Application Material (September 1980)
Docket 50-157

ATTACHMENT B.

# PROPOSED AMENDMENT NO. 8

# TO

# TECHNICAL SPECIFICATIONS

# AND

# LICENSE R-80

September 1980

Cornell University
Ward Laboratory of Nuclear Engineering
Ithaca, New York 14853

PROPOSED AMENDMENT NO. 8 TO LICENSE R-80

(1) Amend paragraph 2.B.(2) to license Cornell University to receive, possess, and use up to 4.0 kilograms of contained U-235 with enrichment greater than 10% but less than 20%, up to 0.080 kilograms of contained U-235 with enrichment greater than 20% (neither of which amounts are exempt) and up to 35 grams of Pu-239 in sealed plutonium-beryllium neutron sources (an amount which is exempt under 10 CFR 73.67(b)(1)(ii)).

(2) Amend paragraph 2.C.(1) to authorize operation at steady state power levels up to 500 kilowatts (thermal).

Explanatory notes:

(a) The additional plutonium allowances under the existing license are no longer needed as Cornell University no longer possesses or expects to possess those materials.

(b) The amounts of SNM given above are slightly different from those stated in our letter to Robert W. Reid dated September 6, 1980; the differences are intended to provide a slightly greater flexibility in experimental programs.

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ATTACHMENT TO LICENSE AMENDMENT NO. 8

FACILITY LICENSE NO. R-80

DOCKET NO. 50-157

Replace the following pages of the Appendix A Technical Specifications with the enclosed pages. The revised pages are identified by Amendment No. and contain vertical lines indicating the area of change.

| Remove | Insert |
|---|---|
| i | i |
| 7 | 7 |
| 8 | 8 |
| 11 | 11 |
| 14 | 14 |
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| 18 | 18 |
| 18a | 18a |
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3. LIMITING CONDITIONS FOR OPERATION

3.1 Reactivity

Applicability

These specifications apply to the reactivity condition of the reactor, and to the reactivity worths of control rods and experiments, and apply for both modes of reactor operation. Reactivity limits on experiments are specified in Section 3.8.

Objectives

The objectives are to assure that the reactor can be shut down at all times and to assure that the fuel temperature safety limit will not be exceeded.

Specifications

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

a. The reactor is subcritical by more than \$0.50 when in the cold, xenon-free condition, and (1) the highest worth control rod is fully withdrawn, (2) the highest worth non-secured experiment is in its most positive reactive state, and (3) secured experiments with movable parts are each in its most reactive state.

b. The reactivity with all control rods fully withdrawn is known to be less than the following when the reactor is cold and xenon-free and no experiments that affect reactivity are in place: \$3.50 in the case of any aluminum clad fuel in the B, C, D, or E rings and \$4.00 in the case of a stainless steel clad core with no aluminum clad fuel except in the E ring.

Bases

The shutdown margin required by specification 3.1a is necessary so that the reactor can be shut down from any operating condition and remain shut down after cooldown and xenon decay even if one control rod (including the transient control rod) should remain in the fully withdrawn position).

The values chosen are intended to limit the fuel temperature to < 1000°C for the stainless steel clad fuel and < 550°C for the aluminum clad fuel in the event of inadvertent or accidental pulsing of the reactor.

3.2 Steady State Operation

Applicability

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

Objective

The objective is to prevent the fuel temperature safety limit from being exceeded during steady state operations and to prevent inadvertent pulse operation of the reactor while it is at a high steady state power level.

Specification

a. The reactor shall not be operated in the steady state mode at power levels above 500 kW.

b. The reactor shall not be operated in the steady state mode at power levels above 10 kW unless, in addition to the conditions of section 3.1, the transient rod is fully withdrawn.

Bases

a. The Cornell TRIGA Hazards Analysis (Supplement 1, 1980) is based on power levels up to 500 kW.

b. At power levels of 10 kW or below, the steady state fuel temperature is small compared to the temperature rise caused by a pulse of $3.00 or less.

3.3 Pulse Operation

Applicability

These specifications apply to operation of the reactor in the pulse mode.

Objective

The objective is to prevent the fuel temperature safety limit from being exceeded during pulse mode operation.

