UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

December 6, 2021

Dr. David M. Slaughter, President
and Reactor Administrator
Aerotest Operations, Inc.
3455 Fostoria Way
San Ramon, CA 94583

SUBJECT: AEROTEST OPERATIONS, INC. – ISSUANCE OF AMENDMENT NO. 6 RE: PERMANENTLY DEFUELED TECHNICAL SPECIFICATIONS AND PARTIAL DENIAL OF AMENDMENT REQUEST (EPID NO. L-2019-LLA-0065)

Dear Dr. Slaughter:

The U.S. Nuclear Regulatory Commission (NRC, the Commission) has issued the enclosed Amendment No. 6 to Facility Operating License No. R-98 for the Aerotest Operations, Inc. (Aerotest, the licensee), Aerotest Radiography and Research Reactor (ARRR) in response to your license amendment request (LAR) dated March 21, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19084A051), as supplemented by letters dated June 28, 2019 (ADAMS Accession No. ML19184A112); August 14, 2019 (ADAMS Accession No. ML19231A127); March 26, 2020 (three letters; ADAMS Accession Nos. ML20098D415, ML20097D279, and ML20134H946); June 8, 2020 (ADAMS Accession No. ML20175A676); July 28, 2020 (ADAMS Accession No. ML20220A422); August 28, 2020 (ADAMS Accession No. ML20248H460); September 28, 2020 (ADAMS Accession No. ML20276A247); March 31, 2021 (ADAMS Accession No. ML21098A157); April 28, 2021 (ADAMS Accession No. ML21126A150); May 19, 2021 (ADAMS Accession No. ML21147A060); and June 22, 2021 (ADAMS Accession No. ML21181A123).

The amendment revises Facility Operating License No. R-98 and the associated technical specifications (TSs) to remove the authority to operate the ARRR, to authorize possession-only of the reactor and fuel, and to remove operational requirements not needed for the possession-only status.

The LAR also requested to replace NRC-licensed reactor operators with certified fuel handlers. Aerotest's proposed Certified Fuel Handler Training and Requalification Program was found acceptable.

Some portions of the LAR, specifically, some proposed license conditions (LCs) and TSs, could only be approved with minor changes, which the NRC staff incorporated into the enclosed Amendment No. 6. In its safety evaluation supporting the issuance of this amendment, which is also enclosed, the staff documents these changes and explains why they were necessary for the staff to find the associated LCs and TSs acceptable. Additionally, one portion of the LAR, specifically, proposed TSs 2.2 and 2.3, could not be approved. Therefore, the LAR is approved in part and denied in part. Accordingly, the NRC is issuing, by means of this letter, a notice of denial of the portion of the LAR that has been denied and is explaining, in the enclosed safety evaluation, the nature of any deficiencies and the reason for the denial.

Under Title 10 of the *Code of Federal Regulations* (10 CFR) 2.103(b)(2), within 20 days from the date of this letter, you may demand an adjudicatory hearing with respect to the denial described above. Under 10 CFR 2.307(a), you may request an extension of this time limit if you can show good cause.

A demand for a hearing must be filed in accordance with 10 CFR Part 2, "Agency rules of practice and procedure," which is accessible electronically on the NRC's website at https://www.nrc.gov/reading-rm/doc-collections/cfr/. Generally, a demand for a hearing should explain why you believe that the NRC denied your application in error and why you believe that the application does, in fact, satisfy the requirements.

A demand for a hearing must also be filed in accordance with the NRC's E-Filing rule at 10 CFR 2.302. The E-Filing process requires participants to submit and serve all adjudicatory documents over the internet, or in some cases, to mail copies on electronic storage media, unless an exemption permitting an alternative filing method, as discussed below, is granted. Detailed guidance on electronic submissions is located in the Guidance for Electronic Submissions to the NRC (ADAMS Accession No. ML13031A056) and on the NRC's website at https://www.nrc.gov/site-help/e-submittals.html.

To comply with the procedural requirements of E-Filing, at least 10 days prior to the filing deadline, the participant should contact the Office of the Secretary by e-mail at hearing.docket@nrc.gov or by telephone at 301-415-1677 to (1) request a digital identification (ID) certificate, which allows the participant (or its counsel or representative) to digitally sign submissions and access the E-Filing system for any proceeding in which it is participating and (2) advise the Secretary that the participant will be submitting a demand for a hearing (even in instances in which the participant, or its counsel or representative, already holds an NRC-issued digital ID certificate). Based upon this information, the Secretary will establish an electronic docket for the proceeding if the Secretary has not already established an electronic docket.

Information about applying for a digital ID certificate is available on the NRC's website at https://www.nrc.gov/site-help/e-submittals/getting-started.html. After a digital ID certificate is obtained and a docket created, the participant must submit adjudicatory documents in Portable Document Format (PDF). Guidance on submissions is available on the NRC's website at https://www.nrc.gov/site-help/electronic-sub-ref-mat.html. A filing is considered complete at the time the document is submitted through the NRC's E-Filing system. To be timely, an electronic filing must be submitted to the E-Filing system no later than 11:59 p.m. Eastern Time on the due date. Upon receipt of a transmission, the E-Filing system time-stamps the document and sends the submitter an e-mail confirming receipt of the document. The E-Filing system also distributes an e-mail that provides access to the document to the NRC's Office of the General Counsel and any others who have advised the Office of the Secretary that they wish to participate in the proceeding, so that the filer need not serve the document on those participants separately. Therefore, applicants and other participants (or their counsel or representative) must apply for and receive a digital ID certificate before adjudicatory documents are filed to obtain access to the documents via the E-Filing system.

A person filing electronically using the NRC's adjudicatory E-Filing system may seek assistance by contacting the NRC's Electronic Filing Help Desk through the "Contact Us" link located on the NRC's website at https://www.nrc.gov/site-help/e-submittals.html, by e-mail to MSHD.Resource@nrc.gov, or by a toll-free call at 1-866-672-7640. The NRC's Electronic Filing Help Desk is available between 9 a.m. and 6 p.m., Eastern Time, Monday through Friday, excluding government holidays.

Participants who believe that they have good cause for not submitting documents electronically must file an exemption request, in accordance with 10 CFR 2.302(g), with their initial paper filing stating why there is good cause for not filing electronically and requesting authorization to continue to submit documents in paper format. Such filings must be submitted in accordance with 10 CFR 2.302(b)-(d). Participants filing adjudicatory documents in this manner are responsible for serving their documents on all other participants. Participants granted an exemption under 10 CFR 2.302(g)(2) must still meet the electronic formatting requirement in 10 CFR 2.302(g)(1), unless the participant also seeks and is granted an exemption from 10 CFR 2.302(g)(1).

Documents submitted in adjudicatory proceedings will appear in the NRC's electronic hearing docket, which is publicly available at https://adams.nrc.gov/ehd, unless excluded pursuant to an order of the presiding officer. If you do not have an NRC-issued digital ID certificate as described above, click "cancel" when the link requests certificates and you will be automatically directed to the NRC's electronic hearing dockets where you will be able to access any publicly available documents in a particular hearing docket. Participants are requested not to include personal privacy information such as social security numbers, home addresses, or personal phone numbers in their filings unless an NRC regulation or other law requires submission of such information. With respect to copyrighted works, except for limited excerpts that serve the purpose of the adjudicatory filings and would constitute a Fair Use application, participants should not include copyrighted materials in their submission.

By e-mail dated November 23, 2021 (ADAMS Accession No. ML21328A197), the NRC staff informed you of its plans for the approval in part and denial in part of the LAR; provided to you a draft of the approved revised ARRR license and TSs; and offered you the opportunity for a teleconference to discuss the approval in part and denial in part of the LAR, prior to the NRC staff's issuance of the approval in part and denial in part of the LAR. By e-mail dated December 2, 2021 (ADAMS Accession No. ML21337A330), you indicated that a teleconference would not be necessary.

Pursuant to 10 CFR 50.51(b), "[e]ach license for a facility that has permanently ceased operations, continues in effect beyond the expiration date to authorize ownership and possession of the production or utilization facility, until the Commission notifies the licensee in writing that the license is terminated." As such, Facility Operating License No. R-98 for the ARRR shall remain in effect pursuant to 10 CFR 50.51(b).

If you have any questions, please contact Geoffrey Wertz at 301-415-0893, or by e-mail at Geoffrey.Wertz@nrc.gov, or Edward Helvenston at 301-415-4067, or by e-mail at Edward.Helvenston@nrc.gov.

Sincerely,

Jeremy S. Bowen

Digitally signed by Jeremy S. Bowen
Date: 2021.12.06 14:08:57 -05'00'

/for/

Mohamed K. Shams, Director
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

Docket No. 50-228
License No. R-98

Enclosures:
1. Amendment No. 6 to
   Facility Operating License No. R-98
2. Safety Evaluation

cc w/enclosures:

California Energy Commission
1516 Ninth Street, MS-34
Sacramento, CA 95814

Radiologic Health Branch
P.O. Box 997414, MS 7610
Sacramento, CA 95899-7414

Test, Research and Training
Reactor Newsletter
Attention: Amber Johnson
Dept of Materials Science and Engineering
University of Maryland
4418 Stadium Drive
College Park, MD 20742-2115

SUBJECT: AEROTEST OPERATIONS, INC. – ISSUANCE OF AMENDMENT NO. 6 RE: PERMANENTLY DEFUELED TECHNICAL SPECIFICATIONS AND PARTIAL DENIAL OF AMENDMENT REQUEST (EPID NO. L-2019-LLA-0065) DATED: DECEMBER 6, 2021

DISTRIBUTION:
PUBLIC
JParrott, NMSS
ZCruz, NMSS
KRoche, NRR
BWatson, NMSS
GWertz, NRR
JBorromeo, NRR
TTate, NRR
EHelvenston, NRR
NParker, NRR
JBowen, NRR
CMontgomery, NRR
JWachutka, OGC
SAnderson, NRR
MShams, NRR
RidsOgcMailCenter
RidsNrrDanu Resource

ADAMS Accession No. ML21242A463 **NRR-058**

OFFICE	**NRR/DANU/UNPL/PM**	**NRR/DANU/UNPL/PM**	**NRR/DANU/UNPL/LA**	**OGC**
NAME	GWertz	EHelvenston	NParker	JWachutka
DATE	9/8/2021	9/8/2021	9/16/2021	10/19/2021
OFFICE	**NMSS/DUWP/RDB**	**NRR/DANU/UNPO/BC**	**NRR/DANU/UNPL/BC**	**NRR/DANU/D**
NAME	BWatson	TTate	JBorromeo	MShams (JBowen for)
DATE	11/3/2021	11/15/2021	11/17/2021	12/6/2021

OFFICIAL RECORD COPY

AEROTEST OPERATIONS, INC.

DOCKET NO. 50-228

AEROTEST RADIOGRAPHY AND RESEARCH REACTOR

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 6
License No. R-98

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

   A. The application for an amendment to Facility Operating License No. R-98, filed by Aerotest Operations, Inc. (the licensee), on March 21, 2019, as supplemented on June 28 and August 14, 2019; March 26 (3 letters), June 8, July 28, August 28, September 28, 2020; and March 31, April 28, May 19, and June 22, 2021, complies, to the extent discussed in the NRC staff's safety evaluation dated December 6, 2021, with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in Title 10 of the *Code of Federal Regulations* (10 CFR) Chapter I;

   B. The facility will be possessed 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) 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;

   E. The issuance of this amendment is in accordance with 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," of the Commission's regulations and all applicable requirements have been satisfied; and

   F. Prior notice of this amendment was not required by 10 CFR 2.105, "Notice of proposed action," and publication of a notice for this amendment is not required by 10 CFR 2.106, "Notice of issuance."

2. Accordingly, the license is amended as indicated in Attachment 1 to this license amendment and by changes to the Technical Specifications as indicated in Attachment 2. The following paragraphs of Facility Operating License No. R-98 are hereby amended to read as follows:

2.B.(1) Pursuant to Section 104c of the Act and 10 CFR Part 50, “Licensing of Production and Utilization Facilities,” to possess the reactor at the designated location in San Ramon, California, in accordance with the procedures and limitations set forth in this license;

2.B.(2) Pursuant to the Act and 10 CFR Part 70, “Special Nuclear Material,” to possess (1) up to 5.0 kilograms of contained uranium-235, (2) such special nuclear material as may have been produced by previous operation of the reactor, and (3) such special nuclear material (in TRIGA fuel elements) produced by operation of other reactors as may have been previously transferred to Facility Operating License No. R-98 prior to December 6, 2018, provided actions involving special nuclear material are limited to those related to fuel storage and decommissioning; and

2.B.(3) Pursuant to the Act and 10 CFR Part 30, “Licensing of Byproduct Material,” (1) to possess a 2 curie americium-beryllium neutron startup source, (2) to possess, but not separate, such byproduct material as may have been produced by previous operation of the reactor, and (3) to possess, but not separate, such byproduct material (in TRIGA fuel elements) produced by operation of other reactors as may have been previously transferred to Facility Operating License No. R-98 prior to December 6, 2018, provided actions involving byproduct material are limited to those related to fuel storage and decommissioning.

2.C.(1) <u>Maximum Power Level</u>

The licensee is not authorized to operate the facility at any power.

2.C.(2) <u>Technical Specifications</u>

The Technical Specifications contained in Appendix A, as revised through Amendment No. 6, are hereby incorporated into the license. The licensee shall maintain the facility in accordance with the Technical Specifications.

2.C.(3) Physical Security Plan

The licensee shall maintain in effect and fully implement all provisions of the NRC-approved physical security plan, including amendments and changes made pursuant to the authority of 10 CFR Section 50.54(p). The approved security plan consists of the document withheld from public disclosure pursuant to 10 CFR 73.21, entitled "Security Plan for ARRR," dated September 28, 2020.

2.F This amended license is effective as of the date of issuance and until the Commission notifies the licensee in writing that the license is terminated.

3. Accordingly, the license is hereby amended by the addition of license condition 2.C.(4) to read as follows:

2.C.(4) Certified Fuel Handler Training and Requalification Program

Whenever the licensee possesses TRIGA fuel elements pursuant to License Condition 2.B.(2), the licensee shall maintain in effect and fully implement all provisions of the NRC-approved Certified Fuel Handler Training and Requalification Program, including changes made to the program without NRC approval as permitted by the program. The approved program consists of the document entitled, "ARRR CFH Training/Requalification Program," dated March 30, 2021. Certified Fuel Handlers qualified in accordance with the program may approve licensee action permitted by 10 CFR 50.54(x).

4. This license amendment is effective as of the date of its issuance and shall be implemented within 30 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Jeremy S. Bowen

Digitally signed by Jeremy S. Bowen
Date: 2021.12.06 14:09:42 -05'00'

/for/

Mohamed K. Shams, Director
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

Attachments:
1. Changes to Facility
   Operating License No. R-98
2. Changes to Appendix A,
   "Technical Specifications"

Date of Issuance: December 6, 2021

ATTACHMENT TO LICENSE AMENDMENT NO. 6

FACILITY OPERATING LICENSE NO. R-98

DOCKET NO. 50-228

Replace the following pages of Facility Operating License No. R-98 with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Facility Operating License

Remove	Insert
2	2
3	3
4	4

F. The issuance of this operating license will not be inimical to the common defense and security or to the health and safety of the public, and does not involve a significant hazards consideration;

G. The receipt, possession, and use of byproduct and special nuclear material as authorized by this license will be in accordance with the Commission's regulations in 10 CFR Parts 30 and 70, including Sections 30.33, 70.23, and 70.31;

H. The licensee is qualified to be the holder of the license; and

I. The transfer of the license is otherwise consistent with applicable provisions of law, regulations, and orders by the Commission pursuant thereto.

