Technical Specifications
for the Oak Ridge Critical
Experiments Facility

R. M. Stinnett
A major purpose of the Technical Information Center is to provide the broadest dissemination possible of information contained in DOE's Research and Development Reports to business, industry, the academic community, and federal, state and local governments.

Although a small portion of this report is not reproducible, it is being made available to expedite the availability of information on the research discussed herein.
Operations Division

TECHNICAL SPECIFICATIONS FOR THE OAK RIDGE CRITICAL EXPERIMENTS FACILITY

R. M. Stinnett

Date of Issue - January 1986

NOTICE: This document contains information of a preliminary nature. It is subject to revision or corrections and therefore does not represent a final report.

Prepared by the
Oak Ridge National Laboratory
Oak Ridge, Tennessee 37831
operated by
Martin Marietta Energy Systems, Inc.
for the
U.S. DEPARTMENT OF ENERGY
Under Contract No. DE-AC05-840R21400
Operations Division

TECHNICAL SPECIFICATIONS FOR THE OAK RIDGE CRITICAL EXPERIMENTS FACILITY

R. M. Stinnett

APPROVALS

G. Newman
Technical Section Head

Oct. 28, 1985

J. P. Wamb
Operations Division Director

10/28/85

ORNL Office of Operational Safety

10/28/85

Department of Energy, Oak Ridge Operations Office

12/10/85
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1 DEFINITIONS</td>
<td>1</td>
</tr>
<tr>
<td>1.1.1 Abnormal Occurrences</td>
<td>1</td>
</tr>
<tr>
<td>1.1.2 Cell</td>
<td>2</td>
</tr>
<tr>
<td>1.1.3 Certified Operator (RO/SRO)</td>
<td>2</td>
</tr>
<tr>
<td>1.1.4 Channel</td>
<td>2</td>
</tr>
<tr>
<td>1.1.5 Channel Calibration</td>
<td>2</td>
</tr>
<tr>
<td>1.1.6 Channel Test</td>
<td>2</td>
</tr>
<tr>
<td>1.1.7 Critical Assemblies (or Assemblies)</td>
<td>2</td>
</tr>
<tr>
<td>1.1.8 Experiment</td>
<td>2</td>
</tr>
<tr>
<td>1.1.9 Experiment Plan</td>
<td>3</td>
</tr>
<tr>
<td>1.1.10 Measuring Channel</td>
<td>3</td>
</tr>
<tr>
<td>1.1.11 Operable</td>
<td>3</td>
</tr>
<tr>
<td>1.1.12 Operating</td>
<td>3</td>
</tr>
<tr>
<td>1.1.13 Operator-in-Training</td>
<td>3</td>
</tr>
<tr>
<td>1.1.14 Safety Channel</td>
<td>3</td>
</tr>
<tr>
<td>1.1.15 Safety Systems</td>
<td>3</td>
</tr>
<tr>
<td>1.1.16 Scram Time</td>
<td>3</td>
</tr>
<tr>
<td>1.1.17 Secured Assembly</td>
<td>4</td>
</tr>
<tr>
<td>1.1.18 Shutdown Assembly</td>
<td>4</td>
</tr>
<tr>
<td>2. SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS</td>
<td>5</td>
</tr>
<tr>
<td>2.1 SAFETY LIMITS</td>
<td>5</td>
</tr>
<tr>
<td>2.1.1 Applicability</td>
<td>5</td>
</tr>
<tr>
<td>2.1.2 Objective</td>
<td>5</td>
</tr>
<tr>
<td>2.1.3 Specifications</td>
<td>5</td>
</tr>
<tr>
<td>2.1.4 Bases</td>
<td>5</td>
</tr>
<tr>
<td>2.2 LIMITING SAFETY SYSTEM SETTINGS (LSSS)</td>
<td>5</td>
</tr>
<tr>
<td>2.2.1 Applicability</td>
<td>5</td>
</tr>
<tr>
<td>2.2.2 Objective</td>
<td>5</td>
</tr>
<tr>
<td>2.2.3 Specifications</td>
<td>5</td>
</tr>
<tr>
<td>2.2.4 Bases</td>
<td>6</td>
</tr>
<tr>
<td>3. LIMITING CONDITIONS FOR OPERATION</td>
<td>7</td>
</tr>
<tr>
<td>3.1 REACTIVITY LIMITATIONS</td>
<td>7</td>
</tr>
<tr>
<td>3.1.1 Applicability</td>
<td>7</td>
</tr>
<tr>
<td>3.1.2 Objective</td>
<td>7</td>
</tr>
<tr>
<td>3.1.3 Specifications</td>
<td>7</td>
</tr>
<tr>
<td>3.1.4 Bases</td>
<td>7</td>
</tr>
<tr>
<td>Section</td>
<td>Page</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>3.2 SCRAM TIMES</td>
<td>7</td>
</tr>
<tr>
<td>3.2.1 Applicability</td>
<td>7</td>
</tr>
<tr>
<td>3.2.2 Objective</td>
<td>8</td>
</tr>
<tr>
<td>3.2.3 Specifications</td>
<td>8</td>
</tr>
<tr>
<td>3.2.4 Bases</td>
<td>8</td>
</tr>
<tr>
<td>3.3 MEASURING CHANNELS</td>
<td>9</td>
</tr>
<tr>
<td>3.3.1 Applicability</td>
<td>9</td>
</tr>
<tr>
<td>3.3.2 Objective</td>
<td>9</td>
</tr>
<tr>
<td>3.3.3 Specifications</td>
<td>9</td>
</tr>
<tr>
<td>3.3.4 Bases</td>
<td>9</td>
</tr>
<tr>
<td>3.4 SAFETY CHANNELS</td>
<td>10</td>
</tr>
<tr>
<td>3.4.1 Applicability</td>
<td>10</td>
</tr>
<tr>
<td>3.4.2 Objective</td>
<td>10</td>
</tr>
<tr>
<td>3.4.3 Specifications</td>
<td>10</td>
</tr>
<tr>
<td>3.4.4 Bases</td>
<td>10</td>
</tr>
<tr>
<td>3.5 RADIATION MONITORING SYSTEMS</td>
<td>10</td>
</tr>
<tr>
<td>3.5.1 Applicability</td>
<td>10</td>
</tr>
<tr>
<td>3.5.2 Objective</td>
<td>10</td>
</tr>
<tr>
<td>3.5.3 Specifications</td>
<td>11</td>
</tr>
<tr>
<td>3.5.4 Bases</td>
<td>11</td>
</tr>
<tr>
<td>3.6 ENGINEERED SAFETY FEATURES</td>
<td>11</td>
</tr>
<tr>
<td>3.6.1 Applicability</td>
<td>11</td>
</tr>
<tr>
<td>3.6.2 Objective</td>
<td>11</td>
</tr>
<tr>
<td>3.6.3 Specifications</td>
<td>11</td>
</tr>
<tr>
<td>3.6.4 Bases</td>
<td>11</td>
</tr>
<tr>
<td>3.7 LIMITATIONS ON EXPERIMENTS</td>
<td>12</td>
</tr>
<tr>
<td>3.7.1 Applicability</td>
<td>12</td>
</tr>
<tr>
<td>3.7.2 Objective</td>
<td>12</td>
</tr>
<tr>
<td>3.7.3 Specifications</td>
<td>12</td>
</tr>
<tr>
<td>3.7.4 Bases</td>
<td>12</td>
</tr>
<tr>
<td>4. SURVEILLANCE REQUIREMENTS</td>
<td>13</td>
</tr>
<tr>
<td>4.1 APPLICABILITY</td>
<td>13</td>
</tr>
<tr>
<td>4.2 OBJECTIVE</td>
<td>13</td>
</tr>
</tbody>
</table>
4.3 SURVEILLANCE FOR CONFORMANCE TO LS&S AND SAFETY LIMITS...

