March 20, 2002

Mr. Donald J. Campbell, Director
NASA Glenn Research Center at Lewis Field
21000 Brookpark Road M.S. 3-2
Cleveland, OH 44135

SUBJECT: ISSUANCE OF AMENDMENT NO. 11 TO FACILITY LICENSE NO. TR-3 AND AMENDMENT NO. 7 FOR FACILITY LICENSE NO. R-93 (TAC NOS. MA8190 AND MB3495)

Dear Mr. Campbell:

The Commission has issued the enclosed Amendment No. 11 to Facility License No. TR-3 and Amendment No. 7 for Facility License No. R-93 for the Test Reactor and the Mockup Reactor, respectively, at National Aeronautics and Space Administration's (NASA's) Plum Brook Reactor Facility (PBRF) in Sandusky, Ohio. These amendments consist of changes to the Facility Licenses in response to NASA's application dated December 20, 1999, as supplemented by letters on March 26, November 19, and December 20, 2001, and January 24, 2002.

The amendment allows decommissioning of the PBRF in accordance with NASA's application as supplemented. Pursuant to 10 CFR 50.82(b)(5), the approved decommissioning plan will be a supplement to the Safety Analysis Report or equivalent.

Prior to issuance of the amendment, the Commission published an Environmental Assessment and Finding of No Significant Impact in the Federal Register, 65 FR 16421, (copy enclosed).

A copy of our related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next biweekly *Federal Register* notice.

Sincerely,

/RA/

Marvin M. Mendonca, Senior Project Manager
Research and Test Reactors Section
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos. 50-30 and 50-185

Enclosures:
1. Amendment No. 11 for Facility License TR-3
2. Amendment No. 7 for Facility License R-93
3. Safety Evaluation Report
4. Environmental Assessment and Finding of No Significant Hazard

cc w/enclosures: Please see next page

National Aeronautics and
Space Administration

Docket Nos. 50-30/185

cc:

Ohio Department of Health
ATTN: Radiological Health Program
Director
P.O. Box 118
Columbus, OH 43216

Ohio Environmental Protection Agency
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The amendment allows decommissioning of the PBRF in accordance with NASA's application as supplemented. Pursuant to 10 CFR 50.82(b)(5), the approved decommissioning plan will be a supplement to the Safety Analysis Report or equivalent.

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

DOCKET NO. 50-30

NASA TEST REACTOR

AMENDMENT TO FACILITY LICENSE

Amendment No. 11
License No. TR-3

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment to Facility License No. TR-3 filed by NASA (the licensee), dated December 20, 1999, as supplemented by letters dated March 26, November 19, and December 20, 2001, and January 24, 2002, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will be decommissioned in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, Facility License No. TR-3 is hereby amended in its entirety to read as follows:

   A. This license applies to the heterogeneous light water-cooled and moderated test reactor referred to as the Plum Brook Reactor Facility (hereinafter referred to as “the reactor” or “PBRF”). The PBRF includes all associated and site support facilities except for the Mock-Up Reactor (MUR), which is under separate License R-93, Docket No. 50-185. The PBRF is owned by National Aeronautics and Space Administration (NASA), an independent agency of the United States Government and located at the NASA Plum Brook Stations near Sandusky, Ohio. The PBRF is described in the application for the full-term license dated January 10, 1964, and amendments thereto, including:

AMENDMENT NO. 5 FOR STANDBY
Application - March 19, 1973
Supplement - May 11, 1973

AMENDMENT NO. 6 TO EXCLUDE STRUCTURES 1121, 1142, 1156
Application - October 27, 1976

AMENDMENT NO. 7 FOR PROTECTED SAFE STORAGE
Application - July 26, 1985

AMENDMENT NO. 8 FOR CHANGE OF ADMINISTRATIVE OVERSIGHT
Application - February 27, 1989
Supplement - June 22, 1989

AMENDMENT NO. 9 FOR CONTINUED SAFE STORAGE
Application - November 4, 1996

Supplement - December 20, 1996
- September 18, 1997
- March 30, 1998
- April 13, 1998

AMENDMENT NO. 10 FOR ORGANIZATIONAL NAME CHANGE
Application - March 24, 1999
Supplement - August 10, 1999

AMENDMENT NO. 11 FOR CHANGE OF ADMINISTRATIVE OVERSIGHT
Application - December 20, 1999,
Supplement - March 26, 2001
- November 19, 2001
- December 20, 2001
- January 24, 2002

3. NASA is authorized to decommission the facility in accordance with their application dated December 20, 1999, and as supplemented on March 26, November 19, and December 20, 2001, and January 24, 2002.

A. This amendment authorizes inclusion of the decommissioning plan and supplements as a supplement to the Safety Analysis Report pursuant to 10 CFR 50.82(b)(5).

1. The licensee may make changes to the above plan and revisions without prior U.S. NRC approval provided the proposed changes do not:

a. Require Commission approval pursuant to 10 CFR 50.59;

b. Reduce the coverage requirements for scan measurements;

c. Increase the derived concentration guideline level and related minimum detectable concentrations (for both scan and fuel measurement methods);

d. Use a statistical test other than the Sign test or the Wilcoxon Rank Sum test for evaluation of the final status survey;

e. Result in significant environmental impacts not previously reviewed;

f. Increase the radioactivity level, relative to the applicable derived concentration guideline level, at which an investigation occurs;

g. Increase the Type I decision error;

h. Decrease an area classification (i.e., impacted to unimpacted; Class 1 to Class 2; Class 2 to Class 3; or Class 1 to Class 3).

2. The licensee shall provide the U.S. NRC notification of any changes to the planned decommissioning schedule that will extend the completion date of December 31, 2007.

3. Reports of any characterization surveys that were not part of this application and the completed final status survey plan shall be submitted to the U.S. NRC for review prior to performing the final status survey.

4. Before backfill operations, the final status survey or the portion of the final status survey covering the area to be backfilled shall be performed and will require U.S. NRC confirmation and approval.

B. Subject to the conditions and requirements incorporated herein, the Commission hereby licenses the NASA Test Reactor:

1. Pursuant to Section 104c of the Act and 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” to possess, but not operate the reactor in accordance with the procedures and limitations described in the application and this license;

2. Pursuant to the Act and 10 CFR Part 30, “Rules and General Applicability to Domestic Licensing of Byproduct Material,” and Part 70, “Domestic Licensing of Special Nuclear Material,” to possess, but not to separate, such byproduct and special nuclear materials as may have been produced by operation of the facility.

3. Pursuant to the Act and 10 CFR Parts 30 and 40 to receive, possess and use in amounts as required any byproduct or source material without restriction to chemical or physical form for instrument and equipment calibration, associated with radioactive apparatus or components, or activities incident to “possess-do-not-operate” and “decommissioning” status.

C. This license shall be deemed to contain and is subject to the conditions specified in Parts 20, 30, 50, 51, 55, 70, and 73 of 10 CFR, Chapter 1, to all applicable provisions of the Act, and to the rules, regulations, and orders of the Commission now, or hereafter in effect.

D. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment 11, are hereby incorporated in the license. The licensee shall maintain the reactor in accordance with these Technical Specifications.

4. This license amendment is effective as of its date of issuance.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

/RA/

Patrick M. Madden, Chief
Research and Test Reactors Section
Operating Reactor Improvement Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Enclosure: Appendix A, Technical Specifications

Date of Issuance: March 20, 2002

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

DOCKET NO. 50-30

NASA TEST REACTOR

AMENDMENT TO FACILITY LICENSE

Amendment No. 7
License No. R-93

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment to Facility License No. R-93 filed by NASA (the licensee), dated December 20, 1999, as supplemented by letters dated March 26, November 19, and December 20, 2001, and January 24, 2002, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will be decommissioned in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance that (i) the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) such activities will be conducted in compliance with the regulations of the Commission;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public;

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the regulations of the Commission and all applicable requirements have been satisfied; and

   F. Prior notice of this amendment was not required by 10 CFR 2.105, and publication of notice for this amendment is not required by 10 CFR 2.106.

2. Accordingly, Facility License No. R-93 is hereby amended in its entirety to read as follows:

   A. This license applies to the NASA Mockup Reactor (hereinafter referred to as “the reactor”) that is owned by NASA and located on the Plum Brook Station in Sandusky, Ohio, and described in the licensee’s application dated December 20,

1999, as supplemented by letters dated March 26, November 19, and December 20, 2001, and January 24, 2002.

3. NASA is authorized to decommission the facility in accordance with their application dated December 20, 1999, and as supplemented on March 26, November 19, and December 20, 2001, and January 24, 2002.

A. This amendment authorizes inclusion of the decommissioning plan and supplements as a supplement to the Safety Analysis Report pursuant to 10 CFR 50.82(b)(5).

1. The licensee may make changes to the above plan and revisions without prior U.S. NRC approval provided the proposed changes do not:

a. Require Commission approval pursuant to 10 CFR 50.59;

b. Reduce the coverage requirements for scan measurements;

c. Increase the derived concentration guideline level and related minimum detectable concentrations (for both scan and fuel measurement methods);

d. Use a statistical test other than the Sign test or the Wilcoxon Rank Sum test for evaluation of the final status survey;

e. Result in significant environmental impacts not previously reviewed;

f. Increase the radioactivity level, relative to the applicable derived concentration guideline level, at which an investigation occurs;

g. Increase the Type I decision error;

h. Decrease an area classification (i.e., impacted to unimpacted; Class 1 to Class 2; Class 2 to Class 3; or Class 1 to Class 3).

2. The licensee shall provide the U.S. NRC notification of any changes to the planned decommissioning schedule that will extend the completion date of December 31, 2007.

3. Reports of any characterization surveys that were not part of this application and the completed final status survey plan shall be submitted to the U.S. NRC for review prior to performing the final status survey.

4. Before backfill operations, the final status survey or the portion of the final status survey covering the area to be backfilled shall be performed and will require U.S. NRC confirmation and approval.

B. Subject to the conditions and requirements incorporated herein, the Commission hereby licenses NASA:

1. Pursuant to Section 104c of the Act and 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," to possess, but not operate the reactor in accordance with the procedures and limitations described in the application and this license;

2. Pursuant to the Act and 10 CFR Part 30, "Rules and General Applicability to Domestic Licensing of Byproduct Material," and Part 70, "Domestic Licensing of Special Nuclear Material," to possess, but not to separate, such byproduct and special nuclear materials as may have been produced by operation of the facility.

3. Pursuant to the Act and 10 CFR Parts 30 and 40 to receive, possess and use in amounts as required any byproduct or source material without restriction to chemical or physical form for instrument and equipment calibration, associated with radioactive apparatus or components, or activities incident to "possess-do-not-operate" and "decommissioning" status.

C. This license shall be deemed to contain and is subject to the conditions specified in Parts 20, 30, 50, 51, 55, 70, and 73 of 10 CFR, Chapter 1, to all applicable provisions of the Act, and to the rules, regulations, and orders of the Commission now, or hereafter in effect.

D. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment 7, are hereby incorporated in the license. The licensee shall maintain the reactor in accordance with these Technical Specifications.

4. This license amendment is effective as of its date of issuance.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

/RA/

Patrick M. Madden, Chief
Research and Test Reactors Section
Operating Reactor Improvements Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Enclosure: Appendix A, Technical Specifications

Date of Issuance: March 20, 2002

ENCLOSURE TO LICENSE AMENDMENT NOS. 11 & 7
FACILITY LICENSES NOS. TR-3 & R-93
DOCKET NOS. 50-30 & 50-185, RESPECTIVELY

Replace in its entirety Appendix A, of License No. TR-3, Docket No. 50-30 and Appendix A, of License No. R-93, Docket No. 50-185 with the enclosed pages.

APPENDIX A

TECHNICAL SPECIFICATIONS

FOR THE

LICENSE NOS. TR-3 AND R-93

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PLUM BROOK STATION

SANDUSKY, OHIO

DOCKET NOS. 50-30 AND 50-185

AMENDMENT NOS. 11 AND 7, RESPECTIVELY

MARCH 2002

TECHNICAL SPECIFICATIONS

1.0 INTRODUCTION

1.1 Scope

These Technical Specifications apply to all activities conducted at the Plum Brook Reactor Facility (PBRF) - specifically to the Plum Brook Research Reactor (PBRR) under provisions of NRC license No. TR-3 and to the Mock-up Reactor (MUR) under NRC license No. R-93. Both the PBRR and MUR were shut down in 1973, all fuel was removed, and they have been maintained in a "possess-do-not-operate" safe storage condition since that time. Both of these reactors and their associated systems are located in the same controlled area at the PBRF on Plum Brook Station, and both will be undergoing decommissioning at the same time. Therefore, these Technical Specifications address both licensed facilities.

1.2 Application

These Technical Specifications shall apply during Plum Brook Reactor Facility decommissioning activities. After completion of the decommissioning activities, NASA shall formally request the termination of the facility operating licenses through the NRC license termination process. Specific procedures or actions to meet the requirements of these Technical Specifications are not a part of these Technical Specifications.

2.0 DEFINITIONS

2.1 General

Authorized Entry. Entry to the PBRF which is sanctioned by the PBRF physical security plan, for those persons having a legitimate need to enter and who have knowledge of the conditions, hazards, and procedures at the facility, or who are accompanied by an authorized person with this knowledge.

Containment. A closure on the overall facility or a volume within the facility, which prevents the uncontrolled spread of contamination and controls the movement of air (inward and outward) through a controlled path.

Containment Device. A Containment Device is an engineered barrier that does not necessarily constitute total enclosure, and is used to prevent the spread of radioactive contamination and airborne radioactivity.

Decommissioning. Decommissioning means to remove a facility or site safely from service and reduce residual radioactivity to a level that permits: (1) release of the property for unrestricted use and termination of the license; or (2) release of the property under restricted conditions and termination of the license.

Decommissioning Activities. Decommissioning activities means all administrative and industrial efforts employed in order to achieve decommissioning. Some examples of such activities include decontamination, demolition, deconstruction, radiological surveys, and the shipping and receiving of radioactive materials, apparatus and equipment.

Kept Dry. The condition of an area, which is normally dry, or drained and mopped dry as soon as practical after becoming inadvertently wet.

Non-operable. The condition of a component or system, which has been intentionally disabled to prevent it from performing its intended function.