2. Facility Operating License No. R-98, issued to Aerotest Operations, Inc., is hereby indirectly transferred to Nuclear Labyrinth, LLC, and the license is amended to read as follows:

A. This license applies to the Aerotest Radiography and Research Reactor (ARRR), a pool-type nuclear reactor owned by Aerotest Operations, Inc. The facility is located at the Aerotest Operations site near San Ramon, California, and is described in the application dated September 14, 1964 (the application), and in supplements thereto, including the application for transfer of license dated April 24, 1974, and the application for indirect transfer dated May 30, 2012.

B. Subject to the conditions and requirements incorporated herein, the Commission hereby licenses Aerotest Operations, Inc.:

(1) Pursuant to Section 104c of the Act and 10 CFR Part 50, "Licensing of Production and Utilization Facilities," to possess the reactor at the designated location in San Ramon, California, in accordance with the procedures and limitations set forth in this license;

(2) Pursuant to the Act and 10 CFR Part 70, "Special Nuclear Material," to possess (1) up to 5.0 kilograms of contained uranium-235, (2) such special nuclear material as may have been produced by previous operation of the reactor, and (3) such special nuclear material (in TRIGA fuel elements) produced by operation of other reactors as may have been previously transferred to Facility Operating License No. R-98 prior to December 6, 2018, provided actions involving special nuclear material are limited to those related to fuel storage and decommissioning; and

(3) Pursuant to the Act and 10 CFR Part 30, "Licensing of Byproduct Material," (1) to possess a 2 curie americium-beryllium neutron startup source, (2) to possess, but not separate, such byproduct material as may have been produced by previous operation of the reactor, and (3) to possess, but not separate, such byproduct material (in TRIGA fuel elements) produced by operation of other reactors as may have been previously transferred to Facility Operating License No. R-98 prior to December 6, 2018, provided actions involving byproduct material are limited to those related to fuel storage and decommissioning.

C. This license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations in 10 CFR Chapter I: Part 20, Section 30.34 of Part 30, Sections 50.54 and 50.59 of Part 50, and Section 70.32 of Part 70; is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

The licensee is not authorized to operate the facility at any power.

(2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 6, are hereby incorporated in the license. The licensee shall maintain the facility in accordance with the Technical Specifications.

(3) Physical Security Plan

The licensee shall maintain in effect and fully implement all provisions of the NRC-approved physical security plan, including amendments and changes made pursuant to the authority of 10 CFR Section 50.54(p). The approved security plan consists of the document withheld from public disclosure pursuant to 10 CFR 73.21, entitled “Security Plan for ARRR,” dated September 28, 2020.

(4) Certified Fuel Handler Training and Requalification Program

Whenever the licensee possesses TRIGA fuel elements pursuant to License Condition 2.B.(2), the licensee shall maintain in effect and fully implement all provisions of the NRC-approved Certified Fuel Handler Training and Requalification Program, including changes made to the program without NRC approval as permitted by the program. The approved program consists of the document entitled “ARRR CFH Training/Requalification Program,” dated March 30, 2021. Certified Fuel Handlers qualified in accordance with the program may approve licensee action permitted by 10 CFR 50.54(x).

D. Reports

In addition to reports otherwise required under the license and applicable regulations:

(1) The licensee shall report in writing to the Commission within 10 days of its observed occurrence any incident or condition relating to the operation of the facility which prevented or could have prevented a nuclear system from performing its safety function as described in the Technical Specifications or in the Hazards Summary Report.

(2) The licensee shall report to the Commission in writing within 30 days of its observed occurrence any substantial variance disclosed by operation of the facility from performance specifications contained in the Hazards Summary Report or the Technical Specifications.

(3) The licensee shall report to the Commission in writing within 30 days of its occurrence any significant change in transient or accident analysis, as described in the Hazards Summary Report.

E. Records

In addition to those otherwise required under this license and applicable regulations, the licensee shall keep the following:

(1) Reactor operating records, including power levels.

(2) Records of in-pile irradiations.

(3) Records showing radioactivity released or discharged into the air or water beyond the effective control of the licensee as measured at the point of such release or discharge.

(4) Records of emergency reactor scrams, including reasons for emergency shutdowns.

F. This amended license is effective as of the date of issuance and until the Commission notifies the licensee in writing that the license is terminated.

FOR THE ATOMIC ENERGY COMMISSION

R/A

Karl R. Goller, Assistant Director
for Operating Reactors
Directorate of Licensing

Attachment:
Change No. 8 to the Technical
Specifications

Date of Issuance: October 22, 1974

ATTACHMENT TO LICENSE AMENDMENT NO. 6

FACILITY OPERATING LICENSE NO. R-98

DOCKET NO. 50-228

Replace the following pages of the Appendix A, “Technical Specifications,” with the attached revised pages. The Technical Specifications are replaced in their entirety and are identified by the amendment number.

Technical Specifications

Remove	Insert
1 – 16	1 – 10

APPENDIX A

LICENSE N0. R-98

TECHNICAL SPECIFICATIONS FOR THE

AEROTEST RADIOGRAPHY AND RESEARCH REACTOR (ARRR)

1.0 Definitions

1.1 Permanent Shutdown

The reactor is permanently shut down when the reactor is maintained in permanent shut down configuration.

1.2 Permanent Shutdown Configuration

Core lattice containing no fuel or reflector elements and control rods disabled fully inserted.

1.3 Operable

A system or component shall be considered operable when it is capable of performing its required function in its normal manner.

1.4 Operating

A component or system is operating if it is performing its required function in its normal manner.

1.5 Experiment

Experiment shall mean any apparatus, device, or material installed in the core or experimental facilities (except for underwater lights, fuel storage racks and the like) which is not a normal part of these facilities.

1.6 Experimental Facilities

Experimental facilities shall mean Glory Hole, vertical tubes, pneumatic transfer systems, central thimble, beam tubes, thermal column, and in-pool irradiation facilities.

1.7 Reactor Safety Circuits

Reactor safety circuits shall mean those circuits, including their associated input circuits, which are designed to initiate a reactor scram.

1.8 Core Lattice

The array of machined positions for fuel or reflector elements in the grid plates.

1.9 Core Structure

The upper and lower grid plates connected by structural members.

2.0 Reactor Site

2.1 The reactor and associated equipment is located within an exclusion area.

2.2 A steel, locked perimeter fence shall surround the ARRR facility, forming an exclusion area. The minimum distance from the center of the reactor pool to the boundary of the exclusion area fencing shall be 50 feet. The restricted area, as defined in 10 CFR 20, shall consist of the entire exclusion area.

3.0 Reactor Building

3.1 The reactor shall be housed in a steel building capable of meeting the following functional requirements:

3.1.1 All circulating fans and air conditioning systems except the system which supplies air to the control room shall have the capability to be shut off from a single control in the control room,

3.1.2 Ventilation shall be achieved by gravity ventilators located on the roof of the building, and

3.1.3 A positive air pressure shall be maintained in the control room with respect to the reactor room.

4.0 Reactor Pool (Primary System)

4.1 The minimum depth of water above the top of the core structure shall be 16 ft. The maximum bulk water temperature shall be 130°F and the minimum 40°F.

4.2 The conductivity of the primary coolant shall be measured at least once quarterly. Corrective action shall be taken to avoid exceeding a conductivity of 5 μmho/cm.

5.0 Reactor Core

5.1 Fuel Elements

No fuel elements shall be allowed in the core lattice.

5.2 Reflector Elements

No reflector elements shall be allowed in core lattice.

5.3 Control Elements

Control elements shall be disabled and fully inserted in core lattice.

6.0 Storage Safety Systems

Safety systems instruments that are related to the safe and secure storage of the irradiated fuel shall be operable when relevant if the irradiated fuel is present in the facility. Those safety system instruments are noted by an asterisk (*) in Table 1. A service period not to exceed thirty days shall be allowed to facilitate any required repairs, replacements, maintenance, and/or calibration to any of the instruments listed in Table 1.

7.0 Radiation Monitoring

7.1 A fixed gamma monitor employing Geiger tube detectors shall be located on the wall connecting the control room and the reactor room. This monitor shall serve as an area radiation monitor and will annunciate through an automatic monitoring system to the San Ramon, California, Fire Department and actuate a siren within the reactor building on high radiation level. The monitor shall have a minimum range of 0 to 20 mr/hr. The annunciation and the siren actuation shall be tested monthly.

7.2 A gas sample shall be continuously withdrawn from above the reactor and below the pool cover in the vicinity of the reactor bridge. The gas-effluent shall be monitored by a beta-gamma detector which shall have a continuous readout in the control room. An annunciator shall indicate when the gas exceeds 2 mr/hr.

7.3 A water radioactivity monitor shall be attached to the process water cleanup system loop adjacent to the demineralizer and shall provide continuous indication in the control room. High radiation levels within the demineralizer or pool water shall annunciate an audible alarm in the control room. The range of the monitor shall be from 0.1 to 100 mr/hr.

7.4 Portable survey instruments (gamma, beta) for measuring beta-gamma dose rates in the range of 0.01 mr/hr to 50 r/hr shall be available at the facility.

7.5 Portable survey instrument (neutron) for measuring fast and thermal neutron dose rates from 0.1 mrem/hr to 1.0 rem/hr shall be available at the facility.

7.6 Radiation dosimeters (gamma, neutron) shall be placed at several locations within the reactor building for area radiation analysis.

7.7 Instrumentation with readout in the control room shall be operating to permit continuous indication of pool water temperature and pool water conductivity. Alarms shall be operable to indicate low water flow, low pool water and bridge crane location. Table 1 contains alarm setpoints for sensors.

8.0 Experimental Facilities

8.1 Large-Component Irradiation Box

Not in pool and shall not be authorized for use.

8.2 Pneumatic Transfer Facility

Not in core lattice and shall not be authorized for use.

8.3 Glory Hole Facility

Not in pool and shall not be authorized for use.

8.4 Neutron Radiography Facility

Shall not be authorized for use.

8.4.1 The beam tube shall consist of a two-section tapered tube having a rectangular cross-section. The upper and lower sections of the tube shall be equipped with a fill and drain line.

8.4.2 All components contacting the pool water shall be fabricated from aluminum or stainless steel.

8.4.3 The beam catcher shield shall consist of a movable radiation shield.

8.5 Thermal Column

Shall be authorized for reflector element storage only.

8.5.1 The thermal column shall be positioned remotely on steel locating pins immediately adjacent to the core structure.

8.5.2 The thermal column shall be composed of a three-foot cube of graphite encased in aluminum containing five rows of 1.5 in. diameter irradiation holes. The rows shall be placed 6 inches apart and contain seven holes per row.

8.6 Vertical Tube

Shall not be authorized for use.

8.7 Other Irradiation Facilities

Shall not be authorized for use.

9.0 Experiment Limitation

No experiments shall be authorized.

10.0 General Operating Limitations

No reactor operation shall be authorized.

11.0 Fuel Transfer and Storage

11.1 The fuel storage pits located in the floor of the reactor room shall accommodate a maximum of 19 fuel elements (700 gm U-235) in storage racks dry or flooded with water. The fuel storage pits shall be secured with a lock and chain when fuel is present except during fuel transfer operations.

11.2 Additional fuel storage racks may be located in the reactor tank. Each of these storage facilities shall be so designed that for all conditions of moderation k_{eff} shall not exceed a value of 0.8.

11.3 A fuel handling tool shall be used in transferring fuel elements of low radioactivity between the storage pits and the reactor; a shielded transfer cask shall be used for the transfer of highly radioactive fuel elements. The fuel handling tool shall remain in a locked cabinet under the cognizance of the Certified Fuel Handler Supervisor when not authorized for use.

11.4 The transfer of irradiated fuel in the reactor tank, storage pits and facility shall be conducted by a minimum staff of two; a Certified Fuel Handler (CFH) and an additional person trained in radiation safety. The staff shall monitor the operation using a hand held Gamma/Beta radiation monitoring instrument. The Radiation Safety Officer or designee shall be present for irradiated fuel transfers outside of the reactor tank.

11.5 No more than one fuel element that is not in storage shall be allowed in the facility. The only movement of the fuel elements shall be for fuel element inspections, canister surveillances, rearrangement of fuel elements in storage, or final placement in the transportation cask.

11.6 CFH or CFH Supervisor does not need to be at the facility on a daily basis. They are only required when there is a transfer/movement of fuel.

12.0 Administrative Requirements

12.1 Organization (Figure 1) showing reporting and communication lines

12.1.1 Aerotest Operations President (Level 1) shall have the responsibilities for all activities associated with obligations and processes associated with operating Aerotest Operations which includes complying with license and Technical Specifications, facility physical security and safety programs. The President of Aerotest Operations, Inc. shall report to the Board of Directors of Aerotest Operations, Inc.

12.1.2 The Reactor Administrator (Level 2) shall have the responsibilities of ensuring security and safety of the Aerotest facility. He/she shall enforce, review and amend procedures associated with security and safety programs. The reactor administrator shall be responsible to the President, Aerotest Operations, Inc. The Reactor Administrator shall have a minimum of 5 years of experience in reactor operations, 2 years of experience with personnel and environmental/occupational radiation monitoring programs, and 2 years of experience with complying with government regulations. Successfully completed college-level work in the nuclear and radiation related fields of study may be considered In lieu of the experience requirement.

12.1.3 The Certified Fuel Handler Supervisor (Level 3) is a non-licensed operator who has qualified in accordance with the ARRR CFH Training/Requalification Program and shall have the responsibility of handling fuel and in all matters pertaining to fuel handling operations and to these Technical Specifications, the Certified Fuel Handler Supervisor shall be responsible to the Reactor Administrator, Aerotest Operations, Inc. The CFH Supervisor shall have at least 5 years of experience in irradiated fuel movements and demonstrated knowledge of the relevant NRC regulations and ALARA principles. Successfully completed college-level work in the nuclear and radiation related fields of study may be considered in lieu of the experience requirement. Maintain health/medical requirements required for the CFH job. The biennial CFH Health Questionnaire will be used to assess health/medical requirements.

12.1.4 The Radiation Safety Officer (Level 3) shall review and approve all procedures involving radiological safety. He/she shall enforce rules, regulations and procedures relating to radiological safety, conduct routine radiation surveys and is responsible to the President, Aerotest Operations, Inc. The Radiation Safety Officer shall have a minimum of 2 years of experience in personnel and environmental/occupational radiation monitoring programs. Successfully completed college-level work in the nuclear and radiation related fields of study may be considered in lieu of the experience requirement.

12.1.5 The Certified Fuel Handler (Level 4) is a non-licensed operator who has qualified in accordance with ARRR CFH Training/Requalification Program. Fuel handling obligations include maintenance, periodic fuel inspections and/or putting the spent fuel in transportation casks for fuel shipment from facility. The CFH only handles fuel when needed and only handles 1 fuel element at a time. The CFH does not make decisions on fuel handling, decommissioning or radiation; those are made by the Reactor Administrator or Radiation Safety Officer (RSO). The CFH shall have at least 2 years of experience in irradiated fuel movements and demonstrated knowledge of the relevant NRC regulations and ALARA principles. Successfully completed college-level work in the nuclear and radiation related fields of study may be considered in lieu of the experience requirement. Maintain health/medical requirements required for the CFH job. The biennial CFH Health Questionnaire will be used to assess health/medical requirements.

