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30 April 1984

Dr. Donald E. Smith, Chairman
Radiation Protection Council
1607 Gardner Hall
NCSU Campus

Subject: Proposed Revisions to the PULSTAR Technical Specifications.

Sir:

In accordance with Section 6.2.2 e. of the PULSTAR Technical Specifications, it is requested that the Radiation Protection Council review and approve the enclosed revisions to the PULSTAR Technical Specifications.

This request supercedes and replaces any open correspondence to the Radiation Protection Council or the Nuclear Regulatory Commission (NRC) concerning proposed revisions to the PULSTAR Technical Specifications.

Note that correspondence from Joab L. Thomas to the Nuclear Regulatory Commission dated July 10, 1979, and October 18, 1979, contained proposed revisions similar to those identified in this document. After literally years of waiting for the response from the NRC, we were informed by the NRC that the request letter did not contain the appropriate nomenclature and, therefore, was set aside. Specifically, the referenced correspondence did not explicitly say, "implement the following revisions", and consequently was deemed by the NRC to not be an official request.

Since this last submittal of proposed revisions to the Technical Specifications, additional necessary changes have been identified, primarily due to organizational changes. It was deemed prudent to reinitiate the review and approval process for all of the proposed Technical Specification revisions due to the considerable amount of time that has passed since initial conception of many of the proposed revisions. In addition, the NRC now requires a different format for the request that incorporates a page-for-page substitution rather than the previous method of "Change this to read:", etc.

Attachment I of this document includes the page-for-page revisions to the PULSTAR Technical Specifications. The revision bar in the right-hand margin indicates the particular section/paragraph that is being changed. Note that in this proposed revision request, no pages were added or deleted from the present format of the PULSTAR Technical Specifications.

Attachment II of this document provides the Supporting Safety Analysis of the proposed revisions. Note that a reference to the page number and applicable section number is provided to cross-reference the proposed revisions with the pertinent safety analysis.

Questions concerning the proposed revisions should be directed either to Mr. Thomas C. Bray, Reactor Operations Manager, or myself.

Your prompt attention to this request would be greatly appreciated.

Respectfully submitted,

Garry Dale Miller

Garry Dale Miller,
Nuclear Operations Administrator,
Associate Director

GDM:lpe

Enclosures: 1) Attachment I - Revised Pages of the PULSTAR Technical Specifications
2) Attachment II - Supporting Safety Analysis

cc: (all with attachments)
Dr. P. J. Turinsky
Dr. J. Wortman, RSAG
Mr. T. C. Bray
Mr. T. L. Brackin
L. Eudy, NRP Admin.

1.10 Measuring Channel - A measuring channel is the combination of sensor, lines, amplifiers and output devices which are connected for the purpose of measuring the value of a process variable.

1.11 Reactor Safety System - The reactor safety system is that specified combination of measuring channels and associated circuitry which forms the automatic protection systems of the reactor, or provides information which requires manual protective action to be initiated.

1.12 Measured Value - The measured value of a process variable is the value of the variable as it appears on the output of a measuring channel.

1.13 True Value - The true value of a process variable is its exact value at any instant.

1.14 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 other independent channels or methods of measuring the same process variable.

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

1.16 Channel Calibration - A channel calibration is the adjustment of a channel, such that its output responds with acceptable range and accuracy, to known values of the parameter that the channel measures. Calibration shall encompass the entire channel, including equipment actuation, alarm and trips.

1.17 Reportable Event - A Reportable Event is any of the following:

a. Operation with any safety system setting less conservative than specified in the Limiting Safety System Settings section of the Technical Specifications;

b. Operation in violation of Limiting Conditions for Operation;

c. Incidents or conditions which prevented or could have prevented the intended safety function of an engineered safety feature or the reactor safety system;

d. Release of fission products from a fuel element;

3.3 Reactor Instrumentation

Applicability

These specifications apply to the instrumentation which must be available and operable for safe operation of the reactor.

Objective

The objective is to require that sufficient information be available to the operator to assure safe operation of the reactor.

Specifications

The reactor shall not be operated unless the measuring channels listed in the following table are operable:

Measuring Channel	Minimum No. Operable
a. Startup Power Level	1[(a)]
b. Safety Power Level	1[(b)]
c. Linear Power Level	1[(b)]
d. Pulse Energy	1[(c)]
e. Primary Flow	1[(d)]
f. Flow Monitor (flapper)	1
g. Pool Water Temperature	1
h. Pool Water Level	1

(a) Required only for reactor startup when power level is less than 4 watts.

(b) Bypassed for five (5) seconds during pulse and square wave modes.

(c) Required only in the pulse mode. Requires 1 out of 2 available channels (Pulse Energy or N-16 Channel).

(d) R~quired only for operation requiring forced convection cooling.

Bases

The neutron detectors and primary coolant flow meter provide assurance that measurements of the reactor power level, total energy and primary coolant flow are adequately covered at low and high ranges. The reactor pool water level indicators provide early warning of the possibility of a leak in the reactor cooling system or the pool. The two channels available for determining total energy are: the N-16 integrator (total energy) and, the pulse integrator (total energy) and pulse oscilloscope (peak power and total energy).

3.4 Reactor Safety System

Applicability

These specifications apply to the reactor safety system channels.

Objective

The objective is to require the minimum number of reactor safety system channels which must be operable in order to assure that the Safety Limits are not exceeded.

