

4. SURVEILLANCE REQUIREMENTS

4.1 GENERAL

Applicability. This specification applies to the surveillance requirements of any system related to Reactor Safety.

Objective. The objective is to verify the proper operation of any system related to Reactor Safety.

Specifications. Any additions, modifications, or maintenance to the ventilation system, the core and its associated support structure, the pool or its penetrations, the pool coolant system, the rod drive mechanism or the reactor safety system shall be made and tested in accordance with the specifications to which the systems were originally designed and fabricated, or to specifications approved by the Reactor Operations Committee. A system shall not be considered operable until after it is successfully tested.

Bases. This specification relates to changes in reactor systems which could directly affect the safety of the reactor. As long as changes or replacements to these systems continue to meet the original design specifications, then it can be assumed that they meet the presently accepted operating criteria.

4.2 SAFETY LIMIT -- FUEL ELEMENT TEMPERATURE

Applicability. This specification applies to the surveillance requirements of the fuel element temperature measuring channel.

Objective. The objective is to assure that the fuel element temperatures are properly monitored.

Specifications.

- a. Whenever a reactor scram caused by high fuel element temperature occurs, an evaluation shall be conducted to determine whether the fuel element temperature safety limit was exceeded.
- b. A calibration of the temperature measuring channels shall be performed ~~semiannually but at intervals not to exceed 8 months.~~
semi-annually (interval not to exceed seven and one-half months).
- c. A Channel Check of the fuel element temperature measuring channel shall be made prior to pulsing operation on a daily basis *(must be done during the calendar day).*

Bases. Operational experience over the past five years with the TRIGA system gives assurance that the thermocouple measurements of fuel element temperatures have been sufficiently reliable to assure accurate indication of this parameter.

4.3 LIMITING CONDITIONS FOR OPERATIONS

4.3.1 Reactivity Requirements

Applicability. These specifications apply to the surveillance requirements for reactivity control of experiments and systems.

Objective. The objective is to measure and verify the worth, performance and operability of those systems affecting the reactivity of the reactor.

Specifications

- a. The reactivity worth of each control rod and the shutdown margin shall be determined annually ~~but at intervals not to exceed 14 months.~~ (interval not to exceed 15 months).
- b. The reactivity worth of an experiment shall be estimated or measured, as appropriate, before reactor operation with said experiment.
- c. The control rods shall be visually inspected for deterioration ~~at intervals not to exceed 2 years.~~ biennially (interval not to exceed two and one-half years).
- d. The transient rod drive cylinder and associated air supply system shall be inspected, cleaned and lubricated as necessary, ~~semiannually, at intervals not to exceed 8 months.~~ semi-annually (interval not to exceed seven and one-half months).
- e. The reactor shall be pulsed semi-annually to compare fuel temperature measurements and peak power levels with those of previous pulses of the same reactivity value. (interval not to exceed seven and one-half months)

Bases. The reactivity worth of the control rods is measured to assure that the required shutdown margin is available and to provide an accurate means for determining the reactivity worths of experiments inserted in the core. Past experience with TRIGA reactors gives assurance that measurement of the reactivity worth on an annual basis is adequate to insure no significant changes in the shutdown margin. The visual inspection of the control rods is made to evaluate corrosion and wear characteristics caused by operation in the reactor. The reactor is pulsed at suitable intervals and a comparison made with previous similar pulses to determine if changes in fuel or core characteristics are taking place.

4.3.2 Control and Safety System

Applicability. These specifications apply to the surveillance requirements for measurements, tests, and calibrations of the control and safety systems.

Objective. The objective is to verify the performance and operability of those systems and components which are directly related to Reactor Safety.

Specifications.

- a. The SCRAM time shall be measured annually ~~but at intervals not to exceed 14 months.~~ (interval not to exceed 15 months).
- b. A Channel Check of each of the reactor safety system channels for the intended mode of operation shall be performed prior to each day's operation or prior to each operation extending more than one day.
- c. A Channel Calibration shall be made of the power level monitoring channels by the calorimetric method annually ~~but at intervals not to exceed 14 months.~~ (interval not to exceed 15 months).
- d. A Channel Test of each item in Table I and Table II other than measuring channels, shall be performed ~~semiannually, but at intervals not to exceed 8 months.~~ ~~seven and one-half months).~~ semi-annually (interval not to exceed 8 months).