Protected Safe Storage. The custodial state of undefined duration, characterized by physical and procedural access control and periodic monitoring, maintenance and inspection.

Radioactive Materials.

> **Radioactive Material** – Items, which spontaneously decay and emit energetic particles or gamma energy. These items may be naturally occurring, may have been activated as a result of previous exposure to a neutron flux from reactor operations, or may have become radioactively contaminated.
>
> **Contaminated Material** – Activated, or non-activated items containing undesirable particles of radioactive materials on their surfaces, either embedded or easily removable.

Shall, should and may. "Shall" is used to denote a requirement; "should" to denote a recommendation; and "may" to denote permission, neither a requirement nor a recommendation.

Surveillance Frequency. Unless otherwise stated in these Technical Specifications, periodic surveillance tests, checks, calibrations, and examinations shall be performed within the specified surveillance intervals. In cases where the elapsed interval has exceeded 100% of the specified interval, the next surveillance interval shall commence at the end of the original specified interval. Allowable surveillance interval, as defined in ANSI/ANS 15.1 (1990) shall not exceed the following:

1. Annual (interval not to exceed 15 months).
2. Semiannual (interval not to exceed seven and one-half months).
3. Quarterly (interval not to exceed four months).
4. Monthly (interval not to exceed six weeks).

2.2 Facility Specific Definitions

Containment Vessel. The Containment Vessel is the structure that provides containment for the main reactor plant components including the Reactor Tank.

Source Term. The magnitude and mix of radio-nuclides present in PBRF systems, structures and components, which are the result of PBRF reactor operations. The major portions of the source term are comprised of the Reactor Tank and internals, associated reactor piping and system components, and activated materials stored in the PBRF Hot Laboratory facilities.

Unrestricted Area. An Unrestricted Area is an area to which access is neither limited nor controlled by the licensee for purposes of the protection of individuals from exposure to radiation and radioactive materials.

3.0 LIMITING CONDITIONS FOR OPERATION

3.1 Control of Access

Applicability

This specification shall apply to all personnel and vehicular access to PBRF, under the following conditions:

(1) While the source term remains on the PBRF site.

(2) While protection of capital assets is required.

(3) When protection of personnel from radiological or industrial hazards exposure is required.

Objective

The objective of this specification is to define the controls required for safe, monitored access and egress of personnel, vehicles and materials at PBRF.

Specification

(1) Common industrial security measures shall be provided at the access of the PBRF fenced area in order to control personnel exposure to radiation and industrial hazards, and to protect capital assets. Written procedures will be utilized in order to achieve these controls. There is no requirement to safeguard special nuclear material since all nuclear fuel has been removed from PBRF and shipped off site.

(2) Personnel shall receive radiological monitoring prior to entry into, and prior to egress from the PBRF site.

Limiting Conditions for Controlling Access

(1) Whenever decommissioning activities are in progress, properly trained personnel shall be stationed in such a manner so as to effectively control personnel, vehicle and material entry into, and egress out of the fenced area making up the PBRF site. Only personnel who have legitimate decommissioning business shall be admitted.

(2) NASA Plum Brook security badges are required prior to gaining access to the interior of the PBRF fenced area, or any buildings and work sites contained therein.

(3) Access to radiologically controlled areas shall be controlled in accordance with 10 CFR Part 20 requirements. Visitors and non-radiological workers shall be properly escorted whenever such entry within the fenced area is warranted.

(4) An effective method of continuously accounting for the presence of all personnel within the fenced PBRF site shall be utilized.

(5) During non-working hours, and at all other times when no decommissioning activity is in progress, the PBRF fenced perimeter shall be locked and secured. Access to keys for the PBRF fence gates is limited to personnel authorized by the NASA Decommissioning Project Manager. Key controls for the PBRF site will be governed by a written procedure, and the list of authorized personnel with access to PBRF keys shall be periodically audited.

Action to be Taken if Access Controls are not Maintained

If access controls are not maintained in accordance with this Specification:

(1) As soon as safe and practicable, all personnel, vehicles and material who may have entered the fenced PBRF site without proper monitoring, as well as all personnel, vehicles and material that may not have been properly monitored prior to egress shall be accounted for.

(2) If key control is lost, perimeter fence locks shall be changed-out and security re-established as soon as practicable.

Bases

The restrictions and limitations of technical specification 3.1 are necessary to provide assurance that effective PBRF site security and control of personnel exposure to radiological and industrial hazards is maintained. Additionally, the monitored egress of personnel from the site is necessary to assure that no uncontrolled radiological or industrial hazards inadvertently leave PBRF.

3.2 Alarm Response

Applicability

This specification applies to the automatic alarms associated with the PBRF under the following conditions:

(1) When CV “Door Open” monitoring is needed to maintain containment when major portions of the source term are present.

(2 When monitoring of high sump levels is required for radiological areas, which require protection from ground water infiltration and must be kept dry.

(3) When loss of electrical power impacts the ability to monitor needed automatic alarms.

Objective

The objective of this specification is to identify automatic alarms associated with the PBRF site and the proper response to these alarms. Automatic alarms include CV Door Open, Loss of Facility Electrical Power and Sump High Ground Water.

Specification

(1) Alarms shall annunciate in the Communication Center (CC) and the PBRF. The CC is continuously staffed.

(2) Alarms shall be in continuous operation except during maintenance. Maintenance actions must be complete within 24 hours or periodic physical inspections shall be prescribed for the duration of maintenance.

Limiting Conditions for Alarms

Alarms in "off normal" conditions indicate the possibility that:

(1) The CV has been improperly accessed, possibly effecting containment;

(2) Ground water infiltration may be in progress within areas that must ordinarily be "kept dry";

(3) Facility and sump pump electrical power was lost resulting in a loss of automatic alarm monitoring and protection from ground water infiltration.

Actions to be Taken for Alarms

Alarms in "off normal" conditions shall be visually investigated in order to determine any cause. This investigation shall be conducted as soon as possible, and within one hour of annunciation. Additionally, the reports on the investigation of "off normal" conditions shall be made via appropriate telephone notifications to PBRF managers.

Bases

This specification ensures a response for abnormal conditions at PBRF when the source term is present and the CV is improperly accessed, possible ground water infiltration into "kept dry" areas is occurring or the loss of electrical power threatens the ability to monitor necessary automatic alarms. Responses to off normal alarms allow personnel to act on abnormal conditions as they are developing or otherwise in a timely manner in order to minimize or prevent radiation or hazardous exposures to workers, the general public or the environment.

3.3 Containment

Applicability

This specification shall apply to all decommissioning activities within the Reactor Building and all other work sites at PBRF when major portions of the source term are present.

Objective

(1) Define those activities and conditions that require containment, the means necessary for achieving and maintaining containment, and the required actions to be taken if containment is not maintained.

(2) Apply, to the extent practical, process or other engineering controls (e.g., containment, decontamination, or ventilation) to control the concentration of radioactive material in air.

Specification

All decommissioning activities that risk the generation of airborne radioactivity in excess of the DAC, and which cannot be controlled by other process or engineering controls, require containment.

Limiting Conditions for Maintaining Containment

(1) Within the Containment Vessel (CV), air lock and roll-up doors shall be kept closed except to facilitate personnel ingress or egress or while equipment is being passed through the doorway. Otherwise, CV integrity may be achieved by affixing common barrier materials (plywood, plastic sheeting, etc.) across air lock and roll-up doors in a manner, which would inhibit the free exchange of air into, or out of the Containment Vessel.

(2) Temporary, appropriately filtered radiological ventilation systems shall be used in conjunction with work in the CV or work within other containment devices at locations other than the Containment Vessel, whenever radiological engineering analysis indicates the risk of generating airborne radioactivity in excess of the DAC. Such ventilation systems shall be configured to promote negative pressure ventilation characteristics within the CV or other containment device, and shall not be configured to exhaust in such a way as to risk the spread of airborne radioactivity or transferable contamination outside of the containment barriers.

(3) When containment devices are opened as a matter of course for removal or insertion of equipment or personnel, ventilation systems shall be operated in a manner so as to produce a negative pressure within the containment, and all activities that could generate airborne contaminants shall be suspended.

(4) Entrances to the CV shall be made secure in such a way as to prevent unauthorized entry, except when the entrance is under the direct control of authorized personnel or if authorized personnel are already inside the Containment Vessel.

(5) The condition of the CV shall be maintained in a manner such that there are no unfiltered airflow pathways open directly to areas external to the containment building, except through air lock or roll-up doors when in use.

(6) To the maximum extent practical, decontamination of components, systems, structures and surfaces shall be performed or maintained as a matter of housekeeping or process engineering in order to minimize the generation of airborne radioactivity during the conduct of decommissioning activities.

Actions to be Taken if Containment is not Maintained

If containment is not maintained in accordance with this Specification:

(1) As soon as safe and practicable, all decommissioning work shall be suspended within the CV or other containment device as it may apply. It is anticipated that such work should cease within one hour or less.

(2) Restore containment as soon as possible.

Bases

Because of component activation and contamination levels, dismantlement activities associated with the removal of the reactor vessel internal contents, the reactor vessel, biological shield and other reactor systems on the PBRF site could cause airborne concentrations in excess of DAC. Maintaining containment and using process or engineering controls during decommissioning activities that have the potential of generating airborne radioactivity prevents the uncontrolled spread of contamination.

The restrictions and limitations in technical specification 3.3 are necessary to provide assurance that an effective containment system will be established and maintained while there is a source term present.

The one-hour action time provided in technical specification 3.3 allows an orderly suspension of activities in the event that containment requirements are not met. If CV integrity is not maintained, other work activities are permitted as long as appropriately filtered radiological ventilation fans operate in such a configuration that does not present the potential for outward airflow.

3.4 Ventilation Systems

Applicability

This specification applies to temporary ventilation systems used to prevent uncontrolled spread of airborne contamination during the PBRF decommissioning. Permanently installed ventilation systems at PBRF are no longer operable.

Objective

This specification describes the minimum requirements for operation and installation of temporary ventilation systems.

Specification

Activities that Require Ventilation

All decommissioning activities, which present the risk of generating airborne radioactivity, shall utilize an appropriately filtered ventilation system, or other process and engineering controls when possible, as described in limiting conditions and section 3.3. Permanently installed PBRF ventilation systems are no longer operable.

Limiting Conditions for Ventilation Systems

(1) During activities that require ventilation, ventilation systems shall be operated to ensure that air flow is from zones of lesser potential for airborne contamination to zones of greater potential for airborne contamination.

(2) Ventilation systems shall be designed to contain radioactive materials and to prevent the uncontrolled release of radioactive material.

(3) Ventilation systems may be of a localized type using temporary containment devices or may be configured in such a manner to provide air exchanges within the CV volume.

(4) Ventilation systems shall discharge through a particulate filter system capable of ensuring that air effluents comply with the requirements of 10 CFR 20.1101 and 1302, for unrestricted areas. Typically, these filters will be High Efficiency Particulate Air (HEPA) filters of 99.97% efficiency, or greater, for 0.3 micron particles.

Actions to be Taken if Ventilation System Requirements are not Maintained

If ventilation system requirements are not maintained, as soon as safe and practicable, suspend all activities within the area served by the inoperable ventilation system. It is anticipated that such work should cease within one hour or less.

If the exhaust release rates are such that effluent limits may be exceeded, immediately suspend activities causing the release. Implement corrective actions to ensure that further releases are within limits.

Bases

The PBRR CV adequately contains the PBRF source term. However, as an additional conservative measure, whenever decommissioning activities are in progress within the CV or any PBRF structure, which could also generate airborne radioactivity, a temporary radiological ventilation system will be used to minimize the spread of contamination to other areas.

The discharge filter and effluent monitor (see Specification 3.5) provide assurance that effluent concentrations are maintained within applicable dose limits for individual members of the public as required in 10 CFR 20.1302. The PBRF Decommissioning accident analyses do not take credit for filtered ventilation for any accidentally released radioactive materials, so no specific filter efficiencies are required. The only requirement for exhaust filter installations is that air effluents must comply with the requirements of 10 CFR 20.

The restrictions and limitations in technical specification 3.4 are necessary to provide assurance that an effective ventilation system will be established and maintained.

The one-hour action time provided in technical specification 3.4 allows orderly suspension of activities in the event that the conditions specified for maintaining ventilation system requirements are not met. Immediate actions are appropriate to correct effluent releases that could exceed 10 CFR 20 limits.

3.5 Radiation and Effluent Monitoring Systems

Applicability

This specification applies to those devices either permanently installed or portable, used to detect radiation and/or contamination levels and to monitor effluents released, if any, from decommissioning activities.

Objective

This specification describes the minimum radiological instrument capabilities that must be available to protect workers and to ensure that any released effluents meet regulatory requirements.

Specifications

Requirements for Monitoring Equipment and Systems

Radiological monitoring instrumentation must be available for use as follows:

(1) Airborne Activity Monitors – Both portable and/or stationary effluent, general area, continuous air monitoring devices, and personal air sampling devices shall be used, as necessary, within PBRF and appropriately located to support activities in progress.

(2) Radiation Detection Instrumentation – An adequate number of portable and stationary instruments of sufficient accuracy and sensitivity shall be available to ensure compliance with the radiation monitoring and measurement requirements of 10 CFR Part 20 including beta-gamma survey meters (up to 1000 R/hr) for radiation dose rates and surface contamination measurement (up to 500,000 cpm) and alpha survey meters for surface contamination (up to 50,000 cpm).

(3) Lab Counting Instrumentation/Methods – gamma spectroscopy and other standard lab counting methods.

All radiation monitoring and analytical equipment shall be controlled and tested to industry standards such as ANSI N323 series.

Actions to be Taken if Required Radiation Monitors are not Operable

If stationary monitors are inoperable, within one hour, install suitable portable instruments or perform additional, periodic surveys or analyses under direction of the Radiation Safety Officer, as substitutes for any of the monitors in this section.

With no operable radiation monitors or applicable surveys or analyses, suspend all activities until corrective actions are implemented.

Bases

The monitoring systems described in 3.5 provide assurance that the radiation levels and the concentration of airborne radioactive material in working areas are properly and accurately measured during decommissioning activities.

3.6 Effluent and Environmental Monitoring

Applicability

This specification applies at all times, to the following:

(1) All decommissioning activities.