12.1.6 The Reactor Safeguards Committee shall be composed of not less than five members, of whom no more than three are members of Aerotest Operations, Inc. The committee shall meet on call of the chairman and they shall meet at least annually. The committee shall be responsible for, but not limited to the following:

12.1.6.1 Reviewing and approving nuclear safety standards associated with the use of the facility;

12.1.6.2 Reviewing ARRR facility's procedures and modifications;

12.1.6.3 Determining whether proposed changes to the facility or procedures are allowed without prior authorization by the NRC, as detailed in 10 CFR 50.59;

12.1.6.4 Conducting periodic audits of procedures, maintenance, equipment performance, and records;

12.1.6.5 Reviewing all reported violations of these Technical Specifications, evaluating the causes of such events and the corrective action taken and recommending measures to prevent reoccurrence and;

12.1.6.6 Reporting their findings and recommendations concerning the above to the President, Aerotest Operations, Inc.

12.2 Procedures

12.2.1 Detailed written procedures shall be provided and followed for the following operations:

12.2.1.1 Fuel Handling operations;

12.2.1.2 Normal operating of all systems and components involving nuclear safety of the ARRR facility;

12.2.1.3 Actions to be taken to correct specific and foreseen potential malfunctions of systems or components, including responses to alarms and suspected primary system leaks;

12.2.1.4 Preventative or corrective maintenance operations which could have an effect on the safety of the facility.

12.2.2 Temporary procedures which do not change the intent of previously approved procedures may be utilized on approval by the Reactor Administrator. Such procedures shall be subsequently reviewed by the Reactor Safeguards Committee.

12.3 Records

Records shall be maintained as required by the facility license and applicable regulations.

TABLE 1

SAFETY SYSTEM FUNCTIONS

TECH SPEC #	SENSOR OR TRIP DEVICE	NO. OF SWITCHES OR SENSORS	ANNUNCIATOR AND ALARM SET POINT
7.7	Pool Water Temperature*	1	≤ 130° F
7.7	Pool Water Conductivity*	1	≤ 5 µmho/cm
7.7	Low Pool Water*	1	≤ 1 ft max decrease
7.7	Bridge Crane Location*	1	When located off storage position
7.1	Area Radiation Monitor	1	≤ 10 mr/hr
7.3	Water Radioactivity*	1	≤ 20 mr/hr
7.7	Low Water Flow*	1	≥ 4 gpm
7.2	Gas Effluent Monitor*	1	≤ 2 mr/hr
7.4	Portable Survey Instruments (Gamma, Beta)	1	Between .01 mrem/hr and 50 rem/hr
7.5	Portable Survey Instrument (Neutron)	1	Between .01 mrem/hr and 1.0 rem/hr
7.6	Radiation Dosimeters (Gamma, Neutron)	As needed	N/A

* Safety system instruments that are related to the safe and secure storage of the irradiated fuel shall be operable when relevant if the irradiated fuel is present in the facility.

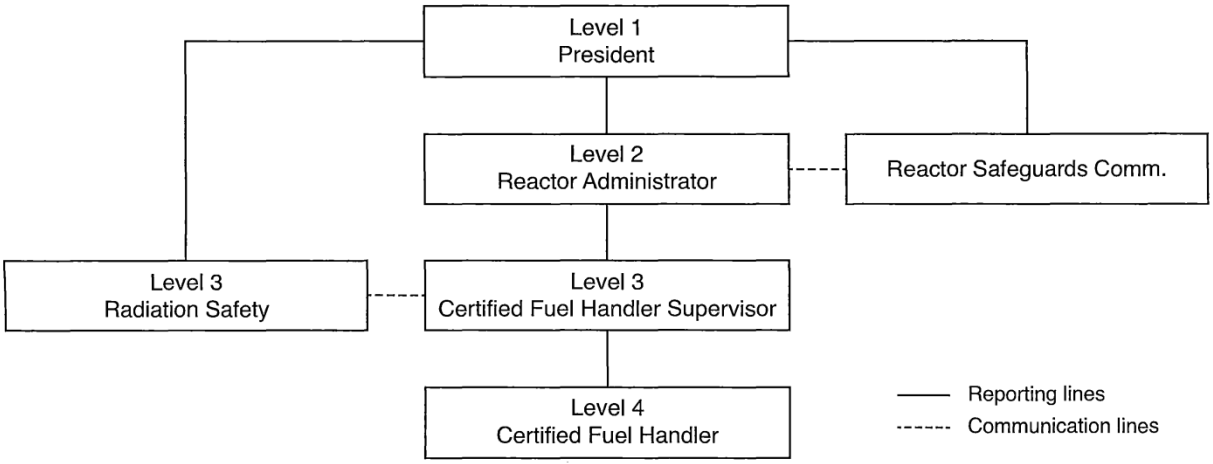

Figure 1 – ARRR ANSI/ANS-15.1 Organization

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 6 TO

FACILITY OPERATING LICENSE NO. R-98

AEROTEST OPERATIONS, INC.

AEROTEST RADIOGRAPHY AND RESEARCH REACTOR

DOCKET NO. 50-228

1.0 INTRODUCTION

By letter dated March 21, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19084A051), as supplemented by letters dated June 28, 2019 (ADAMS Accession No. ML19184A112); August 14, 2019 (ADAMS Accession No. ML19231A127); March 26, 2020 (three letters; ADAMS Accession Nos. ML20098D415, ML20097D279, and ML20134H946); June 8, 2020 (ADAMS Accession No. ML20175A676); July 28, 2020 (ADAMS Accession No. ML20220A422); August 28, 2020 (ADAMS Accession No. ML20248H460); September 28, 2020 (ADAMS Accession No. ML20276A247); March 31, 2021 (ADAMS Accession No. ML21098A157); April 28, 2021 (ADAMS Accession No. ML21126A150); May 19, 2021 (ADAMS Accession No. ML21147A060); and June 22, 2021 (ADAMS Accession No. ML21181A123), Aerotest Operations, Inc. (Aerotest, the licensee) submitted a license amendment request (LAR) to the U.S. Nuclear Regulatory Commission (NRC, the Commission) to amend Facility Operating License No. R-98, including the Appendix A technical specifications (TSs), for the Aerotest Radiography and Research Reactor (ARRR). The licensee stated in its letter dated June 28, 2019, that it plans to amend the ARRR license to a possession-only license in preparation for the decommissioning of the ARRR. In its LAR, the licensee also proposed to replace NRC-licensed reactor operators (ROs) with certified fuel handlers (CFHs) and provided a CFH Training and Requalification Program (CFHTRP) for NRC review and approval.

The licensee's letter dated June 22, 2021, was in response to an NRC staff e-mail dated June 3, 2021 (ADAMS Accession No. ML21201A363), which provided to the licensee a draft request for additional information (RAI) for the licensee to review (ADAMS Accession No. ML21201A364). The licensee acknowledged receipt of the draft RAI by e-mail dated June 3, 2021 (ADAMS Accession No. ML21201A362). The licensee subsequently responded to this draft RAI by its letter dated June 22, 2021, and, accordingly, the NRC staff did not issue a final version of this RAI. Throughout this safety evaluation (SE), the NRC staff refers to the information provided in the licensee's June 22, 2021, letter as "draft RAIs responses."

Some portions of the LAR, specifically, some proposed license conditions (LCs) and TSs, could only be approved with minor changes, which the NRC staff incorporated into the approved LCs and TSs. In this SE, the NRC staff documents these changes and explains why they were necessary for the staff to find the associated LCs and TSs acceptable. Additionally, one portion of the LAR, specifically, proposed TSs 2.2 and 2.3, could not be approved. In this SE, the staff documents this denial and explains the nature of any deficiencies and the reason for the denial.

2.0 REGULATORY EVALUATION

The NRC staff evaluated the LAR based on the following regulations and guidance:

- Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," Section 50.2, "Definitions," which defines a CFH as "a non-licensed operator who has qualified in accordance with a fuel handler training program approved by the Commission."

- Section 50.36, "Technical specifications," of 10 CFR, which requires TSs to be included in utilization facility licenses.

- Section 50.54, "Conditions of licenses," of 10 CFR, which provides conditions for operating licenses for nuclear reactors.

- Section 50.90, "Application for amendment of license, construction permit, or early site permit," of 10 CFR, which requires a licensee that desires to amend a license to fully describe the changes desired.

- Section 50.120, "Training and qualification of nuclear power plant personnel," of 10 CFR, which requires, in part, that the training program for a non-licensed operator must be derived from a systems approach to training (SAT), as defined in 10 CFR 55.4.

- Part 20, "Standards for Protection Against Radiation," Section 20.1101, "Radiation protection programs," of 10 CFR, which, in part, requires the licensee to develop, document, and implement a radiation protection program.

- Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," Section 51.22, "Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review," of 10 CFR, which identifies licensing, regulatory, and administrative actions eligible for categorical exclusion from the requirement to prepare an environmental assessment or environmental impact statement.

- Part 55, "Operators' Licenses," of 10 CFR, which provides the requirements for operators' licenses, including 10 CFR 55.4, "Definitions," which defines, among other things, SAT.

- NRC Regulatory Guide (RG) 5.59, "Standard Format and Content for a Licensee Physical Security Plan for the Protection of Special Nuclear Material of Moderate or Low Strategic Significance," Revision 1, dated February 1983 (ADAMS Accession No. ML100341301).

- NUREG-1537, Part 1, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Format and Content," Chapter 14, "Technical Specifications," Appendix 14.1, "Format and Content of Technical Specifications for Non-Power Reactors" and Chapter 17, "Decommissioning and Possession-Only License Amendments," Section 17.2, "Possession-Only License Amendment" (ADAMS Accession No. ML042430055), which provide guidance to research reactor licensees preparing applications for possession-only license amendments.

- NUREG-1537, Part 2, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Standard Review Plan and Acceptance Criteria,” Chapter 14, “Technical Specifications,” and Chapter 17, “Decommissioning and Possession-Only License Amendments,” Section 17.2, “Possession-Only License Amendment” (ADAMS Accession No. ML042430048), which provide guidance to the NRC staff for performing reviews of possession-only license amendment requests for research reactors.

- American National Standards Institute/American Nuclear Society (ANSI/ANS)-15.1-2007 (R2013), “The Development of Technical Specifications for Research Reactors,” which provides guidance used by the NRC staff, including the parameters and operating characteristics of a research reactor that should be included in the TSs. Although NUREG-1537, issued in 1996, endorsed ANSI/ANS-15.1-1990, the sections of ANSI/ANS-15.1-2007 (R2013) involved in this review were not changed from ANSI/ANS 15.1-1990.

- ANSI/ANS-15.4-2016, “Selection and Training of Personnel for Research Reactors,” which provides guidance for training research reactor personnel.

- ANSI/ANS-15.11-2009, “Radiation Protection at Research Reactor Facilities,” which provides guidance on the responsibility, resources, and authority to implement the radiation protection program at a research reactor.

3.0 TECHNICAL EVALUATION

3.1 Background

The ARRR is a 250 kilowatt-thermal Training, Research, Isotope, General Atomics (TRIGA) research reactor that was used primarily to perform neutron radiography on various industrial components. The ARRR operated from 1965 until it was shut down on October 15, 2010, as documented in NRC Non-Routine Inspection Report No. 50-228/2010-203, dated December 6, 2010 (ADAMS Accession No. ML103340011). All fuel was removed from the reactor core in 2012, as documented in NRC Non-Routine Inspection Report No. 50-228/2012-204, dated August 14, 2012 (ADAMS Accession No. ML12213A001). However, Aerotest continues to own, possess, and store TRIGA fuel elements at the ARRR under Facility Operating License No. R-98.

In its letter dated June 28, 2019, Aerotest stated that the proposed changes to the facility operating license were consistent with a possession-only license amendment, including the elimination of the authority to operate the reactor, and declared the ARRR to be permanently shut down as of December 6, 2018. With Aerotest’s confirmation of the ARRR’s permanent cessation of operations, the NRC staff, by letter dated July 30, 2019 (ADAMS Accession No. ML19193A077), terminated its review of the separate ARRR license renewal application (LRA), dated February 28, 2005 (ADAMS Accession No. ML13120A434), as supplemented. In its July 30, 2019, letter, the NRC staff also noted that, pursuant to 10 CFR 50.51(b), “[e]ach license for a facility that has permanently ceased operations, continues in effect beyond the expiration date to authorize ownership and possession of the production or utilization facility, until the Commission notifies the licensee in writing that the license is terminated.” As such, although the LRA review was terminated prior to its completion, Facility Operating License No. R-98 for the ARRR remains in effect pursuant to 10 CFR 50.51(b).

The guidance in NUREG-1537, Part 1, Section 17.2.1, “An Application for a Possession-Only License Amendment,” states, in part, that “[t]he licensee should commit to a date to submit the applications for authorization to decommission and for license termination.” As also stated in the NRC staff’s letter dated July 30, 2019, Aerotest was required to submit an application for license termination, which must be accompanied or preceded by a proposed decommissioning plan (DP), with contents specified in 10 CFR 50.82, “Termination of license,” paragraph (b)(4), within 2 years following its permanent cessation of operations (i.e., before December 5, 2020). In its response to RAI 1 submitted in its letter dated March 26, 2020, Aerotest indicated that it would submit its proposed DP on or before December 4, 2020. However, by letter dated November 18, 2020 (ADAMS Accession No. ML20332A032), Aerotest stated that due to restrictions and limitations related to the Coronavirus Disease 2019 public health emergency, it would no longer be able to submit its DP prior to December 5, 2020. Aerotest stated that, based on decommissioning planning activities being able to return to normal in the spring of 2021, it would be able to submit its DP by July 31, 2021. By letter dated March 5, 2021 (ADAMS Accession No. ML21048A139), the NRC staff acknowledged Aerotest’s November 18, 2020, letter, and discussed the NRC staff’s exercise of enforcement discretion related to Aerotest’s delay in submitting its DP. Aerotest ultimately submitted its DP by letter dated July 20, 2021 (ADAMS Accession No. ML21230A304).

In its response to RAI 29.1 submitted by letter dated May 19, 2021, the licensee stated that it may conduct certain decommissioning-related activities, under a possession-only license, prior to the NRC approval of the proposed DP. The licensee stated that these activities could include, but would not necessarily be limited to: performing facility and environmental characterization activities; redesigning the facility’s fuel element storage configuration and repackaging fuel elements (see discussion below and in SE Section 3.4); developing relevant decommissioning and waste management procedures; and removing non-essential items and waste that are not directly related to reactor decommissioning. The NRC staff notes that, although certain facility characterization and other activities prior to NRC approval of a DP may be necessary and appropriate to support development of a comprehensive DP, an NRC-approved DP is required for a licensee to begin decommissioning of a facility. Pursuant to 10 CFR 50.82(b)(6), the NRC will only terminate the ARRR license if it determines that the decommissioning of the facility has been performed in accordance with the approved DP. In its response to RAI 29.2 submitted by letter dated May 19, 2021, the licensee stated that the Aerotest President and Reactor Administrator will be responsible for controlling activities prior to an NRC approval of the proposed DP to ensure that only appropriate activities occur. Although, in accordance with proposed ARRR TS 12.1, the President (Level 1) and Reactor Administrator (Level 2) are separate positions, both positions are currently held by one individual, Dr. David M. Slaughter, according to a letter from Aerotest dated January 10, 2018 (ADAMS Accession No. ML18017A231). The NRC staff expects that, if the President and Reactor Administrator positions were held by different individuals, the President would have the ultimate responsibility for ensuring that only appropriate activities occur prior to an NRC approval of the proposed DP, because the President is the individual with overall responsibility for complying with the ARRR license, in accordance with proposed TS 12.1.1.).

As discussed in the NRC staff’s SE for the 2017 indirect transfer of the ARRR license, dated February 28, 2017 (ADAMS Accession No. ML16333A449), Aerotest possesses 116 TRIGA fuel elements. Of these, 39 are stainless-steel clad and the remainder are aluminum clad. Of the 39 stainless-steel clad elements, 12 are new and unused (i.e., unirradiated).

