



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

NRC PDR

May 24, 1979

Docket No. 50-59

Dr. R. R. Berg  
Office of University Research  
Texas A&M University  
College Station, Texas 77843

Dear Dr. Berg:

On April 25, 1979 the Commission issued Amendment No. 12 to Facility Operating License No. R-23 for the AGN-201M nuclear research/training reactor to renew your operating license and incorporate Technical Specifications consistent with the requirements of Section 50.36 of 10 CFR Part 50.

The Technical Specifications Appendix A which were transmitted with the amendment contain a number of incorrect pages. Please replace those pages with the enclosed corrected pages 1, 2, 3, 11, 12, 14, and 15.

We regret any inconvenience this administrative error may have caused you.

Sincerely,

A handwritten signature in cursive script that reads "Robert W. Reid".

Robert W. Reid, Chief  
Operating Reactors Branch #4  
Division of Operating Reactors

Enclosures:  
TS pages 1, 2, 3, 11,  
12, 14, & 15

cc w/enclosures:  
See next page

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Texas A&M University

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cc w/enclosures:

Mayor of the City of College Station  
College Station, Texas 77843

Director, Governor's Budget  
and Planning Office  
Executive Office Building  
411 West 13th Street  
Austin, Texas 78701

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1.0 DEFINITIONS

The terms Safety Limit (SL), Limiting Safety System Setting (LSSS), and Limiting Conditions for Operation (LCO) are as defined in 50.36 of 10 CFR Part 50.

1.1 Channel Calibration - A channel calibration is an adjustment of the channel such that its output responds, within acceptable range and accuracy, to known values of the parameter which the channel measures. Calibration shall encompass the entire channel, including equipment, actuation, alarm, or trip.

1.2 Channel Check - A channel check is a qualitative verification of acceptable performance by observation of channel behavior. This verification may include comparison of the channel with other independent channels or methods measuring the same variable.

1.3 Channel Test - A channel test is the introduction of a signal into the channel to verify that it is operable.

1.4 Experiment -

a. An experiment is any of the following:

- (1) An activity utilizing the reactor system or its components or the neutrons or radiation generated therein;
- (2) An evaluation or test of a reactor system operational, surveillance, or maintenance technique;
- (3) An experimental or testing activity which is conducted within the reactor; or
- (4) The material content of any of the foregoing, including structural components, encapsulation or confining boundaries, and contained fluids or solids.

b. Secured Experiment - Any experiment, or component of an experiment is deemed to be secured, or in a secured position, if it is held in a stationary position relative to the reactor by mechanical means. The restraint shall exert sufficient force on the experiment to overcome the expected effects of hydraulic, pneumatic, bouyant, or other forces which are normal to the operating environment of the experiment or which might arise as a result of credible malfunctions.

c. Unsecured Experiment - Any experiment, or component of an experiment is deemed to be unsecured whenever it is not secured as defined in 1.4.b. above. Moving parts of experiments are deemed to be unsecured when they are in motion.

- d. Movable Experiment - A movable experiment is one which may be inserted, removed, or manipulated while the reactor is critical.
- e. Removable Experiment - A removable experiment is any experiment, experimental facility, or component of an experiment, other than a permanently attached appurtenance to the reactor system, which can reasonably be anticipated to be moved one or more times during the life of the reactor.
- 1.5 Experimental Facilities - Experimental facilities are those portions of the reactor assembly that are used for the introduction of experiments into or adjacent to the reactor core region or allow beams of radiation to exit from the reactor shielding. Experimental facilities shall include the thermal column, glory hole, and access ports.
- 1.6 Explosive Material - Explosive material is any solid or liquid which is categorized as a Severe, Dangerous, or Very Dangerous Explosion Hazard in "Dangerous Properties of Industrial Materials" by N. I. Sax, Third Ed. (1968), or is given an Identification of Reactivity (Stability) index of 2, 3, or 4 by the National Fire Protection Association in its publication 704-M, 1966. "Identification System for Fire Hazards of Materials," also enumerated in the "Handbook for Laboratory Safety" 2nd Ed. (1971) published by The Chemical Rubber Company.
- 1.7 Measuring Channel - A measuring channel is the combination of sensor, lines, amplifiers, and output devices which are connected for the purpose of measuring or responding to the value of a process variable.
- 1.8 Operable - Operable means a component or system is capable of performing its intended function in its normal manner.
- 1.9 Operating - Operating means a component or system is performing its intended function in its normal manner.
- 1.10 Potential Reactivity Worth - The potential reactivity worth of an experiment is the maximum absolute value of the reactivity change that would occur as a result of intended or anticipated changes or credible malfunctions that alter experiment position or configuration.
- Evaluations of potential reactivity worth of experiments also shall include effects of possible trajectories of the experiment in motion relative to the reactor, its orientation along each trajectory, and circumstances which can cause internal changes such as creating or filling of void spaces or motion of mechanical components. For removable experiments, the potential reactivity worth is equal to or greater than the static reactivity worth.
- 1.11 Reactor Component - A reactor component is any apparatus, device, or material that is a normal part of the reactor assembly.
- 1.12 Reactor Operation - Reactor operation is any condition wherein the reactor is not shut down.

