor Facilities", ANSI/ANS-15.11 1977(N628)

[6] "Design Objectives for and Monitoring of Systems Controlling Research Reactor Effluents", ANSI/ANS - 15.12 1977(N647)

12.2.2 Charter and Rules

The operations of the ROC shall be in accordance with an established charter, including provisions for:

a. Meeting frequency (at least twice each year, with approximately 4-8 month frequency).

b. Quorums (not less than one-half the membership where the operating staff does not contribute a majority).

c. Dissemination, review, and approval of minutes.

d. Use of subgroups.

12.2.3 Review Function

The responsibilities of the Reactor Safeguards Committee to shall include but are not limited to review of the following:

a) All new procedures (and major revisions of procedures) with safety significance
b) Proposed changes or modifications to reactor facility equipment, or systems having safety significance
c) Proposed new (or revised) experiments, or classes of experiments, that could affect reactivity or result in the release of radioactivity
d) Determination of whether items a) through c) involve unreviewed safety questions, changes in the facility as designed, or changes in Technical Specifications.
e) Violations of Technical Specifications or the facility operating licensee
f) Violations of internal procedures or instruction having safety significance
g) Reportable occurrences
h) Audit reports

Minor changes to procedures and experiments that do not change the intent and do not significantly increase the potential consequences may be accomplished following review and approval by a senior reactor operator and independently by one of the Reactor Supervisor, Associate Director or Director. These changes should be reviewed at the next scheduled meeting of the Reactor Oversight Committee.

12.2.4 Audit Function

The audit function shall be a selected examination of operating records, logs, or other documents. Audits will be by a Reactor Oversight Committee member or by an individual appointed by the committee to perform the audit. The audit should be by any individual not directly responsible for the records and may include discussions with cognizant personnel or observation of operations. The following items shall be audited and a report made within 3 months to the Director and Reactor Committee:

a. Conformance of facility operations with license and technical specifications at least once each calendar year.

b. Results of actions to correct deficiencies that may occur in reactor facility equipment, structures, systems, or methods of operation that affect safety at least once per calendar year.

c. Function of the retraining and requalification program for reactor operators at least once every other calendar year.

d. The reactor facility emergency plan and physical security plan, and implementing procedures at least once every other year.

12.3 PROCEDURES

Written procedures shall govern many of the activities associated with reactor operation. Activities subject to written procedures will include:

a) Startup, operation, and shutdown of the reactor

b) Fuel loading, unloading, and movement within the reactor.

c) Control rod removal or replacement.

d) Routine maintenance, testing, and calibration of control rod drives and other systems that could have an effect on reactor safety.

e) Administrative controls for operations, maintenance, conduct of experiments, and conduct of tours of the Reactor Facility.

f) Implementing procedures for the Emergency Plan or Physical Security Plan.

Written procedures shall also govern:

a) Personnel radiation protection, in accordance with the Radiation Protection Program as indicated in Chapter 11.

b) Administrative controls for operations and maintenance

c) Administrative controls for the conduct of irradiations and experiments that could affect core safety or reactivity

A master Procedure Control procedure specifies the process for creating, changing, editing, and distributing procedures. Preparation of the procedures and minor modifications of the procedures will be by certified operators. Substantive changes or major modifications to procedures, and new prepared procedures will be submitted to the Reactor Oversight Committee for review and approval. Temporary deviations from the procedures may be made by the reactor supervisor or designated senior operator provided changes of substance are reported for review and approval.

Proposed experiments will be submitted to the reactor oversight committee for review and approval of the experiment and its safety analysis[7], as indicated in Chapter 10. Substantive changes to approved experiments will require re-approval while insignificant changes that do not alter experiment safety may be approved by a senior operator and independently one of the following, Reactor Supervisor, Associate Director, or Director. Experiments will be approved first as proposed experiments for one time application, and subsequently, as approved experiments for repeated applications following a review of the results and experience of the initial experiment implementation.

12.4 REQUIRED ACTIONS

This section lists the actions required in the event of certain occurrences.

12.4.1 Safety Limit Violation

In the event that a Safety Limit is not met,

a. The reactor shall be shutdown, and reactor operations secured.
b. The Reactor Supervisor, Associate Director, and Director shall be notified
c. The safety limit violation shall be reported to the Nuclear Regulatory Commission within 24 hours by telephone, confirmed via written statement by email, fax or telegraph
d. A safety limit violation report shall be prepared within 14 days of the event to describe:
   1. Applicable circumstances leading to the violation including (where known) cause and contributing factors

[7] ANSI/ANS 15.6, op. cit.

2. Effect of the violation on reactor facility components, systems, and structures
3. Effect of the violation on the health and safety of the personnel and the public
4. Corrective action taken to prevent recurrence

e. The Reactor Oversight Committee shall review the report and any followup reports

f. The report and any followup reports shall be submitted to the Nuclear Regulatory Commission.

g. Operations shall not resume until the USNRC approves resumption.

12.4.2 Release of Radioactivity Above Allowable Limits

Actions to be taken in the case of release of radioactivity from the site above allowable limits shall include a return to normal operation or reactor shutdown until authorized by management if necessary to correct the occurrence. A prompt report to management and license authority shall be made. A review of the event by the Reactor Oversight Committee should occur at the next scheduled meeting. Prompt reporting of the event shall be by telephone and confirmed by written correspondence within 24 hours. A written follow up report is to be submitted within 14 days.

12.4.3 Other Reportable Occurrences

In the event of a reportable occurrence, as defined in the Technical Specifications, and in addition to the reporting requirements,

a. The Reactor Supervisor, the Associate Director and the Director shall be notified
b. If a reactor shutdown is required, resumption of normal operations shall be authorized by the Associate Director or Director
c. The event shall be reviewed by the Reactor Oversight Committee during a normally scheduled meeting

12.5 REPORTS

This section describes the reports required to NRC, including report content, timing of reports, and report format. Refer to section 12.4 above for the reporting requirements for safety limit violations, radioactivity releases above allowable limits, and reportable occurrences. All written reports shall be sent within prescribed intervals to the United States Nuclear Regulatory Commission, Washington, D.C., 20555, Attn: Document Control Desk.

12.5.1 Operating Reports

Routine annual reports covering the activities of the reactor facility during the previous calendar year shall be submitted to licensing authorities within three months following the end of each prescribed year. Each annual operating report shall include the following information:

a. A narrative summary of reactor operating experience including the energy produced by the reactor or the hours the reactor was critical, or both.

b. The unscheduled shutdowns including, where applicable, corrective action taken to preclude recurrence.

c. Tabulation of major preventive and corrective maintenance operations having safety significance.

d. Tabulation of major changes in the reactor facility and procedures, and tabulation of new tests or experiments, or both, that are significantly different from those performed previously, including conclusions that no new or unanalyzed safety questions were identified.

e. A summary of the nature and amount of radioactive effluents released or discharged to the environs beyond the effective control of the owner-operator as determined at or before the point of such release or discharge. The summary shall include, to the extent practicable, an estimate of individual radionuclides present in the effluent. If the estimated average release after dilution or diffusion is less than 25% of the concentration allowed or recommended, a statement to this effect is sufficient.

f. A summarized result of environmental surveys performed outside the facility.

g. A summary of exposures received by facility personnel and visitors where such exposures are greater than 25% of that allowed or recommended.

12.5.2 Other or Special Reports

A written report within 30 days to the chartering or licensing authorities of:

a. Permanent changes in the facility organization involving Director or Supervisor.

b Significant changes in the transient or accident analysis as described in the Safety Analysis Report.

12.6. RECORDS

Records of the following activities shall be maintained and retained for the periods specified below[8]. The records may be in the form of logs, data sheets, electronic files, or other suitable forms. The required information may be contained in single or multiple records, or a combination thereof.

12.6.1. Lifetime Records

Lifetime records are records to be retained for the lifetime of the reactor facility. (Note: Applicable annual reports, if they contain all of the required information, may be used as records in this section.)

a. Gaseous and liquid radioactive effluents released to the environs.

b. Offsite environmental monitoring surveys required by Technical Specifications.

c. Events that impact or effect decommissioning of the facility.

d. Radiation exposure for all personnel monitored.

e. Updated drawings of the reactor facility.

12.6.2 Five Year Period

Records to be retained for a period of at least five years or for the life of the component involved whichever is shorter.

a. Normal reactor facility operation (supporting documents such as checklists, log sheets, etc. shall be maintained for a period of at least one year).

b. Principal maintenance operations.

c. Reportable occurrences.

d. Surveillance activities required by technical specifications.

e. Reactor facility radiation and contamination surveys where required by applicable regulations.

[8] "Records and Reports for Research Reactors", ANSI/ANS - 15.3-1974 (N399).

f. Experiments performed with the reactor.

g. Fuel inventories, receipts, and shipments.

h. Approved changes in operating procedures.

i. Records of meeting and audit reports of the review and audit group.

12.6.3 One Training Cycle

Training records to be retained for at least one license cycle are the requalification records of licensed operations personnel. Records of the most recent complete cycle shall be maintained at all times the individual is employed.

12.7 EMERGENCY PLANNING

Emergency planning is guided by an NRC approved Emergency Plan following the general guidance set forth in ANSI/ ANS15.16, Emergency Planning for Research Reactors. The plan specifies two action levels, the first level being a locally defined Non-Reactor Specific Event, and the second level being the lowest level FEMA classification, a Notification of Unusual Event. Procedures reviewed and approved by the reactor Oversight Committee are established to manage implementation of emergency response.

12.8 SECURITY PLANNING

Security planning is guided by an NRC approved Security Plan. The plan incorporates compensatory measures implemented following security posture changes initiated post 9/11. The Plan and portions of the procedures are classified as Safeguards Information. Security procedures implementing the plan, approved by the Reactor Oversight Committee, are established.

12.9 QUALITY ASSURANCE

Objectives of quality assurance (QA) may be divided into two major goals. First is the goal of safe operation of equipment and activities to prevent or mitigate an impact on public health and safety. Second is the reliable operation of equipment and activities associated with education and research functions of the University. The risk or potential release of radioactive materials is the primary impact on public health and safety, and may be divided into direct risks and indirect risks. Direct risks are activities such as waste disposal, fuel transport and decommissioning that introduce radioactive materials into the public domain. Indirect risks are accident conditions created by normal or abnormal operating conditions that generate the potential or actual release of radioactive materials from the controlled areas of a facility.

Quality assurance program procedures have been developed that apply to items or activities determined to be safety-related follows the guidelines of Reg. Guide 2.5[9] [10]. Specific procedures apply to fuel shipment and receipt, a general procedure guides unspecified safety related activities.

12.10. OPERATOR REQUALIFICATION

Regulatory requirements and standards provide guidance for requalification training. Specific regulatory requirements are found in 10CFR55 for the licensing of operators and senior operators with regulations for requalification set forth in section 55.59. Standards for the selection and training of facility personnel and reactor operators are available. Specific regulations in the form of two sets of license conditions also apply to the facility personnel and reactor operators. One set of conditions for the facility license, 10CFR 50.54, applies to facility personnel. The other set of conditions for individual licenses, 10CFR 55.53 applies to operators and senior operators.

An NRC approved UT TRIGA Requalification Plan is used to maintain training and qualification of reactor operators and senior reactor operators. License qualification by written and operating test, and license issuance or removal, are the responsibility of the U.S. Nuclear Regulatory Commission. No rights of the license may be assigned or otherwise transferred and the licensee is subject to and shall observe all rules, regulations and orders of the Commission. Requalification training maintains the skills and knowledge of operators and senior operators during the period of the license. Training also provides for the initial license qualification.

Active status of any licensee requires successful participation in the UT Operator Requalification program. A process is in place to manage re-establishment of active status where conditions of an active license status are not met.

The program addresses training by lectures, instruction, discussion and self-study. The program addresses training topics. The program establishes requirement for a biennial schedule of activities. The program addresses on the job training. The program requires:

a. Observation at least once each year of a satisfactory understanding of the reactivity control system and knowledge of operating procedures.

b. Each operator or senior operator will review facility design changes, procedure changes and license changes as they occur or once each 6 to 8 months.

c. A review of the contents of abnormal and emergency procedures will be done by each

9 "Quality Assurance Requirements for Research Reactors", Nuclear Regulatory Guide 2.5 (77/05).

10 "Quality Assurance Program Requirements for Research Reactors," ANSI/ANS - 15.8 - 1976 (N402).

operator or senior operator at 6 to 8 month intervals so that at least 3 reviews occur during the two year training cycle.

The program addresses performance evaluation of on annual examination and periodic observations, including methods to address deficiencies identified in evaluation. The program addresses records to be generated, including required information and retention schedule.

12.11 STARTUP PROGRAM

Startup and testing of the Balcones Research Center TRIGA facility was completed in 1992, therefore a startup plan is not applicable.

12.12 ENVIRONMENTAL REPORT

The Environmental Report is provided as a separate document.

Table of Contents

1. DEFINITIONS

The following frequently used terms are defined to aid in the uniform interpretation of these specifications. Capitalization is used in the body of the Technical Specifications to identify defined terms.

ACTION	Actions are steps to be accomplished in the event a required condition identified in a "Specification" section is not met, as stated in the "Condition" column of "Actions." In using Action Statements, the following guidance applies: • Where multiple conditions exist in an LCO, actions are linked to the failure to meet a "Specification" "Condition" by letters and number. • Where multiple action steps are required to address a condition, COMPLETION TIME for each action is linked to the action by letter and number. • AND in an Action Statement means all linked steps need to be performed to complete the action; OR indicates options and alternatives, only one item needs to be performed to complete the action. • If a "Condition" exists, the "Action" consists of completing all steps associated with the selected option (if applicable) unless the "Condition" is corrected prior to completion of the steps.
ANNUAL	12 months, not to exceed 15 months.
BIENNIAL	Every two years, not to exceed a 30 month interval.
CHANNEL	A channel is the combination of sensor, line, amplifier, and output devices that are connected for the purpose of measuring the value of a parameter.
CHANNEL CALIBRATION	A channel calibration is an adjustment of the channel so that its output responds, with acceptable range and accuracy, to known values of the parameter that the channel measures.
CHANNEL CHECK	A channel check is a qualitative verification of acceptable performance by observation of channel behavior. This verification shall include comparison of the channel with expected values, other

independent channels, or other methods of measuring the same variable where possible.

CHANNEL TEST	A channel test is the introduction of an input signal into a channel to verify that it is operable.

NOTE:

A functional test of operability is a channel test.

CONFINEMENT	The enclosure which controls the movement of air into and out of the reactor bay through a controlled path.
CONFINEMENT ISOLATION	Condition for reactor bay ventilation where: (1) dampers controlling confinement ventilation are closed, and (2) confinement ventilation fans are secured (3) the reactor bay fume/sort hood fans are secured (4) the reactor bay fume/sort hood dampers are closed The purge system may be operated in manual override
CONTROL ROD (STANDARD)	A standard control rod (stainless steel clad, borated graphite, B4C powder, or boron and its compounds in solid form with a fuel follower) is one having an electric induction or stepper motor drive coupled to the control rod by an electromagnet, with scram capability.
CONTROL ROD (TRANSIENT)	A transient control rod (aluminum clad, borated graphite, B4C powder, or boron and its compounds in solid form followed by air or aluminum) is one that is pneumatically coupled to the control rod drive, is capable of initiating a power pulse, is operated by a motor drive, and/or air pressure operated and has scram capability.
DAILY	Prior to initial operation each calendar day (when the reactor is operated), or before an operation extending more than 1 day
ENSURE	Verify existence of specified condition or (if condition does not meet criteria) take action necessary to meet condition
EXCESS REACTIVITY	That amount of reactivity above the critical condition which would exist if all the control rods were moved to the maximum positive reactivity condition
EXPERIMENT	An EXPERIMENT is (1) any apparatus, device, or material placed in the reactor core region (in an EXPERIMENTAL FACILITY associated with the reactor, or in line with a beam of radiation emanating from

the reactor) or (2) any in-core operation designed to measure reactor characteristics.

EXPERIMENTAL FACILITY	Experimental facilities are the beamports, pneumatic transfer systems, central thimble, rotary specimen rack, and displacement of fuel element positions used for EXPERIMENTS (single-element positions and the multiple element positions fabricated in the upper grid plate displacing 3, 6 or 7 elements).
IMMEDIATE	Without delay, and not exceeding one hour. *NOTE:* *IMMEDIATE permits activities to restore required conditions for up to one hour; this does not permit or imply either deferring or postponing action*
INITIAL STARTUP	A reactor startup and approach to power following: 1 Modifications to reactor safety or control rod drive systems, 2 Fuel element or control rod relocations or installations within the reactor core region, 3 Relocation or installation of any experiment in the core region with a reactivity worth of greater than one dollar, or 4 Recovery from an unscheduled (a) shutdown or (b) significant power reductions.
INTSTRUMENTED FUEL ELEMENT	An instrumented fuel element (IFE) is a stainless steel clad fuel element containing three sheathed thermocouples embedded in the fuel element.
LIMITING CONDITION FOR OPERATION (LCO)	The lowest functional capability or performance levels of equipment required for safe operation of the facility.
LIMITING SAFETY SYSTEM SETTING (LSSS)	Settings for automatic protective devices related to those variables having significant safety functions. Where a limiting safety system setting is specified for a variable on which a SAFETY LIMIT placed, the setting shall be chosen so that the automatic protective action will correct the abnormal situation before a SAFETY LIMIT is exceeded.
MEASURED VALUE	The measured value of a parameter is the value as indicated at the output of a MEASURING CHANNEL.

MONTHLY	30 days, not to exceed 6 weeks.
MOVABLE EXPERIMENT	A MOVABLE EXPERIMENT is one the EXPERIMENT may be moved into, out-of or near the reactor while the reactor is OPERATING.
OPERABLE	A system or component is OPERABLE when it is capable of performing its intended function in a normal manner
OPERATING	A system or component is OPERATING when it is performing its intended function.
PULSE MODE	The reactor is in the PULSE MODE when the key switch is in the "on" position, the reactor mode selection switch is in the pulse position and the reactor display indicates pulse mode. *NOTE:* *In the PULSE MODE, reactor power may be increased on a period of much less than l second by motion of the transient control rod.*
QUARTERLY	3 months, not to exceed 4 months
REACTOR SAFETY SYSTEM	The REACTOR SAFETY SYSTEM is that combination of MEASURING CHANNELS and associated circuitry that is designed to initiate a reactor scram or that provides information that requires manual protective action to be initiated.
REACTOR SECURED MODE	The reactor is secured when the conditions of either item (1) or item (2) are satisfied:

(1) There is insufficient moderator or insufficient fissile material in the reactor to attain criticality under optimum available conditions of moderation and reflection

(2) All of the following:

a. At least three control rods are fully inserted

b. The console key is it the OFF position and the key is removed from the lock

c. No work is in progress involving core fuel, core structure, installed control rods, or control rod drives (unless the drive is physically decoupled from the control rod)

d. No experiments are being moved or serviced that have, on movement, a reactivity worth greater than $1.00

REACTOR SHUTDOWN	The reactor is shutdown if it is subcritical by at least the minimum required amount of reactivity (SHUTDOWN MARGIN) in the REFERENCE CORE CONDITION with the reactivity worth of all experiments included.
REFERENCE CORE CONDITION	The condition of the core when it is at ambient temperature (cold) and the reactivity worth of xenon is negligible (<$0.30)
SAFETY CHANNEL	A safety channel is a MEASURING CHANNEL in the REACTOR SAFETY SYSTEM.
SAFETY LIMITS	Limits on important process variables which are found to be necessary to protect reasonably the integrity of the principal barriers (i.e., fuel element cladding) which guard against the uncontrolled release of radioactivity. The principal barrier is the fuel element cladding.
SECURED EXPERIMENT	A secured EXPERIMENT is an EXPERIMENT held firmly in place by a mechanical device or by gravity providing that the weight of the EXPERIMENT is such that it cannot be moved by forces (1) normal to the operating environment of the experiment or (2) that might result from credible failures.
SHALL (SHALL NOT)	Indicates specified action is required/(or required not to be performed)
SEMIANNUAL	Every six months, with intervals not greater than 7 ½ months
SHUTDOWN MARGIN	The shutdown margin is the minimum shutdown reactivity necessary to provide confidence that the reactor can be made subcritical by means of the control and safety systems, starting from any permissible operating condition (the highest worth MOVEABLE EXPERIMENT in its most positive reactive state, each SECURED EXPERIMENT in its most reactive state), with the most reactive rod in the most reactive position, and that the reactor will remain subcritical without further operator action.
STANDARD FUEL ELEMENT	A standard fuel element is a single TRIGA element of standard type, U-ZrH clad in stainless steel with nominal hydrogen to zirconium ratio of 1.6.

STEADY-STATE MODE — The reactor is in the steady-state mode when the key switch is in the "on" position, the reactor mode selector pushbutton switch has requested either the manual, automatic, or square wave position and the reactor display indicates manual, automatic, or square wave.

TECHNICAL SPECIFICATION VIOLATION —

(1) A violation of a SAFETY LIMIT occurs when the SAFETY LIMIT value is exceeded.

(2) A violation of a Limiting Safety System Setting or Limiting Condition for Operation) occurs when a "Condition" exists which does not meet a "Specification" and the corresponding "Action" has not been met within the required "Completion Time."

