



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 5 TO

FACILITY OPERATING LICENSE NO. R-127

MEMPHIS STATE UNIVERSITY

DOCKET NO. 50-538

Background

On March 15, 1985, Memphis State University (MSU) submitted an application, pursuant to 10 CFR 50.90, for a change of status from operating to possession-only for their 0.1 W AGN-201 Research and Training Reactor. The application included descriptions of current status and proposed facility modifications, revised technical specifications compatible with the possession-only status and a safety analysis of the facility modifications.

Facility Status

All fuel discs, including the small fuel discs inside the control rod fuel capsules, will be removed from the reactor in the presence of an NRC licensed Senior Operator and the MSU Radiation Safety Officer. The fuel discs will be placed into their original shipping/storage containers, sealed and stored in room 010 of the facility with area radiation monitors and alarms remaining operational. Less than 200 grams of U-235 will be stored in any one container to preclude criticality. The 10 mg radium-beryllium sealed neutron source will be removed from the reactor, placed into a shield container and stored in a shipping container in the reactor room. The aluminum core tank and control rod assemblies will be removed from the reactor and stored with covers and gaskets in place in the reactor room.

The reactor configuration during the possession-only status will be as follows: the thermal column tank, access port liner tubes, glory hole liner tube, control rod cover plate, graphite reflector cylinder, lead shielding, access port filler plugs and neutron detectors with interconnecting instrument cables will remain installed. The control rod cover plate will have a gasket to keep the reactor vessel sealed. The power cable to the reactor console control power circuits will be disconnected and removed. The radiation monitor and alarm in the reactor room will remain operational.

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The shield tank and thermal column tank water will be sampled for radioactivity and drained according to approved procedures in the MSU AGN-201 Maintenance and Storage Manual. Prior to storage, the reactor vessel interior including the core tank and fuel capsules will be thoroughly surveyed for residual radioactivity and loose surface contamination. Surface contamination in excess of acceptable concentrations will be clearly identified and documented for future reference. The reactor room and control room will remain locked at all times when authorized personnel are not present.

The technical specifications and the administrative organization will be modified to reflect the possession-only status. Technical specifications addressing performance, safety, surveillance and reporting related to reactor operation will be deleted. Technical specifications addressing fuel storage, monitoring and surveillance, staff and public safety, and related reporting requirements will be retained.

#### Evaluation

Fuel removal will be supervised and will conform with the defueling procedures approved by both the Reactor Safety Committee and the Radiation Safety Subcommittee of MSU. The fuel storage scheme provides for prevention of criticality, reactivity changes and radioactivity releases. Removal of fuel and rod control assemblies assures that the reactor and control systems cannot be operated. Removal of all liquids from the shield tank and thermal column tank will minimize long-term corrosion of the reactor structures. As fuel is still on site, the area radiation monitors and alarms will remain operational in the reactor room and in the fuel storage area. Radiation surveys will identify surface contamination levels that are greater than acceptable for unrestricted access and such areas will be properly documented and posted. Restoration of the reactor vessel, core tank and fuel capsules to their designed liquid-tight integrity will assure containment of any trace residual radioactivity. Physical barriers housing these components will not be open for unrestricted access and shall remain locked at any time authorized personnel are not present. The revised technical specifications reflect the possession-only status of the reactor facility and will continue to assure the health and safety of the reactor staff and the public.

#### Environmental Consideration

This amendment involves changes in the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20 and changes in inspection and surveillance requirements. The staff has

determined that the amendment involves no significant hazards consideration (as discussed below), there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite, and there is no significant increase in individual or cumulative occupational radiation exposure. Accordingly, this amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of this amendment.

#### Conclusion

Accordingly, the staff concludes that amendment of this license to a possession-only status is appropriate. We have further concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of accidents previously evaluated, does not create the possibility of a new or different kind of accident from any accident previously evaluated, and does not involve a significant reduction in a safety margin, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by the proposed activities, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or the the health and safety of the public.