(2) Tritium monitoring associated with the Reactor Tank (RT) Nitrogen purge throughout the time that such purging is performed prior to RT removal.

Objective

This specification assures that air and liquid effluents released from the facility conform to the requirements of 10 CFR 20, and that environmental monitoring is performed to confirm the effectiveness of effluent controls.

Specifications

(1) Limiting Conditions for Air Effluents. Radioactive material discharged to the atmosphere from the decommissioning activities shall conform to the requirements of 10 CFR 20.1101 and 1302.

(2) Limiting Conditions for Liquid Effluents. Liquid effluents exceeding the effluent concentration limits of 10 CFR Part 20, Appendix B, Table 2, Column 2 shall be appropriately handled and processed.

Actions

If air or liquid effluents are determined to exceed the limitations of specifications 3.5 or 3.6 above, activities that produce those effluents shall be immediately suspended until appropriate corrective actions are implemented. It is anticipated that such work should cease within one hour or less.

Bases

Effluents produced during decommissioning activities must continue to meet the radiation protection requirements of 10 CFR 20. The PBRF environmental monitoring standards specified in technical specification 3.6 will continue to verify the environmental impacts of radiological releases from the facility, if any occur. The one-hour action time provided in technical specification 3.6 allows orderly suspension of activities in the event that effluent air fails to conform to the requirements of 10 CFR 20.1101 and 1302. This monitoring program examines air, water, soil, sediment, and other representative environmental media in the surrounding area.

4.0 SURVEILLANCE REQUIREMENTS

4.1 Surveillance, Inspection and Maintenance

Applicability

This specification applies to the surveillance, inspection and maintenance requirements for PBRF buildings, systems and conditions.

Objective

Provide surveillance, inspection and maintenance of PBRF buildings, systems and conditions such that the safety and well-being of PBRF personnel, the general public and the environment are assured, as well as ensuring that PBRF building and system functions support decommissioning.

Specifications

Procedures shall be written that specify the performance of routine surveillance, inspection and maintenance for various PBRF buildings, systems and conditions, and for the environment as follows:

(1) Integrity and Function of PBRF Structures, the CV and Other Containment Devices as they apply to decommissioning

(2) PBRF Fence and Building Security

(3) Radiation Safety

(4) Fire Safety

(5) Environmental Safety

Bases

Compliance with these specifications provides assurance that PBRF buildings, systems and conditions are maintained in an effective state of readiness, integrity and function so as to facilitate safe working conditions, prevent an uncontrolled spread of radioactivity from the site, restrict unauthorized access to the PBRF site, protect capital assets, prevent exposure to radioactivity without implementation of proper radiological controls and to manage environmental safety within the PBRF complex.

4.2 Containment

Applicability

This specification applies to the surveillance requirements for all containment devices used in PBRF decommissioning activities and the CV as long as major portions of the source term are present per technical specification 3.3.

Objective

This specification assures that all containment devices and the CV are maintained in a condition that provides an effective containment boundary.

Specifications

(1) At least annually and prior to initiation of any major phase of decommissioning, facility change records shall be reviewed and the CV shall be visually inspected to determine that there are no pathways open directly to the environment.

(2) At least once per month, a visual examination shall be performed to determine that the entrances/exits are locked or blocked closed whenever no one is inside of the containment building.

(3) At least weekly, inactive containment devices shall be inspected for adequacy of their intended purposes.

(4) At least daily and prior to use, containment devices used in decommissioning work shall be inspected for adequacy of their intended purposes.

Bases

Compliance with these specifications provides assurance that the CV and other containment devices are maintained as effective containment boundaries as long as they are needed.

4.3 Ventilation Systems

Applicability

This specification applies to temporary ventilation systems utilized to support decommissioning activities. Permanently installed PBRF ventilation systems are no longer operable.

Objective

To specify surveillance requirements that assure ventilation systems are operable when required.

Specifications

(1) At least once per week, whenever a ventilation system is required to be operating, verify that the direction of air flow is from zones of lesser potential for airborne contamination to zones of greater potential for airborne contamination.

(2) When a ventilation system is required to be operable, the exhaust air downstream of the filters shall be periodically sampled to show that the specified limits in 10 CFR 20.1302 are not exceeded.

(3) Prior to placing a ventilation system in service, verify that all materials of construction for the ventilation system are fire-resistant. All pre-filters shall be verified to be of a fire-resistant type and, where applicable, listed by Underwriters Laboratories of the Factory Mutual Research Corporation.

(4) Prior to placing a ventilation system filter housing in service, verify that it includes an instrument, device or multiple devices to indicate filter resistance and airflow rate.

(5) Prior to placing a ventilation system filter in service, after each ventilation system filter is replaced or after a ventilation system filter is handled in any manner that may effect the integrity of the filter, each filter shall be efficiency-tested to verify compliance with technical specification 3.4 Limiting Condition for Ventilation Systems (4).

Bases

Compliance with these specifications provides assurance that the ventilation systems are maintained as effective contamination barriers and are available when required.

4.4 Radiation and Effluent Monitoring

Applicability

This specification applies to the equipment and systems installed or used to detect radiation and/or contamination (e.g., laboratory counting instruments and portable radiation monitoring instrumentation).

Objective

This specification describes the check and calibration frequencies for laboratory counting instruments, and portable radiation monitoring instrumentation.

Specification

(1) Upon initial acquisition, after major maintenance, and at least annually, stationary and portable monitoring instruments shall be calibrated using NIST traceable services.

(2) At least quarterly, background and efficiency shall be measured on all laboratory instruments used for counting health physics samples, using standard sources.

(3) Prior to placing an effluent monitoring instrument into service, after major maintenance, and at least annually thereafter while in service, calibration of the ventilation effluent monitoring sampler and/or monitor shall be performed. These tests need not be performed if operation of the pertinent ventilation system is not required.

Bases

These specifications provide assurance that monitoring and analytical instrumentation will be functional when needed.

4.5 Effluents and Environmental Monitoring

Applicability

This specification applies at all times.

Objective

This specification defines the surveillance requirements to verify compliance with 10 CFR 20 requirements and to specify environmental monitoring requirements.

Specification

(1) Air Effluent Surveillance Requirements

Air effluent particulate monitors shall be examined at least once per week during decommissioning activities to verify compliance with 10 CFR 20 limits.

(2) Liquid Effluent Surveillance Requirements

Liquid effluents shall be sampled and analyzed prior to release, to determine whether they can be discharged directly or whether they require processing or dilution prior to discharge.

(3) Environmental Monitoring Requirements

The environmental monitoring requirements of the PBRF environmental monitoring program shall continue to be implemented throughout decommissioning activities.

(4) Lower Level of Detection for Sample Analyses

Table 1 illustrates the lower level of detection for air, liquid and environmental monitoring sample analyses:

Bases

The on-going PBRF program for effluent and environmental monitoring will assure that radiation level measurements, representative samples of airborne radioactive material, water, stream silt, and soil will be collected. These programs are comprehensive and appropriate for the decommissioning work. Additional workplace airborne monitoring may be performed to monitor for compliance with 10 CFR 20 requirements during those decommissioning activities with the potential for creating airborne contamination that could be released to the environment.

Table 1: Lower Limit of Detection (LLD) for Sample Analyses

Analyses	Water (µCi/ml)	Air Particulate or Gases (µCi/ml)	Sediment (pCi/g, dry)
Gross Beta	$5x10^{-8}$ (1,1a)	$2 x10^{-12}$ (2,2b)	
Gross Alpha	$2x10^{-9}$ (3,3a)	$5 x10^{-15}$ (4, 4b)	
Cs-137, gamma spectroscopy	-	-	1(5)
Sr-90, liquid scintillation	-	-	0.5 (6)

1. Strontium-90 (Sr-90) is the most restrictive beta-emitting nuclide in 10CFR20, Appendix B, Table 2. The Sr-90 effluent water concentration limit is $5x10^{-7}$uci/ml as specified by 10CFR20, Appendix B, Table 2. LLDs for beta-emitting radio-nuclides in PBRF environmental water monitoring analyses is set at one tenth this restrictive radio-nuclide's effluent concentration limit or $5x10^{-8}$uCi/ml.

1.a. The trigger level that specifies radio-nuclide specific analyses is set at $5x10^{-7}$uci/ml.

2. This LLD is one tenth of the concentration for Strontium-90 (Sr-90), which is the most restrictive beta-emitting radio-nuclide in 10CFR20 Appendix B, Table 2. It has been adjusted upward for the fraction of prevailing wind direction (0.25) and an occupancy factor (50 hours/168 hours) for NASA personnel at Plum Brook working outside the PBRF fence line. Though discovery of Strontium-90 in environmental air sampling is not anticipated, LLDs for beta-emitting radio-nuclides in PBRF environmental monitoring analyses are based on this restrictive nuclide.

2.b. The trigger level that specifies radio-nuclide specific analyses is set at $2 x10^{-11}$ µCi/ml.

3. Americium-241 (Am-241) is the most restrictive alpha-emitting nuclide in 10CFR20, Appendix B, Table 2. The Am-241 effluent water concentration limit is $2x10^{-8}$ µCi/ml as specified by 10CFR20, Appendix B, Table 2. LLDs for alpha-emitting radio-nuclides in PBRF environmental water monitoring analyses are set at one tenth this restrictive radio-nuclide effluent concentration limit or $2x10^{-9}$uci/ml..

3.a. The trigger level that specifies radio-nuclide specific analyses is set at $2x10^{-8}$ µCi/ml.

4.This LLD is one tenth of the concentration for Americium-241 (Am-241), which is the most restrictive alpha-emitting radio-nuclide in 10CFR20 Appendix B, Table 2. It has also been adjusted upward for the fraction of prevailing wind direction (0.25) and an occupancy factor (50 hours/168 hours) for NASA personnel working outside the PBRF fence line. Though discovery of Americium-241 in environmental air sampling is not anticipated, LLDs for alpha-emitting radio-nuclides in PBRF environmental monitoring analyses are based on this restrictive nuclide.

4.b. The trigger level that specifies radio-nuclide specific analyses is set at $5 x 10^{-14}$ µCi/ml.

5. The DCGL for Cs-137 in surface soils at PBRF has been established at 18 pCi/gram. The LLD for Cs-137 in sediment is set at less than one tenth this value or 1pci/gram.

6. The DCGL for Sr-90 surface soils at PBRF has been established at 32 pCi/gram. The LLD for Sr-90 in sediment is set at less than one tenth this value or 0.5 pCi/gram.

5.0 SITE FEATURES

A site characterization report has already been prepared for this project. The PBRF is located at the NASA Plum Brook Station Site near Sandusky, OH and is owned by the United States Government and operated by the National Aeronautics and Space Administration (NASA). The distance from the reactor building to the posted PBS site boundary is about 0.5 miles. Access to the PBRF controlled area will be limited through the use of physical barriers and appropriately trained personnel.

Bases

The on-going PBRF program for effluent and environmental monitoring will assure that radiation level measurements, representative samples of airborne radioactive material, water, stream silt, and soil will be collected. These programs are comprehensive and appropriate for the decommissioning work. Additional workplace airborne monitoring may be performed to monitor for compliance with 10 CFR 20 requirements during those decommissioning activities with the potential for creating airborne contamination that could be released to the environment.

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The controlled area, as defined in 10 CFR Part 20 of the Commission's regulations, shall be the area enclosed by the chain link fence around the 27-acre PBRF area. The restricted area, as defined in 10 CFR Part 20, shall be specific areas within the PBRF fenced area. These restricted areas will be routinely updated and modified as the decommissioning proceeds, but all will be contained within the larger 27-acre area.

6.0 ADMINISTRATIVE CONTROLS

6.1 Organization

The organization responsible for the management and decommissioning of the Plum Brook Reactor Facility is the National Aeronautics and Space Administration (NASA). NASA shall use the organizational management structure for these activities as stipulated in the PBRF Decommissioning Plan. Other organizational levels/staff may be added to meet specific facility needs. NASA shall provide the necessary resources required to ensure that the decommissioning is performed in a manner that poses no hazard to the general public or to the environment.

Figure 1 shows the decommissioning project organization chart.

(1) Level 1 – Glenn Research Center directorate is responsible for assuring compliance with the reactor facility license and providing regulatory reports and

correspondence. The Director shall have overall responsibility for the license and the subsequent decommissioning and license termination.

(2) Level 2 - The Decommissioning Project Manager shall be responsible for overall on-site operation in safe storage and through license termination. This includes administering programs that assure the proper operation, control, and safeguards are maintained for PBRF. The PBRF Decommissioning Project Manager or his designee shall approve, prior to implementation, each phase of decommissioning or license termination that affect nuclear safety.

(3) Level 3 - The Decommissioning Senior Project Engineer shall be responsible for day-to-day supervision of PBRF activities.

6.1.1 Responsibilities

Responsibility for the reactor facility shall be with the chain of command as specified above in technical specification 6.1. Individuals at the various management levels, in addition to having responsibility for policies and activities conducted at the PBRF, shall be responsible for safeguarding facility personnel, the public and the environment from undue radiation exposures, including releases to the environment and for adhering to all requirements of the facility license and technical specifications of the same.

In all instances, responsibilities of one level may be assumed by designated alternates or by higher levels, conditional upon appropriate qualifications.

6.2 Level 1 Directorate

The GRC Director shall be responsible for assuring compliance with the reactor facility's license and providing regulatory reports and correspondence. He or she shall have overall responsibility for the decommissioning of the facility. The Directorate shall provide the resources to complete the decommissioning.

6.3 Decommissioning Program Manager

The NASA Decommissioning Program Manager (PgM) will assure and direct the safe decontamination and decommissioning of the PBRF and has ultimate responsibility for the decommissioning project. The PgM will track the overall project schedule and budget and will interface directly with GRC management and NASA Headquarters. The PgM will serve as the primary point of contact between NASA GRC and the USACE Project Manager.

6.4 Decommissioning Project Manager

The Decommissioning Project Manager shall be responsible for planning and directing all decommissioning activities and will maintain the ultimate responsibility for safely completing the decommissioning.

6.5 Senior Project Engineer

NASA's Senior Project Engineer will provide direct oversight of PBRF decommissioning activities for Glenn Research Center Management and will serve as NASA's management

representative for activities on site. The Senior Project Engineer will have direct authority over all activities that take place at the PBRF and will be the primary interface with the USACE Civil Engineer.