Specifications

The reactor shall not be operated unless the reactor safety system channels described in the following table are operable:

Measuring Channel	Minimum No. Operable	Function	Operating Mode in which Req'd.
a. Startup Power Level	1	Inhibits Control Rod withdrawal when neutron count is < 2 cps.	Reactor Startup
b. Safety Power Level	1[(a)]	Scram, Enable for flow scrams	All
c. Linear Power Level	1[(a)]	Scram	All
d. Log N Power Level	1	Enable for flow scrams (Manual Scram)	All
e. Pulse Energy	1[(d)]	Provide total energy data on pulse (Manual Scram)	Pulse

Measuring Channel	Minimum No. Operable	Function	Operating Mode in which Req'd.
f. Flow Monitoring (Flapper)	1	Scram	All
g. Primary Coolant Flow	1	Scram	Steady State > 250 kW; all other modes
h. Pool Water Temperature	2	Alarm (Manual Scram)	All
i. Pool Water Level	1	Scram	All
j. Manual Button	1	Manual Scram	All
k. "Reactor on" Key-switch	1	Manual Scram	All
l. Over-the-Pool Radiation Monitor (Bridge)	1[a][b]	Alarm (Manual Scram)	All
m. Bypass Timers	4[c]	Limit bypass time on power level channels	Pulse and Square Wave

(a) Bypasses for five (5) seconds during pulse and square wave modes.

(b) Bypassed for less than one (1) minute during return of a pneumatic rabbit capsule from the core to the unloading station or three (3) during removal of experiments from the reactor pool.

(c) Activated during pulse and square wave modes, with two per applicable power level measuring channel (safety power level and linear power level).

(d) In pulse mode only, requires either the Pulse Energy Channel or N-16 Channel to provide information on pulse energy for manual scram.

Bases

The inhibit function on the startup channel assures the required startup neutron source is sufficient and in its proper location for the reactor startup, such that a minimum source multiplication count rate level is being detected to assure proper operation of the startup channel.

The reactor power level scrams provide the redundant protection channels to assure that, if a condition should develop which would tend to cause the reactor to operate at an abnormally high power level, an immediate automatic protective action will occur to prevent the exceeding of the Safety Limit.

The Pulse Energy Channel or the N-16 Channel provides the information on this parameter. In the event that an abnormal situation should develop, the operator is provided this information following the pulse in order that he may return the reactor to its safest state, and take any other added precautionary action deemed necessary.

The alarms on the redundant pool water temperature channels assure that the reactor operator has sufficient time to take corrective action if the temperature exceeds the specified limit.

The primary coolant flow scrams provide the redundant protection channels to assure when the reactor is at power levels which require forced flow cooling that, if sufficient flow is not present, an immediate automatic shutdown of the reactor will occur to prevent the exceeding of a Safety Limit. The Log N power channel is included in this section since it is one of the two channels which enables the two flow scrams when the reactor is above 250 kW.

The pool water level channel, along with the over-the-pool (Bridge) radiation monitor, provides two diverse channels for shutdown of the reactor and prevents the exceeding of the Safety Limit due to insufficient pool height (pressure).

To prevent unnecessary initiation of the evacuation confinement system during the return of the pneumatic rabbit capsule from the core to the unloading station or during removal of experiments from the reactor pool, the over-the-pool monitor may be bypassed during the specified time interval. A VAMP radiation monitor that is located at the reactor pool bridge will continue to monitor radiation levels as a backup. This unit has also an audible alarm.

The manual scram button and the "reactor on" keyswitch provide two manual scram methods to the reactor operator if unsafe or abnormal conditions should occur.

The redundancy of the bypass timers on each measuring channel insures that no single time failure will negate the activation of the power level automatic protection systems.

3.5 Radiation Monitoring Equipment

Applicability

This specification applies to the availability of radiation monitoring equipment which must be operable during reactor operation.

Objective

To assure that radiation monitoring equipment is available for evaluation of radiation conditions in restricted and unrestricted areas.

Specification

The reactor shall not be operated unless the radiation monitoring equipment listed in the following table is operable.

1. Three fixed area monitors operating in the reactor building.(a)(b)(c)

2. Particulate and gas building exhaust monitors continuously sampling air in the facility exhaust stack.(b)(d)

   (a) One of these monitors must be the over-the-pool (Bridge) radiation monitor. This monitor may be bypassed for five (5) seconds during pulse and square wave modes.

   (b) For periods of time for maintenance to the radiation monitoring channel, the intent of this specification will be satisfied if one of the installed channels is replaced with a gamma-sensitive instrument which has its own alarm or which is kept under visual observation and if reactor operation is limited to the steady state mode.

   (c) The over-the-pool monitor may be bypassed for less than one (1) minute during return of a pneumatic rabbit capsule from the core to the unloading station or three (3) minutes during removal of experiments from the reactor pool.

   (d) May be bypassed for less than one (1) minute immediately after starting the pneumatic blower system.

Bases

A continued evaluation of the radiation levels within the reactor building will be made to assure the safety of personnel. This is accomplished by the area monitoring system of the type described in Section 5.2.2 of the FSAR.

A continued evaluation of the discharge air to the environment will be made using the information recorded from the particulate and gas monitors.

When the radiation levels reach the alarm setpoint on any single area, or stack exhaust monitor, the building will be automatically placed in confinement as described in Section 5 of the FSAR.

To prevent unnecessary initiation of the evacuation confinement system during the return of a pneumatic rabbit capsule from the core to the unloading station or during removal of experiments from the reactor pool, the over-the-pool monitor may be bypassed during the specified time interval. A VAMP radiation monitor that is located at the reactor pool bridge will continue to monitor radiation levels as a back-up. This unit has also an audible alarm.

3.6 Confinement

Applicability

This specification applies to the operation of the reactor building confinement system.

Objective

The objective is to assure that the confinement system is in operation to mitigate the consequences of possible release of radioactive materials resulting from reactor operation.