Specifications

The reactor shall not be operated in the pulse mode unless, in addition to the requirements of section 3.1, the following conditions exist:

a. The transient rod is set such that the reactivity insertion upon its withdrawal is equal to or less than $2.00 in the case of any aluminum clad fuel in the B, C, D, or E rings and $3.00 in the case of a stainless steel clad core with no aluminum clad fuel except in the F ring.

b. The steady state power level of the reactor is not greater than 10 kW.

Bases

These reactivity values limit the fuel temperature to $<1000^{\circ}C$ for stainless steel clad fuel and $<550^{\circ}C$ for aluminum clad fuel. Specification 3.3b is intended to prohibit pulsing from a high steady state power level such that the final peak temperature might exceed the safety limit.

b. The drop time of a standard control rod from the fully withdrawn position of 90 percent of full reactivity insertion is less than one second.

Bases

The fuel temperature scram provides the protection to assure that if a condition results in which the limiting safety system setting is exceeded, an immediate shutdown will occur to keep the fuel temperature below the safety limit. The power level scram is provided as added protection against abnormally high fuel temperature and to assure that reactor operation stays within the licensed limits. The manual scram allows the operator to shut down the system if an unsafe or abnormal condition occurs. The interlock to prevent startup of the reactor with less than one count per second indicated on the startup channel assures that sufficient neutrons are available to assure proper startup of the reactor. The control rod position interlock will prevent the withdrawal of the transient rod in the steady state mode to prevent inadvertent pulses.

3.6 Release of Argon-41

Applicability

This specification applies to the release of radioactive argon-41 from the facility exhaust system to unrestricted areas.

Objective

The objective is to assure that exposures to the public resulting from the release of argon-41 generated by reactor operation will not exceed the limits of 10 CFR Part 20 for unrestricted areas, the ALARA (as low as reasonably achievable) levels of 10 CFR 50 App. I, and the levels of ANS standard 15.12.

Specification

Releases of argon-41 from the reactor bay exhaust plenum to an unrestricted environment shall not exceed 32 Ci/year.

Bases

The Cornell TRIGA Hazards Analysis (Supplement 1, 1980) shows that the release of 32 Ci/year of argon-41 would result in no more than 10 mrem/yr exposure to any person in the unrestricted area and this is only 2% of the allowable releases that would meet 10 CFR 20 requirements.

3.7 Ventilation System

Applicability

This specification applies to the operation of the reactor room ventilation exhaust system.

Specification

A fuel element indicating an elongation greater than 1/8 of an inch over its as manufactured length or a lateral bending greater than 1/8 of an inch shall be considered to be damaged and shall not be used in the core for further operation.

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 clad integrity is important since it represents the only process barrier for the TRIGA reactor.

3.10 Reactor Pool Water

Applicability

This specification applies to the water contained in the Cornell TRIGA Reactor Pool.

Objective

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

Specifications

The Cornell TRIGA shall be placed in the shutdown condition if:

a. The water temperature exceeds 130°F.

b. The water conductivity exceeds 5 μmho/cm averaged over one month.

c. The water level above the core is below 18 1/2 feet as measured from the top of the core.

Bases

The water temperature of the reactor pool is limited by the resin used in the Mixed Bed Deionizer.

High water conductivity over a prolonged period indicates possible corrosion, demineralizer degradation, or slow leakage of fission products.

A reactor pool level of 18 1/2 feet is adequate to providing shielding during power operations.

## 4. SURVEILLANCE REQUIREMENTS

### 4.1 Fuel

Applicability

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

Objective

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

Specification

The standard fuel elements shall be visually inspected for corrosion and mechanical damage and measured for length and bend at intervals separated by not more than 500 pulses of magnitude equal to or less than a pulse insertion of $3.00, or following the exceeding of a Limiting Safety System Setpoint. Elements from the B, C, D, E, and F rings comprising approximately 1/3 of the core shall be inspected annually, but not to exceed 14 months. The selection of elements each year shall be such that the entire core shall be inspected at three year intervals, but not to exceed 38 months.

Bases

The most severe stresses induced in the fuel elements result from pulse operation of the reactor, during which differential expansion between the fuel and the cladding occurs and the pressure of the gases within the elements increases sharply.

### 4.2 Control Rods

Applicability

This specification applies to the surveillance requirements for the transient and standard control rods.