A violation has not occurred if the "Action" statement of (1) an LSSS or LCO is completed or (2) the "Specification" is restored within the prescribed "Completion Time,"

NOTE

"Condition," "Specification," "Action," and "Completion Time" refer to applicable titles of sections in individual Technical Specifications

WEEKLY — 7 days, not to exceed 10 days

2. SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

2.1 Fuel Element Temperature SAFETY LIMIT

2.1.1 Applicability

Specification A and B apply with the reactor in STEADY STATE MODE, REACTOR SHUTDOWN condition, REACTOR SECURED MODE and the PULSE MODE; specification B applies in STEADY STATE MODE.

2.1.2 Objective

This SAFETY LIMIT ensures fuel element cladding integrity

2.1.3 Specification

A	Stainless steel clad, high-hydride fuel element temperature SHALL NOT exceed 1150°C.
B	Steady state fuel temperature shall not exceed 750°C.

2.1.4 Actions

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Stainless steel clad, high-hydride fuel element temperature exceeds 1150°C.	A. ENSURE SHUTDOWN condition AND Report per Section 6.8	A. IMMEDIATE
B. Fuel temperature exceeds 750°C in steady state conditions	B. ENSURE SHUTDOWN condition AND Report per Section 6.8	B. IMMEDIATE

2.1.5 Bases

Safety Analysis Report Chapter 4 (4.2.1 B) identifies design and operating constraints for TRIGA fuel that will ensure cladding integrity is not challenged.

NUREG 1282 identifies the SAFETY LIMIT for the high-hydride ($ZrH_{1.6}$) fuel elements with stainless steel cladding based on the stress in the cladding (resulting from the hydrogen pressure from the dissociation of the zirconium hydride). This stress will remain below the yield strength of the stainless steel cladding with fuel temperatures below 1150°C. A change in yield strength occurs for stainless steel cladding temperatures of 500°C, but there is no scenario for fuel cladding to achieve 500°C while submerged or in air; consequently the SAFETY LIMIT during reactor operations is 1150°C.

Therefore, the important process variable for a TRIGA reactor is the fuel element temperature. This parameter is well suited as a single specification, and it is readily measured. During operation, fission product gases and dissociation of the hydrogen and zirconium builds up gas inventory in internal components and spaces of the fuel elements. Fuel temperature acting on these gases controls fuel element internal pressure. Limiting the maximum temperature prevents excessive internal pressures that could be generated by heating these gases.

Fuel growth and deformation can occur during normal operations, as described in Chapter 4 (4.2.1 Z). Damage mechanisms include fission recoils and fission gases, strongly influenced by thermal gradients. Limiting steady state operating fuel temperature to less than 750°C limits potential fuel growth.

2.2 Limiting Safety System Settings (LSSS)

2.2.1 Applicability

This specification applies when the reactor in STEADY STATE MODE

2.2.2 Objective

The objective of this specification is to ensure the SAFETY LIMIT is not exceeded.

2.2.3 Specifications

A	Power level SHALL NOT exceed 1100 kW (th) in STEADY STATE MODE of operation
B	Instrumented elements in the B or C ring SHALL indicate less than 550°C

2.2.4 Actions

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Steady state power level exceeds 1100 kW (th)	A.1 Reduce power to less than 1100 kW (th) OR A.2. ENSURE REACTOR SHUTDOWN condition	A.1 IMMEDIATE A.2. IMMEDIATE
B. An INTSTRUMENTED FUEL ELEMENT in the B or C ring indicates greater than 550°C	B.1. ENSURE REACTOR SHUTDOWN condition OR B.2 VERIFY the MEASURED VALUE is not correct	B.2. IMMEDIATE B.2 IMMEDIATE

2.2.5 Bases

Analysis in SAR Chapter 4 (4.6 B) demonstrates that if operating thermal (th) power is 1100 kW, the maximum steady state fuel temperature is less than the SAFETY LIMIT for steady state operations by a large margin. For normal pool temperature, calculations in Chapter 4 demonstrate that the heat flux of the hottest area of the fuel rod generating the highest power level in the core during operations is less than the critical heat flux by a large margin up to the maximum permitted cooling temperatures; margin remains even at temperatures approaching bulk boiling for atmospheric conditions. Therefore, steady state operations at a maximum of 1100 kW meet requirements for safe operation with respect to maximum fuel temperature and thermal hydraulics by a wide margin. Steady state operation of 1100 kW was assumed in analyzing the loss of cooling and maximum hypothetical accidents. The analysis assumptions are protected by assuring that the maximum steady state operating power level is 1100 kW.

The actual safety system setting will be chosen to ensure that a scram will occur at a level that does not exceed 1,100 kW.

Instrumented fuel element temperatures less than 550°C ensures the SAFETY LIMIT on fuel temperature is met.

3. LIMITING CONDITIONS FOR OPERATION (LCO)

3.1 Core Reactivity

3.1.1 Applicability

These specifications are required prior to entering STEADY STATE MODE or PULSING MODE in OPERATING conditions; reactivity limits on experiments are specified in Section 3.8.

3.1.2 Objective

This LCO ensures the reactivity control system is OPERABLE, and that an accidental or inadvertent pulse does not result in exceeding the SAFETY LIMIT.

3.1.3 Specification

A	The maximum available core reactivity (EXCESS REACTIVITY) with all control rods fully withdrawn does not exceed 4.9% $\Delta k/k$ ($7.00) when: 1. REFERENCE CORE CONDITIONS exists 2. No MOVEABLE EXPERIMENTS with net-negative reactivity worth are in place
B	SHUTDOWN MARGIN in REFERENCE CORE CONDITIONS is more than 0.2% $\Delta k/k$ ($0.29)

3.1.4 Actions

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Reactivity with all control rods fully withdrawn exceeds 4.9% $\Delta k/k$ ($7.00)	A.1 ENSURE REACTOR SHUTDOWN AND A.2 Configure reactor to meet LCO	A.1 IMMEDIATE A.2 Prior to continued operations

B. The reactor is not subcritical by more than 0.2% Δk/k ($0.29) under specified conditions	B.1.a ENSURE operable control rods are fully inserted AND B.1.b Secure electrical power to the control rod circuits (magnet or motor power) AND B.1.c Secure all work on in-core experiments or installed control rod drives AND B.2 Configure reactor to meet LCO	B.1 IMMEDIATE B.2 Prior to continued operations

3.1.5 Bases

The stated value for excess reactivity was used in establishing core conditions for calculations in SAR Chapter 13 (13.4) to demonstrate fuel temperature limits are met during potential accident scenarios under extremely conservative conditions of analysis. Since the fundamental protection for the UT reactor is the maximum power level and fuel temperature that can be achieved with the available positive core reactivity, experiments with positive reactivity are included in determining excess reactivity. Since experiments with negative reactivity will increase available reactivity if they are removed during operation, they are not credited in determining excess reactivity.

Analysis shows that at the limiting pool water temperature and zero power, fuel temperature approaches 950°C with a reactivity addition of $5.94, and 1050°C with a reactivity addition of $5.66, while a $4.00 reactivity addition results in peak fuel temperature of about 770°C. If the pulse occurs with the reactor operating at 880 MW, a $4.00 reactivity insertion results in peak fuel temperature of 930°C; this is only 3% below the SAFETY LIMIT for cladding with temperature greater than 500°C, but is well below the SAFETY LIMIT when cladding temperature is less than 500°C. Since the cladding temperature is shown to be less than 500°C with the reactor operating in Chapter 4, worst-case steady state operation at 880 kW leads to a maximum fuel temperature well below the SAFETY LIMIT.

The limiting SHUTDOWN MARGIN is necessary so that the reactor can be shut down from any operating condition, and will remain shutdown after cool down and xenon decay, even if one control rod (including the transient control rod) should remain in the fully withdrawn position. Analysis in Chapter 4 (4.5.1) demonstrates the capability of the control rods to meet this requirement.

3.2 PULSED MODE Operations

3.2.1 Applicability

These specifications apply to operation of the reactor in the PULSE MODE.

3.2.2 Objective

This Limiting Condition for Operation prevents fuel temperature SAFETY LIMIT from being exceeded during PULSE MODE operation.

3.2.3 Specification

A	The transient rod drive is positioned for reactivity insertion (upon withdrawal) less than or equal to 2.8% δk ($4.00)

3.2.4 Actions

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. With all stainless steel clad fuel elements, the worth of the pulse rod in the transient rod drive position is greater than $4.00 in the PULSE MODE	A.1 Position the transient rod drive for pulse rod worth less than or equal to $4.00 OR A.2 Place reactor in STEADY STATE MODE	A.1 IMMEDIATE OR A.2 IMMEDIATE

3.2.5 Bases

The value for pulsed reactivity with all stainless steel elements in the core was used in establishing core conditions for calculations in SAR Chapter 13 (13.4) that demonstrate fuel temperature limits are met during potential accident scenarios under extremely conservative conditions of analysis.

3.3 MEASURING CHANNELS

3.3.1 Applicability

This specification applies to the reactor MEASURING CHANNELS during STEADY STATE MODE and PULSE MODE operations.

3.3.2 Objective

The objective is to require that sufficient information is available to the operator to ensure safe operation of the reactor

3.3.3 Specifications

A	The MEASURING CHANNELS specified in TABLE 1 SHALL be OPERATING
B	The neutron count rate on the startup channel is greater 2 mW

TABLE 1: MINIMUM MEASURING CHANNEL COMPLEMENT

MEASURING CHANNEL	Minimum Number Operable	
	STEADY STATE MODE	PULSE MODE
Reactor power level[1]	2	1
Primary Pool Water Temperature	1	1
Fuel Temperature	1	1
Pool area radiation monitor[2]	1	1
Lower or middle level area monitor[2]	1	1
Argon 41 effluent monitor[3]	1	1
Particulate air continuous air monitor	1	1

NOTE[1]: One "Startup Channel" required to have range that indicates <10 W
NOTE[2]: High-level alarms audible in the control room may be used
NOTE[3]: When the auxiliary purge system is operating

3.3.4 Actions

CONDITION	REQUIRED ACTION	COMPLETION TIME
A .1 Reactor power channels not OPERATING (min 2 for STEADY STATE, 1 PULSE MODE)	A.1.1 Restore channel to operation OR A.1.2 ENSURE reactor is SHUTDOWN	A.1.1 IMMEDIATE A.1.2 IMMEDIATE
A.2 Communications between DAC and control console interrupted > 10 s OR High voltage to reactor safety channel (power level) detector less than 80% of required operating value	A.2.1 Establish REACTOR SHUTDOWN condition AND A.2.2 Enter REACTOR SECURED mode	A.2. IMMEDIATE
A.3 Primary water temperature, reactor ay differential pressure or fuel temperature CHANNEL not operable	A.3.1 Restore channel to operation OR A.3.2 Monitor pool water temperature OR A.3.3 ENSURE reactor is SHUTDOWN	A.3.1 IMMEDIATE A.3.2 IMMEDIATE AND At least once per hour A.3.3.3 IMMEDIATE

CONDITION	REQUIRED ACTION	COMPLETION TIME
A.4. Pool Area Radiation Monitor is not OPERATING	A.4.1 Restore MEASURING CHANNEL OR A.4.2 ENSURE reactor is shutdown OR A.4.3 ENSURE personnel are not on the upper level OR A.4.4 ENSURE personnel on upper level are using portable survey meters to monitor dose rates	A.4.1 IMMEDIATE A.4.2 IMMEDIATE A.4.3 IMMEDIATE A.4.4 IMMEDIATE
A.5 Lower or middle level area monitor is not OPERATING	A.5.1 Restore MEASURING CHANNEL OR A.5.2 ENSURE reactor is shutdown OR A.5.3 ENSURE personnel are not in the reactor bay OR A.5.4 ENSURE personnel entering reactor bay are using portable survey meters to monitor dose rates	A.5.1 IMMEDIATE A.5.2 IMMEDIATE A.5.3 IMMEDIATE A.5.4 IMMEDIATE

CONDITION	REQUIRED ACTION	COMPLETION TIME
A.6. Argon monitor is not OPERATING	A.6.1 Restore MEASURING CHANNEL OR A.6.2 ENSURE reactor is shutdown OR A.6.3.a ENSURE continuous air radiation monitor is OPERATING AND A.6.3.b Restore MEASURING CHANNEL	A.6.1 IMMEDIATE A.6.2. IMMEDIATE A.6.3.a. IMMEDIATE A.6.3.b Within 30 working days
A.7 Continuous particulate air radiation monitor is not OPERATING	A.7.1 Restore MEASURING CHANNEL OR A.7.2 ENSURE reactor is shutdown OR A.7.3.a ENSURE Argon 41 monitor radiation monitor is OPERATING AND A.7.3.b Restore MEASURING CHANNEL	A.7.1 IMMEDIATE A.7.2. IMMEDIATE A.7.3.a. IMMEDIATE A.7.3.b Within 30 working days
B. The neutron count rate on the startup channel is not greater than x10^{-7} %	B.1 Do not perform a reactor startup OR B.2 Perform a neutron-source check on the startup channel prior to startup	B.1 IMMEDIATE B.2 IMMEDIATE

3.3.5 Bases

Maximum steady state power level is 1100 kW; neutron detectors measure reactor power level. Chapter 4 and 13 discuss normal and accident heat removal capabilities. Chapter 7 discusses radiation detection and monitoring systems, and neutron and power level detection systems.

Communications between the digital acquisition system and the control console computer is monitored by a periodic signal. If the periodic signal stops, the control system initiates a SCRAM.

According to General Atomics, detector voltages less than 80% of required operating value do not provide reliable, accurate nuclear instrumentation. Therefore, if operating voltage falls below the minimum value the power level channel is inoperable.

Pool water temperature indication is required to assure water temperature limits are met, protecting primary cleanup resin integrity. Analysis in Chapter 4 and 13 assume a maximum fuel temperature based on protection of resin integrity. Fuel temperature indication provides a means of observing that the SAFETY LIMITS are met.

The upper and lower level area radiation monitors provide information about radiation hazards in the reactor bay. A loss of reactor pool water (Chapter 13), changes in shielding effectiveness (Chapter 11), and releases of radioactive material to the restricted area (Chapter 11) that could cause changes in radiation levels within the reactor bay detectable by these monitors. Portable survey instruments will detect changes in radiation levels.

The air monitors (continuous particulate air- and argon radiation-monitor) provide indication of airborne contaminants in the reactor bay. These channels provide evidence of fuel element failure on independent channels; the particulate air monitor gas has maximum sensitivity to iodine and particulate activity, while the argon channel detects noble gas.

Permitting operation using a single channel of atmospheric monitoring will reduce unnecessary shutdowns while maintaining the ability to detect abnormal conditions as they develop. Relative indications ensure discharges are routine; abnormal indications trigger investigation or action to prevent the release of radioactive material to the surrounding environment. Ensuring the alternate airborne contamination monitor is functioning during outages of one system provides the contamination monitoring required for detecting abnormal conditions. Limiting the outage for a single unit to a maximum of 30 days ensures radioactive atmospheric contaminants are monitored while permitting maintenance and repair outages on the other system.

SAR Chapter 13 discusses inventories and releases of radioactive material from fuel element failure into the reactor bay, and to the environment. Particulate and noble gas channels monitor more routine discharges. SAR Chapter 11 discusses routine discharges of radioactive gasses generated from normal operations into the reactor bay and into the environment. SAR Chapters 3 and 9 identifies design bases for the confinement and ventilation system. SAR Chapter 7 discusses air-monitoring systems. The 30 day interval is selected as adequate to accomplish complex repairs, and limited enough that with one system functional there is no significant chance that the system will fail during a period that requires detection of airborne radioactivity.

Experience has shown that subcritical multiplication with the neutron source used in the reactor does not provide enough neutron flux to correspond to an indicated power level of $2x10^{-7}$ %. Therefore an indicated power of $2x10^{-7}$ % (or 2 mW) or more indicates operating in a potential critical condition, and at least one neutron channel is required with sensitivity at a neutron flux level corresponding to reactor power levels less than $2x10^{-7}$ % ("Startup Channel"). If the indicated neutron level is less than the minimum sensitivity for the channel, a neutron source will be used to determine that the channels is responding to neutrons to ensure that the channel is functioning prior to startup.

3.4 Safety Channel and Control Rod Operability

3.4.1 Applicability

This specification applies to the reactor MEASURING Channels during STEADY STATE MODE and PULSE MODE operations.

3.4.2 Objective

The objectives are to require the minimum number of REACTOR SAFETY SYSTEM channels that must be OPERABLE in order to ensure that the fuel temperature SAFETY LIMIT is not exceeded, and to ensure prompt shutdown in the event of a scram signal.

3.4.3 Specifications

A	The SAFETY SYSTEM CHANNELS specified in TABLE 2 are OPERABLE
B	CONTROL RODS (STANDARD) are capable of full insertion from the fully withdrawn position in less than 1 sec.

TABLE 2: REQUIRED SAFETY SYSTEM CHANNELS

Safety System Channel or Interlock	Minimum Number Operable	Function	Required OPERATING Mode	
			STEADY STATE MODE	PULSE MODE
Reactor power level	2	Scram	YES	NA
Manual scram bar	1	Scram	YES	YES
Fuel Temperature	1	Scram	YES	YES
Pool water level	1	Scram	YES	YES
CONTROL ROD (STANDARD) position interlock	1	Prevent withdrawal of standard rods in the PULSE MODE	NA	YES
Pulse rod interlock[1]	1	Prevent inadvertent pulsing while in STEADY STATE MODE	YES	NA

NOTE [1]: The pulse rod interlock prevents air from being applied to the pulse rod unless the transient rod is fully inserted except during pulse mode or square wave operations.

3.4.4 Actions

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Any required SAFETY SYSTEM CHANNEL or interlock function is not OPERABLE	A.1 Restore channel or interlock to operation OR A.2 ENSURE reactor is SHUTDOWN	A1. IMMEDIATE A2. IMMEDIATE

3.4.5 Bases

The power level scram is provided to ensure that reactor operation stays within the licensed limits of 1,100 kW, preventing abnormally high fuel temperature. The power level scram is not credited in analysis, but provides defense in depth to assure that the reactor is not operated in conditions beyond the assumptions used in analysis (Chapter 4 and 13).

The manual scram allows the operator to shut down the system if an unsafe or abnormal condition occurs.

Fuel temperature scram assures the LSSS is met.

The pool water level scram secures operation on a loss of pool water level.

The CONTROL ROD (STANDARD) interlock function is to prevent withdrawing control rods (other than the pulse rod) when the reactor is in the PULSE MODE. This will ensure the reactivity addition rate during a pulse is limited to the reactivity added by the pulse rod.

The pulse rod interlock function prevents air from being applied to the transient rod drive when it is withdrawn while disconnected from the control rod to prevent inadvertent pulses during STEADY STATE MODE operations. The control rod interlock prevents inadvertent pulses which would be likely to exceed the maximum range of the power level instruments configured for steady state operations.

3.5 Gaseous Effluent Control

3.5.1 Applicability

This specification applies to gaseous effluent in STEADY STATE MODE and PULSE MODE.

3.5.2 Objective

The objective is to ensure that exposures to the public resulting from gaseous effluents released during normal operations and accident conditions are within limits and ALARA.

3.5.3 Specification

A	The reactor bay HVAC confinement system SHALL provide ventilation to the reactor bay when particulate continuous air monitor indicates less than 10,000 cpm
B	The reactor bay confinement system will enter CONFINEMENT ISOLATION if the particulate continuous air monitor is in-service and indicates greater than 10,000 cpm
C	Auxiliary purge system SHALL exhaust from reactor bay pool and in-use experiment areas
D	Releases of Ar-41 from the reactor bay to an unrestricted environment SHALL NOT exceed 100 Ci per year.

3.5.4 Actions

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. The reactor bay HVAC confinement ventilation system is not OPERABLE	A.1 ENSURE reactor is SHUTDOWN OR A.2.a ENSURE auxiliary air purge system is OPERATING AND A.2.b SECURE EXPERIMENT operations if failure could result in significant release of rad. gases or aerosols. AND A.2.c ENSURE no irradiated fuel handing	A.1 IMMEDIATE A.2.1 IMMEDIATE A.3.a IMMEDIATE A.3.b IMMEDIATE A.3.c IMMEDIATE
B The particulate continuous air monitor is in service and indicates greater than 10,000 cpm, and the reactor bay confinement system is not in CONFINEMENT ISOLATION	B.1 ENSURE reactor is SHUTDOWN AND B.2 SECURE reactor bay ventilation AND B.3 SECURE the fume/sorting hood	B.1 IMMEDIATE B.1 IMMEDIATE

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. The auxiliary purge system is not OPERABLE	C.1 ENSURE reactor bay HVAC confinement ventilation system is OPERATING. OR C.2.a ENSURE reactor is SHUTDOWN C.2.b Secure EXPERIMENT operations for EXPERIMENT with failure modes that could result in the release of radioactive gases or aerosols C.2.c ENSURE no irradiated fuel handling	C.1 IMMEDIATE C.2.a IMMEDIATE C.2.b IMMEDIATE C.2.c IMMEDIATE
D Calculated releases of Ar-41 from the reactor bay exhaust plenum exceed 100 Ci per year.	D. Do not operate.	D. IMMEDIATE

3.5.5 Bases

The confinement and ventilation system is described in Chapter 9. Routine operations produce radioactive gas, principally Argon 41, in the reactor bay. If the confinement system is not functioning and the purge system is not operating, radioactive gasses will buildup in the reactor bay. During this interval, experiment activities that might cause airborne radionuclide levels to be elevated are prohibited.