4.3.1 Inadvertent Scram
4.3.2 Safety Channel Calibration
4.3.3 Scram Set Points
4.3.4 Radiation Monitoring System Test

4.4 SURVEILLANCE PERTAINING TO LIMITING CONDITIONS FOR OPERATION...

4.4.1 Reactivity Surveillance
4.4.2 Control and Safety System Surveillance
4.4.3 Radiation Monitoring System Surveillance
4.4.4 Surveillance of Experiment Limits

4.5 SURVEILLANCE PERTAINING TO FISSIONABLE MATERIAL...

4.5.1 Inspection and Checks

4.6 SURVEILLANCE PERTAINING TO OPERATION...

4.6.1 Responsibility
4.6.2 Initial Loading
4.6.3 Reactivity Additions

5. DESIGN FEATURES

5.1 APPLICABILITY
5.2 OBJECTIVE
5.3 RADIATION PROTECTION
5.4 REACTOR CORE
5.5 CONTROL AND SAFETY SYSTEMS

5.5.1 Reactivity Removal
5.5.2 Remote Reactivity Addition
5.5.3 Scram
5.5.4 Fine Control
5.5.5 Communication

5.6 RADIATION MONITORING SYSTEM
5.7 FISSIONABLE MATERIAL STORAGE
5.8 BUILDING

5.8.1 Site Description
5.8.2 Containment and Ventilation
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.8.3</td>
<td>Contaminated Waste Collection Tanks</td>
<td>23</td>
</tr>
<tr>
<td>5.8.4</td>
<td>Fire Protection</td>
<td>23</td>
</tr>
<tr>
<td>6.</td>
<td>ADMINISTRATION</td>
<td>24</td>
</tr>
<tr>
<td>6.1</td>
<td>APPLICABILITY</td>
<td>24</td>
</tr>
<tr>
<td>6.2</td>
<td>OBJECTIVE</td>
<td>24</td>
</tr>
<tr>
<td>6.3</td>
<td>GUIDELINES</td>
<td>24</td>
</tr>
<tr>
<td>6.4</td>
<td>ORGANIZATION</td>
<td>25</td>
</tr>
<tr>
<td>6.4.1</td>
<td>Facility Organization</td>
<td>25</td>
</tr>
<tr>
<td>6.5</td>
<td>REVIEW AND AUDIT</td>
<td>28</td>
</tr>
<tr>
<td>6.5.1</td>
<td>Review and Audit System</td>
<td>28</td>
</tr>
<tr>
<td>6.5.2</td>
<td>Document Reviews and Approvals</td>
<td>29</td>
</tr>
<tr>
<td>6.6</td>
<td>ACTION TO BE TAKEN IF A SAFETY LIMIT IS EXCEEDED</td>
<td>29</td>
</tr>
<tr>
<td>6.7</td>
<td>ACTION TO BE TAKEN IN THE EVENT OF AN ABNORMAL OCCURRENCE</td>
<td>29</td>
</tr>
<tr>
<td>6.8</td>
<td>REPORTING REQUIREMENTS</td>
<td>30</td>
</tr>
<tr>
<td>6.8.1</td>
<td>Notification</td>
<td>30</td>
</tr>
<tr>
<td>6.8.2</td>
<td>Written Report</td>
<td>30</td>
</tr>
<tr>
<td>6.9</td>
<td>FACILITY MODIFICATIONS</td>
<td>30</td>
</tr>
<tr>
<td>6.10</td>
<td>FISSILE MATERIAL</td>
<td>30</td>
</tr>
<tr>
<td>6.11</td>
<td>OPERATING PROCEDURES</td>
<td>31</td>
</tr>
<tr>
<td>6.11.1</td>
<td>Preparation of Operating Procedures</td>
<td>30</td>
</tr>
<tr>
<td>6.11.2</td>
<td>Approvals</td>
<td>31</td>
</tr>
<tr>
<td>6.12</td>
<td>OPERATING RECORDS</td>
<td>31</td>
</tr>
<tr>
<td>6.12.1</td>
<td>Experiments</td>
<td>31</td>
</tr>
<tr>
<td>6.12.2</td>
<td>Maintenance</td>
<td>31</td>
</tr>
<tr>
<td>6.12.3</td>
<td>Abnormal Occurrences</td>
<td>32</td>
</tr>
<tr>
<td>6.12.4</td>
<td>Safety-Related Equipment</td>
<td>32</td>
</tr>
<tr>
<td>6.12.5</td>
<td>Procedural Revisions</td>
<td>32</td>
</tr>
<tr>
<td>6.12.6</td>
<td>SS Material Accountability</td>
<td>32</td>
</tr>
<tr>
<td>6.12.7</td>
<td>Radiation Safety</td>
<td>32</td>
</tr>
</tbody>
</table>
TECHNICAL SPECIFICATIONS FOR THE OAK RIDGE CRITICAL EXPERIMENTS FACILITY

1. INTRODUCTION

These Technical Specifications for the Oak Ridge Critical Experiments Facility (CEF) delineate limiting conditions of operation for the facility. The modification of limits, conditions, or other requirements of this document require approval of the Oak Ridge Operations Office of the U.S. Department of Energy (ORO-DOE).

The format of this document is based on the Standard for the Development of Technical Specifications for Research Reactors, ANSI/ANS-15.1-1982. Operation of a critical experiments facility differs in many respects from research reactor operation. These differences are consequently reflected in this document. The primary difference between reactors and critical experiments is that, in reactors, a large fission product inventory is accumulated while, in critical experiments, the fission product inventory is normally insignificant.

The CEF is used primarily for testing the High Flux Isotope Reactor (HFIR) fuel assemblies. Specifically, the Criticality Testing Unit, Liquid (CTUL), located in the CEF, is used for the HFIR fuel assembly test. The test is performed to satisfy the surveillance requirements of the HFIR Technical Specifications. The test is used to determine the water-submerged shutdown margin for each fuel assembly.

1.1 DEFINITIONS

1.1.1 Abnormal Occurrences

An abnormal occurrence is any of the following:

1. Any actual safety system setting less conservative than that specified in the Limiting Safety System Settings Section of the Technical Specifications.