In its response (and subsequent clarification of its response) to RAI 3 in its letters dated March 26 and June 8, 2020, and in its response to RAI 28.1 in its letter dated May 19, 2021, the licensee indicated that the irradiated fuel (104 of its 116 total elements) is stored at the bottom of the core tank, either in floor storage racks, or in a wall-mounted storage rack. The licensee stated

that it has one wall-mounted storage rack and five floor storage racks for TRIGA fuel elements. The five floor storage racks include two floor storage racks for TRIGA fuel elements in canisters. During fuel inspection efforts conducted through 2013, Aerotest identified a total of 24 aluminum-clad TRIGA fuel elements that were damaged, plus one element that was considered potentially damaged because bubbles were observed leaking from the cladding (see NRC Inspection Report Nos. 50-228/2012-204, 50-228/2012-206, and 50-228/2014-201, dated August 14, 2012, January 7, 2013, and December 19, 2014, respectively (ADAMS Accession Nos. ML12213A001, ML12361A147, and ML14351A262, respectively)). In its response to RAI 28.2.1 in its letter dated May 19, 2021, the licensee stated that its subsequent inspections in 2017 confirmed that the one potentially damaged element was in fact undamaged. The damage to the 24 elements involves cracks in the fuel cladding (in addition to the 24 elements with damaged cladding, Aerotest also has some aluminum-clad elements that are swollen and had previously been stuck in the core grid plate). The licensee decided to place 22 of these damaged TRIGA fuel elements in specially designed canisters for storage. The licensee procured the two pool floor canister storage racks specifically to hold the canisters containing damaged TRIGA fuel elements.

Although, as documented in NRC Inspection Report No. 50-228/2012-205, dated September 26, 2012 (ADAMS Accession No. ML12264A000), the licensee previously noted the possibility that two of the stainless-steel clad elements could also have cracks, subsequent NRC inspection reports did not note the licensee's confirmation of the existence of any cracked stainless-steel clad elements. In addition, in its response to RAI 28.2.2 in its letter dated May 19, 2021, the licensee confirmed that there are no damaged stainless-steel clad fuel elements at the ARRR, and that the damaged fuel is limited to aluminum-clad elements.

In Sections 4.3.1 and 4.3.2 of its updated safety analysis report (SAR), submitted by letter dated December 20, 2017 (ADAMS Accession Nos. ML17363A303 and ML18045A571), in support of its LRA (since withdrawn), the licensee stated that the reactor tank is an aluminum cylinder 10 feet in diameter and 23 feet deep that extends 22 feet below the floor level of the reactor building. The tank is open on the top with no openings below the water surface. The tank is set in concrete, which adds greatly to the mechanical integrity; the licensee states that rupture of the tank is very unlikely due to the use of reinforced concrete. The exterior of the tank is treated to minimize corrosion.

In its response (and subsequent clarification of its response) to RAI 3 in its letters dated March 26 and June 8, 2020, the licensee described dose rate and criticality analyses performed for both wet storage (i.e., core tank full of water) and dry storage (i.e., empty core tank) of the irradiated fuel in the core tank. However, the licensee cannot implement dry storage of irradiated fuel in the core tank because proposed TS 4.1 requires at least 16 feet of water depth above the core structure, and this water level is well above the storage racks in the tank.

In its response (and subsequent clarification of its response) to RAI 12 in its letters dated March 26 and June 8, 2020, the licensee stated that the 22 canisters with damaged fuel elements are currently filled with an inert gas (helium), such that each of the 22 elements is in a dry environment within its canister. The licensee stated that the canister design allows for the replacement of the inert gas with air or pool water, if desired. Additionally, in its letter dated May 19, 2021, the licensee stated that in the future, it plans to redesign the damaged element storage configuration and repackage the elements. However, the NRC staff did not review any proposed change in the current canister configuration (e.g., replacement of helium with water or another gas, or repackaging the elements), and the staff does not approve of any such change as part of its review of the LAR. Any future changes to the licensee's fuel storage configuration would be subject to the requirements in 10 CFR 50.59, "Changes, tests, and experiments," as applicable. The current

damaged fuel storage and canister configuration, and its suitability for long-term storage of the fuel, is discussed further and evaluated in Section 3.4 of this SE. The dose and criticality aspects of Aerotest's fuel storage configuration (for all irradiated fuel, including damaged and undamaged fuel) are separately discussed and evaluated in Sections 3.5 and 3.6 of this SE, respectively. The NRC staff reviewed the licensee's current fuel storage configuration, as discussed in Sections 3.4, 3.5, and 3.6 of this SE, as part of its review of the LAR because the LAR would allow the licensee to continue to possess the ARRR fuel after the authorization to operate the ARRR is removed, and because the fuel could, potentially, remain in storage at the ARRR for an extended period of time.

NRC Regulatory Audit

As part of its review of the LAR, on December 11, 2019, the NRC staff conducted an onsite regulatory audit at the ARRR. A regulatory audit report was provided to Aerotest by letter dated February 3, 2020 (ADAMS Accession No. ML20017A278).

Emergency Plan

In its response to RAI 4 in its letter dated March 26, 2020, the licensee stated that it had provided an updated Emergency Plan (EP), which included changes associated with the requested possession-only license, and which the licensee stated was revised in accordance with the requirements in 10 CFR 50.54(q)(3). By separate letter dated March 26, 2020 (ADAMS Accession Nos. ML20097D279 and ML20098D412), Aerotest provided its updated EP, dated March 23, 2020. Subsequently, by letter dated June 22, 2021 (ADAMS Accession No. ML21181A123), the licensee stated that it would be further revising its EP to appropriately reflect facility organization and emergency response responsibilities, and by letter dated July 1, 2021 (ADAMS Accession No. ML21193A089), it provided its new updated EP, also revised in accordance with 10 CFR 50.54(q)(3). Consistent with discussions during the December 11, 2019, audit, as documented in the NRC staff's audit report dated February 3, 2020, because the licensee determined that the changes to the EP did not reduce the effectiveness of the EP from the previous EP, and revised its EP pursuant to 10 CFR 50.54(q), the changes will be reviewed during a future NRC inspection, as appropriate.

Security Plan

In its response to RAI 4 in its letter dated March 26, 2020, the licensee stated that it had provided an updated physical security plan (PSP), which included changes associated with the requested possession-only license, and which the licensee stated was revised in accordance with the requirements in 10 CFR 50.54(p)(2). By separate letter dated March 26, 2020 (ADAMS Accession No. ML20134H946), Aerotest provided its updated PSP. The licensee had determined that the changes to the PSP did not reduce its safeguards effectiveness, and the licensee revised the PSP pursuant to 10 CFR 50.54(p). However, the NRC staff performed a review of the PSP as part of its review of the LAR to verify the adequacy of the PSP given the licensee's plans for continued possession and storage of fuel following the issuance of a possession-only license.

The NRC staff reviewed the PSP revision submitted to the NRC by letter dated March 26, 2020, revising the prior PSP revision that had been submitted to the NRC by letter dated February 22, 2018 (ADAMS Accession No. ML18057A019), and determined that additional information was needed to complete its review of the PSP. Therefore, by letter dated June 18, 2020 (ADAMS Accession No. ML20164A225), the NRC staff issued an RAI regarding the PSP. Aerotest responded to the NRC staff's RAI by letter dated July 28, 2020 (ADAMS Accession No. ML20220A422), and included a revised PSP in its response. The NRC staff reviewed this revised PSP and sent a clarification letter to Aerotest on September 17, 2020 (ADAMS Accession No. ML20234A631). Aerotest subsequently submitted a revised PSP by letter dated September 28, 2020 (ADAMS Accession No. ML20276A247).

The NRC staff completed its review of the Aerotest PSP, dated September 28, 2020, and concluded that it is in compliance with the applicable regulations contained in 10 CFR Part 73, "Physical Protection of Plants and Materials," and referenced in RG 5.59, Revision 1, and that it incorporates the site-specific compensatory security measures discussed in confirmatory action letter (CAL) No. NRR-04-003, dated February 17, 2004 (ADAMS Accession No. ML033510264), which were put in place after the terrorist attacks of September 11, 2001, to enhance security at research reactors. In a letter to Aerotest dated January 7, 2021 (ADAMS Accession No. ML21004A079), the NRC staff documented its approval of the PSP, and requested that Aerotest continue to implement its approved PSP. Furthermore, by letter dated January 28, 2021 (ADAMS Accession No. ML21012A201), the NRC staff closed CAL No. NRR-04-003. (The NRC staff's letters dated January 7 and 28, 2021, contained an incorrect date of October 1, 2020, for the NRC-approved PSP. Therefore, by letter dated July 19, 2021 (ADAMS Accession No. ML21147A373), the NRC staff corrected the date in its January 7 and 28, 2021, letters to the actual date of September 28, 2020.)

Summary of Technical Evaluation Sections of this Safety Evaluation

Sections 3.2 and 3.3 of this SE discuss the proposed changes to the LCs and TSs, respectively, as part of the LAR. As discussed above, Section 3.4 discusses considerations related to the continued storage of damaged fuel at the ARRR, and Sections 3.5 and 3.6 discuss dose and criticality aspects of fuel storage, respectively. Section 3.7 discusses Aerotest's proposed CFHTRP and the proposed replacement of NRC-licensed operators with CFHs.

3.2 Proposed Changes to Facility Operating License No. R-98 for the ARRR

In the LAR, the licensee proposed changes to the ARRR license to reflect the possession-only status of the facility. The NRC staff identified some additional changes to certain LCs and the addition of a new LC as potentially being necessary for the staff to find the amended license acceptable. The licensee incorporated into the LAR some of these additional changes and the addition of the new LC. The new LC relates to the licensee's proposed implementation of CFHs and a CFHTRP. The NRC staff subsequently made further changes to the proposed revised LCs and the proposed new LC that it determined were necessary for accuracy or clarity purposes for it to find the LCs acceptable. The current LCs and the final proposed LCs (including the NRC staff's further changes, which are underlined) are provided below along with the NRC staff's evaluation of the changes.

Current LC 2.B states:

> Subject to the conditions and requirements incorporated herein, the Commission hereby licenses Aerotest Operations, Inc.:
>
> (1) Pursuant to Section 104c of the Act and 10 CFR Part 50, "Licensing of Production and Utilization Facilities," to possess, use, and operate the reactor at the designated location in San Ramon, California, in accordance with the procedures and limitations set forth in this license;
>
> (2) Pursuant to the Act and 10 CFR Part 70, "Special Nuclear Material," to receive, possess, and use up to 5.0 kilograms of contained uranium 235 in connection with operation of the reactor; and
>
> (3) Pursuant to the Act and 10 CFR Part 30, "Licensing of Byproduct Material," (1) to receive, possess, and use a 2 curie americium-beryllium neutron startup source, and (2) to possess, but not to separate, such byproduct material as may be produced by operation of the reactor.

Proposed LC 2.B states:

> Subject to the conditions and requirements incorporated herein, the Commission hereby licenses Aerotest Operations, Inc.:
>
> (1) Pursuant to Section 104c of the Act and 10 CFR Part 50, "Licensing of Production and Utilization Facilities," to possess the reactor at the designated location in San Ramon, California, in accordance with the procedures and limitations set forth in this license;
>
> (2) Pursuant to the Act and 10 CFR Part 70, "Special Nuclear Material," to possess <u>(1)</u> up to 5.0 kilograms of contained uranium<u>-</u>235<u>, (2) such special nuclear material as may have been produced by previous operation of the reactor, and (3) such special nuclear material (in TRIGA fuel elements) produced by operation of other reactors as may have been previously transferred to Facility Operating License No. R-98 prior to December 6, 2018, provided a</u>ctions involving special nuclear material are limited to those related to fuel storage and decommissioning; <u>and</u>
>
> (3) Pursuant to the Act and 10 CFR Part 30, "Licensing of Byproduct Material," (1) to possess <u>a</u> 2 curie americium-beryllium neutron startup source, (2) to possess, but not separate, such byproduct material <u>as may have been produced by previous operation of the reactor, and (3) to possess, but not separate, such byproduct material (in TRIGA fuel elements) produced by operation of other reactors as may have been previously transferred to Facility Operating License No. R-98 prior to December 6, 2018, provided</u> actions involving byproduct material <u>are limited</u> to those related to fuel storage and decommissioning.

In its letter dated June 28, 2019, the licensee proposed removing "use" and "operate" from LC 2.B.(1) because the ARRR is permanently shutdown, and the change limits the LC to allowing possession of the facility only. The NRC staff reviewed this proposed change and finds that it is consistent with the possession-only status of the ARRR, and that it removes the authority to

operate the facility, consistent with the guidance for possession-only LCs in NUREG-1537, Part 1, Section 17.2.1.1. Therefore, the NRC staff concludes that proposed LC 2.B.(1) is acceptable.

In its letters dated June 28, 2019, and March 26, 2020, the licensee proposed to remove the allowances to “receive” and “use” contained uranium-235 (U-235) from LC 2.B.(2), and also proposed to delete the language “in connection with operation of the reactor” from the LC. The licensee stated that these changes prevent the further receipt or use of fuel and are appropriate because the reactor is permanently shutdown. In its letter dated June 22, 2021, the licensee also proposed to add the language “Actions involving special nuclear material are limited to those related to fuel storage and decommissioning” to the LC, to clarify that any Aerotest actions involving the special nuclear material (SNM) on the ARRR license must be limited to those necessary for fuel storage and decommissioning. The NRC staff reviewed these proposed changes and finds that they are consistent with the possession-only status of the ARRR and are appropriate for a facility that is no longer operating. The NRC staff finds that proposed LC 2.B.(2) would allow the licensee to continue to possess the SNM that it currently possesses associated with the ARRR, but would prohibit it from receiving any further SNM. The NRC staff also finds that, although not explicitly stated in proposed LC 2.B.(2), the licensee is prohibited from separating SNM consistent with the ARRR being licensed as a utilization facility but not a production facility under 10 CFR Part 50.

In addition to these changes, the NRC staff made additional changes that were necessary for accuracy (i.e., possession-only LCs must clearly authorize possession of all SNM that will continue to be possessed under the license during the possession-only license period) and clarity such that the staff could find the LC acceptable. Specifically, the NRC staff added language allowing the possession of SNM produced by past operation of the ARRR and SNM in irradiated TRIGA fuel elements transferred to the ARRR from other reactor facilities in the past (prior to December 6, 2018, the date of permanent cessation of ARRR operation) to help ensure the accuracy and comprehensiveness of the LC, since Aerotest currently possesses these materials (in its proposed ARRR restart plan previously submitted by letter dated April 3, 2018 (ADAMS Accession No. ML18096A689), the licensee stated that some of its aluminum-clad fuel elements were previously irradiated when received). In its letter dated June 22, 2021, the licensee stated that it did not believe that it was necessary to include SNM other than U-235 in LC 2.B.(2) because all other SNM at the ARRR, which the licensee states includes calibration and check sources and a plutonium-beryllium source, are possessed under a State of California materials license rather than the NRC Facility Operating License No. R-98. However, the NRC staff notes that the licensee’s description of SNM on the State of California license does not include SNM produced by previous reactor operation (e.g., plutonium in ARRR fuel produced by neutron capture). Furthermore, this type of SNM is typically included in NRC licenses for similar research reactors. Therefore, the NRC staff determined that these changes to LC 2.B.(2) were necessary for the NRC staff to find LC 2.B.(2) acceptable. The NRC staff also determined that other editorial changes to the LC were necessary for clarity purposes for the NRC staff to find LC 2.B.(2) acceptable. Based on the above, the NRC staff concludes that proposed LC 2.B.(2), including NRC staff changes, is acceptable.