Chapter 13 addresses the maximum hypothetical fission product inventory release. Using unrealistically conservative assumptions, concentrations for a few nuclides of iodine would be in excess of occupational derived air concentrations for a matter of hours or days. ^{90}Sr activity available for release from fuel rods previously used at other facilities is estimated to be at most about 4 times the ALI. In either case (radio-iodine or -Sr), there is no credible scenario for accidental inhalation or ingestion of the undiluted nuclides that might be released from a damaged fuel element. Finally, fuel element failure during a fuel handling accident is likely to be observed and mitigated immediately.

The CAP-88 (Clean Air Act Assessment Package-1988) computer model is a set of computer programs, databases and associated utility programs for estimation of dose and risk from radionuclide emissions to air. CAP-88 is composed of modified versions of AIRDOS-EPA (Mo79) and DARTAB (ORNL5692). CAP-88 was used to analyze argon 41 effluents from the UT TRIGA reactor. Analysis shows 100 Ci per year results in a maximum does to individuals in the effluent plume of 0.142 mrem in a year, well within the 10CFR20 limit of 10 mrem/year for stack effluents.

3.6 Limitations on Experiments

3.6.1 Applicability

This specification applies to operations in STEADY STATE MODE and PULSE MODE.

3.6.2 Objectives

The objective is to prevent reactivity excursions that might cause the fuel temperature to exceed the SAFETY LIMIT (with possible resultant damage to the reactor), and the excessive release of radioactive materials in the event of an EXPERIMENT failure

3.6.3 Specifications

A	The reactivity worth of any individual MOVEABLE EXPERIMENT SHALL NOT exceed \$1.00 (0.007 Δk/k)
B	The reactivity worth of any individual SECURED EXPERIMENT SHALL NOT exceed \$2.50 (0.0175 Δk/k)
C	The total reactivity worth of all EXPERIMENTS shall not exceed \$3.00 (0.021 Δk/k)

3.6.4 Actions

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. MOVEABLE EXPERIMENT worth is greater than \$1.00	A.1 ENSURE the reactor is SHUTDOWN AND A.2 Remove the experiment	A.1 IMMEDIATE A.2 Prior to continued operations
B. SECURED EXPERIMENT worth is greater than \$2.50	B.1 ENSURE the reactor is SHUTDOWN AND B.2 Remove the experiment	B.1 IMMEDIATE B.2 Prior to continued operations

C. Total EXPERIMENT worth is greater than $3.00	C.1 ENSURE the reactor is SHUTDOWN AND C.2 Remove the experiment	C.1 IMMEDIATE C.2 Prior to continued operations

3.6.5 Bases

Chapter 13 demonstrates that pulsed reactivity worth less than 2.8% $\Delta k/k$ ($4.00) will not challenge fuel integrity. These limits provide assurance that experiments do not exceed the reactivity analyzed; experiment limits are established lower than analysis limits is used to assure margin for experimental error.

3.7 Fuel Integrity

3.7.1 Applicability

This specification applies to operations in STEADY STATE MODE and PULSE MODE.

3.7.2 Objective

The objective is to prevent the use of damaged fuel in the UT TRIGA reactor.

3.7.3 Specifications

A	Fuel elements in the reactor core SHALL NOT be (1) elongated more than 1/10 in. over manufactured length OR (2) laterally bent more than 1/16 in.
B	Fuel elements SHALL NOT have visual indications of cladding integrity failure.
C	Fuel elements in the core SHALL NOT release fission products.

3.7.4 Actions

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Any fuel element is elongated greater than 1/10 in. over manufactured length, or bent laterally greater than 1/16 in.	Do not re-insert the fuel element into the upper core grid plate.	IMMEDIATE
B. Fuel elements have visual indication of cladding integrity failure	Do insert or not re-insert the fuel element into the upper core grid plate.	IMMEDIATE
B. Fission products are determined to be leaking from fuel elements in the core	C.1 SECURE PULSE MODE operations C.2.a Operate in STEADY STATE MODE only to identify the failed element AND C.2.b Remove the failed element from service	C.1 IMMEDIATE C.2.a IMMEDIATE C.2.b When the element is identified

3.7.5 Bases

The above limits on the allowable distortion of a fuel element have been shown to correspond to strains that are considerably lower than the strain expected to cause rupture of a fuel element and have been successfully applied at TRIGA installations. Fuel cladding integrity is important since it represents the only process barrier for fission product release from the TRIGA reactor.

Lateral bend less than 1/16 in. in adjacent fuel elements assures that there is adequate clearance to prevent element contact during operation.

Limiting the use of fuel elements where cladding has been challenged as specified limits release of fission products to the minimum required for assessing fuel elements.

3.8 Reactor Pool Water

3.8.1 Applicability

This specification applies to operations in STEADY STATE MODE, PULSE MODE, and SECURED MODE.

3.8.2 Objective

The objective is to set acceptable limits on the water quality, temperature, conductivity, and level in the reactor pool.

3.8.3 Specifications

A	Water temperature at the exit of the reactor pool SHALL NOT exceed 110°F (48.9°C)
B	Water conductivity SHALL be less than or equal to 5 μmho/cm averaged over 1 month
C	Water level above the core SHALL be at least 6.5 m from bottom of the pool
D	The pressure difference between chilled water outlet from the pool heat exchanger and pool water inlet SHALL NOT be less than 7 kPa (1 psig)

3.8.4 Actions

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Water temperature at the exit of the reactor pool exceeds 110°F (48.9°C)	A.1 ENSURE the reactor is SHUTDOWN AND A.2 Secure flow through the demineralizer AND A.3 Initiate action to reduce water temperature to less than 110°F	A.1 IMMEDIATE A.2 IMMEDIATE A.3 IMMEDIATE

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Water conductivity is greater than 5 μmho/cm	B.1 ENSURE the reactor is SHUTDOWN AND B.2 Restore conductivity to less than 5 μmho/cm	B.1 IMMEDIATE B.2 Within 1 month
C. Water level above the core SHALL be at least 6.5 m from the bottom of the pool for all operating conditions	C.1 ENSURE the reactor is SHUTDOWN AND C.2 Restore water level	C.1 IMMEDIATE C.2 IMMEDIATE
D. The pressure difference between chilled water outlet from the pool heat exchanger and pool water inlet is less than 7 kPa (1 psig)	D.1 ENSURE the reactor is SHUTDOWN OR D.2 Verify pressure differential is greater than 7 kPa (1 psig) OR D.3 RESTORE pressure difference to greater than 7 kPa (1 psig) OR D.4 Isolate chill water	D.1 IMMEDIATE D.2 IMMEDIATE D.3 IMMEDIATE D.4 IMMEDIATE

3.8.5 Bases

The resin used in the mixed bed deionizer limits the water temperature of the reactor pool. Resin in use (as described in Section 5.4) maintains mechanical and chemical integrity at temperatures below 110°F (48.9°C). Therefore, thermal hydraulic analysis was conducted to a maximum pool temperature of 48.9°C, and limiting pool temperature ensures analysis conditions are met.

Maintaining low water conductivity over a prolonged period prevents possible corrosion, deionizer degradation, or slow leakage of fission products from degraded cladding. Although fuel degradation does not occur over short time intervals, long-term integrity of the fuel is important, and a 4-week interval was selected as an appropriate maximum time for averaging conductivity values.

For normal pool temperature, calculations in Chapter 4 assuming 8.1 and 6.5 m above the bottom of the pool demonstrate that the heat flux of the hottest area of the fuel rod generating the highest power level in the core during operations is less than the critical heat flux by a large margin up to the maximum permitted cooling temperatures; margin remains even at temperatures approaching bulk boiling for atmospheric conditions. Therefore, pool levels greater than 6.5 m above the pool floor meet requirements for safe operation with respect to maximum fuel temperature and thermal hydraulics by a wide margin.

The principle contributor to radiation dose rates at the pool surface is Nitrogen 16 generated in the reactor core and dispersed in the pool. Pool surface radiation dose rates from Nitrogen 16 with 6.5 m of water above the core are acceptable.

Therefore, a minimum pool level of 6.5 feet above the core is adequate to support the core cooling and provide shielding.

The specified pressure difference assures that any postulated heat exchanger leakage will not release potentially contaminated water to the chill water system.

3.9 Retest Requirements

3.9.1 Applicability

This specification applies to operations in STEADY STATE MODE and PULSE MODE.

3.9.2 Objective

The objective is to ensure Technical Specification requirements are met following maintenance or operational activities that occur within surveillance test intervals.

3.9.3 Specifications

Maintenance or operational activities SHALL NOT change, defeat or alter equipment or systems in a way that prevents the systems or equipment from being OPERABLE (when required) or otherwise prevent the systems or equipment from fulfilling the safety basis

3.9.4 Actions

CONDITION	REQUIRED ACTION	COMPLETION TIME
Maintenance or an operational activity is performed that has the potential to change a setpoint, calibration, flow rate, or other parameter that is measured or verified in meeting a surveillance or operability requirement	Perform surveillance OR Operate only to perform retest	Prior to continued, normal operation in STEADY STATE MODE or PULSE MODE

3.9.5 Bases

Operation of the UT TRIGA reactor will comply with the requirements of Technical Specifications. This specification ensures that if maintenance or operations might challenge a Technical Specifications requirement, the requirement is verified prior to resumption of normal operations.

4. Surveillance Requirements

Surveillance activities (except those specifically required for safety when the reactor is shutdown), may be deferred during reactor shutdown, however, they must be completed prior to reactor startup unless reactor operation is necessary for performance of the activity. If a surveillance schedule cannot be met because the reactor is operating while performance requires the reactor not be operating, performance may be deferred until the reactor is shutdown.

4.1 Core Reactivity

4.1.1 Objective

This surveillance ensures that the minimum SHUTDOWN MARGIN requirements and maximum excess reactivity limits of section 3.1 are met.

4.1.2 Specification

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
SHUTDOWN MARGIN Determination	ANNUAL
EXCESS REACTIVITY Determination	ANNUAL
	Following Insertion of experiments with measurable positive reactivity
Control Rod Reactivity Worth determination	BIENNIAL

4.1.3 Basis

Experience has shown verification of the minimum allowed SHUTDOWN MARGIN at the specified frequency is adequate to assure that the limiting safety system setting is met.

When core reactivity parameters are affected by operations or maintenance, additional activity is required to ensure changes are incorporated in reactivity evaluations.

Reactivity limits are verified by comparing critical control rod positions to reference values. The reference values change with burnup and core configuration. Biennial evaluation of control rod position is adequate, although other activities may result in control rod worth determination through retest requirements.

4.2 PULSE MODE

4.2.1 Objectives

The verification that the pulse rod position does not exceed a reactivity value corresponding to $4.00 assures that the limiting condition for operation is met.

4.2.2 Specification

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
ENSURE Transient Pulse Rod position corresponds to reactivity not greater than $4.00	Prior to pulsing operations

4.2.3 Basis

Verifying pulse rod position corresponds to less than or equal to $4.00 ensures that the maximum pulsed reactivity meets the limiting condition for operation.

4.3 MEASURING CHANNELS

4.3.1 Objectives

Surveillances on MEASURING CHANNELS at specified frequencies ensure instrument problems are identified and corrected before they can affect operations.

4.3.2 Specification

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Reactor power level CHANNEL	
CHANNEL TEST	DAILY
Calorimetric calibration	ANNUAL
CHANNEL CHECK loss of high voltage to required power level instruments	DAILY
CALIBRATION high voltage to required power level instruments	ANNUAL
Primary pool water temperature CHANNEL	
CHANNEL TEST	DAILY
CHANNEL CALIBRATION	ANNUAL
Fuel temperature CHANNEL	
CHANNEL TEST	DAILY
CHANNEL CALIBRATION	ANNUAL
Upper level Area radiation monitor	
CHANNEL CHECK	WEEKLY
CHANNEL CALIBRATION	ANNUAL
Lower or middle level Area Radiation Monitor	
CHANNEL CHECK	WEEKLY
CHANNEL CALIBRATION	ANNUAL
(Particulate) Continuous Air Radiation Monitor	
CHANNEL CHECK	DAILY
CHANNEL CALIBRATION	ANNUAL
Argon Monitor	
CHANNEL CHECK	DAILY

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
CHANNEL CALIBRATION (Electronic)	BIENNIAL
Startup Count Rate	DAILY

4.3.3 Basis

The DAILY CHANNEL CHECKS will ensure that the SAFETY SYSTEM and MEASURING CHANNELS are operable. The required periodic calibrations and verifications will permit any long-term drift of the channels to be corrected.

4.4 Safety Channel and Control Rod Operability

4.4.1 Objective

The objectives of these surveillance requirements are to ensure the REACTOR SAFETY SYSTEM will function as required. Surveillances related to safety system MEASURING CHANNELS ensure appropriate signals are reliably transmitted to the shutdown system; the surveillances in this section ensure the control rod system is capable of providing the necessary actions to respond to these signals.

4.4.2 Specifications

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Pool level scram SHALL be functionally tested	MONTHLY
CONTROL ROD (STANDARD) drop times SHALL be measured to have a drop time from the fully withdrawn position of less than 1 sec.	ANNUAL
The control rods SHALL be visually inspected for corrosion and mechanical damage at intervals	BIENNIAL
CONTROL ROD (STANDARD) position interlock functional test	SEMIANNUAL
Pulse rod interlock functional test	SEMIANNUAL
The CONTROL ROD (TRANSIENT) rod drive cylinder and the associated air supply system SHALL be inspected, cleaned, and lubricated, as necessary.	ANNUAL

4.4.3 Basis

Manual and automatic scrams are not credited in accident analysis, although the systems function to assure long-term safe shutdown conditions. The manual scram and control rod drop timing surveillance s are intended to monitor for potential degradation that might interfere with the operation of the control rod systems. The functional test of pool level trip channel assures that the channel will function on demand.

The control rod inspections (visual inspections and transient drive system inspections) are similarly intended to identify potential degradation that lead to control rod degradation or inoperability.

A test of the interlock that prevents the pulse rod from coupling to the drive in the state mode unless the drive is fully down or square wave mode is being used assures that pulses will not unintentionally occur. In particular, instrumentation alignment for the pulsing mode causes safety channels to be capable of monitoring pulse power; if pulsing occurs while the instruments are set to normal, steady state operations, they will not be capable of monitoring peak power.

A test of the interlock that prevents standard control rod motion while in the pulse mode assures that the interlock will function as required.

The functional checks of the control rod drive system assure the control rod drive system operates as intended for any pulsing operations. The inspection of the pulse rod mechanism will assure degradation of the pulse rod drive will be detected prior to malfunctions.

4.5 Gaseous Effluent Control

4.5.1 Objectives

These surveillance ensure that routine releases are normal, and (in conjunction with MEASURING CHANNEL surveillance) that instruments will alert the facility if conditions indicate abnormal releases.

4.5.2 Specification

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
ENSURE confinement HVAC operable	DAILY
ENSURE adequate auxiliary air purge system valve alignment	Prior to entering an operating mode with an EXPERIMENTAL FACILITY in use
CONFINEMENT ISOLATION functional test	MONTHLY
CONFINEMENT ISOLATION damper inspection	ANNUALLY
Calculate Ar41 discharge	SEMIANNUALLY

4.5.3 Basis

Verification that the confinement HVAC system is operable daily is adequate to assure the HVAC function.

Since the experimental facilities in use may vary between operations, the auxiliary purge system valve line up may require multiple manipulations on a given day of operations. If the EXPERIMENTAL FACILITES used in an operation do not change, a review of operating logs and records may be adequate to verify proper valve alignment.

Confinement isolation functional test frequency is adequate to ensure potential failures are detected prior to system demand.

The annual test is adequate to detect degradation of sealing surfaces.

Semiannual calculation of Argon 41 is adequate to ensure that discharge limits are met.

4.6 Limitations on Experiments

4.6.1 Objectives

This surveillance ensures that experiments do not have significant negative impact on safety of the public, personnel or the facility.

4.6.2 Specification

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Experiments SHALL be evaluated and approved prior to implementation.	Prior to inserting a new experiment for purposes other than determination of reactivity worth
Measure and record experiment worth of the EXPERIMENT (where the absolute value of the estimated worth is greater than $0.50).	Initial insertion of a new experiment where absolute value of the estimated worth is greater than $0.50

4.6.3 Basis

These surveillances support determination that the limits of 3.6 are met.

Experiments with an absolute value of the estimated significant reactivity worth (greater than $0.50) will be measured to assure that maximum experiment reactivity worths are met. If an absolute value of the estimate indicates less than $0.50 reactivity worth, any error less than 100% will result in actual reactivity less than the assumptions used in analysis for inadvertent pulsing at low power operations in the Safety Analysis Report (13.2.3, Case I).

4.7 Fuel Integrity

4.7.1 Objective

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

4.7.2 Applicability

This specification applies to the surveillance requirements for the fuel elements in the reactor core.

4.7.3 Specification

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
The STANDARD FUEL ELEMENTS SHALL be visually inspected for corrosion and mechanical damage, and measured for length and bend	500 pulses of magnitude equal to or greater than a pulse insertion of $3.00 AND Following the exceeding of a limited safety system set point with potential for causing degradation
Approximately 1/4 of the core SHALL be visually inspected annually for corrosion and mechanical damage	BIENNIAL
Complete full core inspection	4, not to exceed 5, years

4.7.4 Basis

The most severe stresses induced in the fuel elements result from pulse operation of the reactor, when temperature causes increased gas pressure and fuel-to-cladding differential expansion. The magnitude of $3.00 pulses warrants inspection following a sufficient number of cycles.

Visual inspection of fuel elements at the specified intervals combined with measurements at intervals determined by pulsing as described is considered adequate to identify potential degradation of fuel prior to catastrophic fuel element failure.

4.8 Reactor Pool Water

This specification applies to the water contained in the UT TRIGA reactor pool.

4.8.1 Objective

The objective is to provide surveillance of reactor primary coolant water quality, pool level, temperature and (in conjunction with MEASURING CHANNEL surveillances), and conductivity.

4.8.2 Specification

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Verify reactor pool water level above the inlet line vacuum breaker	DAILY
Verify reactor pool water temperature channel operable	DAILY
Measure reactor pool water conductivity	WEEKLY
	At least every 30 days
CALIBRATE pool water conductivity channel	ANNUALLY
CALIBRATE heat exchanger differential pressure channel	ANNUALLY
CHANNEL CHECK heat exchanger differential pressure channel with loss of differential pressure	DAILY

4.9.3 Bases

Surveillance of the reactor pool will ensure that the water level is adequate before reactor operation. Evaporation occurs over longer periods of time, and daily checks are adequate to identify the need for water replacement. Pool water level status (not high, not low) is indicated on the control console.

Pool water temperature must be monitored to ensure that the temperature limit related to resin will not be exceeded, and that the conditions for analysis are maintained. A daily check on the pool temperature instrument prior to reactor operation is adequate to ensure the instrument is operable when it will be needed.

Water conductivity must be checked to ensure that the pool cleanup system is performing properly and to detect any increase in water impurities. A weekly check is adequate to verify water quality is appropriate and also to provide data useful in trend analysis. If the reactor is not operated for long periods of time, the requirement for checks at least every 30 days ensures water quality is maintained in a manner that does not permit fuel degradation.

Annual calibration of the conductivity channel is adequate to assure the channel functions as required.

Annual calibration of the heat exchanger differential pressure channel has proven adequate to assure the required specification is met.

A daily functional test using loss of differential pressure is adequate to ensure the channel functions as required.

4.9 Retest Requirements

4.9.1 Objective

The objective is to ensure that a system is OPERABLE within specified limits before being used after maintenance or operational activities has been performed.

4.9.2 Specification

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Evaluate potential for maintenance or operational activities to affect operability and function of equipment required by Technical Specifications; for standard procedures, this evaluation is incorporated in instructions.	Following maintenance or operational activities for systems of equipment required by Technical Specifications
Perform surveillance to assure affected function meets requirements	Prior to resumption of normal operations

4.9.3 Bases

This specification ensures that work on systems or components has been properly carried out and that the system or component has been properly reinstalled or reconnected before reliance for safety is placed on it.

5. Design Features

5.1 Reactor Fuel

5.1.1 Applicability

This specification applies to the fuel elements used in the reactor core.

5.1.2 Objective

The objective is to ensure 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.

5.1.3 Specification

(l) The high-hydride fuel element shall contain uranium-zirconium hydride, clad in 0.020 in. of 304 stainless steel. It shall contain nominally 8.5 weight percent uranium which has a maximum nominal enrichment of 20%. There shall be 1.55 to 1.80 hydrogen atoms to 1.0 zirconium atom.

(2) For the fuel loading process, elements shall be loaded in an array except for experimental facilities or for single positions occupied by control rods and a neutron startup source.

5.1.4 Bases

These types of fuel elements have a long history of successful use in TRIGA reactors.

5.2 Reactor Fuel and Fueled Devices in Storage

5.2.1 Applicability

This specification applies to reactor fuel elements in storage

5.2.2 Objective

The objective is to ensure fuel elements or fueled devices in storage are maintained Subcritical in a safe condition.