3. Safety system component malfunction or other component or system malfunction which could, or could threaten to, render the system incapable of performing its intended safety function.

4. An unanticipated release of significant quantities of fission products from fuel.

5. Uncontrolled or unexplained change in reactivity.
6. An observed inadequacy in the implementation of either administrative or procedural controls, such that the inadequacy could have caused the existence or development of an unsafe condition in connection with the operation of the Criticality Testing Unit.


1.1.2 Cell

A cell is an enclosed area in which criticality experiments are performed. Special shielding, air handling equipment, and radiation monitors are used for personnel protection.

1.1.3 Certified Operator (RO/SRO)

An individual who has successfully completed the training, examination, and certification for reactor operator (RO) or senior reactor operator (SRO) pursuant to DOE Order 5480.1A, Chapter VI with specific training in operations at the CEF.

1.1.4 Channel

The combination of sensor, line, amplifier, and output devices which are connected for the purpose of measuring the value of a parameter.

1.1.5 Channel Calibration

A channel calibration is an adjustment of the channel such that its output corresponds with acceptable range and accuracy to known values of the parameters which the channel measures. Calibration shall encompass the entire channel, including equipment actuation, alarm, or trip and shall be deemed to include a channel test.

1.1.6 Channel Test

A channel test is the introduction of a signal into the channel for verification of proper channel response and/or control action.

1.1.7 Critical Assemblies (or Assemblies)

Critical assemblies are assemblies of fissible material in a device designed and used to obtain and sustain nuclear chain reactions. Critical assemblies are not operated at significant steady state power levels; they do not contain appreciable fission product inventories; they have little or no heat removal capability; they may be used as mockups of reactor configurations.

1.1.8 Experiment

An experiment at the Critical Experiments Facility is a planned operation involving either the assembly of fissible material or other measurements involving already-assembled fissible material.
1.1.9 Experiment Plan

A document describing a proposed experiment in detail adequate to permit independent evaluation of the safety of the proposed operation and its conformance to the Technical Specifications of the CEF. Additionally, it provides direction for the conduct of the proposed experiment and a basis for audit of experimental records.

1.1.10 Measuring Channel

A measuring channel is that channel which provides a continuous indication of the value of a process variable.

1.1.11 Operable

Operable means that a component or system is capable of performing its intended function in a normal manner.

1.1.12 Operating

Operating means a component or system is performing its intended function in a normal manner.

1.1.13 Operator-in-Training

An operator-in-training is an individual who is participating in a training program leading to certification as a Reactor Operator or a Senior Reactor Operator at the CEF.

1.1.14 Safety Channel

A safety channel is one which operates primarily to initiate action leading to a shutdown assembly.

1.1.15 Safety Systems

Safety systems are those systems, including their associated input channels, which are designed to initiate automatic protective action.

1.1.16 Scram Time

The scram time is the time required for the mechanical and electrical systems to actuate before the initial introduction of negative reactivity to the system. Specifically, for the HFIR fuel assembly tests, the scram time is the time required for the dump valve to open and allow initial flow of water through the valve.
1.1.17 Secured Assembly

A secured assembly is a shutdown assembly with the source of electrical power to the control console removed and with the switch key in proper custody.

1.1.18 Shutdown Assembly

A shutdown assembly is one that is subcritical by an amount permitting approved manual changes in configurations or quantities of fissile material, reflector, and/or moderator.
2. SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

2.1 SAFETY LIMITS

2.1.1 Applicability

This specification limits the fission product inventory and energy release within the facility.

2.1.2 Objective

The limits specify the maximum fission product inventory in an assembly which may be released without exceeding exposures to the public given in 10 CFR 100\(^1\) and define the maximum neutron intensity presenting no significant risk to operating personnel or damage to the facility.

2.1.3 Specifications

The safety limit for energy release establishes a maximum fission product inventory in any fissile material to be that produced promptly by \(10^{18}\) fissions. Safety channels shall be adjusted to initiate safety and control device action at a radiation field corresponding to a neutron flux of \(10^9\) neutrons/(cm\(^2\)-s) at a detector located 10 m from the source.

2.1.4 Bases

Analysis\(^2\) has shown that release of the fission products of \(10^{18}\) fissions from the experimental cell would result in exposures to the public well below the limits dictated by 10 CFR 100. The neutron flux of \(10^9\) neutrons/(cm\(^2\)-s) at a detector 10 m from a source is about two orders of magnitude below that expected from the first tens of milliseconds into an excursion. The flux specified will cause the safety systems to act in advance of the production of \(10^{18}\) fissions.

2.2 LIMITING SAFETY SYSTEM SETTINGS (LSSS)

2.2.1 Applicability

These specifications apply to experiment design and equipment settings to preclude violation of the CEF Safety Limits (Section 2.1.3).

2.2.2 Objective

The objective of the LSSS is to ensure initiation of protective action prior to reaching the Safety Limit.

2.2.3 Specifications

The LSSS of the safety channels shall be adjusted to initiate safety and control device action at an ionization chamber current of no more 1.5 x \(10^{-6}\) A (150\% of full scale on the 10 x \(10^{-7}\) scale). This setting
shall be no more than 5 decades above the background reading. The background reading is that ionization chamber current obtained after manual manipulation of the assembly and subsequent insertion of a neutron source, but prior to remote assembly of any particular experimental configuration. The safety action is also initiated at 150\% of any range, so that it prevents an inadvertent approach to a safety limit on higher sensitivity scales as well (e.g., 150\% of the \(10 \times 10^{-12}\) scale).

2.2.4 Bases

Reaching or exceeding the specified LSSS will result in the initiation of scram action. This setting is below the previously defined Safety Limit. The ionization chamber current limit is at a level to preclude saturation of the ion chamber. Experience in operating at such levels has shown that, starting with "cold" assemblies, no significant inventory of fission products is built up as evidenced by cooldown times of no more than a few hours before manual manipulation of the assembly is permissible.

The characteristics of the ionization chambers are such that a current of \(1.5 \times 10^{-6}\) A is equivalent to a flux incident on the detector of \(5 \times 10^{6}\) neutrons/(cm\(^2\) s). Thus, if the chambers were located at a maximum of 10 m from an assembly, the flux at the surface of the assembly would not exceed \(5 \times 10^{12}\) neutrons/(cm\(^2\) s), well below the Safety Limit.

The limitation of 5 decades between the maximum current for a scram and the background reading ensures that action is taken automatically to limit fission product generation to an insignificant value.
3. LIMITING CONDITIONS FOR OPERATION

3.1 REACTIVITY LIMITATIONS

3.1.1 Applicability

This specification defines the limiting conditions for operation with respect to reactivity for the CEF.

3.1.2 Objective

The objective is to define limiting conditions for operation of the CEF with respect to reactivity additions.

3.1.3 Specifications

3.1.3.1 Experiments

Experiments designed to result in prompt critical assemblies will require separate and specific approval.