Principal Contributor: Angela Chu

Dated: May 23, 1985

ATTACHMENT TO LICENSE AMENDMENT NO. 5

FACILITY LICENSE NO. R-127

DOCKET NO. 50-538

Revised Appendix A technical specifications are as follows:

Remove Pages

All pages

Insert Pages

New pages

APPENDIX A

LICENSE NO. R-127

TECHNICAL SPECIFICATIONS

FOR

MEMPHIS STATE UNIVERSITY AGN-201 (SERIAL 108)

DOCKET NO. 50-538

DATE: MAY 1985

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## 1.0 DEFINITIONS

- 1.1 Measuring Channel - A measuring channel is the combination of sensors, lines, amplifiers, and output devices which are connected for the purpose of measuring or responding to the value of a process variable.
- 1.2 Safety Channel - A safety channel is a measuring channel in the reactor safety system.
- 1.3 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.
- 1.4 Reactor Component - A reactor component is any apparatus, device, or material that is a normal part of the reactor assembly.
- 1.5 Operable - Operable means a component or system is performing its intended function in its normal manner.
- 1.6 Operating - Operating means a component or system is performing its intended function in its normal manner.
- 1.7 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.
- 1.8 Channel Test - A channel test is the introduction of a signal into the channel to verify that it is operable.



1.9 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.

1.10 Reactor Secured - The reactor shall be considered secured when:

- (1) It contains insufficient fissile material or moderator present in the reactor, adjacent experiments or control rods, to attain criticality under optimum available conditions of moderation and reflection, or
- (2) No work is in progress involving core fuel, control rods or control rod drives unless they are physically decoupled from the reactor, and
- (3) The console key switch is in the off position and the key is removed from the lock.

1.11 Mothball - The reactor facility is considered to be in a mothballed condition when the facility is in a state of protective storage. The facility may be left intact except that all fissionable materials, radioactive wastes, and radioactive fluids shall be removed from the reactor room. The reactor fuel shall be in storage containers and located in a remote fuel storage area in accordance with an approved fuel storage plan. Appropriate surveillance, radiation monitoring, and security procedures are established under a possession-only license to ensure that the health and safety of the public is not endangered.

## 2.0 SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

Not Applicable. The reactor shall remain secured and the facility shall be in mothball status.



### 3.0 LIMITING CONDITIONS FOR OPERATION

Not Applicable. The reactor shall remain secured and the facility shall be in mothball status.

### 4.0 SURVEILLANCE REQUIREMENTS

Actions specified in this section are applicable to the mothballed condition of the facility and shall be performed within the specified surveillance period.

#### 4.1 Facility Support and Protection Systems

##### Applicability

This specification applies to the facility support and protection systems such as physical barriers, fire protection systems, and radiation monitoring activities.

##### Objective

To assure that the public health and safety are not endangered as a result of physical degradation of the facility during the term of the possession-only license period.

##### Specification

- a. Physical barriers to unauthorized entrance into the reactor facility and fuel storage area, e.g., building, rooms, doors, and access openings, shall be visually inspected at least once each calendar quarter (intervals not to exceed four months).
- b. Fuel storage containers, container locking rings, and seals shall be visually inspected at least once each calendar quarter (intervals not to exceed four months).

- c. A radiation survey of the reactor facility and fuel storage area shall be performed at least once each calendar quarter (intervals not to exceed four months).
- d. The reactor building fire alarm system, area fixed radiation monitors and alarms, and reactor room smoke detector, shall be tested annually (intervals not to exceed fifteen months).

### Bases

The physical barriers, e.g. building, rooms doors, and access openings are inspected to assure that these barriers have not deteriorated and that locks and locking apparatus are intact.

Storage containers, container locking rings, and seals are inspected to assure integrity of the containers. This inspection, in conjunction with radiation surveys of the reactor facility and fuel storage area, verifies that radioactive material has not been removed from the containers or is not escaping or being transported through the containment barriers. In addition, the radiation surveys and continued operational radiation monitors and alarms provide assurance that radiation doses to facility personnel and to the public are maintained at a level below 10 CFR 20 limits.

Tests of the reactor building fire alarm system, area fixed radiation monitors and alarms, and reactor room smoke detector verify that these systems are operable.