5.2.3 Specification

(1) All fuel elements or fueled devices shall be in a safe, stable geometry;

(2) The k_{eff} of all fuel elements or fueled devices in storage is less than 0.9;

(3) The k_{eff} of fuel elements or fueled devices in an approved shipping container will meet the applicable Certificate of Compliance specifications for k_{eff};

(4) Irradiated fuel elements or fueled devices will be stored in an array which will permit sufficient natural convection cooling by air or water such that the fuel element or fueled device will not exceed design values.

5.2.4 Bases

This specification is based on American Nuclear Society standard 15.1, section 5.4.

5.3 REACTOR BUILDING

5.3.1 Applicability

This specification applies to the building that houses the TRIGA reactor facility.

5.3.2 Objective

The objective is to ensure that provisions are made to restrict the amount of release of radioactivity into the environment.

5.3.3 Specification

(l) The reactor shall be housed in a closed room designed to restrict leakage when the reactor is in operation, with HVAC system designed to maintain negative differential pressure with respect to adjacent spaces and the environment.

(2) The minimum free volume of the reactor room shall be approximately 4120 m^3.

(3) The reactor bay HVAC confinement ventilation system and the auxiliary purge system is capable of exhausting air or other gases from the reactor room at a minimum of 60 ft. above ground level.

(4) Reactor bay HVAC confinement ventilation system operation is designed to provide a minimum of 2 changes of reactor bay air per hour.

5.3.4 Bases

To control the escape of gaseous effluent, the reactor room contains no windows that can be opened. The room air is exhausted through an independent exhaust system, and discharged above the roof to provide dilution.

5.4 EXPERIMENTS

5.4.1 Applicability

This specification applies to the design of experiments.

5.4.2 Objective

The objective is to ensure that experiments are designed to meet criteria.

5.4.3 Specifications

(1) EXPERIMENTS with design reactivity worth greater than $1.00 SHALL be securely fastened (as defined in Section I, Secured Experiment).

(2) Design shall ensure that failure of an EXPERIMENT SHALL NOT lead to a direct failure of a fuel element or of other experiments that could result in a measurable increase in reactivity or a measurable release of radioactivity due to the associated failure.

(3) EXPERIMENTS SHALL be designed so that they do not cause bulk boiling of core water.

(4) EXPERIMENT design SHALL ensure no interference with control rods or shadowing of reactor control instrumentation.

(5) EXPERIMENT design shall minimize the potential for industrial hazards, such as fire or the release of hazardous and toxic materials.

(6) Where the possibility exists that the failure of an EXPERIMENT (except fueled EXPERIMENTS) could release radioactive gases or aerosols to the reactor bay or atmosphere, the quantity and type of material shall be limited such that

the airborne concentration of radioactivity is less than 1,000 times the Derived Air Concentration.

For in-core samples a decay time of five minutes following irradiation may be used in radioactive inventory calculations to account for processing prior to potential exposure.

(7) Each fueled experiment shall be limited such that the total inventory of (1) radioactive iodine isotopes 131 through 135 in the experiment is not greater than 9.32E5 μCi, and (2) radioactive strontium is not greater than 9.35E4 μCi.

Alternate calculations may be accomplished to demonstrate equivalent times for protective actions based on DAC limits for specific experiments, if desired.

These limits do not apply to TRIGA fuel elements used in experiments as maximum hypothetical accident analysis applies. For in-core samples a decay time of five minutes following irradiation to account may be used in calculations.

(8) The following assumptions shall be used in experiment design:

a. If effluents from an experimental facility exhaust through a hold-up tank which closes automatically at a high radiation level, at least 10% of the gaseous activity or aerosols produced will escape.

b. If effluents from an experimental facility exhaust through a filter installation designed for greater than 99% efficiency for 0.3 micron particles, at least 10% of the aerosols produced will escape.

c. For materials whose boiling point is above 130ºF and where vapors formed by boiling this material could escape only through an undisturbed column of water above the core, at least 10% of these vapors will escape.

(9) Use of explosive solid or liquid material with a National Fire Protection Association Reactivity (Stability) index of 2, 3, or 4 in the reactor pool or biological shielding SHALL NOT exceed the equivalent of 25 milligrams of TNT without prior NRC approval.

5.4.4 Basis

Designing the experiment to reactivity and thermal-hydraulic conditions ensures that the experiment is not capable of breaching fission product barriers or interfering with the control systems (interferences from other - than reactivity - effects with the control and safety systems are also prohibited). Design constraints on industrial hazards ensure personnel safety and continuity of operations. Design constraints limiting the release of radioactive gasses prevent unacceptable personnel exposure during off-normal experiment conditions.

A Derived Air Concentration assumes a 2000 hour per year exposure; if exposure is controlled to a specific time limit, such as time required for recognizing the situation and evacuating, limiting values for an experiment can be higher than a DAC.

Limits on radioiodine and radioactive strontium in fueled experiments permits a 1 hour evacuation time for releases of radioiodine and a 2-hour evacuation time for releases of radioactive strontium based on a TRIGA fuel distribution of the radioisotopes from fission of ^{235}U.

6. Administrative Controls

6.1 Organization and Responsibilities of Personnel

This chapter describes and discusses the Conduct of Operations at the University of Texas TRIGA. The Conduct of Operations involves the administrative aspects of facility operations, the facility emergency plan, the security plan, the Reactor Operator selection and requalification plan, and environmental reports. License is used in Chapter 12 in reference to reactor operators and senior reactors subject to 10CFR50.55 requirements.

6.1.1 Structure

University Administration

Fig. 1 illustrates the organizational structure that is applied to the management and operation of the University of Texas and the reactor facility. Responsibility for the safe operation of the reactor facility is a function of the management structure of Fig. 1[1]. These responsibilities include safeguarding the public and staff from undue radiation exposures and adherence to license or other operation constraints. Functional organization separates the responsibilities of academic functions and business functions. The office of the President administers these activities and other activities through several vice presidents.

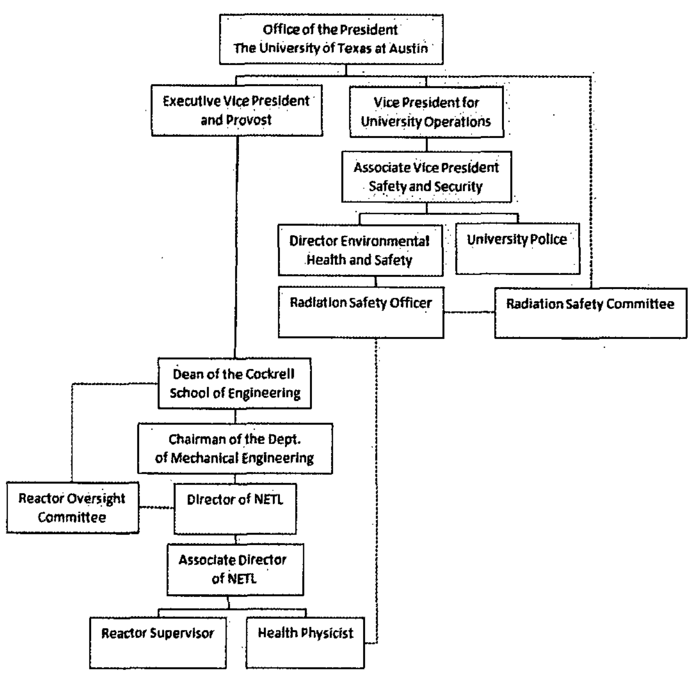

Figure 6.1, Organzational Structure

[1] "Standard for Administrative Controls" ANSI/ANS - 15.18 1979

NETL Facility Administration

The facility administrative structure is shown in Fig. 2. Facility operation staff is an organization of a director and at least four full time equivalent persons. This staff of four provides for basic operation requirements. Four typical staff positions consist of an associate director, a reactor supervisor, a reactor operator, and a health physicist. One or more of the listed positions may also include duties typical of a research scientist. The reactor supervisor, health physicist, and one other position are to be full time. One full time equivalent position may consist of several part-time persons such as assistants, technicians and secretaries. Faculty, students, and researchers supplement the organization. Titles for staff positions are descriptive and may vary from actual designations. Descriptions of key components of the organization follow.

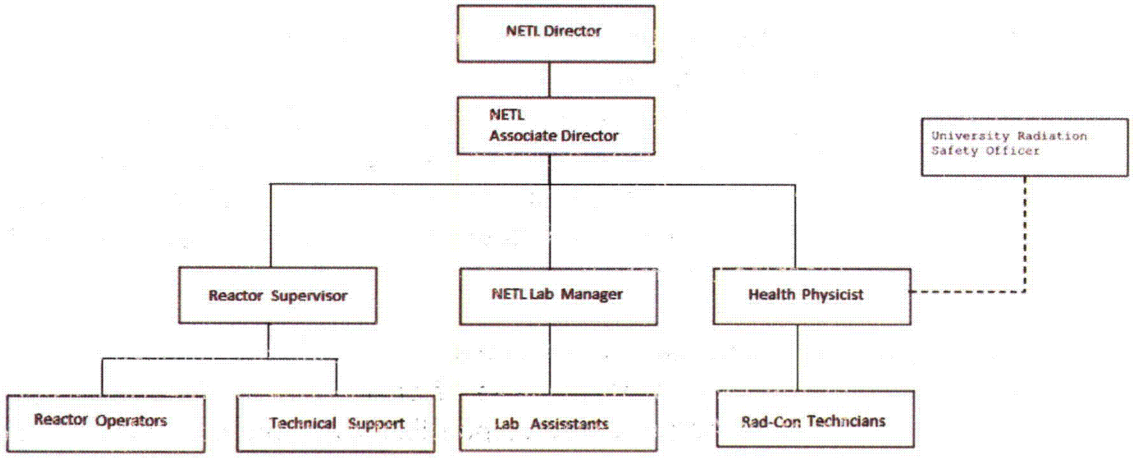

Figure 2, NETL Facility Administration

6.1.2 Functional Responsibility

Vice President and Provost	Research and academic educational programs are administered through the Office of the Executive Vice President and Provost. Separate officers assist with the administration of research activities and academic affairs with functions delegated to the Dean of the College of Engineering and Chairman of the Mechanical Engineering Department.
Vice President for University Operations	University operations activities are administered through the Office of the Vice President for Operations. This office is responsible for multiple operational functions of the University including university support programs, human resources, campus safety and security, campus real estate, and campus planning and facilities management.

Associate Vice President, Campus Safety and Security	The associate vice president for campus safety and security oversees multiple aspects of safety and security on campus including environmental health and safety, campus police, parking and transportation, fire prevention, and emergency preparedness.
Director, Nuclear Engineering Teaching Laboratory	Nuclear Engineering Teaching Laboratory programs are directed by a senior classified staff member or faculty member. The director oversees strategic guidance of the Nuclear Engineering Teaching Laboratory including aspects of facility operations, research, and service work. The director must interact with senior University of Texas at Austin management regarding issues related to the Nuclear Engineering Teaching Laboratory.
Associate Director, Nuclear Engineering Teaching Laboratory	The Associate Director performs the day to day duties of directing the activities of the facility. The Associate Director is knowledgeable of regulatory requirements, license conditions, and standard operating practices. The associate director will also be involved in soliciting and carrying out research utilizing the reactor and other specialized equipment at the Nuclear Engineering Teaching Laboratory.
Reactor Oversight Committee	The Reactor Oversight Committee is established through the Office of the Dean of the College of Engineering of The University of Texas at Austin. Broad responsibilities of the committee include the evaluation, review, and approval of facility standards for safe operation. The Dean shall appoint at least three members to the Committee that represent a broad spectrum of expertise appropriate to reactor technology. The committee will meet at least twice each calendar year or more frequently as circumstances warrant. The Reactor Oversight Committee shall be consulted by the Nuclear Engineering Teaching Laboratory concerning unusual or exceptional actions that affect administration of the reactor program.

Radiation Safety Officer	A Radiation Safety Officer acts as the delegated authority of the Radiation Safety Committee in the daily implementation of policies and practices regarding the safe use of radioisotopes and sources of radiation as determined by the Radiation Safety Committee. The Radiation Safety Program is administered through the University Environmental Health and Safety division. The responsibilities of the Radiation Safety Officer are outlined in The University of Texas at Austin Manual of Radiation Safety.
Radiation Safety Committee	The Radiation Safety Committee is established through the Office of the President of The University of Texas at Austin. Responsibilities of the committee are broad and include all policies and practices regarding the license, purchase, shipment, use, monitoring, disposal, and transfer of radioisotopes or sources of ionizing radiation at The University of Texas at Austin. The President shall appoint at least three members to the Committee and appoint one as Chairperson. The Committee will meet at least once each year on a called basis or as required to approve formally applications to use radioactive materials. The Radiation Safety Committee shall be consulted by the University Safety Office concerning any unusual or exceptional action that affects the administration of the Radiation Safety Program.
Reactor Supervisor	The Reactor Supervisor shall be qualified as a senior operator, and is to be knowledgeable of regulatory requirements, license conditions, and standard operating practices. The Reactor Supervisor is responsible for directing or performing reactor operations. Activities of reactor operators with USNRC licenses will be subject to the direction of a person with a USNRC senior operator license. The reactor supervisor shall assess facility conditions and select appropriate response procedures during normal, abnormal and emergency situations. (1) Prior to operations, the Reactor Supervisor shall ensure conditions and limitations of the license, Technical Specifications, and experiment approvals (as applicable) are met. (2) Reactor Supervisor shall directly supervise all INITIAL STARTUPs.

(3) The Reactor Supervisor will provide direction for, or respond to, situations requiring activation of the Emergency Plan.

(4) In an emergency, the Reactor Supervisor is authorized to direct or perform a reasonable course of action that departs from a license condition or a Technical Specification when this action is immediately needed to protect the public health and safety, and no action consistent with license conditions and technical specifications that can provide adequate or equivalent protection is immediately apparent[2].

Health Physicist — Radiological safety of the Nuclear Engineering Teaching Laboratory is monitored by a health physicist, who will be knowledgeable of the facility radiological hazards. Responsibilities of the health physicist will include calibration of radiation detection instruments, measurements of radiation levels, control of radioactive contamination, maintenance of radiation records, and assistance with other facility monitoring activities.

Activities of the health physicist will depend on two conditions. One condition will be the normal operation responsibilities determined by the director of the facility. A second condition will be communications specified by the radiation safety officer. This combination of responsibility and communication provides for safety program implementation by the director, but establishes independent review. The health physicist's activities will meet the requirements of the director and the policies of an independent university safety organization.

Laboratory Manager — Laboratory operations and research support is provided by a designated Laboratory Manager. The function is typically combined with the Health Physicist position.

Reactor Operators — Reactor operators (and senior reactor operators) are licensed by the USNRC to operate the UT TRIGA II nuclear research reactor. University staff and/or students may be employed as reactor operators.

Technical Support — Staff positions supporting various aspects of facility operations are assigned as required.

Radiological — Radiological Controls Technicians are supervised by the Health

[2] 10CFR50.54(x)

Controls Technicians	Physicist to perform radiological controls and monitoring functions. Radiological Controls Technicians are generally supported as Undergraduate Research Assistant positions.
Laboratory Assistants	Laboratory Assistants are supervised by the Laboratory Manager to perform laboratory operations and analysis. Laboratory Assistants are generally supported as Undergraduate Research Assistant positions.

6.1.3 Staffing

Operation of the reactor and activities associated with the reactor, control system, instrument system, radiation monitoring system, and engineered safety features will be the function of staff personnel with the appropriate training and certification[3].

Whenever the reactor is not secured, the reactor shall be (1) under the direction of or (2) directly operated by a (USNRC licensed) Senior Operator, designated as Reactor Supervisor. The Supervisor may be on call if cognizant of reactor operations and capable of arriving at the facility within thirty minutes.

Whenever the reactor is not secured, a (USNRC licensed) Reactor Operator (or Senior Reactor Operator) who meets requirements of the Operator Requalification Program shall be at the reactor control console, and directly responsible for control manipulations; as indicated above, the Reactor Supervisor may be the Reactor Operator at the controls.

Only the Reactor Operator at the controls or personnel authorized by, and under direct supervision of, the Reactor Operator at the controls shall manipulate the controls. Whenever the reactor is not secured, operation of equipment that has the potential to affect reactivity or power level shall be manipulated only with the knowledge and consent of the Reactor Operator at the controls. The Reactor Operator at the controls may authorize persons to manipulate reactivity controls who are training either as (1) a student enrolled in academic or industry course making use of the reactor, (2) to qualify for an operator license, or (3) in accordance the approved Reactor Operator requalification program.

Whenever the reactor is not secured, a second person (i.e., in addition to the reactor operator at the control console) capable of initiating the Reactor Emergency Plan will be present in the NETL building. Unexpected absence of this second person for greater than two hours will be acceptable if immediate action is taken to obtain a replacement.

[3] "Selection and Training of Personnel for Research Reactors", ANSI/ANS -15.4 - 1970 (N380)

If the reactor supervisor is in the NETL building and not acting as the Reactor operator at the controls, the Reactor Supervisor may act as the second person.

Staffing required for performing experiments with the reactor will be determined by a classification system specified for the experiments. Requirements will range from the presence of a certified operator for some routine experiments to the presence of a senior operator and the experimenter for other less routine experiments.

6.2 Review and Audit

The review and audit process is the responsibility of the Reactor Oversight Committee (ROC).

6.2.1 Composition and Qualifications

The ROC shall consist of at least three (3) members appointed by the Dean of the College of Engineering that are knowledgeable in fields which relate to nuclear safety. The university radiological safety officer shall be a member or an ex-officio member. The committee will perform the functions of review and audit or designate a knowledgeable person for audit functions.

6.2.2 Charter and Rules

The operations of the ROC shall be in accordance with an established charter, including provisions for:

a. Meeting frequency (at least twice each year, with approximately 4-8 month frequency).
b. Quorums (not less than one-half the membership where the operating staff does not contribute a majority).
c. Dissemination, review, and approval of minutes.
d. Use of subgroups.

6.2.3 Review Function

The responsibilities of the Reactor Safeguards Committee to shall include but are not limited to review of the following:

a. All new procedures (and major revisions of procedures) with safety significance
b. Proposed changes or modifications to reactor facility equipment, or systems having safety significance
c. Proposed new (or revised) experiments, or classes of experiments, that could affect reactivity or result in the release of radioactivity

d. Determination of whether items a) through c) involve unreviewed safety questions, changes in the facility as designed, or changes in Technical Specifications.
e. Violations of Technical Specifications or the facility operating licensee
f. Violations of internal procedures or instruction having safety significance
g. Reportable occurrences
h. Audit reports

Minor changes to procedures and experiments that do not change the intent and do not significantly increase the potential consequences may be accomplished following review and approval by a senior reactor operator and independently by one of the Reactor Supervisor, Associate Director or Director. These changes should be reviewed at the next scheduled meeting of the Reactor Oversight Committee.

6.2.4 Audit Function

The audit function shall be a selected examination of operating records, logs, or other documents. Audits will be by a Reactor Oversight Committee member or by an individual appointed by the committee to perform the audit. The audit should be by any individual not directly responsible for the records and may include discussions with cognizant personnel or observation of operations. The following items shall be audited and a report made within 3 months to the Director and Reactor Committee:

a. Conformance of facility operations with license and technical specifications at least once each calendar year.

b. Results of actions to correct deficiencies that may occur in reactor facility equipment, structures, systems, or methods of operation that affect safety at least once per calendar year.

c. Function of the retraining and requalification program for reactor operators at least once every other calendar year.

d. The reactor facility emergency plan and physical security plan, and implementing procedures at least once every other year.

6.3 Procedures

Written procedures shall govern many of the activities associated with reactor operation. Activities subject to written procedures will include:

a. Startup, operation, and shutdown of the reactor
b. Fuel loading, unloading, and movement within the reactor.
c. Control rod removal or replacement.

d. Routine maintenance, testing, and calibration of control rod drives and other systems that could have an effect on reactor safety.
e. Administrative controls for operations, maintenance, conduct of experiments, and conduct of tours of the Reactor Facility.
f. Implementing procedures for the Emergency Plan or Physical Security Plan.

Written procedures shall also govern:

a. Personnel radiation protection, in accordance with the Radiation Protection Program as indicated in Chapter 11
b. Administrative controls for operations and maintenance
c. Administrative controls for the conduct of irradiations and experiments that could affect core safety or reactivity

A master Procedure Control procedure specifies the process for creating, changing, editing, and distributing procedures. Preparation of the procedures and minor modifications of the procedures will be by certified operators. Substantive changes or major modifications to procedures, and new prepared procedures will be submitted to the Reactor Oversight Committee for review and approval. Temporary deviations from the procedures may be made by the reactor supervisor or designated senior operator provided changes of substance are reported for review and approval.

Proposed experiments will be submitted to the reactor oversight committee for review and approval of the experiment and its safety analysis[4], as indicated in Chapter 10. Substantive changes to approved experiments will require re-approval while insignificant changes that do not alter experiment safety may be approved by a senior operator and independently one of the following, Reactor Supervisor, Associate Director, or Director. Experiments will be approved first as proposed experiments for one time application, and subsequently, as approved experiments for repeated applications following a review of the results and experience of the initial experiment implementation.