Specification

The reactor shall not be operated unless the following equipment is operable, and conditions met:

Equipment/Condition	Function	Operating Mode In Which Required
a. All doors, except the control room and basement corridor entrance: self-latching, self-closing; closed and locked.	To maintain reactor building negative differential pressure.[f]	All
b. Control room and basement corridor entrance door: self-latching, self-closing and closed.	To maintain reactor[a] building negative differential pressure.	All

Equipment/Condition	Function	Operating Mode In Which Required
c. Reactor building under a negative differential pressure of not less than 0.2" H_2O with the normal ventilation system or 0.1" H_2O with one confinement fan operating.	To maintain reactor[(b)] building negative differential pressure with reference to outside ambient.	All
d. Confinement initiation system	Operable [(c)]	All
e. Evacuation system	Operable [(d)]	All
f. Magnahelic differential vacuum gauges in control room.	Operable	Pulse and square wave
g. Confinement filter trains	Operable[(e)]	All

(a) Doors may be opened for personnel and equipment transport between corridor area and reactor building.

(b) Except for periods of time not to exceed 24 hours to permit repair of system - during such repairs, the power will be limited to 100 kW and the steady state mode.

(c) Operability demonstrated also with auxiliary power source.

(d) The public address system can serve temporarily for the reactor building evacuation system during short periods of maintenance.

(e) One filter train may be out of service for the purpose of maintenance, repair, and/or surveillance for a period of time not to exceed 45 days. During the period of time in which one filter train is out of service, the standby filter train shall be operating with the reactor building in the confinement mode.

(f) Doors may be opened by authorized personnel for less than (5) five minutes for personnel and equipment transport provided audible and visual indication is available for the reactor operator to verify door status.

Bases

In the unlikely event of a fission product release, the confinement initiation system will secure the normal ventilation fans and close the normal inlet and exhaust dampers. In confinement, a

4.0 SURVEILLANCE REQUIREMENTS[1]

4.1 Fuel

Applicability

This specification applies to the surveillance requirement for the reactor fuel.

Objective

The objective is to obtain data on length, diameter and bow of fuel pins for evaluation of long-term trends of fuel behavior.

Specifications

a. All fuel elements shall be visually inspected biennially but at intervals not to exceed twenty-six (26) months.

b. At least four fuel pins from two different pulsed fuel elements shall be inspected whenever a group of 100 pulses of greater than 1.0% $\Delta k/k$ have been accumulated. One of these pins shall be from the highest flux region in the core.

Bases

The biennial inspection of PULSTAR fuel pins has been shown to be adequate for Zr-2 cladded elements to insure fuel element integrity based on a long history of the prototype PULSTAR steady state and pulse operation.

The above inspection intervals are based on prototype experience. The pins selected for inspection will be those most closely approaching the high energy density region of the core as determined from initial startup testing. As a minimum, the same pins will be measured at each inspection interval so that a trend can be established as a function of time. Baseline data for each fuel pin will be made prior to any usage in the reactor core.

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1. All surveillance tests required by these specifications are scheduled as described; however, some tests may be postponed at the required intervals if that system or a closely associated system is undergoing maintenance. I~ these cases, the surveillance test will be performed immediately after completion of maintenance and prior to reactor startup.

4.2 Pulse and Control Rods

Applicability

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

Objective

The objective is to assure the operability of the pulse and control rods.

Specifications

a. The reactivity worth of the pulse rod and each control rod shall be determined annually but at intervals not to exceed fourteen months for the steady state core in current use. The reactivity worth of the pulse rod and each control rod for the pulsing core in current use shall be determined within six (6) months prior to pulsing operations. The reactivity worth of all rods shall be determined for any new core or rod configuration, prior to routine operation.

b. Control rod drop and drive times and the pulse rod drive time shall be determined annually but at intervals not to exceed fourteen (14) months, and after a control assembly is moved to a new position in the core or after maintenance or modification is performed on the control rod mechanism. Pulse rod turnaround time shall be determined within six (6) months prior to each pulsing operation.

c. The pulse and control rods shall be visually inspected biennially but at intervals not to exceed twenty-six (26) months.

Bases

The reactivity worth of the pulse and control rods is measured to assure that the required shutdown margin is available, to provide a means for determining the reactivity worths of experiments inserted in the core, and to provide the pulse rod positioning for pulse and square wave operations. The measurement of reactivity worths on an annual basis provides a correction for the slight variations expected due to burnup. This frequency of measurement has been found acceptable at similar research reactor facilities, particularly the prototype PULSTAR which has a similar slow change of rod value with burnup. In

the case of a new fuel arrangement in the core, reactivity worth measurements of the control rods will be required prior to routine operations.

Control and pulse rod drive/drop/turnaround time measurements are made to determine whether the rods are functionally operable. These time measurements may also be utilized in reactor transient analysis.

Control and pulse rod visual inspections provide a method of detecting wear or corrosion in rod actuating mechanisms, and rod travel setpoints can be verified during these inspections.

Control and pulse rod surveillance procedure will document proper control rod system reassembly after maintenance and recorded post-maintenance data will identify significant trends in rod performance.

4.3 Reactor Safety System

Applicability

This specification applies to the surveillance requirements for the Reactor Safety System.

Objective

The objective is to assure that the Reactor Safety System (RSS) will remain operable and will prevent the Safety Limits from being exceeded.

Specifications

a. A channel check of each measuring channel in the RSS shall be performed daily when the reactor is in operation.

b. A channel test of each channel in the RSS[a] shall be performed prior to each day's operation, or prior to each operation extending more than one day.

c. A channel calibration of the safety and linear power level measuring channels by the calorimetric method shall be made semi-annually but at intervals not to exceed seven (7) months.

d. A channel calibration of the following channels shall be made semi-annually but at intervals not to exceed seven (7) months.