## 5.0 DESIGN FEATURES

### 5.1 Mothball Status of the Reactor

During a mothballed state of protective storage:

- a. The reactor is defuelled and assembled with the Thermal Column Tank, Access Port Liner Tubes, Glory Hole Liner Tube, and Rod Drive Area Cover Plate installed and gasketed to maintain the design fluid-tight integrity. The graphite reflector cylinder, lead shielding, and access port filler plugs are in place. The Shield Tank and Thermal Column Tank are empty of fluids and dry.
- b. The defuelled aluminum core tank and safety and control rod fuel capsules are removed from the reactor assembly and are sealed to maintain design fluid-tight integrity.
- c. All fissionable material used in connection with operation of the reactor is stored in 6J drums, containing less than 200 grams of U-235 each, and is located in a designated, controlled fuel storage area in accordance with paragraph 5.2 of these technical specifications.
- d. Fixed radiation monitors and alarms in the reactor room and fuel storage area will remain functional.

## 5.2 Fuel Storage

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

## 6.0 ADMINISTRATIVE CONTROLS

6.1 Organization, Responsibilities and Authority. Responsibility for protective storage of the reactor facility shall be with the organization shown in Figure 1 of this section. Individuals at the various management levels shall be responsible for safeguarding the public and facility personnel from undue radiation exposures and for adherence to all requirements of the facility license. Assignment of specific responsibilities shall be as described in the following paragraphs.

6.1.1 President. The President of Memphis State University is the Chief Administrative Officer ultimately responsible to the Tennessee State Board of Regents for the university and its activities. The President is responsible for the reactor facility license.

6.1.2 Vice President for Advancement and Continuing Education. The Vice President for Advancement and Continuing Education is the Administrative Officer directly responsible to the President for maintenance, security and access control, administration, and safety of the reactor facility and fuel storage area. The Vice President may, in this capacity, represent the President in matters pertaining to the facility license and, within limitations set forth by the license, have final approval authority and responsibility for decisions, policies, procedures, and events that would affect the facility, the reactor, reactor components, and reactor fuel. The Vice President for Advancement and Continuing Education shall be responsible for official communications concerning the reactor facility and fuel storage area including all required reports and retention of facility records.

The Vice President for Advancement and Continuing Education shall be advised by the Radiation Safety Subcommittee in all facility matters involving risks to personnel health and safety from ionizing radiation and shall be advised by the Director, MSU Safety and Security Services, in all matters involving physical security of the facility and reactor fuel. The Vice President may appoint personnel having the appropriate qualifications, as necessary, to positions reporting directly to him for purposes of executing requirements of the facility license and assuring safe storage of the facility.

- 6.1.3 Radiation Safety Subcommittee. The Radiation Safety Subcommittee (RSSC) is a subcommittee of the University Standing Committee on Safety (University Safety Committee) whose members are appointed by the President. The RSSC is formed to administer the Radiation Safety Program for the university. In this capacity, the RSSC shall be responsible and have approval authority for all procedures, policies, and activities which involve risks to the health and safety of personnel from ionizing radiation. The RSSC shall advise the Vice President for Advancement and Continuing Education in radiation control and safety matters related to the reactor facility and fuel storage area and shall be informed by the Office of the Vice President of the status and locations of radioactive materials and of any activities involving personnel exposure to ionizing radiation within these facilities.

The Radiation Safety Subcommittee shall hold meetings and shall be responsible for independent reviews and audits of surveillance and maintenance activities including radiation surveys. Based upon these reviews and audits, the RSSC shall make appropriate recommen-

ditions to the Vice President for Advancement and Continuing Education to assure that the state of the facility does not endanger the health and safety of the public.

- 6.1.4 Radiation Safety Officer. The Radiation Safety Officer (RSO) is a member of the Radiation Safety Subcommittee and is empowered to enforce regulations and regulatory procedures established by the university, federal agencies, and state agencies for the control of radioactive materials and protection of personnel from ionizing radiation. The RSO shall be responsible for the performance of radiation surveys and shall maintain survey records in connection with the reactor facility and fuel storage area. In addition to routine surveillance activities delineated in these Technical Specifications, the RSO shall maintain materials inventory records and records of personnel exposures to ionizing radiation. The RSO shall inform the Vice President for Advancement and Continuing Education, in writing, of surveillance and inspection results within 14 days of completing such activities.

The Radiation Safety Officer shall be responsible for and shall supervise activities involving the movement of radioactive materials within the facility and/or the packaging and shipment of radioactive materials off-campus. The RSO shall be directly responsible for the proper identification and posting of restricted areas within the reactor facility and fuel storage area.