In its letters dated June 28, 2019, and March 26, 2020, the licensee proposed to remove the allowances to “receive” and “use” a 2 curie americium-beryllium neutron startup source from LC 2.B.(3), because operation of the reactor would be prohibited and, therefore, it would no longer need to receive or use a startup source. In its letter dated April 28, 2021, the licensee also proposed to add the language “and limit actions involving byproduct material to those related to fuel storage and decommissioning” to the LC, to clarify that any Aerotest actions involving the byproduct material on the ARRR license must be limited to those necessary for fuel storage and

decommissioning. The NRC staff reviewed these proposed changes and finds that they are consistent with the possession-only status of the ARRR and are appropriate for a facility that is no longer operating. The NRC staff finds that proposed LC 2.B.(3) would allow the licensee to continue to possess byproduct material that it currently possesses associated with the ARRR, but would prohibit it from receiving any further byproduct material under NRC Facility Operating License No. R-98.

In addition to these changes, the NRC staff made additional changes that were necessary for accuracy (i.e., possession-only license conditions must clearly authorize possession of all byproduct material that will continue to be possessed under the license during the possession-only license period) and clarity such that the staff could find the LC acceptable. Specifically, the NRC staff added language clarifying that "such byproduct material" in item (2) of LC 2.B.(3) refers to byproduct material produced by past operation of the ARRR (e.g., fission products in fuel and activation products in reactor structural materials). The NRC staff notes that it is not clear what was meant by "such byproduct material" in the licensee's proposed LC 2.B.(3) language in its letter dated June 22, 2021, because the licensee had also proposed to delete the language "as may be produced by operation of the reactor" in addition to the licensee's proposed changes discussed above. Additionally, the NRC staff added language allowing the possession of byproduct material in irradiated TRIGA fuel elements transferred to the ARRR from other reactor facilities in the past (prior to December 6, 2018, the date of permanent cessation of ARRR operation) to help ensure the accuracy and comprehensiveness of the LC, since Aerotest currently possesses these materials (as discussed above, the licensee had stated that some of its aluminum-clad fuel elements were previously irradiated when received). In its letter dated June 22, 2021, the licensee stated that it did not believe that it was necessary to include byproduct material other than that in the americium-beryllium source and that included in "such byproduct material" (which term the NRC staff notes is ambiguous in the proposed LC 2.B.(3) language in the licensee's letter dated June 22, 2021). However, the NRC staff notes that byproduct material such as fission products in reactor fuel and activation products in reactor structural materials is typically included in NRC licenses for similar research reactors, and it is not clear that this material is possessed under any other license. Therefore, the NRC staff determined that these changes to LC 2.B.(3) to clearly include this byproduct material were necessary for the NRC staff to find LC 2.B.(3) acceptable. The NRC staff also determined that other editorial changes to LC 2.B.(3) were necessary for clarity purposes for the NRC staff to find LC 2.B.(3) acceptable. Based on the above, the NRC staff concludes that proposed LC 2.B.(3), including NRC staff changes, is acceptable.

Current LC 2.C.(1) states:

> (1) <u>Maximum Power Level</u>
>
> The licensee is authorized to operate the facility at steady state power levels not in excess of 250 kilowatts (thermal).

Proposed LC 2.C.(1) states:

> (1) <u>Maximum Power Level</u>
>
> The licensee is not authorized to operate the facility at any power.

In its letter dated June 28, 2019, the licensee proposed to revise LC 2.C.(1) to indicate that it is not allowed to operate the facility at any power. The licensee stated that facility operation is no longer allowed since the ARRR has permanently ceased operation. The NRC staff reviewed the

proposed change to LC 2.C.(1) and finds that it is consistent with the possession-only status of the ARRR and that it removes the authority to operate the facility, consistent with the guidance for possession-only LCs in NUREG-1537, Part 1, Section 17.2.1.1. Therefore, the NRC staff concludes that proposed LC 2.C.(1) is acceptable.

Current LC 2.C.(2) states:

> (2) Technical Specifications
>
> The Technical Specifications contained in Appendix A, as revised through Amendment No. 5, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

Proposed LC 2.C.(2) states:

> (2) Technical Specifications
>
> The Technical Specifications contained in Appendix A, as revised through Amendment No. 6, are hereby incorporated in the license. The licensee shall maintain the facility in accordance with the Technical Specifications.

In its letter dated June 28, 2019, the licensee proposed changing “Amendment No. 5” to “Amendment No. 6” and replacing the word “operate” with “maintain.” The licensee stated that the change to “maintain” is appropriate given that the reactor will no longer be operated. The NRC staff reviewed the proposed change to LC 2.C.(2) and finds that it is consistent with the possession-only status of the ARRR and that it removes the authority to operate the facility, consistent with the guidance for possession-only LCs in NUREG-1537, Part 1, Section 17.2.1.1. The NRC staff also finds that the Amendment No. change is appropriate because the LAR would revise the TSs. The NRC staff added a period to the end of the last sentence of proposed LC 2.C.(2), which was missing in Enclosure 3 of the licensee’s letter dated June 22, 2021; the NRC staff determined that this editorial change to the LC was necessary for clarity purposes for the staff to find LC 2.C.(2) acceptable. Based on the above, the NRC staff concludes that proposed LC 2.C.(2), including the NRC staff change, is acceptable.

Current LC 2.C.(3) states:

> (3) Physical Security Plan
>
> The licensee shall maintain in effect and fully implement all provisions of the NRC-approved physical security plan, including amendments and changes made pursuant to the authority of 10 CFR Section 50.54(p). The approved security plan consists of the document withheld from public disclosure pursuant to 10 CFR 2.790(d), entitled “Aerotest Operations, Inc. Security Plan” dated August 10, 1976, submitted by letter dated October 4, 1976, as revised January 16, 1979.

Proposed LC 2.C.(3) states:

(3) Physical Security Plan

The licensee shall maintain in effect and fully implement all provisions of the NRC-approved physical security plan, including amendments and changes made pursuant to the authority of 10 CFR Section 50.54(p). The approved security plan consists of the document withheld from public disclosure pursuant to 10 CFR 73.21, entitled "Security Plan for ARRR," dated September 28, 2020.

In its letter dated March 26, 2020, the licensee proposed removing the LC 2.C.(3) reference to "10 CFR 2.790(d)" because it is an outdated regulatory reference. The licensee also proposed to delete the date references in LC 2.C.(3) to avoid the need to request a license amendment each time it revises its PSP pursuant to 10 CFR 50.54(p). The NRC staff reviewed the proposed changes and finds that the 10 CFR 2.790(d) regulatory reference is incorrect and its removal is appropriate and that the removal of the old PSP date references is appropriate because the current NRC-approved ARRR PSP is dated September 28, 2020 (the NRC staff reviewed and approved the licensee's PSP dated September 28, 2020, in conjunction with the LAR, as discussed in Section 3.1 of this SE).

In addition to these changes, the NRC staff identified some additional changes to proposed LC 2.C.(3) as potentially being necessary for accuracy, clarity, and specificity. Specifically, the NRC staff identified the addition of a reference to 10 CFR 73.21, "Protection of Safeguards Information: Performance requirements," in place of the deleted reference to 10 CFR 2.790(d) because, as noted in the licensee's letter submitting the ARRR PSP, dated September 28, 2020, the PSP is withheld from disclosure as Safeguards Information-Modified Handling (SGI-M) (the licensee's letter dated March 26, 2020, had proposed replacing the deleted reference to 10 CFR 2.790(d) with a reference to 10 CFR 2.390, but the NRC staff notes that 10 CFR 73.21, not 10 CFR 2.390, is the regulation applicable to SGI-M). Additionally, although the old PSP dates are deleted in the proposed LC, the NRC staff identified the addition of a date reference to the LC to clearly indicate the date of the NRC-approved PSP (the NRC staff notes that the inclusion of this date would not prevent the licensee from revising its PSP pursuant to 10 CFR 50.54(p) without the need to submit a LAR to the NRC, because the proposed LC allows the licensee to implement a PSP that includes "amendments and changes made pursuant to the authority of 10 CFR Section 50.54(p)"). In its response to RAI 3 submitted on April 28, 2021, the licensee stated that the proposed LC 2.C.(3) with the additional changes identified by the NRC staff was acceptable, and proposed wording for proposed LC 2.C.(3) incorporating these changes. However, the wording proposed by the licensee referenced "Aerotest Operations, Inc. Security Plan," and "October 1, 2020." Therefore, the NRC staff made additional changes that were necessary for accuracy such that the staff could find the LC acceptable; specifically, the NRC staff corrected the proposed wording to reflect the actual title, "Security Plan for ARRR," and date, "September 28, 2020," of the approved PSP. The NRC staff also added a period to the end of the last sentence of proposed LC 2.C.(3), which was missing in Enclosure 3 of the licensee's letter dated June 22, 2021. Based on the above, the NRC staff concludes that proposed LC 2.C.(3), including NRC staff changes, is acceptable.

Proposed new LC 2.C.(4) states:

(4) Certified Fuel Handler Training and Requalification Program

Whenever the licensee possesses TRIGA fuel elements pursuant to License Condition 2.B.(2), the licensee shall maintain in effect and fully implement all provisions of the NRC-approved Certified Fuel Handler Training and Requalification Program, including changes made to the program without NRC approval as permitted by the program. The approved program consists of the document entitled "ARRR CFH Training/Requalification Program," dated March 30, 2021. Certified Fuel Handlers qualified in accordance with the program may approve licensee action permitted by 10 CFR 50.54(x).

In conjunction with its LAR, the licensee proposed to implement CFHs and a CFHTRP and to eliminate NRC-licensed operators and its Operator Requalification Program (ORP), following issuance of its possession-only license. As discussed in Section 3.7 of this SE, although 10 CFR Part 50 defines CFH for a nuclear power reactor facility as a non-licensed operator who has qualified in accordance with a fuel handler training program approved by the Commission, there are no regulatory requirements related to CFHs and CFHTRPs applicable to non-power reactors such as the ARRR. However, because the licensee's implementation of its proposed CFHTRP forms part of the NRC staff's basis for its approval of the licensee's proposed elimination of NRC-licensed operators and its ORP while fuel is still present at the facility, the NRC staff identified the addition of a new LC 2.C.(4), requiring the licensee to maintain in effect and fully implement its CFHTRP, as potentially being necessary. The NRC staff reviewed and approved the licensee's proposed CFHTRP dated March 30, 2021, submitted by letter dated March 31, 2021 (ADAMS Accession No. ML21098A157), in conjunction with its review of the LAR, as discussed in Section 3.7 of this SE. The proposed new LC allows the licensee to make changes to the NRC-approved CFHTRP as permitted by Section 1.2 of the CFHTRP dated March 30, 2021. Additionally, because the ARRR would no longer have NRC-licensed senior reactor operators (SROs) and because it is not a nuclear power reactor, the proposed new LC also allows ARRR CFHs to approve licensee action permitted by 10 CFR 50.54(x). In its response to RAI 4 submitted on April 28, 2021, the licensee stated that the proposed new LC 2.C.(4) identified by the NRC staff was acceptable and proposed wording for LC 2.C.(4) substantially equivalent to that suggested by the NRC staff. However, the wording proposed by the licensee in its RAI 4 response included minor typographical errors; therefore, the NRC staff made additional changes that were necessary for clarity such that the staff could find the LC acceptable. Based on the above, the NRC staff concludes that the addition of proposed new LC 2.C.(4), including NRC staff changes, is acceptable.

Current LC 2.F states:

This amended license is effective as of the date of issuance and shall expire at midnight April 16, 2005.

Proposed LC 2.F states:

This amended license is effective as of the date of issuance and until the Commission notifies the licensee in writing that the license is terminated.

In its letter dated June 22, 2021, the licensee proposed to revise current LC 2.F to remove the license expiration date and to replace it with a statement that the license shall follow requirements

in 10 CFR 50.51(b) and a summary of the relevant portion of 10 CFR 50.51(b). The regulation at 10 CFR 50.51(b) states, in relevant part, that "[e]ach license for a facility that has permanently ceased operations, continues in effect beyond the expiration date to authorize ownership and possession of the production or utilization facility, until the Commission notifies the licensee in writing that the license is terminated." The guidance in NUREG-1537, Part 1, Section 17.2.1.1, states that possession-only license amendments should not change the expiration date of the license. However, the NRC staff finds that, because Aerotest has permanently ceased ARRR operations as of December 6, 2018 (as confirmed in Aerotest's response to RAI 1 dated June 28, 2019), the date of license termination is subject to 10 CFR 50.51(b) regardless of any expiration date stated in the license and it is therefore no longer necessary for the license to contain a specific expiration date. The NRC staff reviewed the licensee's proposed changes discussed above and finds that they are consistent with the possession-only status of the facility. In addition to these changes, the NRC staff made additional changes to proposed LC 2.F that were necessary for clarity such that the staff could find the LC acceptable. These changes are also consistent with other possession-only 10 CFR Part 50 licenses in which the expiration date has been removed (for example, licenses for Indian Point Nuclear Generating Station, Unit No. 2 (ADAMS Accession No. ML20297A341) and Three Mile Island Nuclear Station, Unit No. 2 (ADAMS Accession No. ML20352A381)). The NRC staff finds that proposed LC 2.F indicates that the license will remain in effect until the Commission notifies Aerotest in writing that the license is terminated, consistent with 10 CFR 50.51(b). Based on the above, the NRC staff concludes that proposed LC 2.F, including NRC staff changes, is acceptable.

3.3 Proposed Changes to the Technical Specifications for the ARRR

The licensee proposed changes and additions to the current TSs for the ARRR in support of its possession-only licensing status by letters dated June 28 and August 14, 2019; March 26 and June 8, 2020; and April 28 and June 22, 2021.

For clarity, this SE provides the current TSs, as applicable, followed by the proposed TSs. In the proposed TSs, additions proposed by the licensee are in **BOLD**. For clarity, since many of the proposed changes involved deleted text, the NRC staff does not identify the text that the licensee proposed to delete, but rather describes these deletions in the staff's evaluation following the proposed TSs. Additionally, the NRC staff made some changes to the proposed TSs that were necessary for accuracy and clarity such that the staff could find the proposed TSs acceptable. Such additions made by the NRC staff are underlined and such deletions made by the NRC staff are in ~~strikethrough~~ and these changes are also discussed in the staff's evaluation following the proposed TSs.

3.3.1 TS 1.1 Permanent Shutdown

Current TS 1.1, "Shutdown," states:

> 1.1 Shutdown
>
> The reactor, with fixed experiments in place, shall be considered to be shut down (not in operation) whenever all of the following conditions have been met: (a) the console key is in the "off" position and the key is removed from the console and under the control of a licensed operator (or stored in a locked storage area); (b) sufficient control rods are inserted so as to assure the reactor is subcritical by a margin greater than 0.7% delta k/k cold, clean critical condition; (c) no work is in

progress involving refueling operations or maintenance of its control rod mechanisms.

Proposed TS 1.1, “Permanent Shutdown,” states:

1.1 **Permanent** Shutdown

The reactor is permanently shutdown when the reactor is maintained in permanent shut down configuration.

By letter dated June 28, 2019, the licensee declared the ARRR permanently shutdown and proposed TS 1.1, “Permanent Shutdown.” In its response to RAI 5 by letter dated April 28, 2021 (ADAMS Accession No. ML21126A150), the licensee proposed the wording suggested by the NRC staff in its RAI letter dated March 31, 2021 (ADAMS Accession No. ML21047A468). The NRC staff finds that proposed TS 1.1 is consistent with the status of the ARRR as permanently shutdown and, in conjunction with proposed TS 1.2, “Permanent Shutdown Configuration,” helps ensure that fuel remains safely stored at the facility. Based on the above, the NRC staff concludes that proposed TS 1.1 is acceptable.

3.3.2 TS 1.2 Permanent Shutdown Configuration

Current TS 1.2, “Reactor Operation,” states:

1.2 Reactor Operation

Reactor operation shall mean any condition wherein the reactor is not shut down.

Proposed TS 1.2, “Permanent Shutdown Configuration,” states:

1.2 **Permanent Shutdown Configuration**

Core lattice containing no fuel or reflector elements and control rods disabled fully inserted.