   1. Pool Water Temperature

   2. Primary Cooling and Flow Monitoring (Flapper)

   3. Pool Water Level

e. A channel calibration of the channel to be used for measuring pulse energy shall be made using a test pulse of less than 1% $\Delta k/k$ reactivity insertion prior to any operation in the pulse mode with reactivity insertions above 1% $\Delta k/k$. During this test pulse, the over-power trip bypass timers shall be verified to be operable.

(a) Testing the channel to be used for measuring pulse energy is required only prior to operation in the pulse or square wave mode.

Bases

The daily channel tests and checks will assure that the safety channels are operable. The calibrations at six (6) month intervals will assure that long-term drift of the channels is corrected. The calorimetric calibration of the reactor power level, in conjunction with the nitrogen 16 channel, will provide continual reference for adjustment of the linear, Log N and safety channel detector positions and current alignment.

4.4 Radiation Monitoring Equipment

Applicability

This specification applies to the surveillance requirements for the area radiation monitoring equipment and the system for the stack radiation monitoring equipment.

Objective

The objective is to assure that the radiation monitoring equipment is operable.

Specificiation

The area and stack monitoring systems shall be calibrated annually but at intervals not to exceed fourteen (14) months. The setpoints shall be verified weekly.

Bases

These systems provide continuous radiation monitoring of the reactor building with a check of readings performed prior to and during reactor operations. Therefore, the weekly verification of the setpoints in conjunction with the annual calibration is adequate to identify long-term variations in the system operating characteristics.

4.5 Confinement System

Applicability

This specification applies to the surveillance requirements for the confinement system.

Objective

The objective is to assure that the confinement system is operable.

Specifications

a. Prior to reactor operation, the confinement and evacuation system shall have been verified to be operable within the previous seven day period.

b. Operation of the confinement system on auxiliary power will be checked every two weeks but at intervals not to exceed twenty-one (21) days.

c. A visual inspection of the door seals and closures, dampers and gaskets of the confinement and ventilation systems shall be performed semi-annually but at intervals not to exceed seven months to verify they are operable.

d. The control room differential pressure gauges shall be calibrated annually but at intervals not to exceed fourteen months.

e. The confinement filter train shall be tested biennually but at intervals not to exceed twenty-six months; and prior to reactor operation following filter replacement.

f. The 600 cfm air flow rate in the confinement stack exhaust duct shall be verified annually but at intervals not to exceed fourteen months.

Bases

Surveillance of this equipment will verify that the confinement of the reactor building is maintained, reference Section 5 of the FSAR.

6.0 ADMINISTRATIVE CONTROLS

6.1 Organization

6.1.1 The reactor facility shall be an integral part of the Department of Nuclear Engineering of the School of Engineering of North Carolina State University. The reactor shall be related to the University structure as shown in Figure 6.1-1.

6.1.2 The Associate Director is responsible for the safe and efficient operation and utilization of the PULSTAR reactor facility. In all matters pertaining to the operation of the facility and these Specifications, the Associate Director shall report to and be directly responsible to the Head, Department of Nuclear Engineering. The minimum qualifications for the Associate Director are at least five years of reactor operating experience. Years spent in baccalaureate or graduate study may be substituted for operating experience on a one-for-one basis up to a maximum of one year.

6.1.3 The reactor shall be under a Reactor Operations Manager who shall be qualified as a licensed senior operator for this reactor. He shall be responsible for assuring that operations are conducted in a safe manner and within the limits prescribed by the facility license and the provisions of the Radiation Protection Council.

6.1.4 There shall be a Reactor Health Physicist responsible for assuring the safety of reactor operations from the standpoint of radiation protection. He shall function independently of the reactor operations organization as shown in Figure 6.1-1.

He shall be able to satisfy the qualifications of a Certified Health Physicist as set forth by the American Board of Health Physics or its acceptable equivalent. He shall be responsible for reporting in accordance with Section 6.7.5f.

6.2 Review and Audit

6.2.1 There shall be a Radiation Protection Council (RPC) whose duties shall be to review and audit reactor operations, to advise the Chancellor, North Carolina State University, and to assure that the facility is operated in a manner consistent with public safety and within the terms of the facility license.

6.2.2 RPC responsibilities shall include:

a. Review proposed tests and untried experiments which may constitute an "unreviewed safety question" pursuant to 10CFR50.59. All such reviews shall be accomplished with consideration of Sections 2 and 3 of these Technical Specifications.

b. Review proposed changes to procedures, equipment or systems having safety significance[1] or which may constitute an "unreviewed safety question" pursuant to 10CFR50.59.

c. Review facility Reportable Events defined in Section 1.17 of these Technical Specifications.

d. Review proposed changes to the Technical Specifications or Facility Operating License except for the NCSU PULSTAR REACTOR SECURITY PLAN which is withheld from public disclosure pursuant to 10CFR2.790(d) and 10CFR73.21.

e. Review and audit facility operation, including equipment performance, operating personnel, operating records and results of surveillance tests and inspections.

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1. Equipment or systems having safety significance are defined as those channels and systems identified in Section 3, Limiting Conditions of Operations, in particular 3.3, 3.4, 3.5, and 3.6

6.2.3 The Radiation Protection Council shall have at least five members, of whom no more than the minority shall be from the line organization shown in Figure 6.1-1. In addition to the Radiation Protection Council, three persons are appointed by the Chancellor, upon the recommendation of the RPC, to form a Reactor Safeguards Advisory Group (RSAG). This group serves as a permanent committee to the RPC and will be solely responsible for independent appraisals of reactor operations, and reporting the results of its investigations to the RPC, Department Head and Associate Director. The RPC and RSAG shall be made up of senior faculty and staff who shall collectively provide experience in reactor engineering, reactor operations, chemistry and radiochemistry, instrumentation and control systems, radiological safety and mechanical and electrical systems. The campus Radiological Safety Officer (RSO) shall be a permanent member of the RPC.