3.1.3.2 Assembly Rates

The rate of reactivity addition by remote control shall always be less than the rate at which reactivity is removed by the scram mechanisms. For the Criticality Testing Unit, Liquids (CTUL) control in the HFIR fuel assembly tests, initial feed rates of liquid shall be established at low source neutron multiplication so that a time of 12 min or longer is required to fill the experimental vessel to the level at which criticality is sought or expected.

3.1.3.3 Reactivity Additions

Reactivity additions shall not be made simultaneously or independently by two or more persons or by two or more methods.

3.1.4 Bases

These limiting conditions for operation follow the cardinal design criterion for delayed critical experiments. This provides for limiting the rate of reactivity addition to be less than the rate of reactivity removal.

3.2 SCRAM TIMES

3.2.1 Applicability

This specification defines the limiting conditions for operation with respect to the scram times for the CEF.
3.2.2 Objective

The objective of this specification is to define scram times which would preclude continuation or repetition of the prompt critical situation. Since actual scram times are longer than the period of the assembly if the assembly is prompt critical, it is not feasible to design and build scram systems which would act in the time required to prevent a prompt critical system from reaching its peak power level in the initial burst.

3.2.3 Specifications

3.2.3.1 Criticality Testing Unit, Liquids (CTUL) Safety

Primary safety action shall be removal of liquid (i.e., water for the HFIR fuel assembly test) through the dump valve. Automatic removal of liquid (water for the HFIR fuel assembly test) through the drain valve is the secondary safety.

Dump and drain valves shall be remotely operable and normally open upon loss of control power.

Dump rates and drain rates shall be established at low source neutron multiplication and shall be greater than the feed rate.

The drain rate shall be greater than the feed rate and the dump rate greater than the drain rate.

The drain rate for the HFIR fuel assembly test shall be such that the time required to drain the vessel is less than 12 min.

The dump rate shall be established so that the vessel will empty in less than 2 min for the HFIR fuel assembly test.

The drain valve shall open in less than 400 ms. The dump valve shall open in less than 400 ms.

3.2.4 Bases

The basis for establishing these scram times is as follows. All systems tested have a negative temperature coefficient of reactivity. Therefore, all systems will terminate bursts by thermal expansion. Cooling of the system will require more than 1 s. Scram times of less than 1 s will, therefore, initiate action to terminate subsequent bursts.

Any significant obstruction in the dump line or dump valve or any misoperation of the dump valve would result in a dump time greater than 2 min. Thus, limiting the maximum dump time to 2 min helps ensure proper functioning of the dump system. Similarly, limiting the maximum drain time to 12 min helps ensure proper functioning of the drain system.
3.3 MEASURING CHANNELS

3.3.1 Applicability

This specification defines the limiting conditions for operation of the CEF with respect to the measuring channels.

3.3.2 Objective

The objective of this specification is to identify the limiting conditions for operation for the CEF with respect to the measuring channels.

3.3.3 Specifications

3.3.3.1 Independence

At least two independent measuring channels shall monitor the neutron intensity in an assembly. Radiation sensors shall be positioned and have sufficient sensitivity so that there will be indications of neutron or gamma-radiation intensity and neutron multiplication on readout instruments.

3.3.3.2 Neutron Source

A source of neutrons of sufficient strength to produce a reliable indication of source neutron multiplication by the assembly as measured by the instrumentation shall be present during initial evaluations prior to assembly for criticality (Section 2.2.3).

3.3.3.3 Fine Control

The status of water level or any variable for fine control of reactivity shall be continuously displayed in the control room. Continuous liquid-level indication is required in order to maintain proper control of reactivity and a desired neutron level.

3.3.4 Bases

To ensure reliable monitoring of neutron intensity, redundancy is necessary. In addition, proper positioning of sensors is necessary to ensure indications of neutron or gamma-radiation intensity and source neutron multiplication on the readout instruments. Such indications are essential for the controlled execution of an experiment.

Two basic principles are involved in the requirements for a neutron source during an approach to criticality. First, the source of neutrons provides a reference point from which changes in multiplication may be measured, thus providing the operator with vital information as to the status of the system. Second, a source of neutrons must be present during an approach to criticality to minimize any delay in the initiation of a chain reaction.
The operator must know the status of principal variables in the experiment. However, for devices having low reactivity value and used to maintain a desired neutron level, such as the source, only "in" and "out" positions are necessary.

3.4 SAFETY CHANNELS

3.4.1 Applicability

This specification defines the limiting conditions for operation of the CEF with respect to the safety channels.

3.4.2 Objective

The objective of this specification is to establish the limiting conditions for operation for the CEF with respect to the safety channels.

3.4.3 Specifications

3.4.3.1 Independence

At least two safety channels shall be capable of independently initiating a scram at a preset radiation level not exceeding the LSSS (Section 2.2.3). These may be the same as those channels in Section 3.3. Each channel shall function independently from all other channels. All monitoring and recording equipment on each channel shall in no way affect the scram functions of the other channel.

3.4.3.2 Scram Level

The scram level for neutron and gamma-radiation linear channels shall be no greater than 150% of the operating on-scale range being used to monitor source multiplication.

3.4.4 Bases

To increase reliability of the safety system, redundancy is necessary. Isolation ensures independence of channels. Scram shall be initiated by a current in the channel to obviate dependence on monitoring or recording equipment.

3.5 RADIATION MONITORING SYSTEMS

3.5.1 Applicability

This specification defines the limiting conditions for the radiation monitoring system during operation of the CEF.

3.5.2 Objective

The objective of this specification is to identify the limiting conditions for operation of the CEF in relation to the radiation monitoring system.
3.5.3 Specifications

3.5.3.1 Operation

Radiation monitors, in a group of three, shall be operating in the experiment area. The building evacuation alarm is actuated by coincidence tripping any two of the three monitors.

Each radiation monitor shall be set to trip at a gamma-radiation level less than 40 R/h at the detectors located inside the cell. Should the building evacuation alarm be actuated while an experiment is in progress, the system shall be manually scrambled.

3.5.4 Bases

The requirement for coincident alarms precludes evacuation resulting from single detector alarms as a consequence of instrument malfunction. A gamma-radiation level of 40 R/h results in alarms below the LSSS.

3.6 ENGINEERED SAFETY FEATURES

3.6.1 Applicability

This specification defines the limiting conditions for operation of the CEF with respect to the engineered safety features.

3.6.2 Objective

The objective of this specification is to define the limiting conditions for operation for the CEF with respect to the engineered safety features.

3.6.3 Specifications

3.6.3.1 Confinement

Critical experiments shall not be performed in the cell unless the cell air pressure is at least 0.1 in. of water negative with respect to the control room and the exterior atmosphere.

3.6.3.2 Emergency Cooling

Experiments at the CEF are conducted and operated below power levels requiring forced cooling of the assembly; therefore, no provisions are required or have been made for emergency cooling.