Bases. Measurement of the scram time on an annual basis is a check not only of the scram system electronics, but also is an indication of the capability of the control rods to perform properly. The channel tests will assure that the safety system channels are operable on a daily basis or prior to an extended run. The power level channel calibration will assure that the reactor will be operated at the proper power levels. Transient control element checks and annual maintenance insure proper operation of this element.

4.3.3 Radiation Monitoring System

Applicability. This specification applies to the surveillance requirements for the area radiation monitoring equipment and the air monitoring systems.

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

Specification. The area radiation monitoring system and the air monitoring systems shall be calibrated annually, ~~but at intervals not to exceed 14 months~~ (interval not to exceed 15 months) and their set points verified weekly (interval not to exceed ten days).

Basis. Experience has shown that weekly verification of area radiation monitoring and air monitoring system set points in conjunction with annual calibration is adequate to correct for any variation in the system due to a change of operating characteristics over a long time span.

4.3.4 Ventilation System

Applicability. This specification applies to the building confinement ventilation system.

Objective. The objective is to assure the proper operation of the ventilation system in controlling releases of radioactive material to the unrestricted area.

Specification. It shall be verified ^{semi-annually (interval not to exceed seven} ~~semiannually, but at intervals~~ ~~not to exceed 8 months,~~ that the ventilation system is operable. _{and one-half months),}

Bases. Experience accumulated in over 7 years of operation has demonstrated that tests of the ventilation system on a semi-annual basis are sufficient to assure proper operation of the system and control over releases of radioactive material. The perfect operating record of this system achieved in the past is sustained by regular mechanical maintenance performed on a monthly basis.

4.3.5 Reactor Pool Water

Applicability. This specification applies to the surveillance requirements for the reactor pool water.

Objective. The objective is to assure that the reactor pool water level and the bulk water temperature monitoring systems are operating, and to verify appropriate alarm settings.

Specification.

- a. The reactor bulk water temperature monitoring system shall be ^{(interval not to} ~~calibrated annually, but at intervals not to exceed 14 months,~~ _{exceed 15 months)} and its set point verified monthly ^{(interval not to exceed six weeks).}
- b. It shall be verified monthly ~~that the reactor pool water level~~ ^(interval not to exceed six weeks) monitoring system is operable.

Basis. Experience over the past 7 years has shown that monthly verifications of set points and annual calibrations of temperature measuring devices are sufficient to ensure proper operation of the system.

4.3.6 Experiment Limits

Applicability. This specification applies to the surveillance requirements for experiments installed in the reactor and its experimental facilities.

Objective. The objective is to prevent the conduct of experiments which may damage the reactor or release excessive amounts of radioactive materials as a result of experiment failure.

Specifications. An experiment shall not be installed in the reactor or its experimental facilities unless a hazards analysis has been performed and reviewed for compliance with Limitations on Experiments, Section 3.8, by the Reactor Operations Committee in full accord with Section 6.2.d.1 of these Technical Specifications, and the procedures which are established for this purpose.

NO CHANGES ON THIS PAGE!

Bases. It has been demonstrated in over 7 years of experience that experiments which are reviewed by the staff of the OSTR and the Reactor Operations Committee can be conducted without endangering the safety of the reactor or exceeding the limits in the Technical Specifications.

4.4 REACTOR FUEL ELEMENTS

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

Objective. The objective is to verify the continuing integrity of the fuel element cladding.

Specifications. All fuel elements shall be inspected visually for damage or deterioration and measured for length and bend at intervals not to exceed the sum of 3,500 dollars in pulse reactivity. The reactor shall not be operated with damaged fuel. A fuel element shall be considered damaged and must be removed from the core if:

- a. In measuring the transverse bend, the bend exceeds 0.063 in. over the length of the cladding,
- b. In measuring the elongation, its length exceeds its original length by 0.100 in., or
- c. A cladding defect exists as indicated by release of fission products.

Bases. The frequency of inspection and measurement schedule is based on the parameters most likely to affect the fuel cladding of a pulsing reactor operated at moderate pulsing levels and utilizing fuel elements whose characteristics are well known.

The limit of transverse bend has been shown to result in no difficulty in disassembling the core. Analysis of the removal of heat from touching fuel elements shows that there will be no hot spots resulting in damage to the fuel caused by this touching. Experience with TRIGA reactors has shown that fuel element bowing that could result in touching has occurred without deleterious effects. The elongation limit has been specified to assure that the cladding material will not be subjected to stresses that could cause a loss of integrity in the fuel containment and to assure adequate coolant flow.