6.6 Project Radiation Safety Officer (Project RSO)

The Project RSO shall be responsible for organization, administration, and direction of the radiological control and monitoring program, and shall assure that the program is adequately performed. The Project RSO shall be responsible for providing on-site advice, technical assistance, and review in all areas related to radiological safety.

6.7 Decommissioning Safety Committee (DSC)

The DSC is established to conduct reviews of all matters with safety implications relative to activities at PBRF, and will provide an executive level overview of PBRF activities. The DSC will have the authority to review any and all programs, plans, and procedures that may have an impact on the safety and health of workers and the public to ensure compliance with all applicable federal, state, and local regulations. The DSC will also be available to provide advice, technical expertise, and guidance to minimize health hazards associated with PBRF activities. The authority to fulfill this responsibility and perform these functions will be granted by the Chairman of the Glenn Executive Safety Board.

A prime consideration of the Committee's activities will be to ensure that all public and employee radiation exposures are maintained as low as reasonably achievable.

DSC activities shall be performed under a written charter or directive containing the following information as a minimum:

(1) Members of the Decommissioning Safety Committee will include:

   a. Decommissioning Program Manager (NASA)
   b. Radiation Safety Officer (NASA)
   c. Chief, Construction Management Branch (NASA)
   d. GRC Safety Officer (NASA)
   e. GRC Environmental Management Office Chief (NASA)
   f. 2-NASA Engineers - Nuclear, Environmental, Safety, Civil, Structural, Mechanical, Electrical

(2) One of the above committee members will serve as chair for the committee.

(3) The Chairman of the Decommissioning Safety Committee shall have a bachelor's degree in engineering or a related physical science.

(4) The DSC quorum shall be composed of not less than three members who collectively provide experience in radiation safety and protection, industrial safety, environmental safety, waste management and program management. In specific instances the Committee will designate the Chairman to act in its stead, and the Chairman will report his or her actions to the Committee at its next regular meeting.

(5) The DSC shall meet semi-annually, and at other times when circumstances warrant. Minutes of DSC proceedings, including recommendations or occurrences, shall be distributed to all DSC members and the Director.

(6) The DSC shall be responsible for the review of the following:

a. Proposed activities that could affect personnel or facility safety or result in an uncontrolled release of radioactivity in excess of 10 CFR 20 limits, and that are conducted without NRC approval to verify that the proposed activity does not constitute a change in Technical Specifications or an un-reviewed safety question.

b. Proposed changes to the facility or organizational processes that could affect radiation safety and that are to be completed without prior NRC approval in order to verify the activity does not constitute a change in the Technical Specifications or any un-reviewed safety question.

c. Organizational processes, which are used to develop the conduct of decommissioning functions, or that are determined to have a significant effect on radiation safety.

d. Proposed changes to the Technical Specifications or the facility license.

e. Violations of the Federal regulations, Technical Specifications, or facility license requirements.

f. Unusual or abnormal occurrences which are reportable to the NRC under provisions of the Federal regulations.

g. Internal and external audit results and the adequacy of corrective actions. Such reviews shall be performed at least once per calendar year. Intervals between such reviews are not to exceed 15 calendar months.

(7) The DSC shall perform annual reviews of records in order to determine compliance with internal rules, procedures, and regulations and with licensed provisions in the Technical Specifications. Such reviews shall be documented and reported to the Director. Intervals between such reviews are not to exceed 15 calendar months.

(8) Records of all DSC activities and decisions shall be retained for the duration of the decommissioning project.

6.8 Project Safety Committee (PSC)

The PSC is comprised of on-site project management. The PSC shall exercise review and approval authority over any and all programs, plans, decisions and procedures that may have impact on the safety and health of workers and the public. The PSC shall assure activities at PBRF comply with all applicable federal, state and local regulations, and these Technical Specifications. The PSC shall be subject to the authority of the DSC on matters associated with licensed activities. PSC activities shall be performed under a written charter or directive containing the following information as a minimum:

(1) The PSC shall be composed of the following on-site project management team:

a. NASA Decommissioning Project Manager (Chairman)

b. NASA Decommissioning Senior Project Engineer (Chairman alternate)

c. NASA Environmental Manager

d. Project Radiation Safety Officer

e. Project Health and Safety Officer

f. Other Environmental, Health and Safety professionals as required

(2) The PSC shall meet monthly, and at other times when circumstances warrant. A quorum shall consist of not less than three members of the PSC membership and shall include the chairman or his designated alternate. Minutes of PSC proceedings, including recommendations or occurrences, shall be distributed to all PSC and DSC members, and the Director.

(3) The PSC shall be responsible for the following:

a. Review and approval of proposed activities that could affect personnel or facility safety or result in an uncontrolled release of radioactivity in excess of 10 CFR 20 limits, and that are conducted without NRC approval. The PSC shall verify that the proposed activity does not constitute a change in Technical Specifications or any un-reviewed safety question.

b. Review and approval of proposed changes to the facility or to procedures that could affect radiation safety and that are to be completed without prior NRC approval. The PSC shall verify the activity does not constitute a change in the Technical Specifications or any un-reviewed safety question.

c. Review and approval of all new procedures and revisions thereto, which direct the conduct of decommissioning functions or that are determined to have a significant effect on radiation safety.

d. Review, approve, and forward to the DSC any proposed changes to the Technical Specifications or the facility license.

e. Assess and report violations of the Federal regulations, Technical Specifications, or facility license requirements.

f. Assess and report unusual or abnormal occurrences which are reportable to the NRC under provisions of the Federal regulations.

g. Perform internal audits on decommissioning records and the performance of the decommissioning contractor's compliance with applicable Federal regulations, Technical Specifications, and facility license requirements. Such audits shall be performed at least once per calendar year. Intervals between such reviews are not to exceed 15 calendar months.

h. Records of all PSC activities and decisions shall be reported to the DSC, and shall be retained for the duration of the decommissioning project.

(4) The PSC shall be responsible for the review of the following:

a. Proposed activities that could affect personnel or facility safety or result in an uncontrolled release of radioactivity in excess of 10 CFR 20 limits, and that are conducted without NRC approval to verify that the proposed activity does not constitute a change in Technical Specifications or any un-reviewed safety question.

b. Proposed changes to the facility or to procedures that could affect radiation safety and that are to be completed without prior NRC approval in order to verify the activity does not constitute a change in the Technical Specifications or any un-reviewed safety question.

c. All new procedures and revisions thereto that direct the conduct of decommissioning functions or that are determined to have a significant effect on radiation safety.

d. Review of violations of the Federal regulations, Technical Specifications, or facility license requirements.

e. Review of unusual or abnormal occurrences which are reportable to the NRC under provisions of the Federal regulations.

6.9 AUDIT REQUIREMENTS

6.9.1 Internal Audits

Internal audits of decommissioning activities shall be performed as part of a Quality Assurance Program that meets the requirements of 10 CFR 50 Appendix B and ANSI/ANS 15.10 (1994). Audits shall include selective, but comprehensive, examinations of activities, records and documents with cognizant personnel, and observation of operations as appropriate. Audit personnel shall be technically qualified and should not have been involved in the performance of the activity being audited. Audits shall include the following:

(1) Facility activities for conformance to the Technical Specifications and license, at least once per calendar year (interval between examinations not to exceed 15 months).

(2) The qualifications of the staff, at least once every other calendar year (interval between examinations not to exceed 30 months).

(3) The results of actions taken to correct those deficiencies that may occur in the reactor facility equipment, systems, structures, or methods of operations that affect facility safety, at least once per calendar year (interval between examinations not to exceed 15 months).

Deficiencies that affect facility radiation safety shall immediately be reported to Level 2 management. A written report of the findings of each audit shall be submitted to Level 2

management and the manager of the radiation safety function within one month after the audit has been completed.

6.9.2 Independent Reviews

Independent reviews of decommissioning activities and records shall be performed at least annually. Personnel performing these reviews shall be appropriately qualified and experienced, and be members of, or appointed by the Executive Safety Board. These reviews shall include an assessment of the PSC and the project Quality Assurance and Audit programs' ability to identify and correct deficiencies. Results of these independent reviews shall be provided to the Level 1 Directorate as well as to the DSC and PSC.

6.10 PROCEDURES

Written procedures, including ALARA, shall be prepared and approved prior to initiating any decommissioning activities listed in this section. Procedures for the following activities may be included in a single manual or set of procedures or divided among various manuals or procedures:

(1) Routine maintenance on major components or systems that could have an effect on radiation safety.

(2) Surveillance tests and calibrations required by the Technical Specifications or those that have an effect on radiation safety.

(3) Personnel radiation protection consistent with applicable regulations.

(4) Administrative controls for maintenance and for the conduct of activities that could affect facility radiation safety.

(5) Shipping and receipt of radioactive material.

(6) Waste Management

(7) Quality Assurance

(8) Environmental Protection Management

(9) Health and Safety Management

Changes to the above procedures shall be made effective only after approval by the PSC. Minor modifications to the original procedures, which do not change their original intent may be made as a temporary change by Level 3 or higher and shall be documented. The Radiation Safety Committee must review all temporary changes that affect radiation safety within the following 45 days. All changes (except one-time deviations) shall be incorporated into the written procedures.

6.11 REQUIRED ACTIONS

The following actions shall be taken in the event of an occurrence of the type identified in technical specifications 6.12.2(1)(a) or (b):

(1) Reactor facility conditions shall be returned to normal or the activities in progress stopped. If it is necessary to stop the activities in progress to correct the occurrence, operations shall not resume unless authorized by Level 2 or the designated alternates.

(2) Occurrences shall be reported to the Level 2 or designated alternates and to the NRC as required.

(3) Occurrences shall be reviewed by the Project Safety Committee.

6.12 REPORTS

All reports shall be addressed to the U.S. Nuclear Regulatory Commission, Washington, DC 20555, Attention: Document Control Desk.

6.12.1 Annual Report

Annually submit to the NRC a report containing the following:

(1) A narrative summary of facility activities.

(2) Tabulation of the major preventative and corrective maintenance operations having safety significance.

(3) A brief description of the major changes in the reactor facility and procedures and activities significantly different from those performed previously and not described in the facility safety analysis report, and a summary of the safety evaluation that shows no un-reviewed safety questions were involved.

(4) A summary of the nature and amount of radioactive effluents released or discharged to the environs beyond the effective control of the licensee as determined at or before the point of such releases or discharge. The summary shall include to the extent practical an estimate of the major individual nuclides present in the effluent.

(5) A summarized result of the environmental survey performed outside the facility.

6.12.2 Special Reports

Special reports used to report unplanned events as well as planned major facility or administrative changes shall be submitted in accordance with the following schedule.

(1) There shall be a report no later than the following working day by telephone and confirmed in writing by telegraph or similar conveyance to the NRC to be followed by a written report that describes the circumstances of the event within 14 days of any of the following:

   (a) Release of radioactivity from the site above allowed limits

   (b) Any of the following:

Activities in violation of limiting conditions for the conduct of activities established in the technical specification unless prompt remedial action is taken.

An observed inadequacy in the implementation of administrative or procedural controls such that the inadequacy causes or could have caused the existence or development of an unsafe condition with regard to facility operations.

(2) A written report within 30 days to the NRC of:

(a) Permanent changes in the facility organization management personnel (Level 1 or 2).

(b) Significant changes in the accident analysis as described in the decommissioning plan safety analysis.

6.13 RECORDS

Records may be in the form of correspondence, reports, logs, data sheets, or other suitable forms. The required information may be contained in single or multiple records or a combination thereof.

6.13.1 Retention of Records

The following records are to be maintained for a period of at least five years or for the life of the component involved if less than five years:

(1) Facility decommissioning operations (but not including supporting documents such as check lists, log sheets, etc which shall be maintained for a period of at least one year.)

(2) Principal maintenance and project activities

(3) Reportable occurrences

(4) Surveillance activities required by the technical specifications

(5) Reactor facility radiation and contamination surveys where required by applicable regulations

(6) Approved changes in operating procedures

(7) Records of meetings and independent examination reports of the review and independent examination group

6.13.2 Records to be Retained for the Lifetime of the Facility:

NOTE: Applicable annual reports, if they contain all of the required information, may be used as records in this section.

(1) Air and liquid radioactive effluents released to the environment.

(2) Off-site environmental monitoring surveys required by the Technical Specification

(3) Radiation exposure for all personnel monitored.

(4) Drawings of the reactor facility.

(5) Records of disposal of licensed material.

6.14 HIGH RADIATION AREA

6.14.1 Access Controls

Pursuant to 10 CFR 20, in lieu of the 'control device' or 'alarm signal', each high radiation area as defined in 10 CFR 20, shall be barricaded and conspicuously posted as a high radiation area and entrance thereto shall be controlled by requiring issuance of a Radiation Work Permit (RWP). Individuals qualified in radiation protection procedures (e.g. Health Physics personnel) or personnel continuously escorted by such individuals may be exempt from the RWP issuance requirement during the performance of their assigned duties in high radiation areas with exposure rates equal to or less than 1000 mR/hr, provided they are otherwise following plant radiation protection procedures for entry into such high radiation areas. Any individual or group of individuals permitted to enter such areas shall be provided with or accompanied by one or more of the following:

(1) A radiation monitoring device which continuously indicates the radiation dose rate in the area, or

(2) A radiation-monitoring device, which continuously integrates the radiation dose rate in the area and alarms when a pre-set integrated dose is received. Entry into such areas with this monitoring device may be made after the dose rate level in the area has been established and personnel have been made knowledgeable of them, or

(3) A health physics qualified individual (i.e. qualified in radiation protection procedures) with a radiation dose rate monitoring device who is responsible for providing positive control over the activities within the area and shall perform periodic radiation surveillance at the frequency specified by the facility Health Physics staff in the RWP.

6.14.2 Control of High Radiation Areas

In addition to the requirements of technical specification 6.14.1, areas accessible to personnel with radiation levels greater than 1000mR/hr at 45 cm (18 inches) from the radiation source or from any surface, which the radiation penetrates, shall be provided with locked enclosures to prevent unauthorized entry, and the keys shall be maintained under the administrative control of health physics. Enclosures shall remain locked except during periods of access by personnel under an approved RWP, which shall specify the dose rate levels in the immediate work area and the maximum allowable stay times for individuals in the area. Direct or remote continuous surveillance (such as the use of closed circuit TV cameras) may be used by personnel qualified in radiation protection procedures in lieu of the stay-time specification of the RWP in order to provide positive exposure control over the activities within the area.