3.6.4 Bases

No confinement system in the sense of sealed physical barriers is provided. However, the experiment cell is normally operated at between 0.1 and 0.2 in. of water negative with respect to the control room and the
exterior atmosphere. The negative pressure is maintained by an exhaust blower which is automatically shut off if a radiation alarm is initiated by the radiation monitoring system. Shutdown of this exhaust blower will result in a flow of air into the assembly cell thus retarding the dispersal of any airborne activity to areas outside the cell. It is estimated, based on the experiment area volume and the available openings to the exterior atmosphere, that fission products would be contained for at least 15 min.

3.7 LIMITATIONS ON EXPERIMENTS

3.7.1 Applicability

This specification defines the limiting conditions for operation of the CEF with respect to experiments.

3.7.2 Objectives

The objective of this specification is to establish the limiting conditions for operation of the CEF regarding experiments.

3.7.3 Specifications

3.7.3.1 Transuranic Elements

No critical experiments will be performed using transuranic elements without prior specific approval by the Office of Operational Safety.

3.7.3.2 Experiment Plan

Experiments will be performed only after review of an Experiment Plan by the ORNL Criticality Committee and approval of the Plan by the Office of Operational Safety (OOS).

3.7.3.3 Reactivity Effects

See Section 3.1 above.

3.7.3.4 Thermal-Hydraulic Effects

Experiments at the CEF are to be conducted and operated below power levels requiring forced cooling of the assembly.

3.7.4 Bases

A re-evaluation of containment and approval by the Office of Operational Safety is required before significant quantities of transuranium elements may be used as fuel in a critical assembly.
4. SURVEILLANCE REQUIREMENTS

4.1 APPLICABILITY

This specification defines the surveillance requirements for conformance to safety specifications and procedures at the CEF.

4.2 OBJECTIVE

The objective is to impose surveillance requirements on those systems and that equipment which have significant relationships or are essential to the safe operation of the CEF. In addition, surveillance is conducted to reduce the possibility of exceeding the LSSS and therefore the Safety Limits for the Facility.

4.3 SURVEILLANCE FOR CONFORMANCE TO LSSS AND SAFETY LIMITS

4.3.1 Inadvertent Scram

Whenever an inadvertent scram occurs, an evaluation shall be conducted to determine the cause and that cause corrected or eliminated before proceeding with the experiment.

4.3.2 Safety Channel Calibration

Safety channels shall be calibrated semiannually and after maintenance which affects calibration and the results recorded in an auditable manner. Verification of the calibration shall be performed prior to operation each day (Sections 4.4.2.2 and 4.4.2.3).

4.3.3 Scram Set Points

Scram set points on the safety channels shall be verified for conformance to the LSSS on a semiannual basis and following maintenance which may affect calibration. In addition, scram set points shall be checked prior to operations each day (Section 4.4.2.2).

4.3.4 Radiation Monitoring System Test

Performance of the Radiation Monitoring Safety System shall be checked on a monthly basis during operation of the CEF and on a quarterly basis when testing is not being done. This includes the audible alarm, shutdown of the ventilation equipment of the cell, transmission of the alarm signal to the Y-12 Plant Shift Superintendent (PSS), and actuation of the warning lights to limit vehicular access.
4.4 SURVEILLANCE PERTAINING TO LIMITING CONDITIONS FOR OPERATION

4.4.1 Reactivity Surveillance

Reactivity surveillance in the normal sense is not applicable to critical experiments as a general criterion since each experiment involves a different configuration of reactive materials. However, the reactivity surveillance for the CEF is accomplished by a review of the ORNL Criticality Committee.

4.4.2 Control and Safety System Surveillance

4.4.2.1

The scram time and fill or closure time (i.e., the feed, drain, and dump rates and the fill, drain, and dump times) for the safety system of the Criticality Testing Unit (CTU) shall be measured prior to initial use, after major maintenance or significant modification, and verified semiannually.

4.4.2.2

The proper functioning of the safety system, i.e., scram by each safety channel, for the Criticality Testing Unit shall be established prior to operations each day.

4.4.2.3

The instrument response to a change in neutron or gamma-radiation intensity shall be observed prior to operations each day.

4.4.3 Radiation Monitoring System Surveillance

4.4.3.1

The response of each of the three monitors in the experiment area to a change in gamma-radiation field shall be observed daily before operation in that area.

4.4.3.2

The group of radiation detectors shall be tested to initiate the radiation monitor alarm and control actions. These tests shall be conducted in such a way that all set points are verified semiannually to be no higher than 40 R/h. The set points shall be calibrated annually.

4.4.4 Surveillance of Experiment Limits

It is the responsibility of the operating personnel to conform to the requirements of this technical specifications document. A review shall be conducted on an annual basis by the ORNL Criticality Committee to ensure the operation is in accordance with established and approved procedures.
4.5 SURVEILLANCE PERTAINING TO FISSILE MATERIAL

Since there is not a significant fission product inventory involved in the performance of critical experiments, surveillance is appropriate only to ensure retention of fissile material in the designed containments and/or configuration during transfer, use, and storage of the material.

4.5.1 Material Analysis

All fuels shall be analyzed for chemical composition, impurities, and isotopic composition prior to being received at the CEF.

4.5.1.1 Compatibility

Fuel elements, metallic fuel, or similar fuel materials generally pose no problem. However, in those circumstances where such items are to be exposed to water or solutions where dissolution of the fuel might occur, compatibility shall be established prior to use, or encapsulation shall be provided. The integrity of such encapsulation shall be verified prior to use.

4.6 SURVEILLANCE PERTAINING TO OPERATION

Audits shall be conducted by the ORNL Criticality Committee on a random basis and at least annually to ensure operation in conformance with the following criteria.

4.6.1 Responsibility

One Senior Reactor Operator shall be in charge of a particular experiment series and shall be responsible for defining the loading and adjustment of assemblies. A minimum of two persons, one being a Senior Reactor Operator, the second being a Reactor Operator or an Operator-in-Training, shall be present during any experiment or operation with fissile material.

4.6.2 Initial Loading

The initial loading of fissile material shall be in a configuration known to be subcritical by geometry, mass, moderator, or reflector limits. Each additional loading shall be based on previous experimental results.

4.6.3 Reactivity Additions

Additions of reactivity beyond those permitted by Section 4.6.2 shall be made by remote operation and shall be guided by neutron detector response. During an initial approach to criticality, a reactivity addition shall not be made unless the effects of preceding additions have been observed and understood. Additions of reactivity shall not be made simultaneously by two or more persons or by two or more distinct methods.
5. DESIGN FEATURES

5.1 APPLICABILITY

This section describes the design features of the CEF having safety significance.

5.2 OBJECTIVE

The objective is to describe those design features of the CEF having safety significance.

5.3 RADIATION PROTECTION

Radiation protection of the personnel in the CEF and those employees in the immediate vicinity of the CEF is provided by the shielding designed into the structure of the Facility (Section 5.8).