- 1.13 Reactor Safety System - The reactor safety system is that combination of safety channels and associated circuitry which forms the automatic protective system for the reactor or provides information which requires manual protective action be initiated.
- 1.14 Reactor Shutdown - The reactor shall be considered shutdown whenever
- a. either:
    1. All safety and control rods are fully withdrawn from the core, or
    2. The core fuse melts resulting in separation of the core,
  - and:
  - b. The reactor console key switch is in the "off" position and the key is removed from the console and under the control of a licensed operator.
- 1.15 Safety Channel - A safety channel is a measuring channel in the reactor safety system.
- 1.16 Static Reactivity Worth - The static reactivity worth of an experiment is the absolute value of the reactivity change which is measurable by calibrated control or regulating rod comparison methods between two defined terminal positions or configurations of the experiment. For removable experiments, the terminal positions are fully removed from the reactor and fully inserted or installed in the normal functioning or intended position.

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watt, and that the total gamma, thermal neutron, and fast neutron dose rate in the accelerator room is less than 15 mrem/hr at reactor power levels less than or equal to 5.0 watts and the thermal column filled with water.

The facility shielding in conjunction with radiation monitoring, control, and restricted areas is designed to limit radiation doses to facility personnel and to the public to a level below 10 CFR 20 limits under operating conditions, and to a level below criterion 19, Appendix A, 10 CFR 50 recommendations under accident conditions.

#### 4.0 SURVEILLANCE REQUIREMENTS

Actions specified in this section are not required to be performed if during the specified surveillance period the reactor has not been brought critical or is maintained in a shutdown condition extending beyond the specified surveillance period. However, the surveillance requirements must be fulfilled prior to subsequent startup of the reactor.

#### 4.1 Reactivity Limits

##### Applicability

This specification applies to the surveillance requirements for reactivity limits.

##### Objective

To assure that reactivity limits for Specification 3.1 are not exceeded.

##### Specification

- a. Safety and control rod reactivity worths shall be measured annually, but at intervals not to exceed 16 months.
- b. Total excess reactivity and shutdown margin shall be determined annually, but at intervals not to exceed 16 months.
- c. The reactivity worth of an experiment shall be estimated or measured, as appropriate, before or during the first startup subsequent to the experiment's insertion.

##### Bases

The control and safety rods reactivity worths are measured annually to assure that no degradation or unexpected changes have occurred which could adversely affect reactor shutdown margin or total excess reactivity. The shutdown margin and total excess reactivity are determined to assure that the reactor can always be safely shut down with one rod not functioning and that the maximum possible reactivity insertion will not result in reactor periods shorter than those that can be adequately terminated by either operator or automatic action. Based on experience with AGN reactors, significant changes in reactivity or rod worth are not expected within a 16-month period.

## 4.2 Control and Safety Systems

### Applicability

This specification applies to the surveillance requirements of the reactor control and safety systems.

### Objective

To assure that the reactor control and safety systems are operable as required by Specification 3.2.

### Specification

- a. Safety and control rod scram times and average reactivity insertion rates shall be measured annually, but at intervals not to exceed 16 months.
- b. Safety and control rods and drives shall be inspected for deterioration at intervals not to exceed 2 years.
- c. A channel test of the following safety channels shall be performed prior to the first reactor startup of the day or prior to each reactor operation extending more than one day:

Nuclear Safety #1, #2, and #3

- d. A channel test of the seismic displacement interlock shall be performed semiannually.
- e. A channel check of the following safety channels shall be performed daily whenever the reactor is in operation:

Nuclear Safety #1, #2, and #3

- f. Prior to each day's reactor operation or prior to each reactor operation extending more than one day, safety rod #1 shall be inserted and scrammed to verify operability of the manual scram system.
- g. The period, count rate, and power level measuring channels shall be calibrated and set points verified annually, but at intervals not to exceed 16 months.
- h. The shield tank water level interlock, shield water temperature interlock and seismic displacement safety channel shall be tested by perturbing the sensing element to the appropriate set point. These tests shall be performed annually, but at intervals not to exceed 16 months.