For individual areas accessible to personnel with radiation levels of greater than 1000 mR/hr that are located within large areas, where no enclosure exists for purposes of locking, and no enclosure can be reasonably constructed around the individual areas, then that area shall be barricaded, conspicuously posted, and a flashing light shall be activated as a warning device whenever the dose rate in the area exceeds or will shortly exceed 1000 mR/hr.

7.0 REFERENCES

"Decommissioning Plan for the Plum Brook Reactor Facility, Rev 2", submitted by National Aeronautics and Space Administration – Glenn Research Center, Plum Brook Station, Sandusky, OH to the U.S. Nuclear Regulatory Commission, October 2001.

"An Evaluation of the Plum Brook Reactor Facility and Documentation of Existing Conditions", prepared by Teledyne Isotopes Inc for NASA-Lewis Research Center, Cleveland, OH, December 1987.

"The Development of Technical Specifications for Research Reactors", ANSI/ANS-15.1-1990, prepared by American Nuclear Society Standards committee Working Group ANS-15.1, American Nuclear Society, LaGrange Park, IL, December 1990.

"Decommissioning of Research Reactors", ANS/ANSI 5.10-1994, prepared by American Nuclear Society Standards Committee Working Group ANS 5.10, American Nuclear Society, LaGrange Park, IL, November 1994.

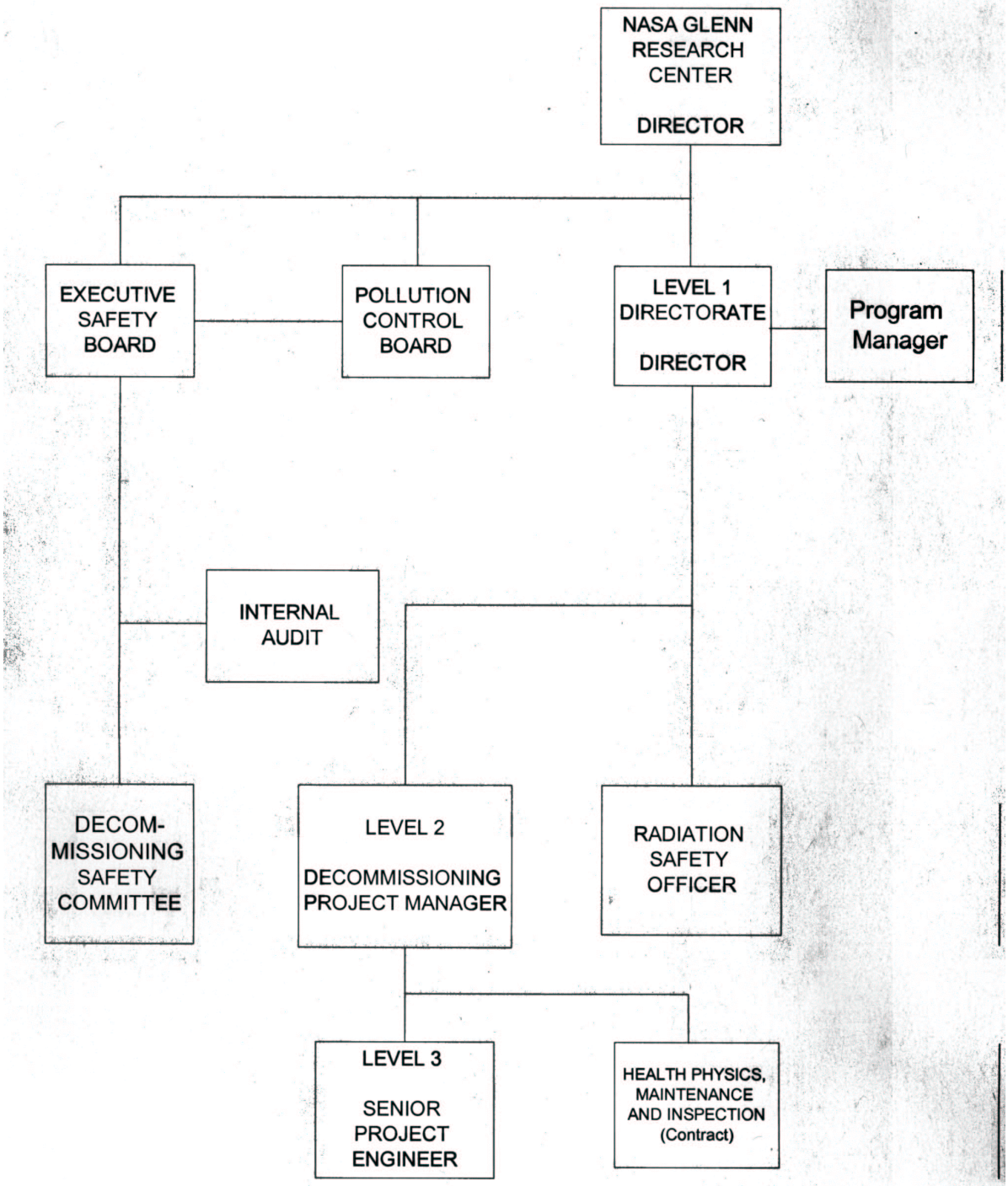
"Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors" (Part 1, Format and Content), prepared by the Office of Nuclear Reactor Regulation, Nuclear Regulatory Commission, February 1996.

Code of Federal Regulations, Title 10, "Energy" Part 20, "Standards for Protection Against Radiation", U.S. Government Printing Office, Washington, DC.

Attachment:

Figure 1 Plum Brook Reactor Facility Decommissioning Project Organizational Structure

GENERIC ORGANIZATION CHART



RESPONSIBILITIES:

LEVEL 1 - Compliance
LEVEL 2 - Surveillance and Maintenance
LEVEL 3 - Day-to-Day Oversight

FIGURE 1

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 11 TO FACILITY LICENSE NO. TR-3, AND

AMENDMENT NO. 7 TO FACILITY LICENSE NO. R-93

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

DOCKET NOS. 50-30 AND 50-185

1.0 INTRODUCTION

By letter dated December 20, 1999, as supplemented by letters dated March 26, November 19, and December 20, 2001, and January 24, 2002, the National Aeronautics and Space Administration (NASA), the licensee, submitted a request for approval of its "Decommissioning Plan for the Plum Brook Reactor Facility" (DP). The Plum Brook Reactor Facility (PBRF) currently has two 10 CFR Part 50 licenses to possess but not operate two reactors: License No. TR-3 for a 60-megawatt materials test reactor and License No. R-93 for a 100-kilowatt swimming pool, mock-up reactor (MUR). Besides the test and research reactors, the PBRF includes a seven-cell hot laboratory complex, reactor operations and laboratory support facilities, general support facilities and areas of environmental contamination. These facilities require radiological decontamination.

NASA first operated the PBRF in 1961. Both reactors have been shut down since 1973 and NASA has removed all fuel from the site.

In the DP, the licensee has included radiological characterization information that was first collected in 1985 and confirmed in 1998. The DP includes this radiological characterization information.

A "Notice and Solicitation of Comments Pursuant to 10 CFR 20.1405 and 10 CFR 50.82(b)(5) Concerning Proposed Action to Decommission the Plum Brook Reactor Facility" was published in the FEDERAL REGISTER (65 FR 12040) on March 7, 2000, and in the Sandusky Register on March 12, 2000. The NRC received no comment from this solicitation.

The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, which was published in the *Federal Register* on January 22, 2002 (67 FR 2924). NRC has not gotten any public comment on this finding. The January 24, 2002, supplemental letter provided additional clarifying information, did not expand the scope of the application as originally noticed, and did not change the staff's original proposed no significant hazards consideration determination.

2.0 BACKGROUND

2.1 Regulatory Basis

The requirements for the contents of decommissioning plan for research and test reactor are in 10 CFR 50.82(b)(4). This regulation requires that the proposed decommissioning plan present:

- The choice of the alternative for decommissioning with a description of activities (See Section 3.1 below);

- A description of the controls and limits on procedures and equipment to protect occupational and public health and safety (See Section 3.2 below);

- A description of the planned final radiation survey (See Section 3.3 below);

- An updated cost estimate for the chosen alternative for decommissioning, comparison of that estimate with present decommissioning funds set aside, and plan for assuring the availability of adequate funds to complete decommissioning (See Section 3.4 below); and

- A description of technical specifications, quality assurance provisions and physical security plan provisions in place during decommissioning (See Sections 3.5, 3.6 and 3.7 below).

Title 10 CFR 50.82(b)(5) states that if the decommissioning plan demonstrates that the decommissioning will be performed in accordance with the regulations in this chapter and will not be inimical to the common defense and security or to the health and safety of the public, and after notice to interested persons, the Commission will approve, by amendment, the plan subject to such conditions and limitations as it deems appropriate and necessary. The basis for the staff acceptance of this amendment is contained in this safety evaluation. License conditions for this amendment were based on “Policy and Guidance Regarding Revising Approved License Termination Plans without NRC Approval,” memorandum from Larry W. Camper, dated June 22, 2001. Further, the staff established a license condition in accordance with the requirement of 10 CFR 50.82(b)(5) that the approved decommissioning plan will be a supplement to the Safety Analysis Report or equivalent.

The requirements after the approval of the decommissioning plans are in 10 CFR 50.82(b)(6). This regulation states that the Commission will terminate the license if it determines that the decommissioning was in accordance with the approved decommissioning plan, and that the terminal radiation survey and associated documentation show that the facility and site are suitable for release in accordance with the criteria for decommissioning in 10 CFR Part 20, Subpart E.

2.2 Summary of Decommissioning Plan and Description of the Facility

NASA is decommissioning the PBRF to allow unrestricted use of the facility.

Decommissioning, as described in the plan, will consist of:

- Transferring licensed radioactive equipment and material from the site;
- Decontamination of the facility to meet unrestricted release criteria;
- Demolition of above grade structures and above grade portions of decontaminated buildings; and
- Backfilling the below grade portions of decontaminated buildings and in-ground structures using, where possible, rubble from uncontaminated and decontaminated above ground structures, uncontaminated soil from the berms associated with the emergency retention basin and off-site backfill sources.

The PBRF consists of a complex of buildings and includes two nuclear reactors. It is within a 27-acre fenced area in the northern portion of NASA's Plum Brook Station, 4 mi south of Sandusky, Ohio. Farmlands and low-density housing surround the Plum Brook Station.

Table 2-1 identifies the facilities and areas composing the PBRF including the major contaminated facilities, contaminated and uncontaminated support facilities and areas of environmental contamination outside the buildings.

3.0 EVALUATION

3.1 Choice of Decommissioning Alternative

The PBRF has effectively been in SAFSTOR since its shutdown in 1973.

For this decommissioning, NASA evaluated a range of decommissioning alternatives including a continuation of SAFSTOR, or using the ENTOMB or DECON alternative. NASA selected the DECON alternative, which allows release of the facility for unrestricted use and termination of the license. Table 2-1, presents the facilities and areas of the PBRF that will be subjected to the DECON alternative.

The DECON alternative includes three major steps:

- Decontamination of the PBRF to levels that allow unrestricted release. This step will involve removal of the reactor tank and its internals, the material in the Hot Dry Storage Area, contaminated equipment and piping in the PBRF buildings and structures, contamination on structures and building surfaces and contaminated soil in areas surrounding the PBRF;

- Demolition of decontaminated buildings and structures and uncontaminated structures, and backfill decontaminated below grade portions of buildings and structures with demolition rubble having no radiological contamination and clean fill. NASA will backfill excavations with clean fill; and

- Preparation of documentation based on the final status surveys that demonstrates compliance with the license termination criteria of 10 CFR Part 20 Subpart E, and submission the documentation to the NRC as part of a request to terminate the existing licenses for the PBRF.

Table 2-1. Facilities and Areas in the PBRF

Major Contaminated Facilities, Components and Systems	Environmental Contamination	Support Facilities
· Reactor Building - Reactor tank and internal components - Reactor primary cooling water system and primary cooling shutdown system - Reactor biological shield - Reactor quadrants and canals and pump-out, re-circulation, and drain systems - Reactor building rooms - Hot drains, sumps, pumps, and valves - Mock Up Reactor (MUR) · Hot Laboratory - Hot Dry Storage Area - Hot cells - Rooms	· Emergency Retention Basin · Drainage System · Water Effluent Monitoring Station (1192) · Pentolite Ditch · Areas of contaminated pavement (includes spill areas)	Contaminated: · Reactor Office and Laboratory Building · Primary Pump House · Fan House · Waste Handling Building · Hot Retention Area · Cold Retention Basins · Hot pipe tunnel Uncontaminated: · Cold pipe tunnel · Reactor Services Equipment Building · Reactor Gas Services Building · Reactor Compressor Building · Reactor Substation · Reactor Security Building · Reactor water tower · Reactor sludge basins · Reactor precipitator · Reactor Cryogenic and Gas Supply Farm and Building · Reactor Gas Storage Structure

The DP presents task analysis schedule, and radiation dose estimates for specific tasks. The DP discusses segmenting and removing radioactive components and materials, and decontamination of structures and building surfaces. It also discusses demolition of buildings and backfill of below grade excavations and structures, contamination control, respiratory protection, local shielding and radioactive waste disposition.

The staff has concluded that the choice of DECON and associated proposed plans are consistent with the decommissioning at similar facilities (e.g., Cintichem License No. R-81) and with the provisions of 10 CFR 50.82(b)(4)(i) for decommissioning and are, therefore, acceptable.

3.2 Controls and Limits on Procedures and Equipment to Protect Occupational and Public Health and Safety

3.2.1 Management, Organization, and Associated Controls during Decommissioning

The DP identifies the overall organizational structure by which the licensee will manage the facility decontamination and dismantlement leading to decommissioning. NASA has selected the U. S. Army Corps of Engineers (USACE) for Project Management and Quality Assurance. The USACE has selected Montgomery Watson Americas (MWA) as the Prime Contractor. MWA is a Total Environmental Restoration Contractor (TERC). While the organization of MWA is not yet available, a typical Prime Contractor organization is presented in the DP. An organizational chart identifies the roles of personnel and identifies key positions for both implementation and oversight of the project. Interface between the contractor and NASA is described in the DP and shown in the organizational chart.