5.4 REACTOR CORE

Reactor core design for critical experiments is limited and controlled by the physical size of the available facilities.

5.5 CONTROL AND SAFETY SYSTEMS

5.5.1 Reactivity Removal

Reactivity removal will be actuated automatically if a preset radiation level is met or exceeded. In addition, such reactivity removal can be initiated manually. Loss of actuating power to any safety device will produce a scram.6

Control and Safety Systems for the CTUL shall include both a drain valve and a dump valve in the reflector/moderator system.

5.5.2 Remote Reactivity Addition

Safety devices shall be operable during remote reactivity additions.

5.5.3 Scram

A scram signal shall automatically prevent further increase of reactivity (Section 5.5.1).

5.5.4 Fine Control

The status of any variable for fine control of reactivity shall be continuously displayed at the control console. The limiting conditions or positions of safety devices shall also be displayed.
5.5.5 Communication

Communication shall be provided between personnel at the control console and those who may be at the critical assembly.

5.6 RADIATION MONITORING SYSTEM

A radiation monitoring system shall be provided to monitor the experiment area to ensure detection and alarm activation if excessive radiation levels accidentally occur in any of these areas. The alarm is the building evacuation signal. The building is provided with radiation threshold detectors, and all personnel are provided with radiation dosimeters in accord with standard ORNL practice in conformance with DOE Order 5480.1A, Chapter XI.

5.7 FISSIONABLE MATERIAL STORAGE

All fissionable material in the CEF not actively being used in an experiment shall be stored in configurations and locations reviewed by the ORNL Criticality Committee and approved by the Office of Operational Safety.

5.8 BUILDING

5.8.1 Site Description

The CEF (Building 9213) is located at a remote site in the southwest portion of the Y-12 Area. It is situated in a pocket in the terrain formed by surrounding hills as much as 200 ft higher than the building itself. The projected distance to the nearest public highway is 3200 ft. The CEF is enclosed in an area to which access is restricted by a chain link fence. Gates in the fence, except the one at the entrance to the CEF, are kept locked. Many of these features are shown in Fig. 1, a plan of the area including elevations. Figures 2 through 4 show the immediate building environment in greater detail.

5.8.1.1 Construction

The CEF is a two-story concrete and concrete block structure about 200 ft long and 80 ft wide. Originally, three experiment areas or test cells extended the full height of the building, i.e., about 35 ft, and each had a floor area between 900 and 1520 ft². A control room was associated with each cell and was separated from it by a 5-ft-thick ordinary concrete wall having a specific gravity of about 2.5. Visual communication between the control and test areas was through water-filled windows or by closed circuit television; verbal communication was provided by an intercom. Of the original three test cells, only the west cell remains in use for criticality experiments and measurements. The control room for
Fig. 1. Y-12 Plant, West End.
Fig. 2. First floor plan, Building 9213.
Fig. 3. Second floor plan, Building 9213.
Fig. 4. Contours, Building 9213.
the west cell is separated from the assembly area by 5-ft-thick concrete walls. Water-filled windows still provide visual communication, as mentioned above. Necessary office, laboratory, and other supporting space is located in the central portion of the building.

The walls on the south side of the west cell (adjacent to the roadway) are of 5-ft-thick concrete. The cell wall on the north side is 12 to 18 in. thick, established by structural needs, and provides significant radiation shielding at the boundary of the area defined by the perimeter fence located at least 50 ft distant.

The walls on the east and west sides are also only 12 to 18 in. thick, for structural purposes. Personnel on the roadway and in other accessible areas are protected from leakage radiation through these walls by additional concrete walls.

Measurement has shown that this shielding provides adequate protection against exposure to projected radiation sources.

Many other features were incorporated in the design to improve overall personnel protection. In some places, for example, windows were substituted for solid walls where the latter would have back scattered radiation into normally occupied areas.

As protection against the scattering of radiation by air, the west cell is covered by a 1-ft-thick concrete slab. The intermediate general-purpose area and the guard shelter are covered by concrete at least 3.5 in. thick. The effective thickness of these roof shields is somewhat greater because of the angle at which the radiation must traverse them in order to be scattered into the central area or onto the road.

Reference is made to the drawings and specifications of the architect-engineer for structural details.7

Many data, amassed over the years of operation from both accidental supercritical excursions and planned experiments, yield an evaluation of the protection of personnel afforded by these structural features. More detailed reference to these supporting data may be found in the discussion of potential incidents in the Safety Analysis Report.8 During operation, personnel are located in shielded areas; their exclusion from nominally unshielded areas is enforced by the perimeter fence or by rigid administrative controls supplemented by alarms which sound in the affected control rooms.
5.8.2 Containment and Ventilation

The building is air conditioned. The cell is heated and ventilated by air circulated and conditioned in a system serving that cell exclusively. All air handling equipment in the building is automatically stopped upon a signal from high-level radiation detectors in the cell so that the air remains stagnant until such time as it is deemed appropriate to reactivate the air handling equipment. This reactivation must be done manually. In addition to the usual air conditioning system, the cell is equipped with a fan having minimum rated capacity of 500 cfm which normally runs continuously and discharges to the atmosphere. This outflow of air maintains the pressure within the cell slightly below that in adjacent areas of the building and also below that of the ambient atmosphere. Thus, at least in the short interval required for air pressures to equilibrate after stoppage of the fan upon an emergency signal, the flow of air is into the potentially contaminated area. Filters are not installed in this exhaust system since personnel can be readily controlled in the remote area in which the CEF is located. Operations within the CEF are contingent upon operability of the ventilating system.

Beyond that which has already been described, there is no provision for containment of airborne activity. The CEF may be inadequate for the risks which might arise in experimentation with uncontained highly toxic materials. Should the use of materials more toxic than uranium become desirable, a more complete evaluation of contamination potentials may make it necessary to install, in the existing cell, a primary containment structure similar to those successfully used routinely in plutonium production operations. An addendum to the safety documentation will be required prior to the use of any other material.

5.8.3 Contaminated Waste Collection Tanks

The liquid waste drains from the laboratory areas lead first to an acid-neutralizing pit and thence to hold tanks which are emptied only after analyses have shown negligible quantities of fissile material present. Large, possibly critical, quantities of fissile material cannot inadvertently flow into the waste tanks because the drains leading to them are either above floor level or are fitted with gasketed pipe caps.

5.8.4 Fire Protection

Fire protection for Building 9213, with the exception of the experiment area, is provided by an automatic sprinkler system. Portable fire extinguishers are provided in the experiment area. The sprinkler system is connected to the Y-12 Plant Gamewell System. Additional protection within the building is provided by portable extinguishers and three hose stations equipped with 1 1/2-in. hose and combination nozzles. A master fire alarm box is provided immediately outside the building. The box is tied into the Y-12 Plant fire alarm system.
6. ADMINISTRATION

6.1 APPLICABILITY

This section provides general administrative and operational guidelines for the CEF. In particular, it specifies the philosophy of operation, and delineates authority and responsibility for each personnel classification.