By letter dated June 28, 2019, the licensee declared the ARRR permanently shutdown and proposed TS 1.2, “Permanent Shutdown Configuration.” The licensee indicated that the fuel had been removed from the reactor and placed in storage racks. The licensee’s proposed TS 1.2 reflects the permanent shutdown condition of the reactor, prohibits the location of fuel or reflector elements in the core lattice, and requires that the control rods are disabled (unable to be withdrawn) and fully inserted. The NRC staff finds that proposed TS 1.2 effectively limits fuel and reflector elements to the storage racks in the reactor pool, which were designed to safely store TRIGA reactor fuel, as described in Sections 3.3 through 3.6 of this SE. The NRC staff finds that current TS 1.2 is no longer applicable because the ARRR will no longer be operated. Based on the above, the NRC staff concludes that proposed TS 1.2 is acceptable.

3.3.3 TS 1.8, Core Lattice, and TS 1.9, Core Structure

Proposed new TSs 1.8, “Core Lattice,” and 1.9, “Core Structure,” state:

1.8 Core Lattice

The array of machined positions for fuel or reflector elements in the grid plates.

1.9 Core Structure

The upper and lower grid plates connected by structural members.

By letter dated June 28, 2019, the licensee proposed two new TS definitions, TS 1.8, “Core Lattice,” and TS 1.9, “Core Structure,” in order to describe these two components independent of the presence of reactor fuel or reflectors, which have been permanently removed from the reactor core. The term “core lattice” is used in proposed TSs 1.2, 5.1, 5.2, 5.3, and 8.2 and the term “core structure” is used in proposed TSs 4.1 and 8.5.1. The NRC staff finds that the definitions are consistent with the guidance in NUREG-1537, Part 1, Chapter 14, “Technical Specifications,” Appendix 14.1, “Format and Content of Technical Specifications for Non-Power Reactors,” Section 1.3, “Definitions,” which states that “Facility-specific definitions may be added to clarify terms referred to in the technical specifications.” Specifically, the NRC staff finds that the proposed definitions are consistent with the facility and help ensure effective understanding of the proposed TSs for the possession-only license. Based on the above, the NRC staff concludes that proposed new TS 1.8 and TS 1.9 are acceptable.

3.3.4 TSs 2.2 and 2.3

Current TSs 2.2 and 2.3 state:

2.2 A steel, locked perimeter fence shall surround the ARRR facility, forming an exclusion area. The minimum distance from the center of the reactor pool to the boundary of the exclusion area fencing shall be 50 feet. The restricted area, as defined in 10 CFR 20, shall consist of the entire exclusion area.

2.3 The principal activities carried on within the exclusion area shall be those associated with the operation of the ARRR reactor and the use of a hot cell and chemistry laboratory.

Proposed TSs 2.2 and 2.3 state:

2.2 A steel, locked perimeter fence shall surround the ARRR facility, forming an exclusion area. The minimum distance from the center of the reactor pool to the boundary of the exclusion area fencing shall be 50 feet. The restricted area, as defined in 10 CFR 20, shall consist of the entire **~~part of the~~** exclusion area. **~~The exclusion area that is part of the non-restricted area is the prior machine shop, the prior electrical shop, the prior chemistry laboratory, the prior tagging room, the prior set-up room, the prior garage, the prior magazine vault, the prior office area, the prior control room and the prior break/meeting room.~~**

2.3 ~~**Within the restriction area activities are limited to fuel storage, fuel handling and decommissioning activities as approved in the decommissioning plan of the ARRR. The non-restricted area can be used for non NRC regulated activities.**~~

By letter dated June 28, 2019, the licensee stated that it had permanently shut down the ARRR and was planning for decommissioning. The licensee stated that it had also terminated the use of the hot cell. In its June 22, 2021 response to draft RAI 6 (ADAMS Accession No. ML21181A123), the licensee proposed the wording of TS 2.2 and TS 2.3 presented above. The licensee provided as justification for this wording that "[t]he non-restricted area of the exclusion area contains no radioactive contamination and the radiation level is at background levels. These areas of the building may be used for activities not regulated by the NRC. The site characterization study performed by Energy Solutions (conducted in 2011) is the basis for the establishment of the non-restricted areas."

The NRC staff reviewed the licensee's proposed changes to TS 2.2 and TS 2.3. The current TS 2.1, which the licensee has not proposed to change, states that "The reactor and associated equipment is located within an exclusion area." Current TS 2.2 defines the exclusion area as the area within the perimeter fence surrounding the ARRR facility (see Figure 2-1 of the licensee's updated SAR, submitted by letter dated December 20, 2017 (ADAMS Accession Nos. ML17363A303 and ML18045A571), in support of its LRA (since withdrawn)) and states that the restricted area, as defined in 10 CFR Part 20, consists of the entire exclusion area. The regulation at 10 CFR 20.1003, "Definitions," states, in part, "Restricted area means an area, access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials." Based on the above, the NRC staff notes that the licensee is required to maintain radiological controls in place in the entire area within the perimeter fence surrounding the ARRR facility, to protect individuals against undue risks from exposure to radiation and radioactive materials. Further, the NRC staff notes that the proposed TSs 2.2 and 2.3 would no longer require that the licensee maintain radiological controls in place to protect individuals against undue risks from exposure to radiation and radioactive materials in this entire area; instead, the licensee's proposed changes to TSs 2.2 and 2.3 would effectively allow portions of the area to be released for unrestricted use. Therefore, in order for the NRC staff to accept the proposed changes to TSs 2.2 and 2.3, it would need, among other things, to perform a detailed review of the radiological surveys and decontamination efforts completed by the licensee to ensure that the areas are free of any radiation or contamination. The NRC staff would also likely need to conduct an independent radiological survey to ensure that all radioactive materials have been removed from the areas.

Although not stated in the licensee's letter dated June 22, 2021, the NRC staff notes that the licensee appears to have proposed wording for TSs 2.2 and 2.3 such that it would be allowed to conduct non-NRC regulated activities within parts of its current restricted area. However, the NRC staff notes that NRC regulations do not generally prohibit the conduct of non-NRC regulated activities within a licensed area or restricted area, provided that applicable LCs and TSs are met.

Based on the above, the NRC staff finds that the level of review needed to support the proposed changes to TSs 2.2 and 2.3 is not consistent with that for a possession-only licensee amendment, nor are these proposed changes within the scope of a possession-only license amendment. The licensee has also not provided detailed information, such as site characterization studies, that would be needed to justify these proposed changes. Therefore, the NRC staff is denying the licensee's proposed changes to TSs 2.2 and 2.3. The NRC staff notes that the licensee could submit a separate LAR if it wanted to propose to release areas of the facility (i.e., the NRC staff's

denial of the proposed changes to TSs 2.2 and 2.3 is without prejudice). Consequently, current TS 2.2 is unchanged. As for current TS 2.3, the NRC staff finds that it is not applicable to, accurate, or necessary for a possession-only license because the reactor is no longer operated, the ARRR hot cell is no longer in use, and the licensee will no longer conduct experiments (see proposed changes to TS 9.0, which are discussed in Section 3.3.11 of this SE). Therefore, as a necessary conforming change associated with its denial of the licensee's proposed changes to TSs 2.2 and 2.3, and its approval of other licensee-proposed LC and TS changes, the NRC staff deleted current TS 2.3.

3.3.5 TS 3.1 and TS 3.2

In its proposed revised TSs submitted by letter dated August 14, 2019 (ADAMS Accession No. ML19231A127), the licensee provided re-typed TSs in which it changed TSs 3.1.1, 3.1.2, and 3.1.3 by capitalizing the first word of each TS. TS 3.1 is otherwise unchanged by the proposed amendment. Because the proposed changes to TSs 3.1.1, 3.1.2, and 3.1.3 are editorial in nature and do not change the substance of the TSs, the NRC staff finds that these changes are acceptable.

In its April 28, 2021, response to RAI 8 (ADAMS Accession No. ML21126A150), the licensee proposed to delete current TS 3.2 as suggested by the NRC staff in its RAI letter dated March 31, 2021 (ADAMS Accession No. ML21047A468). The NRC staff noted that this information was in another NRC-approved licensing document and did not need to be included in the possession-only TSs. Therefore, the NRC staff finds that the proposed deletion of TS 3.2 is acceptable.

3.3.6 TS 4.0 Reactor Pool (Primary System)

Current TS 4.1 states:

> 4.1 The minimum depth of water above the top of the active core shall be 16 ft. The maximum bulk water temperature shall be 130°F and the minimum 60°F.

Proposed TS 4.1 states:

> 4.1 The minimum depth of water above the top of the **core structure** shall be 16 ft. The maximum bulk water temperature shall be 130°F and the minimum **40**°F.

By letter dated June 28, 2019, the licensee proposed lowering the minimum bulk water temperature from 60 degrees Fahrenheit (F) to 40 degrees F based on the shutdown condition of the reactor and the fuel being in a storage condition. The licensee stated that the 60 degrees F limit was a benchmark temperature for estimating temperature coefficients of reactivity when the reactor was operating and is therefore not applicable for a permanently shutdown reactor. The licensee stated that the seasonal water temperature is approximately 50 degrees F. The licensee also stated that the proposed lower water temperature was desired to avoid having to heat the pool water to maintain the current TS limit of 60 degrees F. In its letter dated June 28, 2019, the licensee also proposed changing the wording "active core" to "core structure."

The NRC staff finds that the proposed change in minimum bulk water temperature relaxes a requirement that is applicable for an operating reactor, such that it is more appropriate for a permanently shutdown reactor (reactivity coefficients are used in safety analyses for operating reactors, but are not applicable for a permanently shutdown reactor with fuel removed from the

core). Further, NUREG-1537, Part 1, Section 17.2.1.2, provides guidance that TSs on the reactor coolant can typically be relaxed and the NRC staff finds that the proposed change is consistent with this guidance. The NRC staff also finds that the change from “active core” to “core structure” is appropriate because the core is no longer “active” (i.e., fuel has been removed) and that this is consistent with the licensee’s proposed new TS definition of “core structure.” Based on the above, the NRC staff concludes that proposed TS 4.1 is acceptable.

Current TS 4.2 states:

> 4.2 The pH and conductivity of the primary coolant shall be measured at least once each month. Corrective action shall be taken to avoid exceeding a pH of 7.5 or a conductivity of 5 umho/cm.

Proposed TS 4.2, states:

> 4.2 The conductivity of the primary coolant shall be measured at least once **quarterly**. Corrective action shall be taken to avoid exceeding a conductivity of 5 <u>µmho/cm</u> **~~?mho/cm~~**.

In its LAR, the licensee proposed revising TS 4.2 by changing the monthly primary coolant conductivity surveillance to be quarterly and by eliminating the surveillance and corrective action for pH. In its April 28, 2021, response to RAI 9 (ADAMS Accession No. ML21126A150), the licensee provided justification for changing the conductivity surveillance interval from monthly to quarterly. The licensee indicated that the reactor had not been operated for a long period of time and that the measured surveillance data for the last 10 years showed no significant variation.

By letter dated June 28, 2019, the licensee provided the basis for the proposed elimination of the TS requirement for pH, as described in NRC staff memorandum, “Research and Test Reactors Pool Water – Safety Evaluation on Electrolytic Conductivity,” dated May 11, 2015 (ADAMS Accession No. ML15114A433). The NRC staff memorandum states that for open (to the atmosphere) pool light water reactor coolant systems, the relationship between high purity water and conductivity at or below 5 micromhos per centimeter (µmho/cm) ensures that the pH values will remain within 5.6 to 5.8.

The NRC staff corrected a typographical error in proposed TS 4.2. Specifically, Enclosure 3 of the licensee’s letter dated June 22, 2021 used the symbol “?” instead of the symbol “µ” (as correctly provided in Enclosure 2 of the licensee’s letter dated June 22, 2021). Therefore, the NRC staff replaced the “?” with “µ”. The NRC staff determined that this editorial change to the TS was necessary for clarity purposes for the staff to find the TS acceptable.

The NRC staff reviewed the licensee’s proposed elimination of the current pH surveillance and finds that since TS 4.2 retains the requirement to implement corrective action to avoid exceeding a conductivity of 5 µmho/cm, the requirement to maintain pH is not necessary. The NRC staff also finds that the ARRR facility has an open reactor pool coolant system and, thus, that the guidance in the NRC staff memorandum is applicable to the ARRR. The NRC staff also reviewed the licensee’s proposal to increase the conductivity surveillance frequency to quarterly. Although the guidance in NUREG-1537, Part 1, Appendix 14.1, Section 4.3(6), states that conductivity measurements may be increased to monthly (versus weekly) if a reactor is not operated for long periods, the NRC staff finds that the possession-only status will limit activity in the reactor pool to fuel movement only and that the pool conductivity has shown no significant variation since the reactor was last operated approximately 10 years ago. Furthermore, activities such as

experiments are not authorized and, thus, the addition of materials into the pool that could affect the conductivity of the primary coolant is less likely. As such, the NRC staff finds that the licensee's proposal to extend the conductivity surveillance frequency from monthly to quarterly is consistent with the possession-only status of a permanently shutdown reactor (versus a reactor that is not operated for long periods, but is still operated). Based on the above, the NRC staff concludes that proposed TS 4.2, including NRC staff changes, is acceptable.

3.3.7 TS 5.0 Reactor Core

Current TS 5.0, "Reactor Core," states:

5.0 Reactor Core

5.1 Fuel Elements

5.1.1 The reactor shall contain no more than 90 TRIGA type fuel elements. The core shall be loaded with not more than 3.30 kg of U-235.

5.1.2 The maximum excess reactivity above cold, clean critical, with or without experiments in place, shall be 3 dollars.

5.1.3 The bath temperature coefficient and the prompt fuel temperature coefficient shall be negative at all operating temperatures and the minimum reactivity decrement at full power shall be 80 cents when measured with respect to source power level.

5.1.4 The coolant void coefficient shall be negative across the active core. Maximum in-core operating void shall be 10% of the coolant core volumes as defined by a cylinder bounded by the grid plates.

5.2 Reflector Elements

5.2.1 The overall reflector elements' dimensions shall be the same as the fuel elements.

5.3 Control Elements

5.3.1 The reactor shall be subcritical by a minimum margin of 0.50 dollar when the maximum worth rod is fully withdrawn from the core.

5.3.2 The maximum rate of reactivity addition for the control rods shall be 11 cents/second. There shall be a minimum of three operable control elements.

5.3.3 The total time for insertion of the control rods following receipt of a scram signal by the safety system shall be a maximum of 600 milliseconds.

Proposed TS 5.0 states:

5.1 Fuel Elements

No fuel elements shall be allowed in the core lattice.

5.2 Reflector Elements

No reflector elements shall be allowed in core lattice.

5.3 Control Elements

Control elements shall be disabled and fully inserted in core lattice.

By letter dated June 28, 2019, the licensee proposed changes to TS 5.0 to prohibit fuel and reflector elements in the core lattice and to require the control elements to be disabled and fully inserted into the core lattice.

The NRC staff finds that since the fuel and reflector elements have been removed from the reactor, the proposed changes to TS 5.0 help ensure that the fuel and reflector elements are not allowed in the core lattice and that the control elements are fully inserted into the core lattice and disabled. The NRC staff also finds that the requirements in current TS 5.0 are applicable to an operating reactor and are not necessary for a possession-only license. The NRC staff finds that removing the authorization for fuel and reflector elements to be allowed in the core lattice and requiring the control elements to be disabled and fully inserted into the core lattice is consistent with the guidance provided in NUREG-1537, Part 1, Section 17.2.1.2, which provides that the TSs should be based on conditions in the possession-only status. Specifically, the NRC staff finds that the proposed change is consistent with the possession-only status of the ARRR facility. Based on the above, the NRC staff concludes that proposed TS 5.0 is acceptable.