NASA, as the owner of the facility, has the overall responsibility for the work conducted during decommissioning of the PBRF including planning and management. A PBRF Decommissioning Safety Committee will replace the current Reactor Safety Committee to review and approve the administration and implementation of radiation protection and safety programs related to decommissioning. A contracted Decommissioning Technical Support Team will help NASA in the safety oversight, Quality Assurance (QA) and evaluation of the Decommissioning Contractor.

NASA has specified the organizational structure in the proposed Technical Specifications. The DP describes the detailed duties and responsibilities of each organization and important position.

3.2.1.1 Project Management Structure

The project management structure for the decommissioning of the PBRF reactor is consistent with the guidance provided in Appendix 17.1 of NUREG-1537, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors,” February 1996. The NASA Decommissioning Project Team, the Decommissioning Contractor Team, and the Prime Contractor will continue to be responsible for the overall supervision, compliance with regulations, and the health and safety of the public. NASA

has established minimum education and experience requirements for all key positions in the project management organization.

3.2.1.2 NASA Decommissioning Project Team

The NASA Decommissioning Project Team consists of a mix of NASA employees and NASA support contractors. Team members include the NASA Decommissioning Project Manager, Senior Project Engineer, Environmental Manager and Construction Manager and Contractor Project Safety Officer, Radiation Safety Officer, and Licensing Engineer.

3.2.1.2.1 NASA Decommissioning Project Manager

The NASA Decommissioning Project Manager will plan and direct the decontamination and decommissioning and will be ultimately responsible for the decommissioning project. The Manager will be responsible for planning, directing and monitoring decontamination and decommissioning activities, reviewing work schedules and budgets and maintaining project records. The Manager will interface directly with the Glenn Research Center management. This position will serve as the point of contact for the Decommissioning Team, NRC, U.S. Environmental Protection Agency, State of Ohio and other regulatory agencies. The manager is the technical spokesperson for NASA on decommissioning activities and will ensure that they effectively carry out the QA program. The Project Manager has the authority to enforce safe performance of the decommissioning.

3.2.1.2.2 NASA Senior Project Engineer

The Senior Project Engineer will provide direct oversight of PBRF decommissioning for NASA Glenn Research Center Management and will serve as NASA's management representative on the site. This position will have direct authority over all activities at the PBRF and will interface with the USACE Resident Manager. The Senior Project Engineer will provide technical oversight and guidance; review and suggest updates to DPs, programs and procedures; maintain and direct the risk management program; act as chair of the group of on-site managers that direct the actions of all site personnel; support the Decommissioning Safety Committee as a technical resource; assist the Decommissioning Project Manager in the oversight of the Decommissioning Contractors QA program; assist the Decommissioning Project Manager; and act as the alternate when the Project Manager is not on-site. The Senior Project Engineer has the authority to enforce proper work practices during the decommissioning activities.

3.2.1.2.3 NASA Environmental Manager

The Environmental Manager will be responsible for all environmental aspects of the decommissioning project and will interface with on and off site USACE environmental personnel. This position will ensure that the Decommissioning Contractor properly executes the Environmental Management Plan and the requirements of the Glenn Research Center Environmental Program are satisfied. The Environmental Manager will review contractor programs and procedures to ensure they follow NASA programs, and ensure that the contractor's environmental programs are carried out. This position will identify locations, operations and conditions that have potential for causing environmental problems, ensure that all local and state permits are in place. The Environmental Manager

will oversee the preparation and loading of hazardous waste shipments and sign all manifests. This position will ensure the implementation of the DC QA program related to the environment. The Environmental Manager has the authority to enforce proper environmental practices during the decommissioning activities.

3.2.1.2.4 NASA Construction Manager

The Construction Manager will be NASA's representative in the field. This position will work with the USACE Construction Specialist and other USACE personnel to ensure that work is done safely and efficiently. The Construction Manager will maintain direct control of the PBRF decommissioning and can call upon the engineering resources within the NASA organization. This position will review work procedures, assist the decommissioning contractor in technical and safety issues, and assist the Decommissioning Project Manager especially in ensuring that the QA program implementation. The Construction Manager has the authority to enforce safe performance during the decommissioning activities.

3.2.1.2.5 Project Radiation Safety Officer

The Project Radiation Safety Officer (RSO) will be responsible for organizing, administering and directing the radiation protection program during the decommissioning including radiation safety and environmental health. The RSO's responsibilities include assisting the NASA Glenn RSO in implementing the NASA radiation protection program and initiating or approving the radiation safety aspects of procedures. This position is also responsible for developing and conducting the as low as reasonably achievable (ALARA) program, monitoring health physics coverage of decommissioning activities and monitoring collective doses. The RSO has the authority to interrupt or suspend any activity if the method used is considered unsafe or contrary to appropriate regulations.

3.2.1.2.6 Project Safety Officer

The Project Safety Officer will be responsible for safety and security including industrial safety and hygiene and physical security. The Safety Officer’s responsibilities include assisting the Plum Brook and Glenn Safety Officers in implementing the NASA Safety program, and implementing industrial safety, industrial hygiene and physical security procedures. This position is also responsible for participating in reviews of contractor programs, and conducting surveillance programs and investigations. Additionally, the Project Safety Officer is responsible for identifying potential hazards and instituting corrective actions and assisting in the implementation of the QA program. The Project Safety Officer has the authority to interrupt or suspend any activity if the method used is considered unsafe or contrary to appropriate regulations.

3.2.1.2.7 Licensing Engineer

The Licensing Engineer will assist the NASA Decommissioning Project Manager and the Construction Manager in the planning and directing of decontamination and decommissioning activities. This position will interface directly with the USACE Nuclear Engineer and with the NRC through the NASA Decommissioning Project Manager. Besides monitoring the budget, daily work activities and work schedules, the Licensing Engineer will prepare requests for license amendments or changes to the Technical

Specifications. The Engineer will prepare reports on work progress and ensure implementation of the Decommissioning Contractors QA program.

3.2.1.3 USACE On-site Organization

The USACE has selected MWA as the prime contractor and will provide contract administration and procurement functions to get the necessary subcontractors. USACE on site staff will include a Resident Manager, a nuclear engineer, a civil engineer and a construction specialist.

3.2.1.3.1 Resident Manager

The Resident Manager will ensure the implementation of plans, procedures and the Prime Contractor's QA program. The Manager will ensure that required licenses or permits are available at the site.

The Resident Manager has the authority to direct the suspension of operations at any unit of work where the Prime Contractor does not immediately correct hazards and impediments to work progress.

3.2.1.3.2 Nuclear Engineer

The Nuclear Engineer will assist the Resident Manager and the Prime Contractor Health Physics Supervisor in carrying out the NASA Radiation Protection Program including ALARA engineering and analysis for special jobs.

3.2.1.3.3 Civil Engineer

The Civil Engineer will assist the Resident Manager in the implementation of the Prime Contractor's QA program including observing the Prime Contractor's testing and inspection procedures. This position will also assist in the implementation of radiation protection policies and procedures. The Civil Engineer has the responsibility to advise the Prime Contractor to stop work if identified deficiencies are not corrected.

3.2.1.3.4 Construction Specialist

The Construction Specialist will assist the Resident Manager, Nuclear and Civil Engineers and the Safety Office in carrying out the Prime Contractor's QA program including the QA reporting system.

3.2.1.4 Prime Contractors Organization

The Prime Contractor (MWA) will provide all decontamination and dismantling services and related support including contractor staff training. This organization will prepare detailed procedures, provide sequencing and scheduling plans for processing, packaging, shipping and disposing of radioactive materials. The Prime Contractor, subject to the review of the NASA Decommissioning Project Manager and the Project Radiation Safety Officer, will be responsible for insuring the health and safety of its employees. It will also be responsible for complying with OSHA and NRC requirements.

The Prime Contractor's organization will include project administration personnel, project engineers, scheduling and field supervisors, property custodians, maintenance electricians, mechanics and janitors.

3.2.1.5 NASA Decommissioning Safety Committee

A Decommissioning Safety Committee is to:

- Conduct reviews of all matters with safety implications concerning the decommissioning;
- Review programs, plans and procedures that affect the health and safety of workers and the public to ensure compliance with applicable federal, state and local regulations;
- Provide advice, technical expertise and guidance to minimize health hazards associated with the decommissioning;
- Review and approve proposed changes to the DP;
- Review and approve the training safety standards for PBRF workers, NASA and Contractor;
- Provide an executive level overview of activities at the PBRF; and
- Ensure that all public and employee radiation exposures are maintained ALARA.

The Committee will consist of at least seven individuals in responsible positions at NASA. Contractor personnel are available to assist the Committee. The Technical Specifications have established the qualifications of the Chair of the Committee. The Technical Specifications have defined the meeting frequency and the requirements for a quorum.

3.2.1.6 Conclusion

The staff concludes that the DP provides acceptable organizational structure and control to decontaminate and dismantle the PBRF while maintaining due regard to protecting the public, environment and workers from significant radiological risk.

3.2.2 Radiation Protection and Radioactive Waste Management Programs

3.2.2.1 Radiation Protection

The Radiation Protection Program will be provided under the cognizance of the Project Radiation Safety Officer (Contractor) and the Decommissioning Safety Committee. The prime contractor (MWA) will provide oversight and monitoring for the Program including QA.

The DP designates the responsibilities and oversight functions of key radiation protection positions and committees in the decommissioning organization including the Decommissioning Contractor. The DP also commits to the use of written Job Safety Analyses and Radiation Work Permits that will include ALARA objectives for all relevant tasks.

The DP discusses the use of self–contained ventilation systems, including filters to prevent the release of airborne radioactive particles either to the rest of the containment building or to the environment. In this regard, the licensee recognizes that an environmental monitoring program is necessary to ensure that no releases exceeding regulatory limits will occur during the decommissioning.

The estimated collective doses in person–rem for individual decommissioning tasks are presented in the DP. No releases of airborne radioactivity to the unrestricted environment are expected. Therefore, it is not expected that the public will receive more than minimal radiation exposure related to the reactor decommissioning. The DP indicates that 10 CFR Part 20 requirements for radiological exposures and protection will be met. However, lower site administrative limits will be utilized to ensure compliance with the annual dose limits and the ALARA program.

NASA will establish a respiratory protection program designed to comply with the guidelines of NRC Regulatory Guide 8.15, Acceptable Programs for Respiratory Protection.

3.2.2.2 Radioactive Materials and Waste Management

The DP addresses the potential sources of solid, liquid and gaseous radioactive waste and disposal. In addition, the plan addresses the sources and disposal of mixed wastes (i.e., radioactive and hazardous waste such as asbestos and lead paint).

Solid waste will consist primarily of reactor components such as tanks and demolished concrete. Solid waste will be classified, packaged and shipped to a licensed low level radioactive waste disposal facility in accordance with regulatory requirements.

Liquid waste may result from washing contaminated surfaces, de-watering activities, or dust suppression activities. All liquid waste disposal will be either in accordance with 10 CFR 20.2003 or by solidification and treatment as low level radioactive solid waste.

Gaseous waste may consist of airborne particles generated during the demolition process. These particles will be contained and trapped in HEPA filters that will be disposed of as solid waste in accordance with applicable requirements.

Mixed waste will be categorized, packaged and disposed of at an appropriately licensed facility.

3.2.2.3 Conclusion

The staff concludes that the licensee's plan on radiation protection, and radioactive material and waste management is acceptable based on the use of standard guidance and practices for such programs.

3.2.3 Training

The DP discusses the training of the NASA and contract staff to perform the decontamination and dismantlement, and outlines the training areas and the performance of training. The training program will be developed and conducted by the contractor using personnel qualified in the program content.

The training program for all personnel working on the decommissioning and in the vicinity of the containment building will consist of instructions in radiation safety prior to the commencement of their work activities.

The training will ensure that decommissioning project personnel have sufficient knowledge to perform work activities in accordance with the requirements of the radiation protection program and to accomplish ALARA goals and objectives. The principal objective of the training program is to ensure that personnel understand the responsibilities and the required techniques for safe handling of radioactive materials and for minimizing exposure to radiation.

The training topics will include:

Principles of radiation protection;
Radiation monitoring techniques;
Radiation Monitoring instrumentation;
Emergency procedures;
Radiation hazards and controls;
Concepts of radiation and contamination;
Provisions of 10 CFR 19 and 20;
NRC license conditions;
Responsibilities of workers and supervisors;
Reporting requirements for workers;
Exposure control procedures;
Biological effects of radiation;
Radiation control zone procedures;
Safe Work Permits;
Environmental requirements and procedures including air, water and soil;
Environmental management procedures;
Solid and hazardous waste management;
Confined space entry awareness;
Lead awareness;
Asbestos awareness;
Hazardous materials awareness;
ALARA implementation; and
QA program principles and requirements.

Training will be performed annually. Workers will be tested at the conclusion of training and annually. Records of each individual training session will be maintained on the job site.

The staff considers the personnel training that NASA proposes to be acceptable as it covers the things needed to conduct DP activities safely.

3.2.4 Industrial Safety and Hygiene and Procedural and Equipment Control Programs

3.2.4.1 Industrial Safety and Hygiene Program

The DP discusses various specific plans to control and limit potential non-radiological risks and hazards.

Non-radiological hazards associated with decommissioning will be managed according to the requirements of the *NASA Glenn Research Center Safety Manual* and the *NASA Glenn Environmental Programs Manual* and will be implemented in accordance with 29 CFR 1910, "Occupational Safety and Health Standards" and 29 CFR 1926, "Safety and Health Regulations for Construction". The day-to-day oversight will be provided by the Project Radiation Safety Officer, Project Safety Officer and the Prime Contractor Safety and Health Supervisor. The Decommissioning Safety Committee will review all matters with industrial safety implications.

The PBRF does not have an emergency plan primarily because it has been shut down for over 25 years. However, Technical Specifications issued as part of the 1998 license renewal require emergency procedures that have been approved by the Reactor Safety Committee for fire, floods and tornadoes.

Procedures have been developed to address the responsibilities of all parties and the actions for a variety of emergencies including;

Medical emergencies (including contaminated, injured worker)
Fire
Severe Weather
High Airborne Radioactivity
Spills
Evacuation
Earthquake

In addition, NASA has coordinated the response to various emergencies with the local community emergency responders, including hospitals, police and fire departments. Formal, written agreements have been signed with these response organizations.