Objective

The objective is to assure the integrity of the control rods and to assure that their worth are within prescribed limits

Specifications

a. The reactivity worth of each control rod shall be determined annually, but at intervals not to exceed fourteen months, or following a change in core configuration unless the control rods have been previously calibrated for the particular core configuration.

b. Control rod drop times shall be determined annually, but at intervals not to exceed fourteen months.

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

4.6 Reactor Pool Water

Applicability

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

Objective

The objective is to provide surveillance of reactor pool level, temperature, and conductivity.

Specifications

a. The water level in the reactor pool shall be checked daily during periods when the reactor is in operation.

b. The temperature of the reactor pool water shall be checked daily during periods when the reactor is in operation.

c. The conductivity of the reactor pool water shall be measured and recorded daily during periods when the reactor is in operation.

Bases

Surveillance of the reactor pool will assure that the water level is adequate prior to reactor operation. Water temperature must be checked to assure that the limit of the deionizer will not be exceeded.

Water conductivity must be checked to assure that the demineralizer is performing properly and to detect any increase in water impurities.

4.7 Special Nuclear Materials

Applicability

This specification applies to the surveillance requirements for the sealed plutonium source material.

Objective

The objective is to assure that leakage from sealed plutonium sources does not exceed allowable limits.

Specification

a. Each plutonium source shall be tested for leakage at intervals not to exceed six (6) months. In the absence of a certificate from a transferor indicating that a test has been made within six (6) months prior to the transfer, the sealed source shall not be put into use until tested.

b. The test shall be capable of detecting the present of 0.005 microcurie of alpha contamination on the test sample. The test sample shall be taken from the source or from appropriate accessible surfaces of the device in which the sealed source is permanently or semipermanently mounted or stored. Records of leak test results shall be kept in units of microcuries and maintained for inspection by the Commission.

c. If the test reveals the presence of 0.005 microcurie or more of removable alpha contamination, the licensee shall immediately withdraw the sealed source from use and shall cause it to be decontaminated and repaired by a person appropriately licensed to make such repairs or to be disposed of in accordance with Commission regulations. Within five (5) days after determining that any source has leaked, the licensee shall file a report with the Director of the Office of Inspection and Enforcement, NRC, describing the source, the test results, the extent of contamination, the apparent or suspected cause of source failure, and the corrective action taken. A copy of the report shall be sent to the Director of the nearest NRC Regional Inspection and Enforcement Office listed in Appendix D of Title 10, Code of Federal Regulations, Part 20.

d. The periodic leak test required by this condition does not apply to sealed sources that are stored and not being used. The sources excepted from this test shall be tested for leakage prior to any use or transfer to another person unless they have been leak tested within six (6) months prior to the date of use or transfer.

Bases

Surveillance of the sealed plutonium source material will ensure that the total body or individual organ irradiation does not exceed allowable limits in the event of ingestion or inhalation of the probable leakage from the source material.

4.8 Pool Water Quality

This specification applies to the water contained in the Cornell TRIGA Reactor Pool.

Objective

The objective is to assure that the pH of the pool water is maintained at an acceptable level and to give warning of a buildup of radionuclides in the pool water.

Specification

Semiannually, at intervals not to exceed eight months, the pool water shall be analyzed for pH and the presence of radionuclides.

Bases

Surveillance of the pool water will ensure that the corrosion rate of reactor components is kept to a minimum and that information is available for detection of a crud burst or failure of a fuel element.

## 6. ADMINISTRATIVE CONTROLS

### 6.1 Organization and Responsibilities of Personnel

a. The TRIGA reactor facility shall be an integral part of the J. Carlton Ward, Jr., Laboratory of Nuclear Engineering in the Nuclear Science and Engineering Program of the College of Engineering of Cornell University. The reactor organization shall be related to the University structure as shown in Chart I.

b. The Director of the Nuclear Science and Engineering Program shall be responsible for the appointment of responsible and competent persons as members of the Ward Laboratory Safety Committee and as Director of Ward Laboratory, subject to the approvals delineated below.

c. The Ward Laboratory (including but not limited to the TRIGA reactor) shall be under the supervision of the Laboratory Director, who shall have overall responsibility for safe, efficient, and competent use of its facilities in conformity with all applicable laws, regulations, terms of facility licenses, and provisions of the Ward Laboratory Safety Committee. He shall also have responsibility for maintenance and modification of Laboratory facilities. He shall hold a professorial rank in the Nuclear Science and Engineering Program and shall be appointed by the Director of the Program with the approval of the Dean of the College of Engineering. He shall report to the Director of the Program.