6.4 Review of Proposals for Experiments

a) All proposals for new experiments involving the reactor shall be reviewed with respect to safety in accordance with the procedures in (b) below and on the basis of criteria in (c) below.

b) Procedures:

1. Proposed reactor operations by an experimenter are reviewed by the Reactor Supervisor, who may determine that the operation is described by a

[4] ANSI/ANS 15.6, op. cit.

previously approved EXPERIMENT or procedure. If the Reactor Supervisor determines that the proposed operation has not been approved by the Reactor Oversight Committee, the experimenter shall describe the proposed EXPERIMENT in written form in sufficient detail for consideration of safety aspects. If potentially hazardous operations are involved, proposed procedures and safety measures including protective and monitoring equipment shall be described.

2. The scope of the EXPERIMENT and the procedures and safety measures as described in the approved proposal, Including any amendments or conditions added by those reviewing and approving it, shall be binding on the experimenter and the OPERATING personnel. Minor deviations shall be allowed only in the manner described in Section 6 above. Recorded affirmative votes on proposed new or revised experiments or procedures indicate that the Committee determines that the proposed actions do not involve changes in the facility as designed, changes in Technical Specifications, changes that under the guidance of 10 CFR 50.59 require prior approval of the NRC, and could be taken without endangering the health and safety of workers or the public or constituting a significant hazard to the integrity of the reactor core.

3. Transmission to the Reactor Supervisor for scheduling.

c) Criteria that shall be met before approval can be granted shall include:

1. The EXPERIMENT must meet the applicable Limiting Conditions for Operation and Design Description specifications.

2. It must not involve violation of any condition of the facility license or of Federal, State, University, or Facility regulations and procedures.

3. The conduct of tests or experiments not described in the safety analysis report (as updated) must be evaluated in accordance with 10 CFR 50.59 to determine if the test or experiment can be accomplished without obtaining prior NRC approval via license amendment pursuant to 10 CFR Sec. 50.90.

4. In the safety review the basic criterion is that there shall be no hazard to the reactor, personnel or public. The review SHALL determine that there is reasonable assurance that the experiment can be performed with no significant risk to the safety of the reactor, personnel or the public.

6.5 Operator Requalification

An NRC approved UT TRIGA Requalification Plan is in place to maintain training and qualification of reactor operators and senior reactor operators. License qualification by written and operating test, and license issuance or removal, are the responsibility of the U.S. Nuclear Regulatory Commission. No rights of the license may be assigned or otherwise transferred and the licensee is subject to and shall observe all rules, regulations and orders of the Commission. Requalification training maintains the skills and knowledge of operators and senior operators during the period of the license. Training also provides for the initial license qualification.

6.6 Emergency Plan and Procedures

An NRC approved Emergency Plan following the general guidance set forth in ANSI/ ANS15.16, Emergency Planning for Research Reactors is in place. The plan specifies two action levels, the first level being a locally defined Non-Reactor Specific Event, and the second level being the lowest level FEMA classification, a Notification of Unusual Event. Procedures reviewed and approved by the Reactor Oversight Committee are established to manage implementation of emergency response.

6.7 Physical Security Plan

An NRC approved Security Plan is in place. The plan incorporates compensatory measures implemented following security posture changes initiated post 9/11. The Plan and portions of the procedures are classified as Safeguards Information. Security procedures implementing the plan, approved by the Reactor Oversight Committee, are established.

6.8 Action To Be Taken In The Event A SAFETY LIMIT Is Exceeded

In the event that a SAFETY LIMIT is not met,

a. The reactor shall be shutdown and secured.
b. The Reactor Supervisor, Associate Director, and Director shall be notified
c. The SAFETY LIMIT violation shall be reported to the Nuclear Regulatory Commission within 24 hours by telephone, confirmed via written statement by email, fax or telegraph
d. A SAFETY LIMIT violation report shall be prepared within 14 days of the event to describe:
    1. Applicable circumstances leading to the violation including (where known) cause and contributing factors
    2. Effect of the violation on reactor facility components, systems, and structures
    3. Effect of the violation on the health and safety of the personnel and the public
    4. Corrective action taken to prevent recurrence

e. The Reactor Oversight Committee shall review the report and any followup reports

f. The report and any followup reports shall be submitted to the Nuclear Regulatory Commission.

g. Operations shall not resume until the USNRC approves resumption.

6.9 Action To Be Taken In The Event Of A Reportable Occurrence

a) A reportable occurrence is any of the following conditions:

1. Any actual safety system setting less conservative than specified in Section 2.2, Limiting Safety System Settings;

2. VIOLATION OF SL, LSSS OR LCO;

NOTES

Violation of an LSSS or LCO occurs through failure to comply with an "Action" statement when "Specification" is not met; failure to comply with the "Specification" is not by itself a violation.

Surveillance Requirements must be met for all equipment/components/conditions to be considered operable.

Failure to perform surveillance within the required time interval or failure of a surveillance test shall result in the equipment /component/condition being inoperable

3. Incidents or conditions that prevented or could have prevented the performance of the intended safety functions of an engineered safety feature or the REACTOR SAFETY SYSTEM;

4. Release of fission products from the fuel that cause airborne contamination levels in the reactor bay to exceed 10CFR20 limits for releases to unrestricted areas;

5. An uncontrolled or unanticipated change in reactivity greater than $1.00;

6. An observed inadequacy in the implementation of either administrative or procedural controls, such that the inadequacy has caused the existence or development of an unsafe condition in connection with the operation of the reactor.

b) In the event of a reportable occurrence, as defined in the Technical Specifications, and in addition to the reporting requirements,

1. The Reactor Supervisor, the Associate Director and the Director shall be notified
2. If a reactor shutdown is required, resumption of normal operations shall be authorized by the Associate Director or Director
3. The event shall be reviewed by the Reactor Oversight Committee during a normally scheduled meeting

6.10 Plant Operating Records

Records of the following activities shall be maintained and retained for the periods specified below[5]. The records may be in the form of logs, data sheets, electronic files, or other suitable forms. The required information may be contained in single or multiple records, or a combination thereof.

Lifetime Records

Lifetime records are records to be retained for the lifetime of the reactor facility. (Note: Applicable annual reports, if they contain all of the required information, may be used as records in this section.)

a. Gaseous and liquid radioactive effluents released to the environs.

b. Offsite environmental monitoring surveys required by Technical Specifications.

c. Events that impact or effect decommissioning of the facility.

d. Radiation exposure for all personnel monitored.

e. Updated drawings of the reactor facility.

Five Year Period

Records to be retained for a period of at least five years or for the life of the component involved whichever is shorter.

a. Normal reactor facility operation (supporting documents such as checklists, log sheets, etc. shall be maintained for a period of at least one year).

[5] "Records and Reports for Research Reactors", ANSI/ANS - 15.3-1974 (N399).

b. Principal maintenance operations.

c. Reportable occurrences.

d. Surveillance activities required by technical specifications.

e. Reactor facility radiation and contamination surveys where required by applicable regulations.

f. Experiments performed with the reactor.

g. Fuel inventories, receipts, and shipments.

h. Approved changes in operating procedures.

i. Records of meeting and audit reports of the review and audit group.

One Training Cycle

Training records to be retained for at least one license cycle are the requalification records of licensed operations personnel. Records of the most recent complete cycle shall be maintained at all times the individual is employed.

6.11 Reporting Requirements

This section describes the reports required to NRC, including report content, timing of reports, and report format. Refer to section 12.4 above for the reporting requirements for SAFETY LIMIT violations, radioactivity releases above allowable limits, and reportable occurrences. All written reports shall be sent within prescribed intervals to the United States Nuclear Regulatory Commission, Washington, D.C., 20555, Attn: Document Control Desk.

Operating Reports

Routine annual reports covering the activities of the reactor facility during the previous calendar year shall be submitted to licensing authorities within three months following the end of each prescribed year. Each annual operating report shall include the following information:

a. A narrative summary of reactor operating experience including the energy produced by the reactor or the hours the reactor was critical, or both.

b. The unscheduled shutdowns including, where applicable, corrective action taken to preclude recurrence.

c. Tabulation of major preventive and corrective maintenance operations having safety significance.

d. Tabulation of major changes in the reactor facility and procedures, and tabulation of new tests or experiments, or both, that are significantly different from those performed previously, including conclusions that no new or unanalyzed safety questions were identified.

e. A summary of the nature and amount of radioactive effluents released or discharged to the environs beyond the effective control of the owner-operator as determined at or before the point of such release or discharge. The summary shall include, to the extent practicable, an estimate of individual radionuclides present in the effluent. If the estimated average release after dilution or diffusion is less than 25% of the concentration allowed or recommended, a statement to this effect is sufficient.

f. A summarized result of environmental surveys performed outside the facility.

g. A summary of exposures received by facility personnel and visitors where such exposures are greater than 25% of that allowed or recommended.

Other or Special Reports

There shall be a report not later than the following working day by telephone and confirmed in writing by facsimile or similar conveyance of any reportable occurrence identified in 6.9.

There shall be a written report describing the circumstances of any reportable occurrence identified in 6.9 within 14 days of occurrence.

There shall be a written report within 30 days of:

a. Permanent changes in the facility organization involving Director or Supervisor.

b. Significant changes in the transient or accident analysis as described in the Safety Analysis Report.

Supplemental Information, Table TS-1

Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
	NEW MATERIAL	
[1] (TOC) 3.9 RETEST REQUIREMENTS		New LCO to provide requirements for evaluating how activities affect safety function and follow on testing
Actions are steps to be accomplished in the event a required condition identified in a "Specification" section is not met, as stated in the "Condition" column of "Actions." In using Action Statements, the following guidance applies: • Where multiple conditions exist in an LCO, actions are linked to the failure to meet a "Specification" "Condition" by letters and number. • Where multiple action steps are required to address a condition, COMPLETION TIME for each action is linked to the action by letter and number. • AND in an Action Statement means all linked steps need to be performed to complete the action; OR indicates options and alternatives, only one item needs to be performed to complete the action. • If a "Condition" exists, the "Action" consists of completing all steps associated with the selected option (if applicable) unless the "Condition" is corrected prior to completion of the steps		Guidance for use of TS
[1]CONFINEMENT ISOLATION: Condition for reactor bay ventilation where: (1) dampers controlling confinement ventilation are closed, and (2) confinement ventilation fans are secured (3) the reactor bay fume/sort hood fans are secured (4) the reactor bay fume/sort hood dampers are closed. The purge system may be operated while in CONFINEMENT ISOLATION mode.		New definition
INITIAL STARTUP: A reactor startup and approach to power following: 1 Modifications to reactor safety or control rod drive systems 2 Fuel element or control rod relocations or installations within the reactor core region 3 Relocation or installation of any experiment in the core region with a reactivity worth of greater than one dollar, or 4 Recovery from an unscheduled (a) shutdown or (b) significant power reductions.		Adapted from NUREG 0800 (14.2) and REG GUIDE 1.68 "initial startup testing" as "test activities" including "... that confirm the design bases and demonstrate, to the extent practical, that the plant will operate in accordance with design and is capable of responding as designed to anticipated transients and postulated accidents as specified in the SAR" for item 1-3 with 4 as a facility commitment
3.9.3 Maintenance or operational activities SHALL NOT change, defeat or alter equipment or systems in a way that prevents the systems or equipment from being OPERABLE or otherwise prevent the systems or equipment from fulfilling the safety basis		This specification ensures that if maintenance or operations might

Supplemental Information, Table TS-1

Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
3.9.4 Maintenance or an operational activity is performed that has the potential to change a setpoint, calibration, flow rate, or other parameter that is measured or verified in meeting a surveillance or operability requirement, Perform surveillance OR Operate only to perform retest		challenge a Technical Specifications requirement, the requirement is verified prior to resumption of normal operations.
4.9.2 Evaluate potential for maintenance or operational activities to affect operability and function of equipment required by Technical Specifications; for standard procedures, this evaluation is incorporated in instructions. Following maintenance or operational activities for systems of equipment required by Technical Specifications 4.9.2 Perform surveillance to assure affected function meets requirements. Prior to resumption of normal operations		This specification ensures that work on systems or components has been properly carried out and that the system or component has been properly reinstalled or reconnected before reliance for safety is placed on it.
5.4 Experiments; 5.4.1 Applicability: This specification applies to the design of experiments. 5.4.2 Objective: The objective is to ensure that experiments are designed to meet criteria.		
5.4.3 (1) EXPERIMENTS with design reactivity worth greater than $1.00 SHALL be securely fastened (as defined in Section I, Secured Experiment). 5.4.3 (2) Design shall ensure that failure of an EXPERIMENT SHALL NOT lead to a direct failure of a fuel element or of other experiments that could result in a measurable increase in reactivity or a measurable release of radioactivity due to the associated failure. 5.4.3 (3) EXPERIMENTS SHALL be designed so that they do not cause bulk boiling of core water. 5.4.3 (4) EXPERIMENT design SHALL ensure no interference with control rods or shadowing of reactor control instrumentation. 5.4.3 (5) EXPERIMENT design shall minimize the potential for industrial hazards, such as fire or the release of hazardous and toxic materials 5.4.3 (6) Where the possibility exists that the failure of an EXPERIMENT (except fueled EXPERIMENTS) could release radioactive gases or aerosols to the reactor bay or atmosphere, the quantity and type of material shall be limited such that the airborne concentration of radioactivity is less than 1,000 times the Derived Air Concentration. For in-core samples a decay time of five minutes following irradiation may be used in radioactive inventory calculations to account for processing prior to potential exposure.		Moved material related to experiment design previously listed as LCO into the Design section
5.4.3 (7) Each fueled experiment shall be limited such that the total inventory of (1) radioactive iodine isotopes 131 through 135 in the experiment is not greater than 9.32E5 µCi, and (2) radioactive strontium is not greater than 9.35E4 µCi. - Alternate calculations may be accomplished to demonstrate equivalent times for protective actions based on DAC limits for specific experiments, if desired. - These limits do not apply to TRIGA fuel elements used in experiments as maximum hypothetical accident analysis applies. For in-core samples a decay time of five minutes following irradiation to account may be used in calculations.		New calculations

Supplemental Information, Table TS-1

Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
6.6 Emergency Plan and Procedures An NRC approved Emergency Plan following the general guidance set forth in ANSI/ ANS15.16, Emergency Planning for Research Reactors is in place. The plan specifies two action levels, the first level being a locally defined Non-Reactor Specific Event, and the second level being the lowest level FEMA classification, a Notification of Unusual Event. Procedures reviewed and approved by the Reactor Oversight Committee are established to manage implementation of emergency response.		
6.7 Physical Security Plan An NRC approved Security Plan Security Plan is in place. The plan incorporates compensatory measures implemented following security posture changes initiated post 9/11. The Plan and portions of the procedures are classified as Safeguards Information. Security procedures implementing the plan, approved by the Reactor Oversight Committee, are established.		
REVISED MATERIAL		
1.1 Certified Operators (1.1.1/1.1.2)	Deleted	The terms are fully understood without definitions, and USNRC approved Reactor Requalification Program identifies RO/SRO
1.2 Channel (TOC) 1.2 Instrumentation Channel: A channel is the combination of sensor, line, amplifier, and output devices which are connected for the purpose of measuring the value of a parameter	[1] CHANNEL: A channel is the combination of sensor, line, amplifier, and output devices that are connected for the purpose of measuring the value of a parameter	ANSI/ANS 15.1-7
1.2.1 Channel Test: A channel test is the introduction of an input signal into a channel to verify that it is operable.	[1] CHANNEL TEST A channel test is the introduction of an input signal into a channel to verify that it is operable. *NOTE: A functional test of operability is a channel test.*	Note added for clarification
1.2.2 Channel Check: A channel check is a qualitative verification of acceptable performance by observation of channel behavior. This verification, where possible, shall include comparison of the channel with expected values, other independent channels, or other methods of measuring the same variable.	CHANNEL CHECK: A channel check is a qualitative verification of acceptable performance by observation of channel behavior. This verification shall include comparison of the channel with expected values, other independent channels, or other methods of measuring the same variable where possible.	Editorial
1.2.3 Channel Calibration: A channel calibration is an adjustment of the 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 a trip and shall be deemed to include a channel test.	CHANNEL CALIBRATION: A channel calibration is an adjustment of the channel so that its output responds, with acceptable range and accuracy, to known values of the parameter that the channel measures.	Editorial; calibration of argon monitor is split into electronic calibration and a source calibration and conducted at different intervals

Supplemental Information, Table TS-1

Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
1.3 Confinement: Confinement means an enclosure on the overall facility which controls the movement of air into it and out through a controlled path	[1]CONFINEMENT: The enclosure which controls the movement of air into and out of the reactor bay through a controlled path.	Editorial
1.4 Experiment: Any operation, component, or target (excluding devices such as detectors, foils, etc.), which is designed to investigate non-routine reactor characteristics or which is intended for irradiation within the pool, on or in a beam tube or irradiation facility and which is not rigidly secured to a core or shield structure so as to be part of their design.	EXPERIMENT: An EXPERIMENT is (1) any apparatus, device, or material placed in the reactor core region (in an EXPERIMENTAL FACILITY associated with the reactor, or in line with a beam of radiation emanating from the reactor) or (2) any in-core operation designed to measure reactor characteristics.	
1.4.1 Experiment, Moveable: A moveable experiment is one where 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.	MOVABLE EXPERIMENT: A MOVABLE EXPERIMENT is one the EXPERIMENT may be moved into, out-of or near the reactor while the reactor is OPERATING.	
1.4.2 Experiment, Secured: A secured experiment is any experiment, experiment facility, or component of an experiment that is held in a stationary position relative to the reactor by mechanical means. The restraining force 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 a result of credible conditions.	A secured EXPERIMENT is an EXPERIMENT held firmly in place by a mechanical device or by gravity providing that the weight of the EXPERIMENT is such that it cannot be moved by forces (1) normal to the operating environment of the experiment or (2) that might result from credible failures.	
1.4.3 Experimental Facilities: Experimental facilities shall mean rotary specimen rack, pneumatic transfer tube, central thimble, beam tubes and irradiation facilities in the core or in the pool.	EXPERIMENTAL FACILITY: Experimental facilities are the beamports, pneumatic transfer systems, central thimble, rotary specimen rack, and displacement of fuel element positions used for EXPERIMENTS (single-element positions and the multiple element positions fabricated in the upper grid plate displacing 3, 6 or 7 elements).	
1.5 Fuel Element, Standard: A fuel element is a single TRIGA element of standard type. Fuel is U-ZrH clad in stainless steel clad. Hydrogen to zirconium ratio is nominal 1.6.	Deleted	Not used in specifications

Supplemental Information, Table TS-1

Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
1.6 Fuel Element, Instrumented: An instrumented fuel element is a special fuel element fabricated for temperature measurement. The element shall have at least one thermocouple embedded in the fuel near the axial and radial midpoints.	Deleted	Not used in specifications
1.7 Mode; Manual, Auto, Pulse, Square Wave: Each mode of operation shall mean operation of the reactor with the mode selection switches in the manual, auto, pulse or square wave position.	Deleted	Not used in specifications
1.8 Steady-state: Steady-state mode operation shall mean any operation of the reactor with the mode selection switches in the manual, auto or square wave mode. The pulse mode switch will define pulse operation	STEADY-STATE MODE: The reactor is in the steady-state mode when the key switch is in the "on" position, the reactor mode selector pushbutton switch has requested either the manual, automatic, or square wave position and the reactor display indicates manual, automatic, or square wave.	
1.9 Operable: Operable means a component or system is capable of performing its intended function.	OPERABLE: A system or component is OPERABLE when it is capable of performing its intended function.	No change
1.10 Operating: Operating means a component or system is performing its intended function.	Deleted	Not used as a defined term
1.11 Protective Action: Protective action is the initiation of a signal or the operation of equipment within the reactor safety system in response to a variable or condition of the reactor facility having reached a specified limit. 1.11.1 Instrument Channel Level: At the protective instrument channel level, protective action is the generation and transmission of *a* trip signal indicating that a reactor variable has reached the specified limit. 1.11.2 Instrument System Level: At the protective instrument system level, protective action is the generation and transmission of the command signal for the safety shutdown equipment to operate. 1.11.3 Reactor Safety System Level: At the reactor safety system level, protective action is the operation of sufficient equipment to immediately shut down the reactor.	Deleted	Not used as a defined term in specifications

Supplemental Information, Table TS-1

Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
1.12 Reactivity, Excess: Excess reactivity is that amount of reactivity that would exist if all the control rods were moved to the maximum reactive condition from the point where the reactor is exactly critical.	EXCESS REACTIVITY: That amount of reactivity above the critical condition which would exist if all the control rods were moved to the maximum positive reactivity condition	
1.13 Reactivity Limit: The reactivity limits are those limits imposed on the reactor core excess reactivity. Quantities are referenced to a reference core condition.	Deleted	Not used as a definition
1.14 Reactor Core, Standard: A standard core is an arrangement of standard TRIGA fuel in the reactor grid plate and may include installed experiments.	Deleted	Not used in specification
1.15 Reactor Core, Operational: An operational core *is a* standard core for which the core parameters of excess reactivity, shutdown margin, fuel temperature, power calibration, and reactivity worths of control rods and experiments have been determined to satisfy the requirements set forth in the Technical Specifications.	Deleted	Not used in specification
1.16 Reactor Operating: The reactor is operating whenever it is not secured or shutdown.	Deleted	Not used in specification
1.17 Reactor Safety Systems: Reactor safety systems are those systems, including their associated input channels, which are designed to initiate automatic reactor protection or to provide information for initiation of manual protective action.	REACTOR SAFETY SYSTEM: The REACTOR SAFETY SYSTEM is that combination of MEASURING CHANNELS and associated circuitry that is designed to initiate a reactor scram or that provides information that requires manual protective action to be initiated.	