3.2.4.2 Procedural Controls

NASA is required by the Technical Specifications to have procedural controls for access control, surveillance, inspection and maintenance requirements for PBRF buildings, systems and conditions, personnel radiation protection consistent with applicable regulations, shipping and receipt of radioactive material, waste management, quality assurance, environmental protection management, and health and safety management. Further, NASA has alarm response procedures to deal with equipment or other problems.

3.2.4.3 Equipment Control

Besides the radiological control programs equipment controls, NASA has also equipment controls on containment and Technical Specifications have required ventilation systems. Further the monitoring and control of equipment and conditions are also required.

3.2.4.4 Conclusion

The industrial safety program, procedural and equipment controls are consistent with such programs at decommissioning reactors, and are therefore acceptable.

3.2.5.1 Accident Analysis

Under conservative assumptions, the licensee has analyzed the consequences of six radiological accidents as follows:

Scenario 1: Cutting Reactor Tank Internal Components with a Plasma Torch Releases Activation Products.
Scenario 2: Cutting a Beryllium Component in the Reactor Tank with a Plasma Torch Releases Tritium.
Scenario 3: Dropping a Component Stored in the Hot Dry Storage Area.
Scenario 4: Dropping a 55-gallon Drum of Contaminated Concrete Dust Generated from the Biological Shield or Hot Cells.
Scenario 5: Contaminated Soil Released From the Emergency Retention Basin.
Scenario 6: Fire Involving Dry Solid Waste.

The licensee has calculated the TEDE for these accidents considering a worker and a member of the public at the PBRF fence-line. These calculations show the postulated accident scenarios would result in TEDEs to a member of the general public at the site boundary that are much less than the 15 mrem whole body dose identified as the lowest action level in Table 1 of ANSI/ANS 15.16, "Emergency Planning for Research Reactor". Doses that workers could receive from an accident are much less than the allowable annual exposure for workers.

Because of the training of all involved personnel, the quantity and form of radioactive material on the site and the radiation protection and industrial safety programs, the staff expects the probability and consequences of accidents to be very low.

The staff concluded that the accident analyses show potential radiological consequences well within acceptable limits.

3.3 Planned Final Radiation Survey

3.3.1 Radiological Status of the Facility

NASA conducted a major characterization survey in 1985 and a confirmatory survey in 1998. The results from the two surveys indicate that most of the residual radioactivity at the PBRF is generally confined within equipment and piping, with limited environmental contamination. The reactor tank internals and waste in the Hot Dry Storage Area contain most of the radioactivity. The following sections summarize the radiological characterization information for the major PBRF facilities and environmental areas presented in Table 2-1.

The characterization studies show that small amounts of fission products are contained in the contamination. Although there were no documented fuel failures at the PBRF reactors, there were some minor fuel leaks during the operation of the plant. The operating philosophy of the plant was that anytime during operation that a leak was detected, the reactor was shut down and the suspected fuel element replaced. In addition, the presence of fission products can be attributed to post experiment examination and segmentation of irradiated fuel elements in the Hot Lab. Liquid waste from these, other examinations and

fuel storage locations was often pumped around to different locations to accommodate changing operational conditions and requirements.

Both the initial 1985 survey and the 1998 confirmatory survey were intended to provide information on the nature and extent of the contamination. The 1985 survey showed that most of the contamination was in engineered systems and components intended to contain contamination and that there was minimum localized contamination in the buildings and the environment. The 1998 survey was intended to test this understanding of the general nature and extent of the contamination. While the 1998 study found a few more hot spots or some slightly higher contaminated areas, it confirmed that there was minimal and localized contamination outside the reactor vessel, the hot cells and the process equipment. It is in this sense that the results of the 1998 survey confirm the results of the 1985 survey.

3.3.1.1 Reactor Building

3.3.1.1.1 Reactor Tank

Most of the radioactivity in the Reactor Building is contained inside the reactor tank of the 60-megawatt reactor. Separate calculations were performed to estimate the radioactivity of the reactor tank and each of the major components in the reactor tank.

The radioactivity in and around the 100-kilowatt reactor was measured in the summer of 2000. The highest exposure rate reading was about 2 mrem/hr and found well inside the structure. No significant loose contamination was found.

3.3.1.1.2 Reactor Primary Cooling Water Systems and the Primary Cooling Shutdown System

The radioactivity associated with the Reactor Primary Cooling Water System and the Primary Cooling Shutdown System was determined experimentally to be Co-60 and Eu-152, 154 and 155. The levels of activity are between 256 and 375 dpm/100 cm^2. There was no fission product activity in the samples analyzed. In 1985, the exposure rate from piping and equipment in this area was less than 30 mrem/hr.

3.3.1.1.3 Reactor Biological Shield

Samples from the concrete and reinforcing steel in the biological shield were analyzed and found to contain Co-60. The average concentrations are 17.5 and 325 pCi/g respectively.

3.3.1.1.4 Reactor Quadrants and Canals, and Their Pump-out and Re-circulation Systems

NASA took and analyzed samples of crud and direct radiation readings for the reactor quadrants and canals and their pump-out and re-circulation systems with the following results.

The average concentration of loose alpha and beta contamination and direct radiation readings in the canals was approximately 2 dpm/100 cm^2, 1000 dpm/100 cm^2 and 0.1 mrem/hr, respectively.

Direct radiation readings range from 0.001 to 0.3 mrem/hr. Deep, underground soil samples were collected beneath two of the canals and show that contaminated water did not leak into the ground.

The pump-out and re-circulation systems are internally contaminated with little external contamination. External dose rates from piping and valves range from 0.01 to 0.6 mrem/hr. Crud samples contained 0.1 to 1 pCi/g of gross alpha activity and up to 20,000 pCi/g of gross beta. Co-60 is the major gamma-emitting radio-nuclide.

A concrete core sample was collected from the canal that connects to the MUR and the Hot Laboratory and analyzed. Cs-137 and Co-60 were detected at concentrations of 2.7 pCi/g and 156 pCi/g, respectively.

3.3.1.1.5 Reactor Building Rooms

Loose and fixed contamination and direct radiation measurements were made in Reactor Building rooms both inside and outside the containment with the following results for the 1985 survey. Inside the containment vessel, loose alpha and beta contamination range from 0 to 5 dpm/100cm^2 and 0 to almost 200 dpm/100cm^2, respectively. Direct radiation readings range from 0.006 to a maximum of 500 mrem/hr in the sub-pile room to an average of 0.01 to 0.045 mrem/hr in other areas.

Outside the containment vessel, loose alpha and beta contamination levels ranged from 0 to 5 dpm/100cm^2 and 0 to almost 350 dpm/100cm^2, respectively. Direct radiation readings range from 0.005 to 0.230 mrem/hr.

The confirmatory measurements performed in 1998 produced higher readings in rooms outside the containment and identified a hot spot. A sample of concrete taken at the hot spot was analyzed and showed the presence of Co-60 and Cs-137.

3.3.1.1.6 Hot Drains, Sumps, Pumps and Valves

Direct radiation readings from the hot drain system sumps ranged from 0.007 to 2 mrem/hr. Crud from these sumps showed alpha and gamma activity ranging from 15 to 9500 pCi/g and 580 to 130,000 pCi/g respectively. The dominant gamma activity is due to Co-60 and Cs-137.

3.3.1.2 Hot Laboratory

3.3.1.2.1 Hot Dry Storage Area

The Hot Dry Storage Area has the second highest estimated radio-nuclide inventory in the PBRF. Estimates have been made of the inventory as of December 31, 2003, when decommissioning in this area may be anticipated. The estimates showed the following results.

Nuclide	Inventory (curies)
H-3	8,223
Co-60	559
Fe-55	16
Zn-65	0
Total	8,798

3.3.1.2.2 Hot Cells

The 7 Hot Cells were surveyed using instrument scans and wipe samples. Loose alpha and beta-gamma contamination ranged from 0 to 370 dpm/100 cm^2 and 200 to 173,000 dpm/100cm^2, respectively. Direct radiation ranged from 1 to 450 mrem/hr. Co-60 and Cs-137 dominate the measured activity.

3.3.1.2.3 Rooms

The floors, walls and ceilings of the rooms in the Hot Laboratory were surveyed using instrument scans and wipe samples. Loose alpha and beta-gamma contamination in all rooms except the decontamination room, ranged from 0 to 8 dpm/100 cm^2 and 0 to 18,852 dpm/100 cm^2, respectively. Direct radiation ranged from 0.003 to 1 mrem/hr. The decontamination room had loose alpha and beta-gamma contamination ranging as high as 208 dpm/100 cm^2 and 337,000 dpm/100 cm^2, respectively. Dose rates were as high as 8 R/hr.

3.3.1.3 Support Facilities at the PBRF

While all of these facilities require decontamination of equipment and surfaces, the surveys reveal that contamination has not entered the ground.

3.3.1.4 Environmental Contamination

The areas of environmental contamination were shown in Table 2-1 and include in-ground and earthen structures or soil that was contaminated from past operations.

3.3.1.4.1 Emergency Retention Tanks

Soil samples were taken to a depth of 10-ft and showed that the contamination is confined to the first 6 in. The near-surface gross beta activity averaged 78 pCi/g. An isotopic analysis showed average Co-60, Cs-137 and Sr-90 concentrations of 22, 32 and 2.4 pCi/g, respectively. During the 1998 confirmatory survey, a gamma scan was conducted in addition to the analysis of 5 soil samples.

3.3.1.4.2 Drainage System

The drainage system is described in Section 2.1.1.12. Underground piping and silt deposits in this system are contaminated. The gross beta activity in the silt is in a range from 7 to 330 pCi/g. The average contamination of piping is less than 1200 dpm/100 cm^2 with one sample of 5000 dpm/100 cm^2. Isotopic analysis has shown that the activity in the

catch basins is predominately natural K-40 with concentrations of Cs-137 and C0-60 ranging from 1 to 11 and from 1 to 5 pCi/g, respectively.

3.3.1.4.3 Water Effluent Monitoring Station Building

The Water Effluent Monitoring Station is described in Section.2.1.1.13. Contamination was measured in the 1985 study and in 1998 in the trench, behind the flumes, in soil adjacent to the trench and concrete surfaces in the building. Isotopic analysis confirmed the presence of Cs-137 and Co-60 at levels of 4 to 11 and 1 to 4 pCi/gm, respectively.

3.3.1.4.4 Pentolite Ditch

The pentolite ditch is described in Section 2.1.1.14. Contamination was measured in the 1985 and 1998 surveys, which indicate that contamination is confined to depths less than 6 in. Samples taken along the ditch showed Cs-137 and Co-60 in the range of 2 to 15 and 0 to 1 pCi/g, respectively.

3.3.1.4.5 Plum Brook

In November 2000, several silt and water samples were taken from Plum Brook approximately 0.25 miles downstream from its confluence with Pentolite Ditch. The results from these samples indicate that there are man-made isotopes present in Plum Brook beyond the Plum Brook Station fence line. The quantities are so low as to be the result of discharges that are within the release limits for these isotopes.

No man-made radio-nuclides have been identified in Plum Brook above 1 pCi/g. An environmental monitoring Lower Limit of Detection (LD) of 1 pCi/g Cs-137 in sediment and soil from Plum Brook will be utilized to ensure detection of radio-nuclide contamination well below the DCGLs presented in this DP.

The licensee plans to validate that Plum Brook (the stream) does not contain residual radioactivity above background from facility operations. If the licensee determines that Plum Brook (the stream) contains residual radioactivity above background from facility operations, the licensee is required to submit site-specific soil derived concentration guideline levels and re-mediation plan for NRC review and approval.

While it is not expected, sediment and soil locations that contain concentrations above the DCGLs will be re-mediated.

Further samples will be taken to validate these results.

3.3.1.4.6 Areas of Contaminated Pavement

The areas of contaminated pavement are discussed in Section 2.1.1.15, above. The survey results show the presence of contamination near the waste handling building and near the entrance to the reactor building. Core samples taken near the waste handling building show alpha and beta contamination down to about 6 ft. Samples taken from the pavement near the entrance to the reactor building show beta activity up to 42,000 dpm/100 cm^2.

3.3.1.5 Uncontaminated Facilities

Based on some survey data and historical data, some of the areas to be decommissioned are believed to be uncontaminated. These areas are listed in Table 2-1. These facilities will be surveyed as part of the final status survey to confirm that they are not contaminated.

3.3.2 Radiological Release Criteria

The NRC Final Rule on License Termination, 10 CFR 20.1402 provides radiological criteria for release of a site for unrestricted use. The release criterion for unrestricted use is a maximum Total Effective Dose Equivalent (TEDE) of 25 mrem per year from residual radioactivity above background to the average member of the critical group (AMCG). Application of As Low As Reasonably Achievable (ALARA) is also a requirement. In the DP, the licensee has described the methods for determining the residual contamination levels that would lead to this dose and the methods for determining that the levels of residual contamination are ALARA. The licensee will utilize Draft Regulatory Guide DG-4006, "Demonstrating Compliance With the Radiological Criteria for License Termination" (hereinafter DG-4006) for the dose assessment and the ALARA determination.

DG-4006 presents derived concentration guidelines (DCGLs) that are the residual contamination levels that will result in the TEDE. According to NUREG-1549, "Using Decision Methods for Dose Assessment to Comply with Radiological Criteria for License Termination," the licensee may use site specific analysis for developing DCGLs in place of those derived in DG-4006. NASA has chosen to develop site specific DCGLs for the PBRF.

DG-4006, NUREG-1549 and other NRC documents discuss generic screening and site-specific dose assessment in the decision framework. Under the generic screening approach, pathways, scenarios, models and model parameter values are specified in the documents and analysis is performed to determine the levels of contamination consistent with release criteria. The pathways and scenarios constitute the residential farmer and building reuse scenarios. These documents also allow the use of site specific data and models other than the generic models provided that the licensee provides information supporting the use of site specific data or models.

NASA has chosen to use a site specific model and data. RESRAD Version 6 has been chosen for analysis of residual soil contamination, residential farmer scenarios and residual subsurface structure contamination; RESRAD-BUILD Version 2.2 has been chosen to analyze building re-use scenarios. (Although NASA does not now plan to dispose of the property, it has chosen the conservative residential farmer and building re-use scenarios.)