6.2 OBJECTIVE

The objective is to provide general administrative and operational guidelines for the CEF and to specify operational philosophy and delineate authority and responsibility for each personnel classification.

6.3 GUIDELINES

The operations within the Facility are guided by a few fundamental practices and conditions which are summarized here.

1. Protection of personnel, both employee and public, from radiation and other accidental injury is of the utmost importance.

2. The prevention of damage to property and the consummation of a sound technical program are also important.

3. Every reasonable effort is made to avoid unplanned criticality, but no absolute guarantee thereof can be made. There is, however, always assurance of operable mechanisms for the termination of such criticality within a short time following its occurrence.

4. The cardinal design criterion for the usual delayed critical experiment is provision for automatically removing reactivity at a rate greater than that at which it can be added by normal means. The absolute values of rates of reactivity change, whether positive or negative, are relatively unimportant provided this criterion is met.

5. The integrity and dependability of the mechanical and electrical equipment are established for each experiment. Experiments are performed with well-designed and regularly tested equipment.

6. A carefully planned emergency procedure is in effect. Orderly action and full communication are recognized as essential in any emergency. On the other hand, the local emergency procedures grant permission to knowledgeable individuals who are directly informed about the location of the emergency to deviate from the prescribed evacuation routes if to do so is, in their judgment, a better action.
7. Recognition of the accident potential was cause for the design and construction of a relatively costly laboratory having unique features providing the protection demanded in Item 1 above. Many of the protection capabilities attributable to construction and to location have been directly measured and found more than adequate. All other capabilities have been analyzed by experts in the respective disciplines and also have been found acceptable for the conditions expected. These characteristics of the Facility were best expressed by the U.S. AEC in describing the Facility as "...a critical experiments laboratory specifically designed to accommodate such occurrences (unplanned criticality incidents), since events of this nature cannot be considered entirely unexpected in an experimental facility of this sort."

6.4 ORGANIZATION

The Critical Experiments Facility is physically located within the Y-12 Plant. The west cell is located in the west end of the Critical Experiments Facility, Building 9213. Administration of the facility is by Martin Marietta Energy Systems, Inc., under contract DE-AC05-84OR21400 with the United States Department of Energy. Within the Martin Marietta Energy Systems, Inc., organization, management of the CEF is part of the Operations Division of ORNL, which reports to the Executive Director of ORNL.

"...ORNL Operations Division has the responsibility to conduct HFIR fuel element reactivity measurements in the cell to satisfy requirements for reactor operation. ORNL is responsible for all facets of the HFIR fuel reactivity measurements and any other critical measurements performed by ORNL forces in the cell, including all safety documentation, technical specifications, safety reviews, and obtaining DOE/ORO approval for such operation. ORNL is also responsible for maintenance and checkout of all measurement and control systems employed in west cell operations.

Y-12 will maintain the building proper, including fire, radiation, and any security alarm systems. Y-12 will also continue to provide all other services to the facility necessary to assure safety of all operations in the building, including utilities as well as security, fire, and emergency response.

Y-12 is also responsible for review, approval, and handling of all waste and environmental discharges from the building in accordance with standard Y-12 operating practices..."11

6.4.1 Facility Organization

The CEF is a part of the Operations Division of the Oak Ridge National Laboratory. The responsibility for the facility's operation is vested in the Technical Section of the Operations Division. Those responsible for
the experimental or testing programs are the Technical Section Head, Senior Reactor Operators, Reactor Operators, and Technicians. The organization of the Critical Experiments Facility is shown in Fig. 5.

In order to qualify for the classifications of Senior Reactor Operator and Reactor Operator, staff members must fulfill certain academic and/or practical experience requirements. A person who has attained a particular classification is vested with specific authority and responsibility as described. These requirements, authority, and responsibility are summarized below for each staff classification. All staff members must have a working knowledge of the operational safety requirements of the facility and must assume responsibility for their execution and enforcement. Any operation shall be suspended pending resolution of any concern expressed by a staff member about the adequacy of safety provisions.

Any potentially unsafe condition shall be reported immediately to the appropriate Senior Reactor Operator who shall be responsible for its elimination.

6.4.1.1 Senior Reactor Operator

A Senior Reactor Operator shall have a working knowledge of reactor theory and must be familiar with the installed instrumentation and equipment. The person shall have worked at the facility an adequate time to become thoroughly familiar with the facility to gain operational experience and to demonstrate the qualifications to become a Senior Reactor Operator in the CEF.

Each experimental program is under the direction of a Senior Reactor Operator. The Operator is responsible for setting and verifying specifications for mechanical and electrical equipment, for defining loading and adjusting critical assemblies, and for preparing the necessary documentation.

6.4.1.2 Reactor Operator

A Reactor Operator shall have a knowledge of critical experiments and should be familiar with the instrumentation and equipment in the assigned work area. A Reactor Operator shall have worked at the facility an adequate time to become thoroughly familiar with the facility to gain operational experience and to demonstrate the qualifications to become a Reactor Operator. Upon completion of sufficient academic studies to provide a working knowledge of reactor theory, a Reactor Operator may become a Senior Reactor Operator provided the qualifications for that position are demonstrated.

6.4.1.3 Personnel qualification

The CEF shall be operated by personnel examined and certified under the general provisions of DOE 5480.1A, Chapter VI, and approved by the ORNL Operations Division Director.
Fig. 5. Staff organization for the Critical Experiments Facility.
6.4.1.4 Operator-in-Training

An Operator-in-Training shall be a person who is in the process of training and qualifying as a Reactor Operator or a Senior Reactor Operator.

6.4.1.5 Technician

A technician shall be familiar with the operation of the equipment in the assigned work area. No specific academic or tenure requirements are specified for a technician. Upon completion of sufficient academic and practical training, a technician may become a Reactor Operator provided the qualifications for that position are demonstrated.

6.5 REVIEW AND AUDIT

Periodic reviews and audits of the facility operations shall be conducted by personnel not directly connected with the CEF. In addition, all documentation that pertains to operations at the CEF shall undergo a specific review and approval sequence depending on its subject. These reviews, audits, and approvals serve to inform ORNL Management and DOE-ORO of the operating conditions and practices at the facility.

6.5.1 Review and Audit System

The review and audit system for the CEF shall consist of committees comprised of personnel not directly connected with the CEF. These committees report to the ORNL Executive Director.

6.5.1.1 Specific functions of the ORNL Criticality Committee

The Criticality Committee is responsible for independent reviews of safety-related operations with significant quantities of fissionable material. Such reviews will, therefore, include, but not be limited to, Experiment Plans, proposed equipment modifications or alterations, and records of experimental operations. The Criticality Committee shall review annually the safety-related operations at the CEF. The Committee may call upon experts within Energy Systems for consultations and guidance in the performance of specific reviews. The CEF personnel will provide the Criticality Committee all information needed to perform its function.