6.2.4 The Radiation Protection Council shall have written statements on its responsibilities and authority.

6.2.5 Minutes of each RPC meeting shall be distributed to the Chancellor and all RPC members. Minutes of each RSAG meeting shall be distributed to the RPC; Head, Department of Nuclear Engineering and Associate Director.

6.2.6 A quorum shall consist of not less than a majority of the full RPC or RSAG, and shall include the chairman or his designated alternate. Only a minority or less of the line organization shown in Figure 6.1-1 shall be present in any quorum.

6.2.7 The RPC shall meet at least every four calendar months, and upon call of the Chairman; while the RSAG shall meet at least every six calendar months and upon call of the Chairman.

6.3 Operating Procedures

a. Operating procedures shall be written, updated periodically and followed for these operations:

1. Normal startup, operation, and shutdown of the reactor and components involving nuclear safety of the system;

2. Refueling operations and installation and removal of Control Rods and experimental facilities;

3. Actions to be taken to correct specific and foreseen potential malfunctions of systems or components, including responses to alarms, suspected primary coolant system leaks, and abnormal reactivity changes;

4. Emergency conditions involving potential or actual release of radioactivity, including provisions for evacuation, re-entry, recovery, medical support;

5. Preventive and corrective maintenance operations which could have an effect on reactor safety;

6. Civil disturbance on or near the campus;

7. Periodic surveillance including channel test and channel calibration of reactor instrumentation and Reactor Safety Systems, area monitors and continuous air monitors.

8. Radiation control. These procedures shall be maintained and be available to all operations personnel.

9. Review and approval of changes to operating procedures;

10. Preparation, approval and periodic review of facility Emergency Plan and Security Plan.

b. Substantive changes to the above procedures shall be made only with the approval of the Radiation Protection Council. Temporary changes to the procedures that do not change their original intent may be made with the approval of the Associate Director. All such temporary changes to the procedures shall be documented and subsequently reviewed by the RPC;

c. Drills on emergency procedures shall be conducted annually.

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

In the event a Safety Limit is exceeded, or thought to be exceeded.

a. The reactor shall be shut down and reactor operations shall not be resumed until authorized by the Nuclear Regulatory Commission;

b. An immediate report of the occurrences shall be made to the Chairman of the Radiation Protection Council, and reports shall be made to the Nuclear Regulatory Commission in accordance with Section 6.7 of these specifications; and

c. A report shall be made which shall include an analysis of the causes and extent of possible damage, efficacy of corrective action, and recommendations for measures to prevent the probability of recurrence. This report shall be submitted to the Radiation Protection Council for review, and a suitable similar report submitted to the Nuclear Regulatory Commission when authorization to resume operation of the reactor is sought.

6.5 Action to be Taken for Reportable Events

In case of a reportable event, as defined in Section 1.17 of these specifications, the following action shall be taken:

a. The Reactor Operations Manager, Associate Director, Reactor Health Physicist and Radiation Protection Council shall be notified of the occurrence. Prior to resumption of operations, action shall be taken to correct the initiating condition and to prevent its recurrence.

b. A report shall be made to the Radiation Protection Council for review. The report shall include an analysis of the cause of the occurrence, the effectiveness of corrective action taken, and recommendations for measures to prevent or reduce the probability of recurrence.

c. A report shall be submitted to the Nuclear Regulatory Commission in accordance with Section 6.7 of these specifications.

6.6 Plant Operating Records

In addition to the requirements of applicable regulations and in no way substituting therefor, records and logs of the following items, as a minimum, shall be kept in a manner convenient for review and shall be retained as indicated:

a. Records to be retained for a period of at least five (5) years:

   1. Normal plant operation and maintenance;

   2. Principal maintenance activities;

   3. Reportable events;

   4. Equipment and components surveillance activities;

   5. Experiments performed with the reactor;

b. Records to be retained for the life of the facility:

   1. Gaseous and liquid radioactive waste released to the environs;

   2. Off-site environmental monitoring surveys;

   3. Radiation exposures for all PULSTAR personnel;

   4. Facility radiation and contamination surveys;

   5. Fuel inventories and transfers;

   6. Updated, corrected, and as-built facility drawings.

6.7 Reporting Requirements

In addition to the requirements of applicable regulations and in no way substituting therefor, reports shall be made to the NRC as follows:

6.7.1 Within 24 hours, a report (by telephone or telegraph to the NRC Region II Regulatory Operations) of:

a. Any accidental off-site release of radioactivity above permissible limits, whether or not the release resulted in property damage, personal injury or exposure;

b. Any significant variation of measured values from a corresponding predicted or previously measured value of safety-related operating parameters occurring during operation of the reactor.

c. Any Reportable Event as defined in Section 1.17 of these specifications; and

d. Any violation of a Safety Limit.

6.7.2 A report within ten days (in writing to the Deputy Director for Reactor Projects, Directorate of Licensing, USNRC, Washington, D. C. 20545, with a copy to the NRC Region II Regulatory Operations) of:

a. Any significant variation of measured values from a corresponding predicted value of previously measured value of safety-related operating characteristics occurring during operation of the reactor;

b. Incidents or conditions relating to operation of the facility which prevented or could have prevented the performance of engineered safety features as described in these specifications;

c. Any Reportable Event as defined in Section 1.17 of these specifications; and

d. Any violation of a Safety Limit.