- 6.1.5 Director, Security and Safety Services. The Director of Security and Safety Services is the management official directly responsible for the physical security of university property and the enforcement of university security and safety regulations on the MSU South



Campus. In this capacity, the Director of Security and Safety Services shall provide the services and trained security officers necessary to implement the facility security plan approved as part of this license to assure protective storage of the reactor and fuel. He shall advise the Vice President for Advancement and Continuing Education in matters involving physical security and access control of the reactor facility and fuel storage area and shall be informed of personnel authorized for access by the Office of the Vice President.

6.2 Radiation Safety Subcommittee Meetings, Reviews, Audits, and Records

6.2.1 Qualifications. The Radiation Safety Subcommittee is established as a subcommittee of the University Safety Committee. Members of the University Safety Committee are appointed by the President. The Subcommittee is appointed by the Chairperson of the University Safety Committee and includes a chairperson, the University Safety Director, the Radiation Safety Officer and several members selected on the basis of their expertise in radiation safety and related matters. The Subcommittee is empowered to meet and keep minutes independently of the University Safety Committee and with the authority to administer the university's radiation safety program.

6.2.2 Meetings and Quorum. The Radiation Safety Subcommittee shall meet as necessary but at least once each calendar quarter (intervals not to exceed four months). A quorum for review and approval functions shall consist of the chairperson, or designated alternate, and two other members.



6.2.3 Reviews. The Radiation Safety Subcommittee shall review:

- a. All procedures and major revisions thereto pertaining to the reactor facility and fuel storage area and which have radiological safety significance, or include changes to facility equipment or systems, or affect authorized personnel access to the facility.
- b. Proposed changes to the facility license, technical specifications, or charter.
- c. Violations of the license, technical specifications, or charter.
- d. Reportable occurrences listed in 6.4.
- e. Abnormalities in, or deviations from, the normal and expected status of facility equipment and protective barriers.

6.2.4 Audits. The Radiation Safety Subcommittee shall conduct audits that include selective (but comprehensive) examination of facility and fuel storage area records, logs, and other documents. Discussions with cognizant personnel and observation of activities should also be conducted as appropriate. In no case shall the individual immediately responsible for an area perform the audit in that area. The following items shall be audited:

- a. Facility surveillance, and maintenance for conformance to the Technical Specifications and applicable license conditions, at least once per calendar year (intervals between audits not to exceed fifteen months).

- b. The results of actions taken to correct deficiencies that may occur in reactor facility and fuel storage area equipment, systems, structures, and radioactive materials storage containers, at least once per calendar year (intervals between audits not to exceed fifteen months).
- c. The reactor facility and fuel storage area security plan and implementing procedures, at least once every other calendar year (intervals between audits not to exceed 30 months).
- d. The reactor facility and fuel storage area emergency plan and implementing procedures, at least once every other calendar year (intervals between audits not to exceed 30 months).

6.2.5 Records and Reports. The Chairperson of the Radiation Safety Subcommittee shall ensure that records of the committee's activities are prepared, distributed, and retained as follows:

- a. Minutes of each Radiation Safety Subcommittee meeting shall be prepared and retained on file in the University Radiation Safety Office. A copy of these minutes shall be forwarded to the Vice President for Advancement and Continuing Education within 30 days following each meeting.
- b. A written report or minutes of the findings and recommendations of each review group shall be prepared and submitted to the Vice President for Advancement and Continuing Education and all Radiation Safety Subcommittee Members in a timely manner after the review has been completed. A copy of each report shall be retained on file in the University Radiation Safety Office.

- c. Deficiencies uncovered that affect radiation safety or protective storage of the reactor or reactor fuel shall be immediately reported to the Vice President for Advancement and Continuing Education. A written report of the findings of each audit shall be submitted to the Vice President and all Radiation Safety Subcommittee Members within three months after the audit has been completed. A copy of all audit reports shall be retained on file in the University Radiation Safety Office.
  
- d. The Chairperson of the Radiation Safety Subcommittee shall submit an annual report to the President prior to March 31, of each calendar year. The report shall contain an assessment of the facility's suitability for continued protective storage of radioactive materials, including the reactor fuel, and any appropriate recommendations. Copies of this report shall be submitted to the Vice President for Advancement and Continuing Education and retained on file in the University Radiation Safety Office.