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
1.18 Reactor Secure: The reactor is secure when: 1.18.1 Subcritical : There is insufficient fissile material or moderator present in the reactor, control rods or adjacent experiments, to attain criticality under optimum available conditions of moderation and reflection, or 1.18.2 The following conditions exist : a. The minimum number of neutron absorbing control rods are fully inserted in shutdown position, as required by technical specifications. b. The console key switch *is* in the off position and the key is removed from the lock. c. 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. d. No experiments are being moved or serviced that have, on movement, a reactivity worth equal to or exceeding one dollar.	[1]REACTOR SECURED MODE: The reactor is secured when the conditions of either item (1) or item (2) are satisfied: (1) There is insufficient moderator or insufficient fissile material in the reactor to attain criticality under optimum available conditions of moderation and reflection (2) All of the following: a. No experiments are being moved or serviced that have, on movement, a reactivity worth greater than $1.00. b. The reactivity value of fully inserted control rods exceeds the minimum shutdown margin value c. The console key is it the OFF position and the key is removed from the lock d. No work is in progress involving core fuel, core structure, installed control rods, or control rod drives (unless the drive is physically decoupled from the control rod)	Essentially unchanged except in referencing and using the minimum shutdown margin
1.19 Reactor Shutdown: The reactor is shutdown if it is subcritical by at least one dollar in the reference core condition with the reactivity of all installed experiments included.	REACTOR SHUTDOWN: The reactor is shutdown if it is subcritical by at least the minimum required amount of reactivity (shutdown margin) in the REFERENCE CORE CONDITION with the reactivity worth of all experiments included.	Previous definition was not consistent with minimum shutdown requirements
1.20 Reference Core Condition: The condition of the core when it is at ambient temperature (cold) and the reactivity worth of xenon is negligible (<$0.30).	REFERENCE CORE CONDITION: The condition of the core when it is at ambient temperature (cold) and the reactivity worth of xenon is negligible (<$0.30).	No change
1.21 Research Reactor: A research reactor is defined as a device designed to support a self-sustaining neutron chain reaction for research, development, educational, training, or experimental purposes, and which may have provisions for the production of radioisotopes.	DELETED	Not used in Specifications

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
1.22 Rod, Control: 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 loses. A control rod may be coupled to its drive unit allowing it to perform a safety function when the coupling is disengaged. 1.22.1 Shim Rod: A shim rod is a control rod with an electric motor drive that does not perform a special function such as automatic control or pulse control. The shim rod shall have scram capability. 1.22.2 Regulating Rod: A regulating rod is a control rod used to maintain an intended power level and may be varied manually or by a servo-controller. The regulating rod shall have scram capability. 1.22.3 Standard Rod: The regulating rod and shim rods are standard control rods.	[1]CONTROL ROD (STANDARD): A standard control rod (stainless steel clad, borated graphite, B4C powder, or boron and its compounds in solid form with a fuel follower) is one having an electric induction or stepper motor drive coupled to the control rod by an electromagnet, with scram capability.	(1) Reduced to single definition as used in Specifications (2) IAW ANSI/ANS-15.1-2007 Section 5, control rod descriptions are revised to incorporate specific material specifications to allow reducing information in Design Specifications.
1.22.4 Transient Rod: A transient rod is a control rod used to initiate a power pulse that is operated by a motor drive and/or air pressure. The transient rod shall have scram capability.	[1]CONTROL ROD (TRANSIENT): A transient control rod (aluminum clad, borated graphite, B4C powder, or boron and its compounds in solid form followed by air or aluminum) is one that is pneumatically coupled to the control rod drive, is capable of initiating a power pulse, is operated by a motor drive, and/or air pressure operated and has scram capability.	(1) Reduced to single definition as used in Specifications (2) IAW ANSI/ANS-15.1-2007 Section 5, control rod descriptions are revised to incorporate specific material specifications to allow reducing information in Design Specifications.
1.23 Safety Limit: Safety Limits are limits on important process variables which are found to be necessary to protect reasonably the integrity of the principal barriers (i.e., fuel element cladding) which guard against the uncontrolled release of radioactivity. The principal barrier is the fuel element cladding.	[1]SAFETY LIMITS: Limits on important process variables which are found to be necessary to protect reasonably the integrity of the principal barriers (i.e., fuel element cladding) which guard against the uncontrolled release of radioactivity. The principal barrier is the fuel element cladding.	No change
1.24 Scram Time: Scram time is the elapsed time between reaching *a* limiting safety system set point and *a* specified control rod movement.	Not defined	Not used in the Technical Specifications as a defined term
1.25: Shall, Should and May: The word shall is used to denote a requirement. The word should is used to denote a recommendation. The word may is used to denote permission, neither a requirement nor a recommendation.	SHALL (SHALL NOT) Indicates specified action is required/(or required not to be performed)	In the context of action statements, Should and May are not used

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
1.26: Shutdown Margin: Shutdown margin shall mean the minimum shutdown reactivity necessary to provide confidence that the reactor can be made subcritical by means of the control an safety systems starting from any permissible operating condition and with the most reactive rod in its moist reactive position, and the that reactor will remain subcritical without further operator action	[1] SHUTDOWN MARGIN: The shutdown margin is the minimum shutdown reactivity necessary to provide confidence that the reactor can be made subcritical by means of the control and safety systems, starting from any permissible operating condition (the highest worth NONSECURED EXPERIMENT in its most positive reactive state, each SECURED EXPERIMENT in its most reactive state), with the most reactive rod in the most reactive position, and that the reactor will remain subcritical without further operator action.	Clarity
1.27: Shutdown, Unscheduled: An unscheduled shutdown is defined as any unplanned shutdown of the reactor caused by actuation of the reactor safety system, operator error, equipment malfunction, or a manual shutdown in response to conditions which could adversely affect safe operation, not including shutdowns which occur during testing or check-out operations.	Deleted	Not used in the Technical Specifications as a defined term
1.28: Value, Measured	Deleted	Not used in the Technical Specifications as a defined term
1.29: Value, True: The true value is the actual value of a parameter.	Deleted	Not used in the Technical Specifications as a defined term
1.30: Surveillance Activities: Surveillance activities (except those specifically required for safety when the reactor is shutdown), may be deferred during reactor shutdown, however, they must be completed prior to reactor startup unless reactor operation is activities scheduled to occur during an operating cycle which cannot be performed with the reactor operating may be deferred to the end of the cycle.	[1]4. SURVIELLANCE REQUIREMENTS Surveillance activities (except those specifically required for safety when the reactor is shutdown), may be deferred during reactor shutdown, however, they must be completed prior to reactor startup unless reactor operation is necessary for performance of the activity. If a surveillance schedule cannot be met because the reactor is operating while performance requires the reactor not be operating, performance may be deferred until the reactor is shutdown.	Not used in the Technical Specifications as a defined term; information relocated to Surveillance section
1.31: Surveillance Intervals - Maximum intervals are to provide operational flexibility and not to reduce frequency. Established frequencies shall be maintained over the long term. Allowable surveillance intervals shall not exceed the following:	Deleted	Intervals are included in Technical Specifications as separately defined rather than grouped; 5 years, Quarterly are not used
1.31.1 - 5 years (interval not to exceed 6 years).	Deleted	Not used

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
1.31.3 - Annual (interval not to exceed 15 months).	ANNUAL: 12 months not to exceed 15 months.	Editorial
1.31.2 -0 2 years (interval not to exceed 2-1/2 years).	BIENNIAL: Every two years, not to exceed a 30 month interval	Editorial
1.31.4 - Semiannual (interval not to exceed 7-1/2 months).	SEMIANNUAL: Every six months, with intervals not greater than 7 ½ months	Editorial
1.31.5 - Quarterly (interval not to exceed 4 months).	[1]QUARTERLY: 3 months, not to exceed 4 months	Editorial
1.31.6 - Monthly (interval not to exceed 6 weeks).	[1]MONTHLY: 30 days, not to exceed 6 weeks.	Editorial
1.31.7 - Weekly (interval not to exceed 10 days).	[1]WEEKLY: 7 days, not to exceed 10 days	Editorial
1.31.8 - Daily (must be done during the calendar day).	DAILY: Prior to initial operation each calendar day (when the reactor is operated), or before an operation extending more than 1 day	
<u>2.0 Safety Limit</u> Specification(s) The maximum temperature in a standard TRIGA fuel element shall not exceed1150°C for fuel element clad temperatures less than 500°C and shall not exceed 950°C for fuel element clad temperatures greater than 500°C. Temperatures apply to any condition of operation.	2.1.3 Specifications (A) Stainless steel clad, high-hydride fuel element temperature SHALL NOT exceed 1150°C. (B) Steady state fuel temperature shall not exceed 750°C.	(1) Analysis shows clad temperature will not exceed 500°C (2) GA data indicates steady state operations at 750°C can cause deformation
	2.1.5 Bases: Safety Analysis Report Chapter 4 (4.2.1 B)	Typographical error

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
2.2, LIMITING SAFETY SYSTEM SETTINGS		
2.2.1 Fuel Temperature Specifications(s) The limiting safety system setting shall be 550°C as measured in an instrumented fuel element. One instrumented element shall be located in the B or C ring of the reactor core configuration.		
2.2.2 Power Level (Manual, Auto Square Wave) Specifications(s) The maximum operating power level for the operation of the reactor shall be 1100 kilowatts in the manual, auto and square wave modes. 2.2.3 Reactivity Insertion (Pulse) Specifications(s) The maximum transient reactivity insertion for the pulse operation of the reactor shall be 2.2% Bk/k in the pulse mode.	2.2.3 Specifications (A) Power level SHALL NOT exceed 1100 kW (th) in STEADY STATE MODE of operation (B) Instrumented elements in the B or C ring SHALL indicate less than 550°C	Setpoints remain the same; reactivity specification is not a setpoint or LSSS and is therefore move to an LCO
3.1.1, Excess reactivity, Maximum excess reactivity shall be 4.9% Dk/k.	The maximum available core reactivity (EXCESS REACTIVITY) with all control rods fully withdrawn does not exceed 4.9% Δkk ($7.00) when: 1. REFERENCE CORE CONDITIONS exists 2. No MOVEABLE EXPERIMENTS with net-negative reactivity worth are in place	Limiting value unchanged
3.1.2, Shutdown Margin, The reactor shall not be operated unless the shutdown margin provided by control rods is greater than 0.2% Dk/k with: a. The reactor in the reference core condition. b. The most reactive control rod fully withdrawn.	[1]3.1.2 B: SHUTDOWN MARGIN in REFERENCE CORE CONDITIONS is more than 0.002 Δk/k ($0.29)	Major rewording based on definition; limiting value unchanged
3.1.3, Transient Insertions -- Total worth of the transient rod shall be limited to 2.82 Dk/k, and the total withdrawal time for the rod shall not exceed 15 seconds.	3.2.3 Specification: The transient rod drive is positioned for reactivity insertion (upon withdrawal) less than or equal to 2.8% δk ($4.00)	Limiting value unchanged for pulsed reactivity; no safety basis for total withdrawal time
3.1.4,	3.7, Fuel Integrity	Essentially unchanged

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
3.2.1 Control Assemblies, Specification(s): The reactor shall not be operated unless the control rods are operable, and a. Control rods shall not be operable if damage is apparent to the rod or drive assemblies. b. The scram time measured from the instant a simulated signal reaches the value of a limiting safety system setting to the instant that the slowest scrammable control rod reaches its fully inserted position shall not exceed 1 second. c. Maximum reactivity insertion race of a standard control rod shall be less than 0.2% Δk/k per second.	3.4.3 Specifications, CONTROL RODS (STANDARD) are capable of full insertion from the fully withdrawn position in less than 1 sec.	(a) Safety function is a reactor scram, (b) specification for insertion unchanged, (c) pulsed insertion bounds motor driven insertion
3.2.2 (a) Startup Withdrawal- Prevent rod up movement if startup signal less than 2 counts per second.	3.3.3 B The neutron count rate on the startup channel is greater 2 mW; interlock not credited	Safety basis is operability of the startup channel which is covered by 3.3, Measuring Channel; units are revised to instrument with the relationship between cps and % power provided in basis
3.2.2 (b) Simultaneous Withdrawal interlock- prevent rod up movement for two or more rods.	Deleted	Bounded by reactivity addition of pulsing
3.2.2 (c) Non-pulse condition, prevent air actuation if rod is not down	3.4.3 Table 2: Pulse rod interlock[1] - Prevent inadvertent pulsing while in STEADY STATE MODE *NOTE [1]: The pulse rod interlock prevents air from being applied to the pulse rod unless the transient rod is fully inserted except during pulse mode or square wave operations.*	No change; safety basis – instrument gain set by pulse mode
3.2.2 (d) Pulse withdrawal – prevent withdrawal of non-pulse rod	3.4.3 Table 2: CONTROL ROD (STANDARD) position interlock - Prevent withdrawal of standard rods in the PULSE MODE	No change; safety basis – pulsed reactivity analysis
3.2.2 (e) Transient Withdrawal- prevents air actuation if linear power is more than 1 kilowatt.	Deleted	Analysis used max pulse at the max available SS power level

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
3.2.2, Reactor Safety System minimum safety channels Scram at <550°C Scram at <1.1 MW Scram at <2000 MW Scram on loss High Voltage Scram on loss of Magnet Current Scram on loss of timer reset Scram on demand	LSSS: A. Power level SHALL NOT exceed 1100 kW (th) in STEADY STATE MODE of operation B. Instrumented elements in the B or C ring SHALL indicate less than 550°C 3.3.3 The MEASURING CHANNELS specified in TABLE 1 SHALL be OPERATING 3.3.4 - A.2 High voltage to reactor safety channel (power level) detector less than 80% of required operating value 3.4.3 A The SAFETY SYSTEM CHANNELS specified in TABLE 2 are OPERABLE Table 2: Reactor power level – SCRAM Fuel temperature SCRAM Manual scram bar - SCRAM	(1) Trip points for LSSS moved to LSSS (2) HV requirement moved to Measuring Channels (3) Pulsing power deleted; no safety basis (4) Magnet current, no safety basis (fail safe) (5) Loss of time reset coved by 3.4, Reactor Power Level operability (6) SCRAM on demand in 3.4
3.2.4, Instrument channels: Minimum of 2 operable fuel temperature channels	3.3.3 Table 1: Minimum of 1 operable fuel temperature channels	No safety basis for 2 channels
3.2.4, Instrument channels: 2 power level channels	3.3.3 Table 1: 2 reactor power level channels	No change
3.2.4, Instrument channels: 1 pulse power channel	3.3.3 Table 1: 1 pulse power level channel	No change
3.2.4, Instrument channels Minimum of 1 operable pulse energy measuring channel	Deleted	No safety basis
3.3.1 Water Coolant Systems (a) Corrective action shall be taken or the reactor shut down if any of the following: The bulk pool water temperature exceeds 48°C	3.8.3 (A) Water temperature at the exit of the reactor pool SHALL NOT exceed 110°F (48.9°C); 3.8.4 Actions: (A)	Analysis performed for 110°F/49°C
3.3.1 Water Coolant Systems (b) Corrective action shall be taken or the reactor shut down if any of the following: The water depth is less than 6.5 meters measured from the pool bottom to the pool water surface	3.8.3 (C) Water level above the core SHALL be at least 6.5 m from bottom of the pool; 3.8.4 Actions: (C)	No change
3.3.1 Water Coolant Systems (c) Corrective action shall be taken or the reactor shut down if any of the following: The water conductivity exceeds 5.0 pmho/cm for the average value during measurement periods of one month	3.8.3 (B) Water conductivity SHALL be less than or equal to 5 μmho/cm averaged over 1 month, 3.8.4 Actions: (B)	No change

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
3.3.1 Water Coolant Systems (d) Corrective action shall be taken or the reactor shut down if any of the following: The pressure difference during heat exchanger operation is less than 7 kPa (1 psig) measured between the chilled water outlet pressure and the pool water inlet pressure to the heat exchanger.	3.8.3 (D) The pressure difference between chilled water outlet from the pool heat exchanger and pool water inlet SHALL NOT be less than 7 kPa (1 psig); 3.8.4 Actions (D)	No change
3.3.1 (e) Pool water data from periodic measurements shall exist for water pH and radioactivity. Radioactivity measurements shall include total alpha-beta activity and gamma ray spectrum analysis.	Deleted	No safety basis
3.3.2 Water Coolant Systems Corrective action...(a) Equipment shall be operable to isolate the reactor area by closure of room ventilation supply and exhaust dampers, and shutdown of system supply and exhaust fans.	(1) definition of CONFINEMENT ISOLATION and (2) 3.3.3 C The particulate continuous air monitor SHALL be operating and capable of initiating CONFINEMENT ISOLATION	Essentially unchanged
3.3.2 Air Confinement Systems Corrective action...(b) The reactor room ventilation system shall have an automatic signal to isolate the area if air particulate radioactivity exceeds preset values.	(1) definition of CONFINEMENT ISOLATION and (2) 3.3.3 C The particulate continuous air monitor SHALL be operating and capable of initiating CONFINEMENT ISOLATION	Essentially unchanged
3.3.2 Air Confinement Systems Corrective action...(c) An auxiliary air purge system to exhaust air from experiment systems shall have a high efficiency particulate filter.	Deleted	Auxiliary air system HEPA filters are not required in analysis
3.3.2 Air Confinement Systems Corrective action...(d) Room ventilation shall require two air changes per hour or exhaust of pool areas by the auxiliary air purge system.	5.3.3 (2) Reactor bay HVAC confinement ventilation system operation is designed to provide a minimum of 2 changes of reactor bay air per hour.	This is a design specification, not an LCO
3.3.3 Radiation Monitoring Systems (a) continuous air monitor (particulate) shall be operable with readout and audible alarm. The monitor shall sample reactor room air within 5 meters of the pool at the pool access level. Alarm set point shall be equal to or less than *a* measurement concentration of 2 x 10^{-9} µCi/cm3 with a two hour particulate accumulation.		