6.7.3 A report within 30 days (in writing to the Deputy Director for Reactor Projects, Directorate of Licensing, USNRC, Washington, D. C. 20545, with a copy to the NRC Region II Regulatory Operations) of:

a. Any substantial variance from performance specifications contained in these specifications or in the Safety Analysis Report;

b. Any significant change in the transient or accident analyses as described in the Safety Analysis Report;

c. Any changes in facility organization; and

d. Any observed inadequacies in the implementation of administrative or procedural controls.

6.7.4 A report within 120 days until October 30, 1973, then 60 days thereafter following completion of startup testing of the reactor (in writing to the Deputy Director for Reactor Projects, Directorate of Licensing, USNRC, Washington, D. C. 20545) upon receipt of a new facility license, or an amendment to the license authorizing an increase in reactor power level, describing the measured values of the operating conditions or characteristics of the reactor under the new conditions including:

a. An evaluation of the safety analysis submitted with the license application in light of measured operating characteristics when such measurements indicate that there may be substantial variance from analysis.

b. A reassessment of the safety analysis submitted with the license application in light of measured operating characteristics when such measurements indicate that there may be substantial variance from prior analysis.

6.7.5 An annual report within 60 days following the 30th of June of each year (in writing to the Deputy Director for Reactor Projects, Directorate of Licensing, USNRC, Washington, D. C. 20545, with a copy to the NRC Region II Regulatory Operations) providing the following information:

a. A brief narrative summary of (1) operating experience including a cross section of experiments performed, (2) changes in performance characteristics related to reactor safety and occurring during the reporting period, and (3) results of surveillance tests and inspections;

b. Tabulation of the energy output (in megawatt days) of the reactor, amount of pulse operation, hours reactor was critical, and the cumulative total energy output since initial criticality;

c. The number of emergency shutdowns and inadvertent scrams, including reasons therefor;

(a) Method of disposal.

(b) Total radioactivity in the tank (in microcuries) prior to disposal.

(c) Total volume of liquid in tank (in liters).

(d) The dried residue of a one (1) liter sample shall be analyzed for the principal gamma-emitting radionuclides. The identified isotope composition with estimated concentrations shall be reported. The tritium content shall be included.

Gaseous Waste (summarized on a monthly basis)

1. Radioactivity discharged during the reporting period (in curies) for:

   (a) Gases

   (b) Particulates, with half lives greater than eight days.

2. The MPC used and the estimated activity (in curies) discharged during the reporting period, by nuclide, for all gases and particulates based on representative isotopic analysis.

Solid Waste

1. The total amount of solid waste packaged (in cubic feet).

2. The total activity involved (in curies).

3. The dates of shipment and disposition (if shipped off-site).

g. A summary of radiation exposures received by facility personnel and visitors, including pertinent details of significant exposures.

h. A summary of the results of radiation and contamination surveys performed within the facility; and

i. A description of any environmental surveys performed outside the facility.

6.8 Review of Experiments

6.8.1 All proposed experiments utilizing the PULSTAR reactor shall be evaluated in writing by the experimenter and by a licensed Senior Reactor Operator staff member approved by the Associate Director. The evaluation of the experiment shall be reviewed by the Reactor Operations Manager (and by the Reactor Health Physicist when appropriate) to assure compliance with the provisions of the facility license, these Technical Specifications, and the NRC regulations. If the Reactor Operations Manager and the Reactor Health Physicist determine that it is a tried experiment, it may be approved by the Reactor Operations Manager or Associate Director. The evaluation of the experiment shall include:

a. The reactivity worth of the experiment;

b. The integrity of the experiment, including the effects of changes in temperature, pressure, chemical composition, or radiolytic decomposition.

c. Any physical or chemical interaction which could occur with the reactor components; and

d. Any radiation hazard that may result from the activation of materials or from external beams.

If it is the opinion of any one of the above, that the experiment does not meet the criteria, it shall be submitted, by the experimenter, to the Radiation Protection Council as an "untried experiment" for approval and issuance of a project number.

6.8.2 Prior to performing an untried experiment in the reactor, it shall be reviewed and approved in writing by the RPC, following their determination that it does not involve an unreviewed safety question. The RPC review shall consider the following:

a. The purpose of the experiment;

b. A procedure for the performance of the experiment;

c. Evaluation made as in paragraph 6.8.1 above; and

d. Evaluation approved by the Associate Director.

6.8.3 In evaluating experiments, the following assumptions shall be used for the purpose of determining that failure of the experiment would not cause the appropriate limits of 10 CFR 20 to be exceeded:

a. If the possibility exists that airborne concentration of radioactive gases or aerosols may be released within the confinement, 100% of the gases or aerosols will escape;

b. If the effluent exhausts through a filter installation designed for greater than 99% efficiency for 0.3 micron particles, at least 10% of the particulates will escape; and

c. For a material whose boiling point is above 130°F and where vapors formed by boiling this material could escape only through a volume of water above the core, at least 10% of these vapors will escape.