6.5.1.2 Criticality safety and Health Physics

The ORNL Criticality Committee shall review any fissile material storage and handling practices at the CEF. These practices shall be approved by the Office of Operational Safety. Any changes in storage conditions or handling practices require the prior review and approval previously mentioned. Storage and handling practices shall be such as to ensure conformance to DOE Order 5480.1A, Chapter V.
ORNL Radiation and Safety Surveys Section shall review and approve Health Physics activities at the CEF to ensure conformance to the applicable sections of DOE Order 5480.1A, Chapter I.

6.5.2 Document Reviews and Approvals

Required documentation originated by the Senior Staff pertaining to the safety of the Facility operations must be reviewed and approved by ORNL Management.

Each experimental program undertaken by the Facility staff shall be directed by a Senior Reactor Operator responsible for all phases of the program with particular emphasis placed on personnel safety. Each series of experiments shall be performed in accordance with an Office of Operational Safety approved written Experiment Plan.

6.6 ACTION TO BE TAKEN IF A SAFETY LIMIT IS EXCEEDED

In the event a Safety Limit is exceeded, all critical experiments in the CEF shall be secured. Critical experiments shall not be resumed without specific approval of the DOE.

An immediate report shall be made to the Laboratory Executive Director and the Office of Operational Safety.

A report shall be made no later than the next work day to DOE.

A report shall be made which shall include an analysis of the causes and the extent of possible resultant damage, effectiveness of corrective action, and recommendations for measures to prevent or reduce the probability of recurrence. This report shall be sent to the Criticality Committee and a similar report submitted to DOE when authorization to resume operation of the facility is sought.

6.7 ACTION TO BE TAKEN IN THE EVENT OF AN ABNORMAL OCCURRENCE

In the event of an abnormal occurrence, as defined in Section 1, the following action shall be taken.

The facility supervisor and other appropriate management personnel shall be notified and corrective action taken.

A report shall be made which shall include an analysis of the cause of the occurrence, efficacy of corrective action, and recommendations for measures to prevent or reduce the probability of recurrence, in accordance with DOE 5484.2, Unusual Occurrence Reporting System.

A report shall be submitted to DOE per Section 6.8, Reporting Requirements.
6.8 REPORTING REQUIREMENTS

6.8.1 Notification

A notification shall be made no later than the next work day to the Environment, Safety and Health Division, Contracting Office Technical Representative (COTR), DOE, Oak Ridge Operations, of the following conditions:

1. Any release of radioactivity to the environment above the permissible limits specified in DOE 5480.1, Chapter XI, Requirements for Radiation Protection.

2. Any violation of a safety limit (Section 2.1).

   NOTE: An immediate report shall be made to the Laboratory Executive Director and the Office of Operational Safety.

3. Any exposures to personnel in controlled or uncontrolled areas that exceed the standards in DOE 5480.1, Chapter XI, Requirements for Radiation Protection.

6.8.2 Written Report

A written report shall be made within ten work days to DOE-ORO for any abnormal occurrence as defined in Section 1.

6.9 FACILITY MODIFICATIONS

1. Changes in technical specifications or modifications to the plant protection, reactivity control systems, or engineered safety features, or changes that involve a safety question not reviewed in the safety analysis report shall require prior review and authorization by the Criticality Committee and DOE.

2. Certain mechanical and instrumentation and control design changes may be made by the contractor provided the effect of the change does not involve a change in a technical specification or an unreviewed safety question. Formal procedures shall be established for documenting important mechanical and instrumentation and control design changes.

6.10 FISSILE MATERIAL

Fissile material for critical experiments in the CEF is limited by the exclusion of transuranium elements. Experiments involving transuranium elements may be conducted only after DOE approval of an addendum to this Technical Specification.
6.11 OPERATING PROCEDURES

6.11.1 Preparation of Operating Procedures

Operating procedures shall be written for the CTUL and associated safety systems.

1. Operating procedures shall include those facets of the operation having safety significance.

2. Operating procedures shall include actions to be taken to correct malfunctions. These shall include response to alarms, suspected or actual leaks, and abnormal reactivity changes.

3. Emergency procedures shall be prepared and will be coordinated with the Y-12 Plant Shift Superintendents' Office.

4. Procedures shall be prepared for checkout of equipment after significant maintenance or alterations.

5. Procedures shall be prepared describing the means employed to implement surveillance and testing requirements.

6. Radiation control procedures shall be in conformance with ORNL radiation control administrative procedures to ensure conformance with applicable DOE regulations and standards.

6.11.2 Approvals

All procedures shall clearly indicate the approvals required for both the initial issue and for subsequent revision.

6.12 OPERATING RECORDS

6.12.1 Experiments

Records of experiments shall be prepared and retained. Such records serve two basic purposes. First, they document the information obtained during an experiment and are therefore the basic source of data for reports describing the work and results of the work. Second, these records are the basic source of information used in auditing for conformance with Experiment Plans.

6.12.2 Maintenance

Principal maintenance activities having safety significance shall be documented to provide that information necessary for surveillance to ensure continued conformance with the specified safety characteristics applicable to that equipment as delineated in these Technical Specifications.
6.12.3 Abnormal Occurrences

Records shall be maintained of abnormal occurrences including copies of the reports and reviews of such occurrences.

6.12.4 Safety-Related Equipment

Records shall be maintained by the organization conducting checks, inspections, tests, and/or calibrations of safety-related components and/or systems.

6.12.5 Procedural Revisions

Records of changes to procedures shall be maintained in the affected procedures. Records of equipment changes or modifications shall be maintained in the log of the affected equipment.

6.12.6 SS Material Accountability

Shipments, receipts, and inventory of SS materials shall be documented using the Y-12 Plant Accountability System which conforms to DOE Order 5630.2. Shipments and receipts of other radioactive materials shall be documented using the applicable Y-12 Plant system.

6.12.7 Radiation Safety

Plant radiation and contamination surveys shall be made either by or under the direction of the ORNL Radiation Safety Survey Department to ensure conformance with DOE Order 5480.1A, Chapter XI. Such surveys shall be documented.

6.13 ROUTINE OPERATING REPORTS

6.13.1 Routine Operation

Progress reports shall be prepared on a routine basis in conformance with standard procedures of the ORNL Operations Division.

6.13.2 Experiment Programs

Reports shall be prepared describing any experimental program and the results thereof.
REFERENCES

1. Title 10 Code of Federal Regulations, Part 100.


5. Ref. 2, p. 72.


8. Ref. 2, pp. 61-76.


11. Memorandum of Understanding on ORNL and Y-12 Responsibilities for Operation of the Critical Experiments Facility (CEF) Building 9213 at Y-12, between Herman Postma, Director, Oak Ridge National Laboratory, and Gordon G. Fee, Vice President and Y-12 Plant Manager, April 1985.
6.13 ROUTINE OPERATING REPORTS .......................... 32
6.13.1 Routine Operation .................................. 32
6.13.2 Experiment Programs ............................... 32
REFERENCES .................................................. 33