3.3.8 TS 6.0 Reactor Safety Systems

Current TS 6.0, “Reactor Safety Systems,” states:

6.0 Reactor Safety Systems

6.1 The reactor safety system shall include sensing devices and associated circuits which automatically actuate visual and audible alarms and, when certain pre-set limits are exceeded, scram the reactor. The systems shall be fail-safe (de-energizing shall cause a scram). Table 1 describes the minimum requirements of the safety system.

6.2 The nuclear, process and radiation monitoring instrumentation shall provide the functions and have the set point ranges and associated annunciations listed in Table 2 of these specifications.

6.3 The safety system shall be designed such that no single component failure or circuit fault shall simultaneously disable both the automatic and manual scram circuits.

6.4 Reactor sequences, interlocks and safety circuits shall remain operable while fuel is in the core except that one channel may be removed for maintenance purposes when the reactor is shut down.

6.5 Interlocks shall prevent safety rod withdrawal unless all of the following conditions exist:

6.5.1 The master switch is in the ON position;

6.5.2 The safety system has been reset;

6.5.3 All four nuclear instruments channels are in the OPERATE mode;

6.5.4 The startup channel count rate is greater than 2 cps.

It shall not be possible to withdraw more than the safety rod until it has reached the upper limit interlock, at which time either the shim or regulating rod may be moved, but only one at a time.

6.6 During a critical experiment, subcritical multiplication plots shall be obtained from at least three instrumentation channels. These channels may be used in addition to the normal operating instrumentation in Table 1.

6.7 Process instrumentation with readout in the control room shall be operating to permit continuous indication of pool water temperature and conductivity. Alarms shall be operable to indicate low water flow, low pool water and improper location of the crane bridge.

Proposed TS 6.0, "Storage Safety Systems," states:

6.0 **Storage** Safety Systems

Safety systems instruments that are related to the safe and secure storage of the irradiated fuel shall be operable when relevant if the irradiated fuel is present in the facility. Those safety system instruments are noted by an asterisk (*) in Table 1. A service period not to exceed thirty days shall be allowed to facilitate any required repairs, replacements, maintenance, and/or calibration to any of the instruments listed in Table 1.

In its June 22, 2021, response to draft RAI 10 (ADAMS Accession No. ML21181A123), the licensee proposed to revise TS 6.0. By letter dated June 28, 2019, the licensee indicated that current TS 6.0 would be replaced in its entirety by a proposed TS 6.0. The licensee deleted current TSs 6.1 through 6.6 because they involved instruments used to measure parameters associated with reactor operations, including sequences, interlocks, and safety systems, which are no longer needed since reactor operation would not be authorized by the possession-only license. Requirements of current TS 6.7 were moved to proposed TS 7.7 (see Section 3.3.9 of this SE).

In its June 22, 2021, response to draft RAI 10.5, the licensee proposed for TS 6.0 the wording "Safety systems instruments that are related to the safe and secure storage of the irradiated fuel shall be operable when relevant if the irradiated fuel is present in the facility. Those safety system instruments are noted by an asterisk (*) in Table 1." The safety system instruments with an

asterisk in proposed TS Table 1 are those related to pool water temperature, pool water conductivity, pool water level, bridge crane location, pool water radioactivity, pool water cleanup loop flow, and gas effluent monitoring. Proposed TS Table 1 is discussed and found acceptable later in Section 3.3 of this SE. The licensee indicated that once there is no fuel in the pool (storage racks) or ARRR core structure, the water in the pool is no longer needed as a shield to radiation exposure. The pool will be drained in compliance with the DP. Furthermore, once the radiation sources (fuel elements) are eliminated from the pool, there is no need to continue the use of certain safety systems.

In its June 22, 2021, response to draft RAI 10.6, the licensee stated that up to 30 days was a reasonable time frame to assess the mode of failure, order and install replacement parts, and calibrate any instrument after maintenance. The licensee also stated that under the circumstance of fuel storage, the systems monitored are extremely stable and have not shown dynamic changes and that, therefore, this merits a 30-day allowance for repair and calibration.

The NRC staff finds that since the fuel and reflector elements have been removed from the reactor, the TSs previously associated with TS 6.0 are no longer relevant. The NRC staff also finds that proposed TS 6.0 is appropriate for a possession-only license since the fuel and reflector elements are not allowed in the core lattice and, thus, there is no need for the current TS requirements to monitor core parameters associated with an operating reactor. The NRC staff finds that the equipment required by proposed TS 6.0 is appropriate because it includes equipment relevant to fuel storage in the pool, such as equipment for ensuring pool water quality. The NRC staff also finds that it is reasonable that proposed TS 6.0 does not require the licensee to continue to keep equipment relevant to fuel storage operable if irradiated fuel is no longer present in the facility. The NRC staff notes that it considers instruments related to safe and secure storage or irradiated fuel (i.e., instruments designated by an asterisk in proposed TS Table 1) to be relevant at any time when irradiated fuel is in the pool. The NRC staff notes that although the proposed ARRR TSs do not include specific surveillance requirement TSs for equipment required by proposed TS 6.0 (or TS 7.0), the licensee needs to test and or calibrate equipment as appropriate to ensure it is "operable" as required by proposed TS 6.0. The NRC staff finds that an out of service period of 30 days is reasonable given that the fuel will remain in storage during the possession-only period. The NRC staff finds that the out of service allowance would also be applicable to the equipment in proposed TS 7.0 that is required by both TS 6.0 and TS 7.0, unless otherwise stated. Further, NUREG-1537, Part 1, Section 17.2.1.2, provides guidance that TSs on the reactor core parameters can typically be relaxed and the NRC staff finds that the proposed change is consistent with this guidance. Based on the above, the NRC staff concludes that proposed TS 6.0 is acceptable.

3.3.9 TS 7.0 Radiation Monitoring

Current TS 7.0, "Radiation Monitoring," states:

7.0 Radiation Monitoring

"7.1 A fixed gamma monitor employing Geiger tube detectors shall be located on the wall connecting the control room and the reactor room. This monitor shall serve as both an area radiation monitor and a criticality alarm and will annunciate through an automatic monitoring system to the San Ramon, California, Fire Department and actuate a siren within the reactor building on high radiation level. The monitor shall have a minimum range of 0 to 20 mr/hr. The annunciation and the siren actuation shall be tested monthly."

7.2 During reactor operation, a gas sample shall be continuously withdrawn from the roof vent above the reactor, or from the vicinity of the reactor bridge and glory hole over the reactor core, and pumped through a radioactive gas detection chamber. The gas chamber shall be monitored by a beta-gamma detector which shall have a continuous readout in the control room. An annunciator shall indicate when the gas exceeds 2 mr/hr.

7.3 A fission product water monitor shall be attached to the process water cleanup system loop adjacent to the demineralizer and shall provide continuous indication in the control room. High radiation levels within the demineralizer or pool water shall annunciate an audible alarm on the reactor console. The range of the monitor shall be from 0.1 to 100 mr/hr.

7.4 Portable survey instruments for measuring beta-gamma dose rates in the range of 0.01 mr/hr to 50 r/hr shall be available at the facility.

7.5 Portable instruments for measuring fast and thermal neutron dose rates from 0.1 mrem/hr to 1.0 rem/hr shall be available at the facility.

7.6 Radiation detector packets containing a series of threshold detectors shall be placed at several locations within the reactor building for post-accident radiation analyses.

Proposed TS 7.0, “Radiation Monitoring,” states:

7.0 Radiation Monitoring

7.1 A fixed gamma monitor employing Geiger tube detectors shall be located on the wall connecting the control room and the reactor room. This monitor shall serve as an area radiation monitor and will annunciate through an automatic monitoring system to the San Ramon, California, Fire Department and actuate a siren within the reactor building on high radiation level. The monitor shall have a minimum range of 0 to 20 mr/hr. The annunciation and the siren actuation shall be tested monthly.

7.2 A gas sample shall be continuously withdrawn from above the **reactor and below the pool cover in the** vicinity of the reactor bridge. The **gas-effluent** shall be monitored by a beta-gamma detector which shall have a continuous readout in the control room. An annunciator shall indicate when the gas exceeds 2 mr/hr.**”**

7.3 A **water radioactivity** monitor shall be attached to the process water cleanup system loop adjacent to the demineralizer and shall provide continuous indication in the control room. High radiation levels within the demineralizer or pool water shall annunciate an audible alarm **in the control room**. The range of the monitor shall be from 0.1 to 100 mr/hr.

7.4 Portable survey instruments **(gamma, beta)** for measuring beta-gamma dose rates in the range of 0.01 mr/hr to 50 r/hr shall be available at the facility.

7.5 Portable **survey** instrument **(neutron)** for measuring fast and thermal neutron dose rates from 0.1 mrem/hr to 1.0 rem/hr shall be available at the facility.

7.6 Radiation **dosimeters (gamma, neutron)** shall be placed at several locations within the reactor building for **area** radiation analysis.

7.7 **Instrumentation** with readout in the control room shall be operating to permit continuous indication of pool water temperature and **pool water** conductivity**.** Alarms shall be operable to indicate low water flow, low pool water and bridge crane **location. Table 1 contains alarm setpoints for sensors**.

TS 7.1

In its June 22, 2021, response to draft RAI 10.4.1 and draft RAI 30, the licensee proposed to remove from current TS 7.1 the reference to the criticality alarm and the quotation marks. The licensee indicated that the criticality monitor shall serve as an "area radiation monitor" and is listed on Table 1 as "area radiation monitor." Further, the licensee indicated that the minimum TS-required range on the monitor is "0 to 20 mr/hr" and that the alarm set point on Table 1 is less than or equal to 10 millirem per hour (mrem/hr) which is within the TS monitor range.

The licensee further stated that the current use of the term "criticality alarm" suggests that the alarm associated with a criticality accident is different than the alarm for reaching a threshold radiation rate in the area. The licensee clarified, though, that the alarm is set off by reaching a measured threshold radiation rate; one possible cause for which may be from a criticality accident. The licensee stated that its proposed broader language would allow for the responder to consider more likely causes given the fuel storage restrictions and circumstances, but that the instrument and its function would remain the same.

The NRC staff reviewed the proposed changes to TS 7.1 to remove the reference to the criticality alarm and the quotation marks. The NRC staff finds that the fixed gamma monitor using Geiger tube detectors is acceptable to meet area radiation monitoring requirements of a possession-only licensed facility. The NRC staff finds that the use of a Geiger tube detector will sense and alarm due to the gamma radiation emitted from any source, including an inadvertent criticality accident. Further, the NRC staff finds that the gamma monitoring system includes a siren to alert any workers, it provides external notification to the San Ramon Fire Department to elicit offsite support, and it is tested monthly to help ensure that the system will function when needed. In addition, the NRC staff finds that the area radiation monitoring described in proposed TS 7.1 is consistent with the description provided in proposed TS Table 1, item TS # 7.1. The proposed change to delete the quotation marks is editorial in nature and does not change the substance of the TS. Based on the above, the NRC staff concludes that proposed TS 7.1 is acceptable.

TS 7.2

In its June 22, 2021, response to draft RAI 10.4.2 and draft RAI 31, the licensee proposed changes to TS 7.2 to reflect that fuel is no longer allowed in the reactor core and to clarify that the gas-effluent monitor is continuously monitoring the gas above the reactor. The licensee also stated that the "Gas Effluent Monitor" is identified in proposed Table 1 and is operational at all times.

The NRC staff corrected a typographical error in proposed TS 7.2. Specifically, the NRC staff removed a quotation mark from the end of the last sentence of the TS, as provided in Enclosure 3 of the licensee's letter dated June 22, 2021, and replaced it with a period. The NRC staff determined that this editorial change to TS 7.2 was necessary for clarity purposes for the staff to find TS 7.2 acceptable.

The NRC staff finds that the proposed changes are consistent with a reactor that has been permanently shutdown and defueled, but for which the fuel remains in the reactor pool. NUREG-1537, Part 1, Section 17.2.1.2, provides guidance that the licensee should consider the radiological condition of the facility and the protection of the health and safety of the public when modifying TSs for radiation monitoring and effluent releases. The NRC staff finds that the gas sample is continuously withdrawn from above the reactor but below the pool cover so that any gaseous radionuclides would be detected. The NRC staff finds that the beta-gamma monitor is sufficient for the radionuclides which could be released from the stored fuel elements in the pool (although such releases are highly unlikely, because most gaseous or volatile fission products have decayed away in the approximately 10 years since the reactor was last operated, and any other fission products in the fuel would likely be mostly scrubbed by the pool water if released). The NRC staff finds that the control room annunciator provides indication to the workers of any radioactive release. The NRC staff finds that the proposed TS helps ensure that radiation monitoring will be conducted during fuel movement in or immediately above the pool to detect any radiological releases and that workers and the public will be protected. In addition, the NRC staff finds that the gas effluent radiation monitoring described in proposed TS 7.2 is consistent with the description provided in proposed TS Table 1, item TS # 7.2. Based on the above, the NRC staff concludes that proposed TS 7.2, including NRC staff changes, is acceptable.

TS 7.3

By letter dated June 28, 2019, the licensee proposed to change current TS 7.3 by replacing “on the reactor console” with “in the control room.” The licensee stated that “As the prohibition of adding fuel to the core structure eliminates the need for reactor controls, this allows for alarms to be consolidated at a single alarm panel within the protected area of the control room.” Further, in its June 22, 2021, response to draft RAI 10.4.3, the licensee proposed to replace “fission product monitor” with “water radioactivity monitor” to better align with the possession-only status of the facility.

The NRC staff corrected a typographical error in proposed TS 7.3. Specifically, the NRC staff added a period at the end of the last sentence of the TS. The NRC staff determined that this editorial change to TS 7.3 was necessary for clarity purposes for the staff to find TS 7.3 acceptable.

The NRC staff finds that the proposed change to TS 7.3 to change the audible alarm location from the reactor console to the general control room area would allow the licensee the ability to consolidate the alarms to a single alarm panel. Further, the NRC staff finds that since the alarm is audible and since its location would remain within the control room, this change would not decrease the effectiveness of ARRR staff to notice and respond as required.

The NRC staff also finds that the proposed change from “fission product monitor” to “water radioactivity monitor” is consistent with the possession-only status of the facility, which permits only storing fuel elements in preparation for eventual shipment off-site and decommissioning. The NRC staff finds that the proposed TS 7.3 changes are consistent with the guidance in NUREG-1537, Part 1, Section 17.2.1.2, that states that the TSs should be based on conditions in the possession-only status. In addition, the NRC staff finds that the water radioactivity monitor described in proposed TS 7.3 is consistent with the description provided in proposed TS Table 1, item TS # 7.3. Based on the above, the NRC staff concludes that proposed TS 7.3, including NRC staff changes, is acceptable.

TS 7.4

In its June 22, 2021, response to draft RAI 10.4.4, the licensee proposed to change TS 7.4 by adding "(gamma, beta)" to the description of the portable survey instruments. The NRC staff finds that this change provides additional clarity to the portable survey instruments description and that it is consistent with the description provided in proposed TS Table 1, item TS # 7.4. Based on the above, the NRC staff concludes that proposed TS 7.4 is acceptable.

TS 7.5

In its June 22, 2021, response to draft RAI 10.4.4, the licensee proposed to change TS 7.5 by adding "(neutron)" to the description of the portable survey instrument and by changing the plural "portable instruments" to the singular "portable survey instrument." The licensee stated that the plural to singular change was appropriate because the licensee only has one instrument used for neutron measurement purposes. The NRC staff finds that these changes provide additional clarity to the portable survey instrument description and that they are consistent with the description provided in proposed TS Table 1, item TS #7.5. Based on the above, the NRC staff concludes that proposed TS 7.5 is acceptable.