6.3 Procedures and Procedure Approvals.

6.3.1 Procedures. There shall be written procedures for the following.

- a. Surveillance and testing of equipment and systems required for protective storage of the reactor and reactor fuel.
  
- b. Personnel radiation protection consistent with 10 CFR 20.
  
- c. Access control to the reactor facility and fuel storage area.

- d. Implementation of the security plan and emergency plan.
- e. Notification of the proper authorities in the event of unauthorized entries of personnel into the facility and significant changes in the radiation or contamination levels within the facility.

6.3.2 Procedure Approvals. The Vice President for Advancement and Continuing Education shall have final approval authority for all procedures in connection with the reactor facility and fuel storage area. The Radiation Safety Subcommittee shall review and have approval authority for those procedures which may include risks to the health and safety to personnel from ionizing radiation in addition to those reviews specified in 6.2.3. The Director of Security and Safety Services shall review and have approval authority for procedures written to implement the security plan and emergency plan.

#### 6.4 Reporting Requirements

- 6.4.1 Annual Report. An annual report describing the status of the facility, the results of environmental and facility radiation surveys, an evaluation of the performance of security and surveillance measures, personnel exposures to radiation, and any abnormal occurrences during the previous calendar year shall be submitted to the Director of Nuclear Reactor Regulation, ATTN: Document Control Desk, with a copy of the Regional Administrator, Region II, prior to March 31, of each calendar year.
- 6.4.2 Reportable Occurrences. Reportable occurrences shall be reported as expeditiously as possible by telephone and confirmed by telegraph, mailgram or facsimile transmission to the Administrator of NRC Region II, or his representative, no later than

the first work day following the event. A written followup report describing the reportable occurrence including causes, probable consequences, corrective actions, and measures to prevent recurrence shall be submitted within 14 days. Information provided shall contain narrative material for a complete explanation of circumstances surrounding the event. The following events shall be reported:

- a. Discovery of significant, unexplained increase in radiation or contamination levels within or around the reactor facility or fuel storage area.
- b. Abnormal degradation discovered in protective barriers for the reactor facility or fuel storage area which would compromise the physical security established for protective storage of the reactor and reactor fuel.

6.4.3 Special Reports. Special reports which may be required by the Nuclear Regulatory Commission shall be submitted to the Director of Nuclear Reactor Regulation, ATTN: Document Control Desk, with a copy to the Administrator, Region II, within the time period for each report.

6.5 Records Retention.

6.5.1 Records. Records or logs relative to the following items shall be kept and retained until the license is terminated, unless otherwise specified by the NRC:

- a. Environmental surveys.
- b. Facility radiation surveys.
- c. Inspections of physical barriers.
- c. Abnormal occurrences.
- e. Records of meetings of the Radiation Safety Subcommittee.