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Attachment II

PULSTAR TECHNICAL SPECIFICATION REVISION SUPPORTING SAFETY ANALYSIS

ITEM#	PAGE#	SECTION	SAFETY ANALYSIS
(1)	2	1.17	The term "Abnormal Occurrence" has been replaced by "Reportable Event" per the standard use by the nuclear industry. Note that this change is an editorial change and does not affect reactor safety.
(2)	2	1.17 c.	Purpose of rewriting ¶ 1.17 c is to make statement conform more nearly to that of ANS 15.1/ANSI N378-74. Sense of the statement is unchanged but language and terminology has been improved.
(3)	17	3.3 d.	The N-16 Channel Integrator reliability has been demonstrated in our Start-Up program and subsequent routine pulsing. The N-16 Channel responds in the same manner as the Pulse Energy Channel, providing a direct measurement of pulse energy following the pulse. The requested changes for Sections 3.3 and 3.4 identify the N-16 Channel as an available channel for measuring pulse energy. The PULSTAR Final Safety Analysis Report approves the use of the N-16 Channel for Pulse energy measurement in Section 7.1.4. Note that the Commission had previously approved the requirement of only one pulse energy channel by virtue of footnote (c) to Section 3.3; therefore, the requested change is editorial in nature.
(4)	17	3.4 footnote (c)	Additional clarification has been added of the available pulse energy channels. Note that the analysis of item (3) above applies.
(5)	18	3.4 e	The specified change adds a footnote clarifying the choice of pulse energy channels available during pulsing operations. Note that the analysis of item (3) above applies.
(6)	19	3.4 footnote (d)	Same as for item (4) above.
(7)	20	3.4 Bases 3rd Paragraph)	Same as for item (3) above.

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ITEM#	PAGE#	SECTION	SAFETY ANALYSIS
(8)	21	3.5.2	A footnote (d) has been added allowing the bypass of the specified monitors during the initiation of the pneumatic blower system. The requested change will prevent the unnecessary alarm which initiates the evacuation and confinement system. The initiation of the pneumatic blower system during power operation results in a small volume of air with an Argon-41 activity level, above the normal setpoints, moving through the ventilation system causing the stack exhaust monitors to alarm. The requested change will inhibit the unnecessary evacuation during the short-term transient of stack exhaust activity without compromising reactor safety. In the event that a fission product release should occur simultaneously with the bypass of the specified monitors, the over-the-pool monitor would still be capable of initiating evacuation and confinement. The bypass would be performed by momentarily depressing the Fail/Reset button on the specified monitors. Upon release of the Fail/Reset button, the channel automatically resets itself to the alarm-ready status. This bypass action only bypasses the alarm initiation and not the monitoring function of the channels. Specifically, the three channels normally used for monitoring stack exhaust activity, i.e. Stack Gas, Particulate and the Auxiliary GM, are all recorded for subsequent calculation of stack exhaust releases.
(9)	21	3.5.2(c)	Changed word "is" in first line to "may be". Original language implied an automatic function. Function has always been manual, at the discretion of the reactor operator.
(10)	22	3.5 foot-note (d)	Same as for item (8) above.
(11)	22	3.5 Bases	Added word "alarm" to describe type of set-point that, when tripped, will automatically place the reactor building in confinement.

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ITEM#	PAGE#	SECTION	SAFETY ANALYSIS
(11)	22	3.5 Bases (continued)	Changed language also to specify that any single area or stack exhaust monitor will provide the automatic action.
(12)	23	3.6 a.	A footnote that allows the specified doors to be opened with certain restrictions has been added. Maintaining the reactor building differential pressure while operating is the responsibility of the reactor operator. The requested change will allow any reactor bay door to be opened for periods of time to permit transport of equipment and personnel. In the event a radioactive release should occur, the evacuation and confinement system would be placed in operation at the direction of the reactor operator and if the reactor bay door had been open for personnel or equipment transport, the door would self-close upon exit of personnel, thereby maintaining required negative differential pressure in the confinement mode. Furthermore, audible and visual indication of the door status will enable the operator to verify that the doors are closed in accordance with operating procedures following the initiation of the evacuation and confinement system.
(13)	24	3.6 footnote (f)	Same as for item (12) above.
(14)	28	4.2 a.	It is North Carolina State's intention to adapt its Technical Specifications to ANS-15.1/N378-1974, "Standard for the Development of Technical Specifications for Research Reactors," and toward this end, a tolerance interval has been added to the surveillance intervals. This tolerance shall provide for continuity of surveillance test, maintenance, and reactor operations. Based upon results of proven satisfactory performance of the current PULSTAR Surveillance Program, adding a tolerance interval to the subject specifications will not compromise reactor safety. The requested tolerance intervals are consistent with Section 4 of ANS-15.1/N378-1974, e.g. an annual surveil-

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ITEM#	PAGE#	SECTION	SAFETY ANALYSIS
(14)	28	4.2 a. (continued)	lance item has two-month tolerance, etc.
(15)	29	4.2 a.	The terms "standard reference core" and "pulse core" has been replaced by "steady state core in current use" and "pulsing core in current use", respectively, in order to adapt the surveillance requirement to the latest core configuration in operation. The rod worth measurements for the pulsing core within six months prior to the pulsing insures that recent data will be available to precisely position the pulse rod, and the surveillance of the steady state core will provide adequate information about changes in rod worths due to burnup.
(16)	29	4.2 b.	The requirement for measuring pulse rod drop time has been removed since this measurement has no physical significance. Proper movement of the pulse rod is tested by pulse rod turn-around time measurements. The addition of a tolerance on the surveillance interval is consistent with the safety analysis of item (14) above.
(17)	29	4.2 c.	Safety analysis consistent with item (14) above.
(18)	30	4.2 Bases	Safety analysis consistent with item (16) above.
(19)	30	4.3 c.	Safety analysis consistent with item (14) above.
(20)	30	4.3 d.	Safety analysis consistent with item (14) above.
(21)	30	4.3 e.	The requested change for Section 4.3 e. insures that the appropriate surveillance test shall be performed on the channel that is to be used for measuring pulse energy (either the Pulse Energy Channel or N-16 Channel). Analysis for use of the N-16 Channel to measure pulse energy is consistent with the safety analysis of Section 3.4.
(22)	31	4.3 foot-note (a)	Safety analysis consistent with item (21) above.
(23)	31	4.4	Safety analysis consistent with item (14) above.