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
3.3.3 Radiation Monitoring Systems (a) The particulate continuous air monitor shall be operating when the reactor is operating. A set point of the monitor will initiate the isolation signal for the air ventilation system.	The reactor bay confinement system will enter CONFINEMENT ISOLATION if the particulate continuous air monitor is in-service and indicates greater than 10,000 cpm	Isolation signal units are revised to the instrument reading, with the correlation to concentration in the basis
3.3.3 Radiation Monitoring Systems (a) The particulate air monitor may be out of service for a period of 1 week provided the filter is evaluated daily, and a signal from the argon-41 continuous air monitor is available to provide information for manual shutdown of the HVAC.	-- Continuous particulate air radiation monitor is not OPERATING: Restore MEASURING CHANNEL OR ENSURE reactor is shut down IMMEDIATELY. OR ENSURE Argon 41 monitor radiation monitor is OPERATING IMMEDIATELY and restore MEASURING CHANNEL within 30 working days.	(1) The likelihood of fuel element failure coincident with CAM failure is sufficiently low enough that coupled with the capability of the Ar-41 monitor, 30 days to effect repairs or replacement is satisfactory
3.3.3 Radiation Monitoring Systems (b) A continuous air monitor (argon-41) shall be operable with readout and audible alarm. The monitor shall sample exhaust stack air from the auxiliary air purge system when the system is operating	[1]3.3.3, Table 1: Argon 41 effluent monitor[3] NOTE[3]: When the auxiliary purge system is operating	Essentially unchanged
3.3.3 Radiation Monitoring Systems (b) Alarm set point shall be equal to or less than a measurement concentration of 2 x 10-5 µCi/cm3 for a daily release.	Deleted	No safety basis; CAP-88 indicates effluent limits are met at much greater than 100 Ci annual discharge
3.3.3 Radiation Monitoring Systems (b) If the argon-41 monitor is not operable, operating the reactor with the auxiliary air purge system shall be limited to a period of ten days.	3.3.4 Actions: If the Argon monitor is not OPERATING: Restore MEASURING CHANNEL or ENSURE reactor is shutdown or ENSURE continuous air radiation monitor is OPERATING immediately and restore MEASURING CHANNEL within 30 working days.	The likelihood of fuel element failure coincident with Ar-41 monitor failure is sufficiently low enough that coupled with the capability of the particulate cam, 30 days to effect repairs or replacement is satisfactory
3.3.3 Radiation Monitoring Systems (c) Area radiation monitors (gamma) shall be operable with readout and audible alarm. Alarm set point shall be a measurement value equal to or less than 100 mr/hr.	Alarm setpoint deleted.	Personnel exposure is controlled by the approved Radiation Protection Program, with specific requirements for monitoring high radiation areas

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
3.3.3 Radiation Monitoring Systems (c) One area radiation monitor shall be operating at the pool level when the reactor is operating. Two additional area radiation monitors shall be operating at other reactor areas when the reactor is operating.	3.3.3 Table 1: 1 pool area radiation monitor and one lower or middle level area monitor required for minimum measuring channel for reactor operation.	Essentially unchanged
3.4.1 (a) A moveable experiment shall have a reactivity worth less than 1.00 dollar	3.6.3 (a) The reactivity worth of any individual MOVEABLE EXPERIMENT SHALL NOT exceed \$1.00 (0.007 $\Delta k/k$)	Essentially unchanged
3.4.1 (b) The reactivity worth of any single secured experiment shall be less than 2.50 dollars.	3.6.3 (b) The reactivity worth of any individual SECURED EXPERIMENT SHALL NOT exceed \$2.50 (0.0175 $\Delta k/k$)	Essentially unchanged
3.4.1 (c) The total of absolute reactivity worths of reactor core experiments shall not exceed 3.00 dollars, including the potential reactivity which might result from malfunction, flooding, voiding, or removal and insertion of the experiments.	3.6.3 (c) The total reactivity worth of all EXPERIMENTS shall not exceed \$3.00 (0.021 $\Delta k/k$)	Essentially unchanged
3.4.2 (a) Experiments containing materials corrosive to reactor components, compounds highly reactive with water, potentially explosive materials, and liquid fissionable materials shall be doubly encapsulated. Guidance for classification of materials shall use the "Handbook of Laboratory Safety" Tables of Chemical Information published by CRC Press.	Not required	This is a design requirement for experiments which would be identified in experiment review and approval
3.4.2 (b) If a capsule fails and releases material which could damage the reactor fuel or structure by corrosion or other means, removal and physical inspection shall be performed to determine the consequences and need for corrective action. The results of the inspection and any corrective action taken shall be reviewed by the Director, or his designated alternate, and determined to be satisfactory before operation of the reactor is resumed.	Not required	This is a corrective action which would be incorporated in reviews
3.4.2 (c) Explosive materials in quantities greater than 25 milligrams shall not be irradiated in the reactor or experimental facilities. Explosive materials in quantities less than 25 milligrams may be irradiated provided the pressure produced upon detonation of the explosive has been calculated and/or experimentally demonstrated to be less than the design pressure of the container.	5.1.3 (2), Use of explosive solid or liquid material with a National Fire Protection Association Reactivity (Stability) index of 2, 3, or 4 in the reactor pool or biological shielding SHALL NOT exceed the equivalent of 25 milligrams of TNT without prior NRC approval.	Moved to Design, Revised to bound "explosive" in a standard method

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
3.4.2 (d) Each fueled experiment shall be controlled such that the total inventory of iodine isotopes 131 through 135 in the experiment is no greater than 750 millicuries and the maximum strontium inventory is no greater than 2.5 millicuries.	Each fueled experiment shall be limited such that the total inventory of (1) radioactive iodine isotopes 131 through 135 in the experiment is not greater than 9.32E5 uCi, and (2) radioactive strontium is not greater than 9.35E4 uCi.	Based on analysis
3.4.2 (e) Experiment materials, except fuel materials, which could off-gas, sublime, volatilize, or produce aerosols under (1) normal operating conditions of the experiment or reactor, (2) credible accident conditions in the reactor, (3) possible accident conditions in the experiment shall be limited in activity such that if 100% of the gaseous activity or radioactive aerosols produced escaped to the reactor room or the atmosphere, the airborne concentration of radioactivity averaged over a year would not exceed the occupational limits for maximum permissible concentration.	Where the possibility exists that the failure of an EXPERIMENT (except fueled EXPERIMENTS) could release radioactive gases or aerosols to the reactor bay or atmosphere, the quantity and type of material shall be limited such that the airborne concentration of radioactivity is less than 1,000 times the Derived Air Concentration.	Provides adequate time for evacuation
3.4.2 (f) If the effluent from an experimental facility exhausts through a filter installation designed for greater than 99% efficiency for 0.25 micron particles, at least 10% of these vapors can escape.	If effluents from an experimental facility exhaust through a filter installation designed for greater than 99% efficiency for 0.3 micron particles, at least 10% of the aerosols produced will escape.	HEPA filters are rated for 0.3 micron
4.1.1 Excess reactivity shall be determined annually or after significant control rod or reactor core changes.	EXCESS REACTIVITY determination performed annually or following insertion of experiments with measurable positive reactivity	3.9, RETEST REQUIREMENTS, requires evaluation of all maintenance and operations for effect on safety function
4.1.2 Shutdown margin shall be determined annually or after significant control rod or reactor core changes.	SHUTDOWN MARGIN determination performed annually.	3.9, RETEST REQUIREMENTS, requires evaluation of all maintenance and operations for effect on safety function
4.1.3 Transient Insertion Transient rod function shall be evaluated annually or after significant control rod or reactor core changes. The transient rod drive and associated air supply shall be inspected annually, and the drive cylinder shall be cleaned and lubricated annually.	4.4.2 The CONTROL ROD (TRANSIENT) rod drive cylinder and the associated air supply system SHALL be inspected, cleaned, and lubricated, as necessary. ANNUAL.	No Change
4.1.3 Transient Insertion A comparison of pulse data shall be made with previous measurements at annual intervals or each time the interval to the previous measurement exceeds the annual interval.	Deleted	No safety basis

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
	SURVIELLANCE REQUIREMENTS SURVEILLANCE	
Fuel Elements Specification(s) The reactor fuel elements shall be examined for physical damage by a visual inspection, including a check of the dimensional measurements, made at biennial intervals.	The standard fuel elements SHALL be visually inspected for corrosi and mechanical damage, and measured for length and bend, 500 ı of magnitude equal to or greater than a pulse insertion of $3.00 AND Following the exceeding of a limited safety system set point with potential for causing degradation	Operating experience has demonstrated reliability of TRIGA fuel that justifies less frequent surveillance
	Approximately 1/4 of the core SHALL be visually inspected annuall corrosion and mechanical damage BIENNIAL	
	Complete full core inspection 4 not to exceed 5 years	
4.2.1 Control rod worths shall be determined annually or after significant control rod or reactor core changes	Control Rod Reactivity Worth determination with a frequency of biennially	3.9 requires verification that control rod worths are not significantly affected, at intervals related to other SRs; the need for a complete determination is evaluated frequently with a full determination biennially
4.2.1 (a) Each control rod shall be inspected at biennial intervals by visual observation.	4.4.2 The control rods SHALL be visually inspected for corrosion and mechanical damage at intervals	No change
4.2.1 (b) The scram time of a scrammable control rod shall be measured annually or after maintenance to the control rod or drive.	4.4.2 CONTROL ROD (STANDARD) drop times SHALL be measured to have a drop time from the fully withdrawn position of less than 1 sec.	In conjunction with Retest Requirements, no change.
4.2.1 (c) The reactivity insertion rate of a standard control rod shall be measured annually or after maintenance to the control rod or drive.	Deleted	Reactivity insertion rate LCO removed

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
4.2.2 The minimum safety interlocks shall be tested at semiannual intervals or after repair or modification.	4.4.2 CONTROL ROD (STANDARD) position interlock functional test SEMIANNUAL; Pulse rod interlock functional test SEMIANNUAL	No change for required interlocks
4.2.3 The minimum safety channels shall be calibrated annually or after repair or modifications. A channel test shall be done prior to each day's operation, after repair or modifications, or prior to each extended period of operation.	4.3.2 Reactor power level CHANNEL, CHANNEL TEST DAILY Calorimetric Calibration ANNUAL; Pool and Fuel temperature CHANNELs, CHANNEL TEST DAILY, CHANNEL CALIBRATION ANNUAL; 4.4.2, Pool level scram shall be functionally tested MONTHLY; 4.4.2 Manual scram SHALL be tested by releasing partially withdrawn CONTROL RODS (STANDARD) DAILY	Pool level scram check is monthly based on reliability of channel; no other changes for required safety system channels; Channel test or functional test moved to individual channel specifications
4.2.3 Reactor Safety System: Specification(s; The minimum safety channels shall be calibrated annually or after repair or modifications. A channel test shall be done prior to each day's operation, after repair or modifications, or prior to each extended period of operation.	Calibrations of required measuring channels and channel tests are incorporated in 4.2.3; channel test for argon monitor, continuous air monitor, area monitors are changed to channel check	Calibrations of required measuring channels are incorporated in 4.2.3
4.2.4 Reactor Instrument System: Specification(s); The minimum configuration of instrument channels shall be calibrated annually or after repair or modification. Calibration of the power measuring channels shall be by the calorimetric method. A channel check and channel test of the fuel temperature instrument channels and power level instrument channels shall be made prior to each day's operation or prior to each extended period of operation.	Calibrations of required measuring channels and channel tests are incorporated in 4.2.3	Calibrations of required measuring channels are incorporated in 4.2.3
4.3.1 (a) The pool temperature channel shall have a channel calibration annually, channel check monthly and will be monitored during reactor operation.	Primary pool water temperature CHANNEL CALIBRATION annually Verify reactor pool water temperature channel operable daily	Monthly channel check superseded by daily check

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
4.3.1 (b) The pool water depth channel shall have a channel calibration annually, channel check monthly and will be monitored during reactor operation.	4.8.2, Verify reactor pool water level above the inlet line vacuum breaker; DAILY	The minimum pool level is 6.5 m, well below the level range. Minimum level is assured by the design of the vacuum breakers. Termination of reactor operations on a loss of pool water is not credited above 6.5 m. Therefore any trip using the pool level instrument is adequate to assure the analysis is preserved. A monthly functional trip from the pool level channel will be incorporated in supplementary information.
4.3.1 (c) The water conductivity channel shall have a channel calibration annually and pool water conductivity will be measured weekly.	4.8.2; Measure reactor Pool water conductivity; WEEKLY at least every 30 days	Annual calibration will be incorporated in supplementary information. 30 day requirement assures monitoring during long shutdown periods
4.3.1 (d) The pressure difference channel shall have a channel test prior to each days operation, after repair or modifications, or prior to each extended period of operation of the heat exchanger and will be monitored during operation.	4.8.2, CALIBRATE heat exchanger differential pressure channel ANNUALLY; CHANNEL CHECK heat exchanger differential pressure channel with loss of differential pressure DAILY	Essentially no change based on definition of DAILY and Specifications 3.9/4.9
4.3.1 (e) Measure pool water pH with low ion test paper or equivalent quarterly. Sample pool water radioactivity quarterly for total alpha-beta activity. Analyze pool water sample by gamma spectroscopy annually for isotope identification.	Not listed	See previous item re pH and radioactivity

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
4.3.2 (a) Annual examination of door seals and isolation dampers.	4.5.2, CONFINEMENT ISOLATION damper inspection annually, removed door seal inspection as a TS issue	Damper operation has demonstrated reliability since initial criticality that justifies annual inspection; accident analysis assumes large gap at approximate door frame clearance
4.3.2 (b)Monthly functional test of air confinement isolation.	4.5.2, CONFINEMENT ISOLATION functional test MONTHLY	No change.
4.3.2 (c) Monthly check of the auxiliary air purge system valve alignments for experimental areas.	4.5.1, ENSURE adequate auxiliary air purge system valve alignment: Prior to entering an operating mode with an EXPERIMENTAL FACILITY in use	Required to ensure auxiliary purge system function
4.3.2 (d) Daily check of ventilation system alignment for proper exhaust conditions prior to reactor operation.	4.5.2,ENSURE confinement HVAC operable, DAILY	No change
4.3.3 (a) Calibrate particulate air monitor at semiannual intervals and check operability weekly.	4.3.2, Continuous Particulate Air Monitor CHANNEL CHECK MONTHLY CHANNEL CALIBRATION ANNUAL	Monthly check, Annual calibration is adequate.
4.3.3 (b) Calibrate argon-41 air monitor at biennial intervals and check operability monthly.	4.3.2, Argon monitor CHANNEL CHECK DAILY CHANNEL CALIBRATION (Electronic) SEMIANNUALLY	Typographical error should be Biennial vice Semiannual.
4.3.3 (c) Calibrate area radiation monitors at semiannual intervals and check operability weekly prior to reactor operation.	4.3.2, Upper /Lower or middle level Area Radiation Monitor CHANNEL CHECK WEEKLY CHANNEL CALIBRATION ANNUALLY	Area monitors are not used to measure personnel dose rates, therefore annual calibration
4.4.1 Reactivity; Specification(s): The reactivity of an experiment shall be measured before an experiment is considered functional.	4.6.2, Measure and record experiment worth of the EXPERIMENT (where the absolute value of the estimated worth is greater than $0.50): Initial insertion of a new experiment where absolute value of the estimated worth is greater than $0.50	Specific criteria for the surveillance
4.4.2 Materials: Specification(s); Any surveillance conditions or special requirements shall be specified as a part of the experiment approval.	4.6.2, Experiments SHALL be evaluated and approved prior to implementation: Prior to inserting a new experiment for purposes other than determination of reactivity worth	Experiment approval is not surveillance.

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
5.1.1 Location; Specifications: a. The site location is in the northeast corner of The University of Texas at Austin J.J. Pickle Research Campus. b. The TRIGA reactor is installed in a designated room of a building constructed as a Nuclear Engineering Teaching Laboratory. c. The reactor core is assembled in an above ground shield and pool structure with horizontal and vertical access to the core. d. License areas of the facility for reactor operation shall consist of the room enclosing the reactor shield and pool structure, and the adjacent area for reactor control (room 1.104, corridor 3.200; and rooms 3.202, 3.204, and 3.208).	Deleted	ANSI/ANS-15.1-2007, "This section should be kept to a minimum considered necessary to ensure that major alteration to safety related components or equipment are not made prior to safety reviews." None of the previously identified material is subject to change without review independent of the specification in section 5.
5.1.2 (a) The reactor room shall be designed to restrict leakage and will have a minimum enclosed air volume of 4120 cubic meters.	5.3.3 (2) The minimum free volume of the reactor room shall be approximately 4120 m^3.	Essentially no change
5.1.2 (b) Ventilation system should provide two air changes per hour and shall isolate air in the reactor area upon detection of a limit signal related to the radiation level	5.3.3 (4) Reactor bay HVAC confinement ventilation system operation is designed to provide a minimum of 2 changes of reactor bay air per hour.	Essentially no change; the isolation is moved into an LCO
5.1.2 (c) An air purge system should exhaust experiment air cavities and shall be filtered by high efficiency particulate absorption filters	Deleted	No safety basis
5.1.2 (d) All exhaust air from the reactor area enclosure shall be ejected vertically upward at a point above the facility roof level.	5.3.3 (4) The reactor bay HVAC confinement ventilation system and the auxiliary purge system is capable of exhausting air or other gases from the reactor room at a minimum of 60 ft. above ground level.	Better description
5.1.3 Safety Related Systems, Specifications: Any modifications to the air confinement or ventilation system, the reactor shield, the pool or its penetrations, the pool coolant system, the core and its associated support structure, the rod drive mechanisms or the reactor safety system shall be made and tested in accordance with the specifications to which the systems were originally designed and fabricated. Alternate specifications may be approved by the Nuclear Reactor Committee. A system shall not be considered operable until after it is tested successfully.	Not listed.	This is part of the review process for design changes, requiring 10CFR50.59 review

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
5.2.1 Natural Convection, Specification(s): The reactor core shall be cooled by natural convection flow of water.	Not listed	Forced convention is a design change, requiring 10CFR50.59 review
5.3 Fuel Elements, Specification(s): The standard TRIGA fuel element at fabrication shall have the following characteristics: a. Uranium content: 8.5 Wt% uranium enriched to a nominal 19.7%Uranium-235. b. Zirconium hydride atom ratio: nominal 1.6 hydrogen to zirconium, ZrHx. c. Cladding: 304 stainless steel, nominal .020 inches thick.	The high-hydride fuel element shall contain uranium-zirconium hydride, clad in 0.020 in. of 304 stainless steel. It shall contain a nominal 8.5 weight percent uranium which has a maximum enrichment of 20%. There shall be 1.55 to 1.80 hydrogen atoms to 1.0 zirconium atom.	Essentially no change
5.3, continued – control rods The shim, regulating, and transient control rods shall have scram capability, and a. Include stainless steel or aluminum clad and may be followed by air or aluminum, or for a standard rod may be followed by fuel with stainless steel clad. b. Contain borated graphite, B4C powder, or boron and its compounds in solid form as a poison. c. The transient rod shall have a mechanical limit. An adjustable limit will allow a variation of reactivity insertions. d. Two shim rods, one regulating rod and the transient rod are the minimum control rods.	Not Listed	The definition of control rods to preserve the materials of construction; the required complement is that which meets required reactivity limits
5.4 Reactor Fuel Element Storage, Specification(s): a. All fuel elements shall be stored in a geometrical array where the effective multiplication is less than 0.8 for all conditions of moderation. 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 design values.	All fuel elements or fueled devices shall be in a safe, stable geometry; The k_{eff} of all fuel elements or fueled devices in storage is less than 0.9; The k_{eff} of fuel elements or fueled devices in an approved shipping container will meet the applicable Certificate of Compliance specifications for k_{eff}; Irradiated fuel elements or fueled devices will be stored in an array which will permit sufficient natural convection cooling by air or water such that the fuel element or fueled device will not exceed design values.	(1) No change, (2) ANSI/ANS-15.1-2007 indicates k_{eff} 0.9 (3) Certificates of Compliance have specific requirements (4) No change

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
5.5 Reactor Pool Irradiator, Specification(s): The irradiator assembly shall be an experiment facility. a. A 10,000 Curie gamma irradiator may be located in the reactor pool. The irradiator isotope shall be cobalt-60. b. Location of the assembly shall be at a depth of at least 4.5meters and at a distance of at least 0.5 meters from the reactor core structure. c. Pool water sample requirements shall monitor pool water for source leakage. At a pool water activity of 2.5x10 µCi/cm3the gamma irradiator components shall be tested to locate and remove any leaking source.	Not Listed	The irradiator is removed, with no plans to resume or restore capabilities
6.1.1 The facility shall be under the control of the Director, Associate Director or a delegated Senior Reactor Operator. The management for operation of the facility shall consist of the organizational structure as follows: (FIGURE)	Rewritten in 6.1	
6.1.2 Responsibility The Director shall be responsible to the Dean of the College of Engineering and the Chairman of the Department of Mechanical Engineering for safe operation and maintenance of the reactor and its associated equipment. These responsibilities may be delegated to the Associate Director during the Director's absence from the Facility. A member of Facility Management (Director or Associate Director) or a Senior Reactor Operator shall review and approve all experiments and experimental procedures prior to their use in the reactor. Line Management designated in Section 6.1.1 shall be responsible for the policies and operation of the facility, shall be responsible for safeguarding the public and facility personnel from undue radiation exposures and for adhering to the operating license and technical specifications.	Rewritten in Section 6, with partial incorporation in 4.6.2	
No previous specification	6.1 (c) Operation of the reactor and activities associated with the reactor, control system, instrument system, radiation monitoring system, and engineered safety features will be the function of staff personnel with the appropriate training and certification[1].	

[1] "Selection and Training of Personnel for Research Reactors", ANSI/ANS -15.4 - 1970 (N380)

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
6.1.3 Staffing: The minimum staffing when the reactor is not shutdown shall be: a. A certified operator in the control room	6.1 (c) Whenever the reactor is not secured, a (USNRC licensed) Reactor Operator (or Senior Reactor Operator) who meets requirements of the Operator Requalification Program shall be at the reactor control console, and directly responsible for control manipulations; as indicated above, the Reactor Supervisor may be the Reactor Operator at the controls.	
No previous specification	Only the Reactor Operator at the controls or personnel authorized by, and under direct supervision of, the Reactor Operator at the controls shall manipulate the controls. Whenever the reactor is not secured, operation of equipment that has the potential to affect reactivity or power level shall be manipulated only with the knowledge and consent of the Reactor Operator at the controls. The Reactor Operator at the controls may authorize persons to manipulate reactivity controls who are training either as (1) a student enrolled in academic or industry course making use of the reactor, (2) to qualify for an operator license, or (3) in accordance the approved Reactor Operator requalification program.	
6.1.3 Staffing: The minimum staffing when the reactor is not shutdown shall be: b. A second person in the facility area that can perform Prescribed written instructions. Unexpected absence for two hours shall require immediate action to obtain an alternate person.	Whenever the reactor is not secured, a second person (i.e., in addition to the reactor operator at the control console) capable of initiating the Reactor Emergency Plan will be present in the NETL building. Unexpected absence of this second person for greater than two hours will be acceptable if immediate action is taken to obtain a replacement. If the reactor supervisor is in the NETL building and not acting as the Reactor operator at the controls, the Reactor Supervisor may act as the second person.	
No previous specification	Staffing required for performing experiments with the reactor will be determined by a classification system specified for the experiments. Requirements will range from the presence of a certified operator for some routine experiments to the presence of a senior operator and the experimenter for other less routine experiments.	