### Specification

- a. All portable radiation survey instruments assigned to the reactor facility shall be calibrated under the supervision of the Radiological Safety Officer annually, but at intervals not to exceed 16 months.
- b. Prior to each day's reactor operation or prior to each reactor operation extending more than one day, the reactor room high radiation area alarm shall be verified to be operable. (See Article 3.4.e).
- c. A radiation survey of the reactor room, reactor control room, and accelerator room shall be performed under the supervision of the Radiological Safety Officer annually, but at intervals not to exceed 16 months, to determine the location of radiation and high radiation areas corresponding to reactor operating power levels.

### Bases

The periodic calibration of radiation monitoring equipment and the surveillance of the reactor room high radiation area alarm will assure that the radiation monitoring and control systems are operable during reactor operation. (See Article 3.4.e).

The periodic radiation surveys will verify the location of radiation and high radiation areas and will assist reactor facility personnel in properly labeling and controlling each location in accordance with 10 CFR 20.

## 5.0 DESIGN FEATURES

### 5.1 Reactor

- a. The reactor core, including control and safety rods, contains approximately 660 grams of U-235 in the form of <20% enriched  $UO_2$  dispersed in approximately 11 kilograms of polyethylene. The lower section of the core is supported by an aluminum rod hanging from a fuse link. The fuse melts at a fuse temperature of about  $120^{\circ}C$  causing the lower core section to fall away from the upper section reducing reactivity by at least 5%  $\Delta k/k$ . Sufficient clearance between core and reflector is provided to insure free fall of the bottom half of the core during the most severe transient.
- b. The core is surrounded by a 20 cm thick high density ( $1.75 \text{ gm/cm}^3$ ) graphite reflector followed by a 10 cm thick lead gamma shield. The core and part of the graphite reflector are sealed in a fluid-tight aluminum core tank designed to contain any fission gases that might leak from the core.
- c. The core, reflector, and lead shielding are enclosed in and supported by a fluid-tight steel reactor tank. An upper or "thermal column tank" may serve as a shield tank when filled with water or a thermal column when filled with graphite.

- d. The 6½ foot diameter, fluid-tight shield tank is filled with water constituting a 55 cm thick fast neutron shield. The fast neutron shield is formed by filling the tank with approximately 1000 gallons of water. The complete reactor shield shall limit doses to operating personnel in unrestricted areas to levels less than permitted by 10 CFR 20 under operating conditions.
- e. Two safety rods and one control rod (identical in size) contain less than 20 grams of U-235 each in the same form as the core material. These rods are lifted into the core by electromagnets, driven by reversible DC motors through lead screw assemblies. Deenergizing the magnets causes a spring-driven, gravity-assisted scram. The fourth rod or fine control rod (approximately one-half the diameter of the other rods) is driven directly by a lead screw. This rod may contain fueled or unfueled polyethylene.

## 5.2 Fuel Storage

Fuel, including fueled experiments and fuel devices not in the reactor, shall be stored in locked rooms in the nuclear engineering department laboratories. The storage array shall be such that  $K_{eff}$  is no greater than 0.8 for all conditions of moderation and reflection.

## 5.3 Reactor Room, Reactor Control Room, Accelerator Room

- a. The reactor room houses the reactor assembly and accessories required for its operation and maintenance.
- b. The reactor control room houses the reactor control console.
- c. The accelerator room is directly above the reactor room and a hole in the accelerator room floor provides access to the thermal column.
- d. The reactor room, reactor control room, and accelerator room are separate rooms in the Zachry Engineering Center, constructed with adequate shielding and other radiation protective features to limit doses in restricted and unrestricted areas to levels no greater than permitted by 10 CFR 20, under normal operating conditions, and to a level below criterion 19, Appendix A, 10 CFR 50 recommendations under accident conditions.
- e. The access doors to the reactor room, reactor control room, and accelerator room shall contain locks.

## 6.0 ADMINISTRATIVE CONTROLS

### 6.1 Organization

The administrative organization for control of the reactor facility and its operation shall be as set forth in Figure 1 attached hereto. The authorities and responsibilities set forth below are designed to comply with the intent and requirements for administrative controls of the reactor facility as set forth by the Nuclear Regulatory Commission.