6.5.2 Prior Facility Operation.

6.5.2.1 Records or logs relative to the following items shall be retained for a period of at least five years:

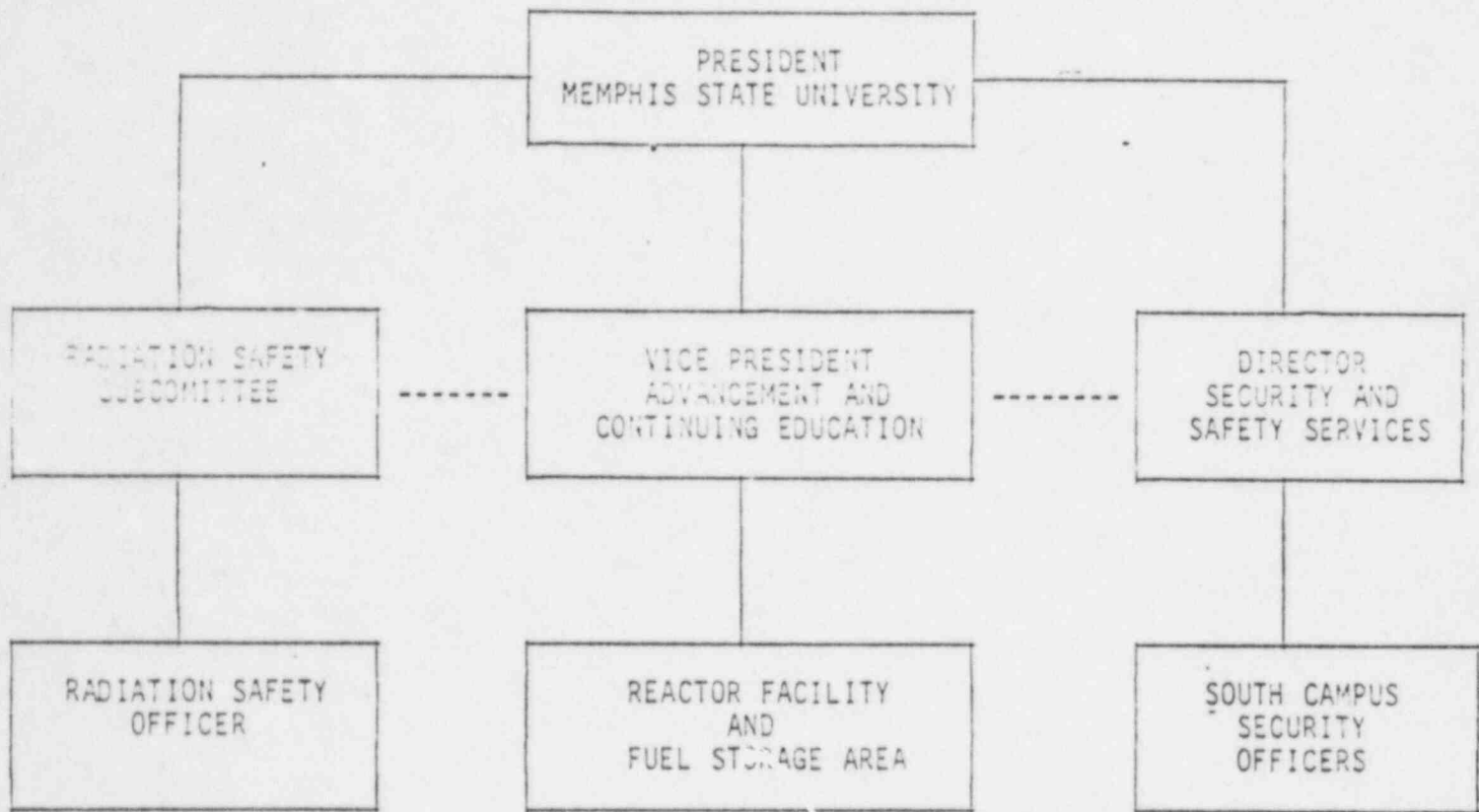
- a. Operating logs or data which shall identify:
  1. Completion of pre-startup checkout, start-up, power changes, and shutdown of the reactor.
  2. Installation or removal of fuel elements, control rods, or experiments that could affect core reactivity.
  3. Installation or removal of jumpers, special tags or notices, or other temporary changes to reactor safety circuitry.
  4. Rod worth measurements and other reactivity measurements.
- b. Principal maintenance operations.
- c. Reportable occurrences.
- d. Surveillance activities required by technical specifications.
- e. Facility radiation and contamination surveys.
- f. Experiments performed with the reactor.
- g. Changes to operating procedures.



6.5.2.2 Records or logs relative to the following items shall be retained for the life of the facility, unless otherwise specified by the NRC:

- a. Gaseous and liquid radioactive effluents released to the environs.
- b. Appropriate off-site environmental monitoring surveys.
- c. Fuel inventories and fuel transfers.
- d. Radiation exposures for all personnel.
- e. Updated as-built drawings of the facility.
- f. Records of transient or operational cycles for those components designed for a limited number of transients or cycles.
- g. Records of training and qualifications for members of the facility staff.
- h. Records of reviews performed for changes made to procedures or equipment or reviews of tests and experiments pursuant to 10 CFR 50.59.
- i. Records of meetings of the Reactor Safety Committee.





\_\_\_\_\_ Direct Line of Authority  
 - - - - - Advisory/Assistance Capacity

FIGURE 1. REACTOR FACILITY ORGANIZATION FOR "POSSESSION-ONLY" STATUS