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ITEM#	PAGE#	SECTION	SAFETY ANALYSIS
(24)	32	4.5 a.	The proposed change provides for a more realistic test of the confinement initiation and evacuation system on the auxiliary generator. The present specification for testing the confinement initiation system on the auxiliary generator requires a line-up of circuit breakers that would normally not be present during reactor operations. This is due to the fact that upon loss of commercial power to the Control Room Distribution Panel, the confinement initiation relay de-energizes so that upon return of commercial power or auxiliary generator power, the reactor building is automatically placed in the confinement mode. Therefore, the requested changes to Sections 4.5 a. and 4.5 b. remove the requirements to test the confinement initiation system on the auxiliary generator. The evacuation system, including logic relays and evacuation horns, is powered from the Control Room Distribution Panel. There is no dedicated bus from the generator to the evacuation/confinement initiation system, therefore, if the confinement system will initiate on commercial power, then it will also initiate on auxiliary power. Consequently, the ability of the evacuation/confinement initiation system to operate on the auxiliary generator is assured by the combination of two tests: 1) the test demonstrating that the Control Room Distribution Panel can be powered from the auxiliary generator and 2) the weekly test of the evacuation/confinement initiation system on the console power via commercial power to the Control Room Distribution Panel.
(25)	32	4.5 c.	This surveillance requirement has been found more convenient to perform on a semi-annual basis. Since the requested change reduces the surveillance intervals, reactor safety is not compromised.
(26)	32	4.5 d.	Safety analysis consistent with item (14) above.

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ITEM#	PAGE#	SECTION	SAFETY ANALYSIS
(27)	32	4.5 e.	Safety analysis consistent with item (14) above.
(28)	32	4.5 f.	Safety analysis consistent with item (14) above.
(29)	36	6.1.2	A re-organization of the Nuclear Reactor Program has resulted in the change of titles for the Nuclear Operations Administrator and Reactor Supervisor positions. Responsibilities/qualifications for these positions have remained unchanged; therefore, this change is only editorial in nature. Note that positions in the Nuclear Reactor Program that are not directly related to the PULSTAR Reactor Operation have been intentionally omitted from Section 6.0 of the Technical Specifications.
(30)	36	6.1.3	Consistent with the safety analysis of item (29) above.
(31)	36	6.1.4	As part of the re-organization described in item (29) above, the "Technical Services Group" has been integrated into other divisions of the Nuclear Reactor Program. The Reactor Health Physicist position, however, remains as an independent review of the reactor operations. The Reactor Health Physicist reports to the Head, Department of Nuclear Engineering.
(32)	37	Figure 6.1-1	Safety analysis consistent with items (27) and (29) above.
(33)	38	6.2.2	The intent of rewriting ¶ 6.2.2 under Review and Audit is twofold: To adhere more closely to the guidelines of ANS-15.1/ANSI N378-1974 and to make editorial changes for the purpose of clarity. All the review and audit features of the original Technical Specifications have been retained while the actual number of separate statements under Para. 6.2.2 have been reduced. All references to "abnormal" occurrences, conditions and operations have been re-edited to categorize these instances as "reportable events", in keeping with ANS 15.1 terminology.

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ITEM#	PAGE#	SECTION	SAFETY ANALYSIS
(34)	39	6.2.3, line 8	Substituting word "operations" for "procedures" gives RSAG broader review authority. Reactor Operations includes procedures and other audit areas as well. Word change conforms to terminology identified in ANS 15.1.
(35)	39	6.2.3, line 10	Safety analysis consistent with item (29) above.
(36)	39	6.2.5	Safety analysis consistent with item (29) above.
(37)	40	6.3 b.	Safety analysis consistent with item (29) above.
(38)	41	6.5 a.	Safety analysis consistent with item (29) above.
(39)	41	6.5 c.	Change is editorial in nature only.
(40)	42	6.6.a.3.	Safety analysis consistent with item (1) above.
(41)	42	6.7	Change is editorial in nature only.
(42)	43	6.7.1 c.	Safety analysis consistent with item (1) above.
(43)	43	6.7.2 c.	Safety analysis consistent with item (1) above.
(44)	44	6.7.5 a.	The requested change clarifies the necessary reporting requirements by removing the duplication between 6.7.5a and 6.7.5e. In particular, changes in facility design and changes in operating procedures were previously included in both sections. Reporting requirements for experiments have also been clarified, i.e., a cross-section of experiments performed is now reported for Section 6.7.5a and the safety evaluation and description of new experiments and tests are reported in Section 6.7.5e.
(45)	45a	Continuation of 6.7.5.f	The letter g. was removed from the "Gaseous Waste (Summarized on a Monthly Basis)" as an editorial correction. Gaseous waste falls under the general category of radioactive effluents detailed in 6.7.5 f.
(46)	46	6.7.5 g,h,i	The requested changes to 6.7.5 g, 6.7.5 h, and the

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ITEM#	PAGE#	SECTION	SAFETY ANALYSIS
(46)	46	6.7.5 g,h,i (continued)	addition of 6.7.5 i. clarifying the reporting requirements for surveys and exposures. The requested change to 6.7.5 g. replaces the words "date and time" with "pertinent details". This change will provide for an increase in reporting requirements from just date and time to more significant details such as when, where and how the exposure occurred. The latter details are more important in terms of reporting a significant exposure rather than just when it occurred.
(47)	46	6.8.1	Safety analysis consistent with item (29) above.
(48)	47	6.8.2	Safety analysis consistent with item (29) above.