d. The Reactor Supervisor shall serve as the deputy of the Laboratory Director in all matters relating to the enforcement of established rules and procedures (but not in matters such as establishment of rules, appointments, and similar administrative functions). He should have at least two years of technical training beyond high school and shall possess a Senior Operator's license. He shall have had reactor operating experience and have a demonstrated competence in supervision. He shall be appointed by the Laboratory Director with the approval of the Program Director, and shall report to the Laboratory Director.

e. The Responsible Person on Duty shall be responsible for enforcing all applicable rules, procedures, and regulations while he is on duty, for ensuring adequate exchange of information between operating personnel when shifts change, and for reporting all malfunctions, accidents, and other potentially hazardous occurrences and situations to the Reactor Supervisor and/or Laboratory Director. Responsible Persons shall possess a Senior Operator's license, shall be appointed by the Laboratory Director with the approval of the Laboratory Safety Committee, and shall report to the Reactor Supervisor.

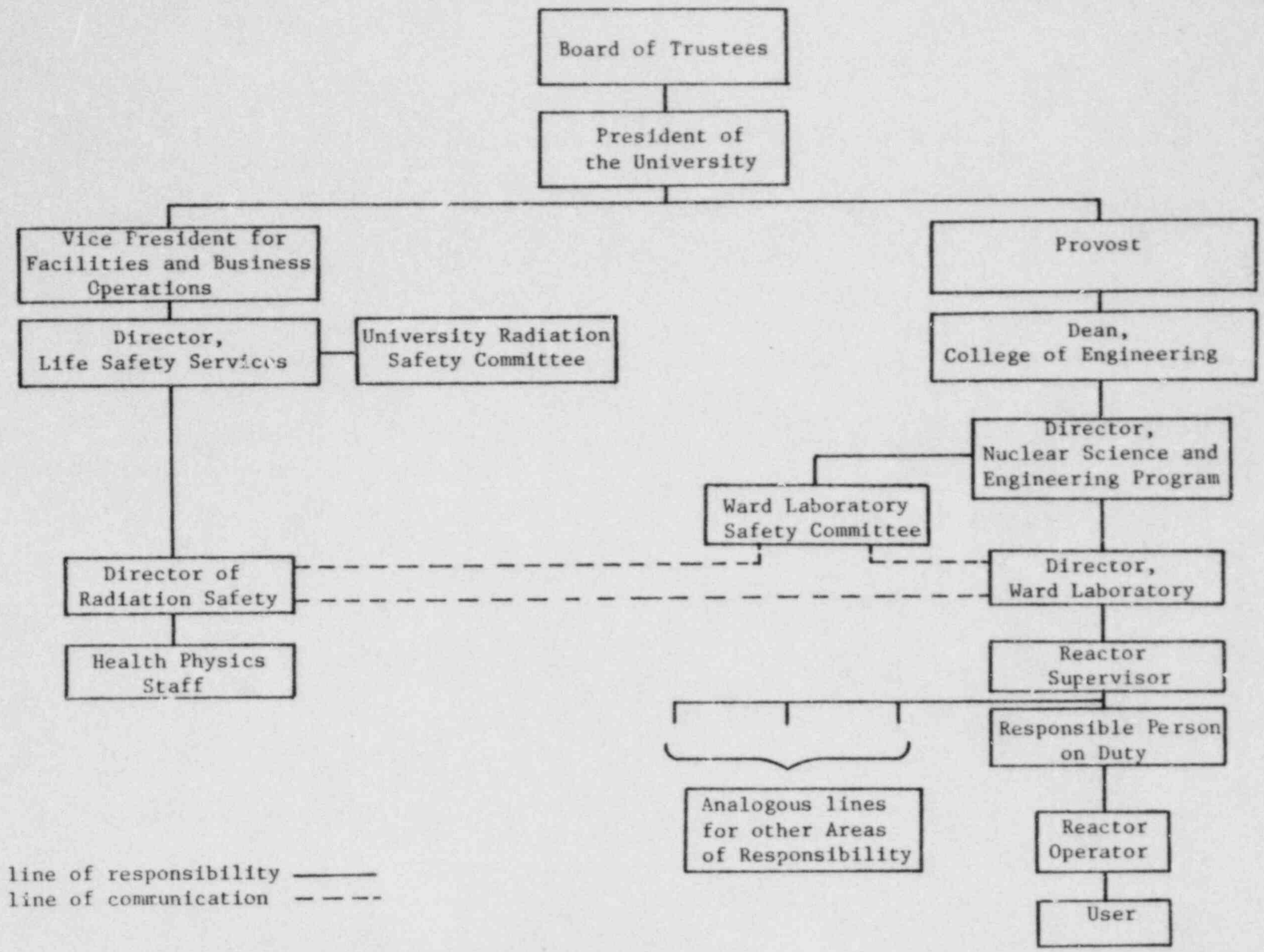


Chart I. Organizational Structure

9. Approval of appointments of Responsible Persons.

c. The Committee shall be composed of:

(1) two persons proficient in reactor and nuclear physics,
(2) two persons proficient in chemistry or chemical engineering,
(3) one person proficient in radiation biology,
(4) the Laboratory Director, ex officio,
(5) the Director of Radiation Safety or his deputy, ex officio, and
(6) the Director of the Nuclear Science and Engineering Program or his deputy, ex officio.

The same individual may serve under more than one category above, but the minimum membership shall be seven. All members (except the Director of Radiation Safety) shall be chosen from the faculty.

d. The Committee shall have a written statement defining its authority and responsibilities, the subjects within its preview, and other such administrative provisions as are required for its effective functioning. Minutes of all meetings and records of all formal actions of the Committee shall be kept.

e. The chairman of the Committee shall be elected by the Committee from its members, except that the Laboratory Director shall not serve as chairman. A quorum shall consist of not less than a majority of the full Committee and shall include the chairman or his designee.

f. The Committee shall meet a minimum of three times a year.

## 6.3 Procedures

a. Written procedures, reviewed and approved by the Ward Laboratory Safety Committee, shall be followed for the activities listed below. The procedures shall be adequate to assure the safety of the reactor, persons within the Laboratory, and the public, but should not preclude the use of independent judgment [illegible]tion should the situation require it.