Using the characterization data presented in Section 2.2 and site-specific pathway scenarios, the applicant has calculated DCGLs and developed estimates of dose over time for the AMCG. Permissible residual contamination in surface soils, buildings and sub-surface structures has been calculated.

A methodology for conducting ALARA analyses is discussed in the DP and examples of the analyses are presented.

The staff has reviewed the discussion of the radiological release criteria presented in the DP and has determined that it is complete. The results of the final survey will be used to demonstrate that the predicted dose to a member of the public from any residual activity is ALARA and does not exceed the 25 mrem per year dose limit. The staff considers the licensee's proposed methods to satisfy the release requirements to be acceptable.

3.3.3 Proposed Final Status Survey Plan

Section 4 of the DP includes a proposed final status survey plan to ensure that the facility meets unrestricted release criteria. NASA has developed the survey plan according to the guidance in:

> NUREG 1575, "Multi-agency Radiation Survey and Site Investigation Manual (MARSSIM)";
> Draft Regulatory Guide DG-4006, "Demonstrating Compliance with the Radiological Criteria for License Termination"; and NUREG 1505, "A Non-parametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys".

Consistent with this guidance, the final status survey plan has been designed incorporating the Data Quality Objectives (DQO) process. This process is iterative and is applied from the current base of information (e.g., from the site characterization survey) and revised as information and data is collected and analyzed. MARSSIM has been extensively used as guidance in the outline of the decision making process.

The DP includes a discussion of the seven step DQO planning process that NASA will use to ensure that the type, quantity and quality of the data used in decision making are appropriate for the intended application, which is support of the decision that the PBRF, after decontamination and dismantlement, meets the release criteria for unrestricted use. Because the process is iterative, the DP cannot outline specific aspects of each step. However, where it is possible (e.g., Step 3, Identifying Inputs to the Decision, Identification of Measurement Techniques), specifics have been provided; where it is not possible (e.g., Step 3, Identifying Inputs to the Decision, Nature and number of measurements), examples have been provided. In addition the final status survey plan uses re-mediation plans, decision errors and statistical parameters that have not been subjected to review by the NRC.

The above grade portions and 1 meter of the below grade portions of some buildings will be demolished, size-reduced and collapsed into the remaining below grade cavities of the buildings after completion and confirmation of the final status survey. Before demolition, the final status survey will require NRC confirmation and approval. In addition, the status of the remaining below grade structures will require NRC confirmation and approval.

NASA will submit documentation of the satisfactory completion of its Final Status Survey to the NRC. The documentation will include a summary of PBRF operations, site characterization data, re-mediation data, all elements of the DQO process and a description of the survey QA. Building demolition and backfill operations will not proceed until the NRC has reviewed and evaluate this documentation.

3.3.4 Conclusion

The NRC staff has reviewed the equipment and areas identified for decontamination and dismantlement and concludes that the list is complete. The NRC staff concludes that no significant events occurred in the operating history of the facility that would inhibit the acceptable decommissioning of the PBRF as proposed. Further, the staff considers the licensee's estimates of the radiological conditions and radiation measurements to be acceptable in that there are no discrepancies from the expected conditions. Finally, the staff finds the final survey plan acceptable based on the application of accepted guidance.

3.4 Cost Estimate and Funding

The DP presents a detailed cost estimate to complete the tasks and a commitment by NASA, an agency of the Federal government, to provide the necessary funds. The staff finds the cost estimate consistent with similar decommissioning cost estimates, and the funding commitment to provide acceptable assurance of completion of the decommissioning activities.

3.5 Technical Specifications

NASA has changed the Technical Specifications to reflect conditions needed for decommissioning and to possess but not operate the reactors in accordance with this safety evaluation. Based on the review the Technical Specifications are consistent for the conduct of decommissioning in accordance with the DP, and are therefore acceptable.

3.6 Quality Assurance Provisions

The licensee has committed to the use of QA programs. NASA will prepare the QA program based on the applicable sections of 10CFR 50, Appendix B and ANSI/ANS 15.8. The licensee has extensive QA experience and is fully capable of developing specific plans and procedures to implement the program. Audit and review requirements are established by Technical Specifications. The staff finds these QA provisions acceptable to conduct decommissioning at the facility.

3.7 Safeguards and Physical Security

The fuel has been shipped off the site. Therefore, safeguards provisions are no longer necessary and the physical security task has been reduced to ensuring access control of the facility for protection from radiation and industrial hazards and protection of capital assets. Access will be controlled by properly trained personnel, or locked physical barriers.

The staff concludes that the DP and Technical Specifications describe acceptable physical security measures to prevent inadvertent exposure of workers and members of the public to radiation and hazards.

4.0 ENVIRONMENTAL CONSIDERATION

The Commission has prepared an Environmental Assessment and Finding of No Significant Impact (EA), which was published in the Federal Register on March 28, 2000, 65 FR 16421.

On the basis of the EA and this safety evaluation, the Commission has determined that no environmental impact statement is required and that issuance of this amendment approving decommissioning will have no significant adverse effect on the quality of the human environment.

5.0 CONCLUSION

Based on the staff's review of the licensee's DP, it is concluded that the licensee is adequately cognizant of its continuing responsibilities to protect the health and safety of both workers and the public from undue radiological risk. The DP provides reasonable evidence that the licensee is prepared to dismantle the reactor, and dispose of all significant reactor-related radioactive materials in accordance with applicable regulations and applicable NRC guidance. The staff, therefore, finds the licensee's plans to be acceptable.

The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding which was published in the *Federal Register* on January 22, 2002 (67 FR 2924).

The staff has concluded, based on the considerations above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by the proposed activities; (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of this amendment will not be inimical to the common defense and security or the health and safety of the public.

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Date: March 20, 2002

UNITED STATES NUCLEAR REGULATORY COMMISSION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

DOCKET NOS. 50-30 AND 50-185

PLUM BROOK REACTOR AND PLUM BROOK MOCK-UP REACTOR

ENVIRONMENTAL ASSESSMENT AND FINDING OF

NO SIGNIFICANT IMPACT

The U.S. Nuclear Regulatory Commission (the Commission) is considering issuance of an amendment to Facility Operating License Nos. TR-3 and R-93, issued to the National Aeronautics and Space Administration (NASA), the licensee. The license amendment would allow decommissioning of the Plum Brook Reactor and the Plum Brook Mock-up Reactor at the Plum Brook Reactor Facility (PBRF) near Sandusky, Ohio.

ENVIRONMENTAL ASSESSMENT

Identification of the Proposed Action:

The PBRF consists of a complex of buildings with two non-power reactors. Both reactors have been shut down and defueled. The Plum Brook Reactor (Docket No. 50-30, NRC License No. TR-3) is a 60-megawatt materials test reactor, constructed to perform irradiation testing of fueled and unfueled experiments for space program application. The Plum Brook Mock-up Reactor (Docket No. 50-185, NRC License No. R-93) is a 100-kilowatt swimming-pool type reactor constructed to test “mock-up” irradiation components for the Plum Brook Reactor. The PBRF reactors were shut down in 1973. NASA currently has possession only licenses to possess the residual radioactive materials

at the facility. All reactor fuel elements have been removed from the facility and the possession only licenses do not allow operation of the reactors.

NASA has proposed to decontaminate the facility to levels that would allow unrestricted release of the 11-hectare (27-acre) PBRF and termination of the licenses. The licensee submitted a decommissioning plan in accordance with 10 CFR 50.82(b) on December 20, 1999. Decommissioning, as described in the plan, will consist of transferring licensed radioactive equipment and material from the site and decontamination of the facility to meet unrestricted release criteria (this is called the DECON option, as described in NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities"). While the decontamination work is in process, remedial action status surveys will be conducted to ensure that the contaminated material has been removed to levels below the limits required for unrestricted release (25 mrem/yr). Final status surveys will be conducted also. After the Commission verifies that the release criteria have been met, the reactor license will be terminated.

A "Notice and Solicitation of Comments Pursuant to 10 CFR 20.1405 and 10 CFR 50.82(b)(5) Concerning Proposed Action to Decommission the Plum Brook Reactor Facility" was published in the FEDERAL REGISTER (65 FR 12040) on March 7, 2000.

Further, 10 CFR 51.53(d) requires that each applicant for a license amendment to authorize decommissioning of a production or utilization facility must submit an environmental report that reflects any new information or significant environmental change associated with the proposed decommissioning activities. The licensee's environmental report is contained in Section 8 of the licensee's decommissioning plan.

The Need for the Proposed Action:

The proposed action is necessary because the licensee has decided to decommission the facility rather than other alternatives. As specified in 10 CFR 50.82, any licensee may apply to the NRC for authority to decommission the affected facility.

Environmental Impacts of the Proposed Action:

The NRC staff has evaluated the radiological impacts of the proposed action as presented in Section 8.5 of the decommissioning plan submitted on December 20, 1999, and concludes that the associated radiological effects of the decommissioning will be acceptable. The staff considered impacts on onsite workers, on transportation workers, and on the public, both during the decommissioning activities and after license termination.

The licensee has established controls to ensure occupational exposure remains below NRC regulatory limits for decommissioning personnel. The collective total dose equivalent to all onsite workers for all of the decommissioning activities is estimated to be about 70 person-rem over the approximate 4-year decommissioning project. This is less than the estimated occupational exposure of 344 person-rem presented in NUREG-0586 and is a result of the approximately 30 years of decay that has already taken place.

Occupational exposure associated with shipment of low level waste has been estimated at less than 18 person-rem. This is similar to the estimate of 22 person-rem for the reference test reactor presented in NUREG-0586 and, again, the lower dose can be attributed to the decay that has occurred since the reactors were shutdown.

The licensee concluded that the offsite public exposure would be small from routine release, based on the generic estimates of NUREG-0586 and on analyzed exposures for potential accidents ("the largest accident analyzed resulted in an offsite dose of about 0.5 mrem"). The licensee's estimates for transportation related exposures were less than 8.2 person-rem and were also consistent with NUREG-0586, again considering the decay time since shutdown. The licensee has also established an As Low As Reasonably Achievable (ALARA) program to minimize exposure and must ensure that decommissioning activities

will not exceed the limits in 10 CFR 20.1301, "Dose Limits for Individual Members of the Public."

The anticipated potential exposure to the public after license termination will be negligible. To be released for unrestricted use, the maximum dose to the "average member of the critical group" must be less than 25 mrem/yr. The actual dose to the public is expected to be much less than 25 mrem/yr because decontamination will be more extensive than that required to meet minimum license termination requirements and public exposure will not occur for some time because the licensee has no plans to make the site available for public reuse.

Based on its review of the specific proposed activities associated with the dismantling and decommissioning of the PBRF, the NRC staff concludes that the proposed action will not increase the probability or consequences of accidents, no changes are being made in the types of any effluents that may be released off site, and there is no significant increase in occupational or public radiation exposure. Therefore, there are no significant radiological environmental impacts associated with the proposed action.

With regard to potential non-radiological impacts, the proposed action does not involve any historic sites. Non-radiological hazardous materials, including friable lead paint and asbestos insulation, will be managed as described in the decommissioning plan and transported offsite for disposal at a licensed burial site. The proposed action does not affect non-radiological plant effluents and has no other environmental impact. Therefore, there are no significant non-radiological environmental impacts associated with the proposed action.

Accordingly, the Commission concludes that there are no significant environmental impacts associated with the proposed action.

Alternatives to the Proposed Action:

The three alternatives to the proposed action for the PBFR are SAFSTOR, ENTOMB, and no action.

SAFSTOR (safe storage) is the alternative in which the nuclear facility is placed and maintained in a condition that allows the nuclear facility to be safely stored and subsequently decontaminated (delayed decontamination) to levels that permit release for unrestricted use. Implementing this alternative would necessitate continued surveillance and maintenance of the PBRF over a period of time. Impacts during the storage period would be minimal, although there would be substantial monitoring and maintenance costs. Eventually, decontamination and decommissioning would be required. The radiological impacts of delayed decontamination and decommissioning would be comparable to, or slightly less than, those of the proposed action because of radioactive decay prior to DECON.

ENTOMB (entombment) is the alternative in which radioactive contaminants are encased in a structurally long-lived material, such as concrete. The entombed structure would be appropriately maintained and continued surveillance would be necessary over a substantial period of time until radioactivity decayed to a level permitting release of the property for unrestricted use. The time period necessary for entombment has been estimated to last for time frames on the order of a hundred years. The ENTOMB option would result in lower radiological exposure, but would require continued use of resources and would incur the costs associated with such long-term monitoring and maintenance.

The no-action alternative would leave the facility in its present configuration, SAFSTOR, and would limit the activities that the licensee could conduct on the site.

However, the regulations in 10 CFR 50.82(b) only allow this condition to exist for a limited period of time.

The licensee has determined that the proposed action (DECON) is the most efficient use of the existing facility, because the SAFSTOR, ENTOMB, and no-action alternatives would entail continued surveillance, maintenance, and physical security measures to be in place and continued monitoring by licensee personnel. The alternatives would also entail the costs associated with these activities.

Alternative Use of Resources:

This action does not involve the use of any resources different from those previously committed for construction and operation of the PBRF.

Agencies and Persons Consulted:

In accordance with its stated policy, on January 21, 2000, the staff consulted with the State of Ohio official, Ruth Vandegrift, Supervisor Decommissioning for the Ohio Department of Health, Bureau of Radiation Protection regarding the environmental impact of the proposed action. The state official had no comments.

FINDING OF NO SIGNIFICANT IMPACT

On the basis of the environmental assessment, the Commission concludes that the proposed action will not have a significant effect on the quality of the human environment. The environmental impacts are expected to be bounded by the analyses in NUREG-0586. Accordingly, the Commission has determined not to prepare an environmental impact statement for the proposed action.

For further details with respect to the proposed action, see the licensee's letter dated December 20, 1999, which is available for public inspection at the Commission's Public Document Room, the Gelman Building, 2120 L Street, NW., Washington, DC. It is

also available at http://www.nrc.gov/OPA/reports under “What’s New on This Page,” “Decommissioning” or “Other Documents.”

Dated at Rockville, Maryland, this 21st day of March 2000.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

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