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
6.1.3 Staffing: The minimum staffing when the reactor is not shutdown shall be: c. A senior reactor operator readily available. The available operator should be within thirty minutes of the facility and reachable by telephone	6.1 (c) Whenever the reactor is not secured, the reactor shall be (1) under the direction of or (2) directly operated by a (USNRC licensed) Senior Operator, designated as Reactor Supervisor. The Supervisor may be on call if cognizant of reactor operations and capable of arriving at the facility within thirty minutes.	No change
Events requiring the direction of a senior reactor operator shall be: a. All fuel element or control rod relocations within the reactor core region. b. Relocation of any experiment with a reactivity worth of greater than one dollar. c. Recovery from an unscheduled shutdown or significant power reduction. d. Initial startup and approach to power.	The Reactor Supervisor shall directly supervise any INITIAL STARTUP.	No change; definition OF INITIAL STARTUP encompasses previous specification.
A list of reactor facility personnel by name and telephone number shall be available to the operator in the control room. The list shall include: a. Management personnel. b. Radiation safety personnel. c. Other operations personnel.	Not listed	Implementing procedures of the USNRC approved Emergency Plan provides contact information.
6.1.4 Selection and Training of Personnel The selection, training and requalification of operators shall meet or exceed the requirements of American National Standard for Selection and Training of Personnel for Research Reactors ANSI/ANS -15.4. Qualification and requalification of licensed operators shall be subject to an approved NRC (Nuclear Regulatory Commission) program.	6.5 Operator Requalification: An NRC approved UT TRIGA Requalification Plan is in place to maintain training and qualification of reactor operators and senior reactor operators. License qualification by written and operating test, and license issuance or removal, are the responsibility of the U.S. Nuclear Regulatory Commission. No rights of the license may be assigned or otherwise transferred and the licensee is subject to and shall observe all rules, regulations and orders of the Commission. Requalification training maintains the skills and knowledge of operators and senior operators during the period of the license. Training also provides for the initial license qualification.	Editorial changes
6.2, Review and Audit	6.2 Review and Audit The review and audit process is the responsibility of the Reactor Oversight Committee (ROC).	

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
6.2.1, Composition and Qualifications: A Nuclear Reactor Committee shall consist of at least three (3) members appointed by the Dean of the College of Engineering that are knowledgeable in fields which relate to nuclear safety. The university radiological safety officer shall be a member or an ex-officio member. The committee will perform the functions of review and audit or designate a knowledgeable person for audit functions.	Composition and Qualifications: The ROC shall consist of at least three (3) members appointed by the Dean of the College of Engineering that are knowledgeable in fields which relate to nuclear safety. The university radiological safety officer shall be a member or an ex-officio member. The committee will perform the functions of review and audit or designate a knowledgeable person for audit functions.	
6.2.2 Charter and Rules The operations of the Nuclear Reactor Committee shall be in accordance with an established charter, including provisions for: a. Meeting frequency (at least once each six months). b. Quorums (not less than one-half the membership where the operating staff does not represent a majority). c. Dissemination, review, and approval of minutes. d. Use of subgroups.	Charter and Rules The operations of the ROC shall be in accordance with an established charter, including provisions for: a. Meeting frequency (at least twice each year, with approximately 4-8 month frequency). b. Quorums (not less than one-half the membership where the operating staff does not contribute a majority). c. Dissemination, review, and approval of minutes. d. Use of subgroups.	

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
6.2.3 Review Function The review function shall include facility operations related to reactor and radiological safety. The following items shall be reviewed: a. Determinations that proposed changes in equipment, systems, tests, experiments, or procedures do not involve an unreviewed safety question. b. All new procedures and major revisions thereto, and proposed changes in reactor facility equipment or systems having safety significance. c. All new experiments or classes of experiments that could affect reactivity or result in the release of radioactivity. d. Changes in technical specifications or license. e. Violations of technical specifications or license. f. Operating abnormalities or violations of procedures having safety significance. g. Other reportable occurrences. h. Audit reports.	Review Function The responsibilities of the Reactor Safeguards Committee to shall include but are not limited to review of the following: a. All new procedures (and major revisions of procedures) with safety significance b. Proposed changes or modifications to reactor facility equipment, or systems having safety significance c. Proposed new (or revised) experiments, or classes of experiments, that could affect reactivity or result in the release of radioactivity d. Determination of whether items a) through c) involve unreviewed safety questions, changes in the facility as designed, or changes in Technical Specifications. e. Violations of Technical Specifications or the facility operating licensee f. Violations of internal procedures or instruction having safety significance g. Reportable occurrences h. Audit reports	
	Minor changes to procedures and experiments that do not change the intent and do not significantly increase the potential consequences may be accomplished following review and approval by a senior reactor operator and independently by one of the Reactor Supervisor, Associate Director or Director. These changes should be reviewed at the next scheduled meeting of the Reactor Oversight Committee.	

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
6.2.4 Audit Function: The audit function shall be a selected examination of operating records, logs, or other documents. An audit will be by a person not directly responsible for the records and may include discussions with cognizant personnel or observation of operations. The following items shall be audited and a report made within 3 months to the Director and Nuclear Reactor Committee: a. Conformance of facility operations with license and technical specifications at least once each calendar year. b. Results of actions to correct deficiencies that may occur in reactor facility equipment, structures, *systems,* or methods of operation that affect safety at least once per calendar year. c. Function of the retraining and requalification program for reactor operators at least once every other calendar year. d. The reactor facility emergency plan and physical security plan, and implementing procedures at least once every other year.	Audit Function The audit function shall be a selected examination of operating records, logs, or other documents. Audits will be by a Reactor Oversight Committee member or by an individual appointed by the committee to perform the audit. The audit should be by any individual not directly responsible for the records and may include discussions with cognizant personnel or observation of operations. The following items shall be audited and a report made within 3 months to the Director and Reactor Committee: a. Conformance of facility operations with license and technical specifications at least once each calendar year. b. Results of actions to correct deficiencies that may occur in reactor facility equipment, structures, systems, or methods of operation that affect safety at least once per calendar year. c. Function of the retraining and requalification program for reactor operators at least once every other calendar year. d. The reactor facility emergency plan and physical security plan, and implementing procedures at least once every other year.	

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
6.3 Operating Procedures: Written operating procedures shall be prepared, reviewed and approved by the Director or a supervisory Senior Reactor Operator and the Nuclear Reactor Committee prior to initiation of the following activities: a. Startup, operation, and shutdown of the reactor. b. Fuel loading, unloading and movement in the reactor. c. Routine maintenance of major components of systems that could have an effect on reactor safety. d. Surveillance calibrations and tests required by the technical specifications or those that could have an effect on reactor safety. e. Administrative controls for operation, maintenance: and the conduct of experiments or irradiations that could have an effect on reactor safety. f. Personnel radiation protection, consistent with applicable regulations or guidelines, and shall include a management commitment and programs to maintain exposures and releases as low *as* reasonably achievable. g. Implementation of required plans such as the emergency plan or physical security plan.	6.3 Procedures Written procedures shall govern many of the activities associated with reactor operation. Activities subject to written procedures will include: a. Startup, operation, and shutdown of the reactor b. Fuel loading, unloading, and movement within the reactor. c. Control rod removal or replacement. d. Routine maintenance, testing, and calibration of control rod drives and other systems that could have an effect on reactor safety. e. Administrative controls for operations, maintenance, conduct of experiments, and conduct of tours of the Reactor Facility. f. Implementing procedures for the Emergency Plan or Physical Security Plan.	Control rod removal or replacement added
Substantive changes to the above procedures shall be made effective after approval by the Director or a supervisory Senior Reactor Operator and the Nuclear Reactor Committee. Minor modifications to the original procedures which do not change the original intent may be made by a senior reactor operator but the modifications must be approved by the Director or a supervisory Senior Reactor Operator. Temporary deviations from the procedures may be made by a senior reactor operator in order to deal with special or unusual circumstances or conditions. Such deviations shall be documented and reported to the Director or a supervisory Senior Reactor Operator.	Minor changes to procedures and experiments that do not change the intent and do not significantly increase the potential consequences may be accomplished following review and approval by a senior reactor operator and independently by one of the Reactor Supervisor, Associate Director or Director. These changes should be reviewed at the next scheduled meeting of the Reactor Oversight Committee.	Substantive changes addressed explicitly; Associate Director added to list of positions that can independently review minor changes

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
	Written procedures shall also govern: a. Personnel radiation protection, in accordance with the Radiation Protection Program as indicated in Chapter 11 b. Administrative controls for operations and maintenance c. Administrative controls for the conduct of irradiations and experiments that could affect core safety or reactivity	Split from "Operating Procedures" for emphasis
	A master Procedure Control procedure specifies the process for creating, changing, editing, and distributing procedures. Preparation of the procedures and minor modifications of the procedures will be by certified operators. Substantive changes or major modifications to procedures, and new prepared procedures will be submitted to the Reactor Oversight Committee for review and approval. Temporary deviations from the procedures may be made by the reactor supervisor or designated senior operator provided changes of substance are reported for review and approval.	
	Proposed experiments will be submitted to the reactor oversight committee for review and approval of the experiment and its safety analysis[2], as indicated in Chapter 10. Substantive changes to approved experiments will require re-approval while insignificant changes that do not alter experiment safety may be approved by a senior operator and independently one of the following, Reactor Supervisor, Associate Director, or Director. Experiments will be approved first as proposed experiments for one time application, and subsequently, as approved experiments for repeated applications following a review of the results and experience of the initial experiment implementation.	Associate Director added as independent reviewer

[2] ANSI/ANS 15.6, op. cit.

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
6.4 Experiment Review and Approval All new experiments or classes *of* experiments shall be approved by the Director or *a* Supervisory Senior Reactor Operator and the Nuclear Reactor Operations Committee. a. Approved experiments shall be carried out *in* accordance with established and approved procedures. b. Substantive changes to previously approved experiments shall require the same review as a new experiment. c. Minor changes to an experiment that do not significantly alter the experiment may be made by *a* supervisory senior reactor operator	Review of Proposals for Experiments a) All proposals for new experiments involving the reactor shall be reviewed with respect to safety in accordance with the procedures in (b) below and on the basis of criteria in (c) below. b) Procedures: 1. Proposed reactor operations by an experimenter are reviewed by the Reactor Supervisor, who may determine that the operation is described by a previously approved EXPERIMENT or procedure. If the Reactor Supervisor determines that the proposed operation has not been approved by the Reactor Oversight Committee, the experimenter shall describe the proposed EXPERIMENT in written form in sufficient detail for consideration of safety aspects. If potentially hazardous operations are involved, proposed procedures and safety measures including protective and monitoring equipment shall be described. 2. The scope of the EXPERIMENT and the procedures and safety measures as described in the approved proposal, Including any amendments or conditions added by those reviewing and approving it, shall be binding on the experimenter and the OPERATING personnel. Minor deviations shall be allowed only in the manner described in Section 6 above. Recorded affirmative votes on proposed new or revised experiments or procedures must indicated that the Committee determines that the proposed actions do not involve changes in the facility as designed, changes in Technical Specifications, changes that under the guidance of 10 CFR 50.59 require prior approval of the NRC, and could be taken without endangering the health and safety of workers or the public or constituting a significant hazard to the integrity of the reactor core.	Rewritten to reflect current practice

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
	3. Transmission to the Reactor Supervisor for scheduling. c) Criteria that shall be met before approval can be granted shall include: 1. The EXPERIMENT must meet the applicable Limiting Conditions for Operation and Design Description specifications. 2. It must not involve violation of any condition of the facility license or of Federal, State, University, or Facility regulations and procedures. 3. The conduct of tests or experiments not described in the safety analysis report (as updated) must be evaluated in accordance with 10 CFR 50.59 to determine if the test or experiment can be accomplished without obtaining prior NRC approval via license amendment pursuant to 10 CFR Sec. 50.90. 4. In the safety review the basic criterion is that there shall be no hazard to the reactor, personnel or public. The review SHALL determine that there is reasonable assurance that the experiment can be performed with no significant risk to the safety of the reactor, personnel or the public.	

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
6.5.1 Action to be Taken in Case of a Safety Limit Violation In the event of a safety limit violation, the following action shall be taken: a. The reactor shall be shut down and reactor operation shall not be resumed until a report of the violation is prepared and authorization to restart by the Nuclear Regulatory Commission (NRC) is issued. b. The safety limit violation shall be promptly reported to the Director of the facility or a designated alternate. c. The safety limit violation shall be subsequently reported to the NRC. d. A safety limit violation report shall be prepared and submitted to the Nuclear Reactor Committee. The report shall describe:(1) Applicable circumstances leading to the violation including, when known the cause and contributing factors, (2)Effect of the violation on reactor facility components, systems, or structures and on the health and safety of the public, (3) Corrective actions taken to prevent recurrence.	6.8 Action to be Taken in the Event that a Safety Limit is Exceeded In the event that a Safety Limit is not met, a. The reactor shall be shutdown and secured. b. The Reactor Supervisor, Associate Director, and Director shall be notified c. The safety limit violation shall be reported to the Nuclear Regulatory Commission within 24 hours by telephone, confirmed via written statement by email, fax or telegraph d. A safety limit violation report shall be prepared within 14 days of the event to describe: 1. Applicable circumstances leading to the violation including (where known) cause and contributing factors 2. Effect of the violation on reactor facility components, systems, and structures 3. Effect of the violation on the health and safety of the personnel and the public 4. Corrective action taken to prevent recurrence e. The Reactor Oversight Committee shall review the report and any follow-up reports f. The report and any follow-up reports shall be submitted to the Nuclear Regulatory Commission. g. Operations shall not resume until the USNRC approves resumption.	No significant change
6.5.2 Action to be taken in the Event of an Occurrence that is Reportable. In the event of a reportable occurrence, the following action shall be taken: a. Reactor conditions shall be returned to normal or the reactor shutdown. If it is necessary to shut down the reactor to correct the occurrence, operations shall not be resumed unless authorized by the Director or his designated alternate. b. Occurrence shall be reported to the Director or his designated alternate and to the Nuclear Regulatory Commission *as* required. c. Occurrence shall be reviewed by the Nuclear Reactor Committee at the next regularly scheduled meeting.	b) In the event of a reportable occurrence, as defined in the Technical Specifications, and in addition to the reporting requirements, 1. The Reactor Supervisor, the Associate Director and the Director shall be notified 2. If a reactor shutdown is required, resumption of normal operations shall be authorized by the Associate Director or Director 3. The event shall be reviewed by the Reactor Oversight Committee during a normally scheduled meeting	

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
6.6.2 Special Reports A written report within 30 days to the NRC of: A. Permanent changes in the facility organization involving Level 1 or Level 2 personnel. B. Significant changes in transient or accident analysis as described in the Safety Analysis Report.	6.11 There shall be a written report within 30 days of: a. Permanent changes in the facility organization involving Director or Supervisor. b. Significant changes in the transient or accident analysis as described in the Safety Analysis Report.	
A report to NRC Operations Center *by* telephone not later than the following working day and confirmed in writing by telegraph or similar conveyance to be followed by a written report within 14 days that describes the circumstances of the event of any of the following:	6.11 Other or Special Reports There shall be a report not later than the following working day by telephone and confirmed in writing by facsimile or similar conveyance of any reportable occurrence identified in 6.9. There shall be a written report describing the circumstances of any reportable occurrence identified in 6.9 within 14 days of occurrence.	
a. Violation of fuel element temperature safety limit.		
b. Release of radioactivity above allowable limits.		
c. Other reportable occurrences. Other events that will be considered reportable events are listed in this section. A return to normal operation or curtailed operation until authorized by management will occur. (Note: Where components or systems are provided in addition to those required by the technical specifications, the failure of components or systems is not considered reportable provided that the minimum number of components or systems specified or required perform their intended reactor safety function.)	6.9 a) A reportable occurrence is any of the following conditions:	
a. Operation with actual safety-system settings for required systems less conservative than the limiting safety system settings specified in the technical specifications.	1. Any actual safety system setting less conservative than specified in Section 2.2, Limiting Safety System Settings;	

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
b. Operation in violation of limiting conditions for operation established in technical specifications unless prompt remedial action is taken.	2. VIOLATION OF SL, LSSS OR LCO; *NOTES* - *Violation of an LSSS or LCO occurs through failure to comply with an "Action" statement when "Specification" is not met; failure to comply with the "Specification" is not by itself a violation.* - *Surveillance Requirements must be met for all equipment/components/conditions to be considered operable.* - *Failure to perform a surveillance within the required time interval or failure of a surveillance test shall result in the /component/condition being inoperable*	
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 shutdowns.	Incidents or conditions that prevented or could have prevented the performance of the intended safety functions of an engineered safety feature or the REACTOR SAFETY SYSTEM;	
d. An unanticipated or uncontrolled change in reactivity greater than one dollar. Reactor trips resulting from a known cause are excluded.	An uncontrolled or unanticipated change in reactivity greater than $1.00;	
e. Abnormal and significant degradation in reactor fuel, or cladding, or both, coolant boundary, or confinement boundary (excluding minor leaks) where applicable which could result in exceeding prescribed radiation exposure limits of personnel or environment, or both.	Release of fission products from the fuel that cause airborne contamination levels in the reactor bay to exceed 10CFR20 limits for releases to unrestricted areas;	
f. An observed inadequacy in the implementation of administrative or procedural controls such that the inadequacy causes or could have caused the existence or development of an unsafe condition with regard to reactor operations.	An observed inadequacy in the implementation of either administrative or procedural controls, such that the inadequacy has caused the existence or development of an unsafe condition in connection with the operation of the reactor;	
	6.11 Routine annual reports covering the activities of the reactor facility during the previous calendar year shall be submitted to licensing authorities within three months following the end of each prescribed year. Each annual operating report shall include the following information:	

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
a. A narrative summary of reactor operating experience including the energy produced by the reactor or the hours the reactor was critical, or both. b. The unscheduled shutdowns including, where applicable, corrective action taken to preclude recurrence. c. Tabulation of major preventive and corrective maintenance operations having safety significance. d. Tabulation of major changes in the reactor facility and procedures, and tabulation of new tests or experiments, or both, that are significantly different from those performed previously, including conclusions that no unreviewed safety questions were involved. e. A summary of the nature and amount of radioactive effluents released or discharged to the environs beyond the effective control of the university as determined at or before the point of such release or discharge. The summary shall include to the extent practicable an estimate of individual radionuclides present in the effluent. If the estimated average release after dilution or diffusion is less than 25% of the concentration allowed or recommended, a statement to this effect is sufficient. A summary of exposures received by facility Personnel and visitors where such exposures are greater than 25% of that allowed or recommended. g. A summarized result of environmental surveys performed outside the facility.	a. A narrative summary of reactor operating experience including the energy produced by the reactor or the hours the reactor was critical, or both. b. The unscheduled shutdowns including, where applicable, corrective action taken to preclude recurrence. c. Tabulation of major preventive and corrective maintenance operations having safety significance. d. Tabulation of major changes in the reactor facility and procedures, and tabulation of new tests or experiments, or both, that are significantly different from those performed previously, including conclusions that no new or unanalyzed safety questions were identified. e. A summary of the nature and amount of radioactive effluents released or discharged to the environs beyond the effective control of the owner-operator as determined at or before the point of such release or discharge. The summary shall include, to the extent practicable, an estimate of individual radionuclides present in the effluent. If the estimated average release after dilution or diffusion is less than 25% of the concentration allowed or recommended, a statement to this effect is sufficient. f. A summarized result of environmental surveys performed outside the facility. g. A summary of exposures received by facility personnel and visitors where such exposures are greater than 25% of that allowed or recommended.	

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
6.6.2.3 A written report within 90 days after the completion of startup tests or 9 months after initial criticality, whichever is earlier, of the startup test program, to the NRC of: Characteristics of the reactor such as critical mass, excess reactivity, power calibration, control rod calibrations, shutdown margin and experiment facility worths, describing the measured values of the operating conditions including: a. Total control reactivity worth and reactivity of the rod of highest reactivity worth. b. Minimum shutdown margin of the reactor both at ambient and operating temperatures. c. An evaluation of facility performance to date in comparison with design conditions and measured operating characteristics, and *a* reassessment of the safety analysis when measurements indicate that there may be substantial variance from prior analysis submitted with the license application.	Deleted	Does not apply
6.7 RECORDS	1.3 Plant Operating Records: Records of the following activities shall be maintained and retained for the periods specified below[3]. The records may be in the form of logs, data sheets, electronic files, or other suitable forms. The required information may be contained in single or multiple records, or a combination thereof.	

[3] "Records and Reports for Research Reactors", ANSI/ANS - 15.3-1974 (N399).

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Current Technical Specifications	Proposed Technical Specifications	Analysis of Change
6.7.1 Lifetime of the Facility	CONT. Lifetime Records : Lifetime records are records to be retained for the lifetime of the reactor facility. (Note: Applicable annual reports, if they contain all of the required information, may be used as records in this section.) a. Gaseous and liquid radioactive effluents released to the environs. b. Offsite environmental monitoring surveys required by Technical Specifications. c. Events that impact or effect decommissioning of the facility d. Radiation exposure for all personnel monitored. 1.3 e. Updated drawings of the reactor facility	
6.7.2 Five Years or the Life of the Component 6.7.3 One Licensing Cycle	CONT. Five Year Period: Records to be retained for a period of at least five years or for the life of the component involved whichever is shorter. a. Normal reactor facility operation (supporting documents such as checklists, log sheets, etc. shall be maintained for a period of at least one year). b. Principal maintenance operations. c. Reportable occurrences. d. Surveillance activities required by technical specifications. e. Reactor facility radiation and contamination surveys where required by applicable regulations. f. Experiments performed with the reactor. g. Fuel inventories, receipts, and shipments. h. Approved changes in operating procedures. i. Records of meeting and audit reports of the review and audit group. One Training Cycle Training records to be retained for at least one license cycle are the requalification records of licensed operations personnel. Records of the most recent complete cycle shall be maintained at all times the individual is employed.	
Appendices	Incorporated in specifications	