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

(a) startup checkout procedures to test the reactor instrumentation and safety systems, area monitors, and continuous air monitors, and

(b) shutdown procedures to assure that the reactor is secured before operating personnel go off duty.

2. Installation or removal of fuel elements, control rods, and other core components that significantly affect reactivity or reactor safety.

(a) pressure change
(b) temperature change
(c) collapse, implosion, or explosion
(d) change of state of sample during irradiation
(e) chemical reactions (including corrosion)
(f) leakage of radioactive material (double encapsulation is sometimes required)
(g) radiation levels and personnel exposure upon removal of sample
(h) internal and external radiation hazards to personnel in proposed operations subsequent to sample removal
(i) radiation levels in accessible areas during reactor operation (e.g., for beam experiments)
(j) adequacy of proposed measures to safeguard against accident during experiment
(k) adequacy of proposed emergency procedures (if needed) to supplement standard emergency procedures in event of accident
(l) number of reactor operations personnel required
(m) number and type of radiation monitors required
(n) reactivity effects (normal and accidental)
(o) other relevant factors not included above

(5) No explosive material as defined in Title 49, Parts 172 and 173 of the Code of Federal Regulations is permitted within the reactor bay.

6.5 Emergency Plan and Procedures

An emergency plan shall be established and followed in accordance with NRC regulations. The plan shall be reviewed and approved by the Laboratory Safety Committee prior to its submission to the NRC. In addition, emergency procedures that have been reviewed and approved by the Laboratory Safety Committee shall be established to cover all foreseeable emergency conditions potentially hazardous to persons within the Laboratory or to the public, including, but not limited to, those involving an uncontrolled reactor excursion or an uncontrolled release of radioactivity.

6.6 Operator Requalification

An operator requalification program shall be established and followed in accordance with NRC regulations.

6.7 Physical Security Plan

A physical security plan for protection of the reactor plan shall be established and followed in accordance with NRC regulations.

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

In the event a safety limit is exceeded:

a. The reactor shall be shut down and reactor operation shall not be resumed until authorized by the Director, Division of Reactor Licensing, USNRC.