TS 7.6

In its June 22, 2021, response to draft RAI 32, the licensee proposed to change current TS 7.6 by replacing "detector packets containing a series of threshold detectors" with "dosimeters (gamma, neutron)" and "post-accident" with "area." The licensee stated that the detector packets described in the current TS were designed for high neutron flux measurements and are not appropriate for an accurate radiation measurement for the reconstruction from a radiation accident involving fuel storage. The licensee indicated that the detector packets were replaced with "[l]uminous gamma and neutron monitors (dosimeters)," which the licensee stated have the appropriate sensitivity to measure incident radiation to assist in any reconstruction of radiation exposure involving fuel storage.

The NRC staff finds that these proposed changes clarify the types of radiation monitors used for area radiation analysis of the reactor building. Also, the NRC staff finds that such monitors provide an acceptable method for measuring area radiation and that their description in proposed TS 7.6 is consistent with the description provided in proposed TS Table 1, item TS # 7.6. Based on the above, the NRC staff concludes that proposed TS 7.6 is acceptable.

TS 7.7

By letter dated June 28, 2019, the licensee proposed to renumber and relocate current TS 6.7 to proposed TS 7.7 and to add to the end of it: "Table 1 contains alarm setpoints for sensors." In its June 22, 2021, response to draft RAI 10.4.4, the licensee further proposed to modify TS 7.7 by removing the first word "Process," by adding "pool water" before the conductivity parameter, and by changing "improper location of the crane bridge" to "bridge crane location." As discussed later in Section 3.3 of this SE, the licensee separately proposed to specify in proposed TS Table 1 (items labeled TS # 7.7) pool water temperature, pool water conductivity, low pool water, bridge crane location, and low water flow sensors, as described in proposed TS 7.7.

The NRC staff corrected a typographical error in proposed TS 7.7. Specifically, the NRC staff added a period at the end of the last sentence of the TS. The NRC staff determined that this

editorial change to TS 7.7 was necessary for clarity purposes for the staff to find TS 7.7 acceptable.

The NRC staff finds that the proposed changes to TS 7.7, including referencing TS 7.7 instrumentation in proposed TS Table 1, items TS # 7.7, clarify the required instrumentation for the possession-only status of the ARRR. The NRC staff finds that removing the word “process” is acceptable because the facility will no longer operate and the licensee will not need to monitor processes related to reactor operation, but only possess fuel elements for storage and decommissioning. Further, the NRC staff finds that adding “pool water” clarifies a monitored parameter and that the use of “bridge crane location” is effective to indicate monitoring the location of the bridge crane. The NRC staff also finds that the proposed changes are consistent with the guidance in NUREG-1537, Part 1, Section 17.2.1.2, that states that the TSs should be based on conditions in the possession-only status. Based on the above, the NRC staff concludes that proposed TS 7.7, including NRC staff changes, is acceptable.

3.3.10 TS 8.0 Experimental Facilities

Current TS 8.0, “Experimental Facilities,” states:

8.0 Experimental Facilities

8.1 Large-Component Irradiation Box

8.1.1 A large-component irradiation box shall have a maximum volume of 20 cu. feet. The box shall encompass not more than 120° arc of the core and shall be designed so that it can be placed no closer than 5 cm to the outer row of active fuel elements.

8.1.2 The platform shall be positioned remotely relative to the reactor core by a positive drive and shall be captive to the stand which is bolted to the floor of the tank. Positive mechanical stops shall prevent moving the experiment box into the active reactor core. CO_2 shall be used for purging and to maintain a slight positive pressure in the box relative to the pool water pressure.

8.1.3 To remove or install the experiment box, the platform shall be moved two or more feet away from the reactor core. The box shall then be lowered onto the platform and bolted in place with remote handling equipment. The voided box shall be purged of air prior to exposure to neutrons.

8.2 Pneumatic Transfer Facility

8.2.1 A pneumatic transfer facility may be located in any reactor core position. The facility shall be operated with dry CO_2 and exhausted through a filter ventilation system, which is monitored for radioactivity.

8.2.2 The in-core portion of the transfer facility shall have a maximum void volume of 34 cu. in. in the active fuel region. A manual control shall be provided which is capable of overriding the automatic timer control.

8.3 Glory Hole Facility

8.3.1 A dry glory hole facility may be located in any reactor core position. The glory hole shall accept capsules to a maximum of 1.35 in. in diameter.

8.3.2 The glory hole shall be purged with CO_2 to prevent formation of excessive amounts of argon-41. Gas samples shall be taken near the pool when the glory hole facility is operated without a shield plug to insure adequate monitoring of radioactive gases.

8.4 Neutron Radiography Facility

8.4.1 The beam tube shall consist of a two-section tapered tube having a rectangular cross section. The upper and lower sections of the tube shall be equipped with a fill and drain line.

8.4.2 All components contacting the pool water shall be fabricated from aluminum or stainless steel.

"8.4.3 The beam catcher shield shall consist of a movable radiation shield."

8.5 Thermal Column

8.5.1 The thermal column shall be positioned remotely on steel locating pins immediately adjacent to the reactor core.

8.5.2 The thermal column shall be composed of a three-foot cube of graphite encased in aluminum containing five rows of 1.5 in. diameter irradiation holes. The rows shall be placed 6 inches apart and contain seven holes per row. Slotted beams shall be provided to allow experiments to be attached directly to the thermal column.

8.6 Vertical Tube

8.6.1 Vertical irradiation tubes, having diameters up to 6 in., may be attached to the thermal column.

8.6.2 The vertical tube shall be purged with CO_2 to prevent the formation of excess amounts of argon-41.

8.7 Other Irradiation Facilities

8.7.1 The central 7 fuel elements of the reactor may be removed from the core and a central irradiation facility installed provided the cross-sectional area of the facility does not exceed 16 in^2.

8. 7.2 Two triangular exposure facilities are available which shall allow the insertion of circular experiments to a maximum of 2.35 in. diameter or triangular experiments to a maximum of 3.0 in. on a side.

8.7.3 Irradiation capsules in the shape of dummy fuel elements shall have a maximum inner void volume of 34 cu. in. in the active fuel region.

Proposed TS 8.0, “Experimental Facilities,” states:

8.0 Experimental Facilities

8.1 Large-Component Irradiation Box

Not in pool and shall not be authorized for use.

8.2 Pneumatic Transfer Facility

Not in core lattice and shall not be authorized for use.

8.3 Glory Hole Facility

Not in pool and shall not be authorized for use.

8.4 Neutron Radiography Facility

Shall not be authorized for use.

8.4.1 The beam tube shall consist of a two-section tapered tube having a rectangular cross-section. The upper and lower sections of the tube shall be equipped with a fill and drain line.

8.4.2 All components contacting the pool water shall be fabricated from aluminum or stainless steel.

8.4.3 The beam catcher shield shall consist of a movable radiation shield.

8.5 Thermal Column

Shall be authorized for reflector element storage only.

8.5.1 The thermal column shall be positioned remotely on steel locating pins immediately adjacent to the ~~**reactor**~~ core **structure**.

8.5.2 The thermal column shall be composed of a three-foot cube of graphite encased in aluminum containing five rows of 1.5 in. diameter irradiation holes. The rows shall be placed 6 inches apart and contain seven holes per row.

8.6 Vertical Tube

Shall not be authorized for use.

8.7 Other Irradiation Facilities

Shall not be authorized for use.

By letter dated June 28, 2019, the licensee proposed to eliminate the use of all experimental facilities, as described by current TSs 8.1 through 8.7, for experiments. The licensee stated that since there were no longer fuel or reflector elements in the reactor core lattice, experimental facilities could not be used. Further, the licensee proposed to modify TS 8.5, "Thermal Column," to allow only the storage of reflector elements in the thermal column. As stated in Section 4.2.2, "Fuel-Moderator Elements," of the licensee's updated SAR, submitted by letter dated December 20, 2017 (ADAMS Accession Nos. ML17363A303 and ML18045A571), in support of the ARRR LRA (since withdrawn): "The graphite reflector elements are clad in aluminum and have aluminum end fixtures and spacer blocks. These elements are of the same dimensions as the fuel elements, but are filled entirely with graphite."

The licensee also proposed to delete most descriptive information related to experimental facilities from TSs 8.1 through 8.7, with the exception of information in current TSs 8.4.1, 8.4.2, and 8.4.3 (although quotation marks were proposed to be deleted from TS 8.4.3) and some information in current TSs 8.5.1 and 8.5.2, as detailed below.

In its April 28, 2021, response to RAI 11 (ADAMS Accession No. ML21126A150), the licensee indicated that it planned to revise TS 8.5.1 to reflect the NRC-suggested corrections in the NRC staff's letter dated March 30, 2021 (ADAMS Accession No. ML21047A468). The NRC staff had suggested using the term "core structure" rather than the proposed term "reactor core" because "core structure" would be defined in proposed TS 1.9. However, the language provided in Enclosure 3 of the licensee's letter dated June 22, 2021, retained the term "reactor structure." Consistent with the licensee's previous response, the NRC staff replaced the term "reactor structure" with the term "core structure" in the proposed TS 8.5.1. The NRC staff determined that this change to the TS was necessary for consistency purposes for the staff to find the TS acceptable.

By letter dated June 28, 2019, the licensee proposed to delete the following sentence from current TS 8.5.2: "Slotted beams shall be provided to allow experiments to be attached directly to the thermal column." The other information in current TS 8.5.2 would remain in proposed TS 8.5.2. The licensee stated that "[w]ith no source of neutrons for experimentation, there is no longer a need to allow experiments to be attached to the thermal column." The NRC staff finds that the proposed deletion is acceptable for a possession-only license as the facility will not be authorized to operate or perform any experiments, thus, there is no need to attach experiments to the thermal column.

The NRC staff finds that the proposed changes to TSs 8.1 through 8.4 and TSs 8.6 and 8.7 remove the authorization for the use of those respective experimental facilities and that this is consistent with the guidance in NUREG-1537, Part 1, Section 17.2.1.2, that states that the TSs should be based on conditions in the possession-only status, and experiments will not be conducted during the ARRR possession-only status. The NRC staff also finds that the proposed change to TS 8.5 to remove the authorization for experimental use of the thermal column but to allow its use for storage of non-SNM bearing graphite reflector elements is similarly consistent with the guidance in NUREG-1537, Part 1, Section 17.2.1.2. The NRC staff finds that the licensee's proposed deletion of descriptive information in TSs 8.1 through 8.3 and 8.6 and 8.7 is appropriate because this information in no longer relevant for a facility that is permanently shutdown and in which experiments are no longer performed and that the licensee's proposed revisions to descriptive information in TSs 8.4 and 8.5 are also consistent with the facility status or are editorial in nature. Based on the above, the NRC staff concludes that proposed TS 8.0, including NRC staff changes, is acceptable.

3.3.11 TS 9.0 Experiment Limitations

Current TS 9.0, “Experiment Limitations,” states:

9.0 Experiment Limitations

9.1 Experiments shall be evaluated in the most reactive condition.

9.2 The documentation of experiments, which shall be reviewed and approved prior to insertion in the reactor, shall include at least:

9.2.1 The purpose of the experiment;

9.2.2 A description of the experiment; and

9.2.3 An analysis of the possible hazards associated with the performance of the experiment.

9.3 The value of the reactivity worth of any single independent experiment shall not exceed 2 dollars. If such experiments are connected or otherwise related so that their combined reactivity could be added to the core simultaneously, their combined reactivity shall not exceed 2 dollars.

9.4 The reactivity worth of any single independent experiment not rigidly fixed in place shall not exceed 1 dollar. If such experiments are connected or otherwise related so that their combined reactivity could be added to the core simultaneously, their combined reactivity worth shall not exceed 1 dollar.

9.5 No experiment shall be installed in the reactor in such a manner that it could shadow the nuclear instrumentation system monitors.

9.6 No experiment shall be installed in the reactor in such a manner that a failure could interfere with the insertion of a reactor control element.

9.7 No experiment shall be performed involving materials which could:

9.7.1 Contaminate the reactor pool causing corrosive action on the reactor components or experiments;

9.7.2 Cause excessive production of airborne radioactivity; or

9.7.3 Produce an uncontained violent chemical reaction.

9.8 Experiments shall not be performed involving equipment whose failure could result in fuel element damage.

9.9 The amount of special nuclear material contained in an experiment shall be limited to 5 grams in the form of solid samples or 3 grams in the form of liquid. Liquid special nuclear materials shall be doubly encapsulated.

9.10 Experiments having moving parts shall be designed to have reactivity insertion rates less than 10 cents/sec except that moving parts worth less than 5 cents may be oscillated or removed at higher frequencies.

"9.11 Solid explosive materials may be brought into the facility for the purpose of being radiographed in the neutron radiography facilities located above the pool, provided that the following conditions are met:

9.11.1 Individual explosive devices shall be limited to 1000 grains equivalent TNT encased in metallic sheathing.

9.11.2 The maximum quantity of explosive material that may be possessed at one time shall be limited to 50 pounds equivalent TNT.

9.11.3 Explosive material shall be stored in designated areas within the reactor facility.

9.11.3.1 Only the explosive devices to be radiographed within 4 hrs, not to exceed a maximum of ten pounds equivalent TNT, may be removed from the storage area at one time for radiographing, including preparation but excluding packaged shipments.

9.11.3.2 An accountability log shall be maintained to show the amount of explosive material in the reactor facility all times, and shall contain a description of the explosive, and the location within the facility (e.g., storage, radiographing facility, or shipping dock).

9.11.4 The maximum amount of explosive material contained in devices that may be placed in the radiography facilities at a time shall be limited to five pounds equivalent TNT.

9.11.4.1 Explosive material in the radiation field at one time shall be limited to 1 pound equivalent TNT.

9.11.4.2 Explosive material contained in long device(s) shall be limited to 0.5 pound equivalen[t] TNT per foot."

"9.12 Personnel handling the explosive devices shall be trained and familiar with the devices being radiographed.

9.12.1 Personnel handling the explosive devices shall use special equipment, such as nonsparking tools and shoes, protective clothing, safety shields and grounded benches as required for the explosives being handled.

9.12.2 Unshielded high frequency generating equipment shall not be operated within 50 feet of any explosive device.

9.12.3 The explosive devices shall be subjected to a total exposure not to exceed 3×10^{11} neutrons/cm^2 and 3×10^3 roentgens of gammas.

9.12.4 Explosive devices that, upon ignition, have or provide a thrust in a definite direction shall be positioned so as to be aimed away from the reactor and components."

Proposed TS 9.0, "Experiment Limitation," states:

9.0 Experiment Limitation

No experiments shall be authorized.

By letter dated June 28, 2019, the licensee stated that since there will be no fuel or reflector elements allowed in the reactor core lattice, experimental facilities cannot be used. Therefore, the licensee proposed changes to TS 9.0 to remove current limitations related to experiments and to eliminate the authorization to perform any experiments.

The NRC staff finds that removing the authorization for the use of experimental facilities is consistent with the guidance provided in NUREG-1537, Part 1, Section 17.2.1.2, that states that the TSs should be based on conditions in the possession-only status, and experiments will not be conducted during the possession-only status. Further, the NRC staff toured the ARRR facility on December 11, 2019, and observed that the fuel had been removed from the reactor core lattice, which rendered the facility unable to perform experiments. Based on the above, the NRC staff concludes that proposed TS 9.0 is acceptable.

3.3.12 TS 10.0 General Operating Limitations

Current TS 10.0, "General Operating Limitations," states:

10.0 General Operating Limitations

10.1 Reactor operation shall be permitted only when two or more personnel are in the reactor building, at least one of whom is a licensed Operator.

10.2 The reactor shall not be operated wherever there are significant defects in fuel elements, control rods or control circuitry.

10.3 Upon occurrence of abnormal operation of the reactor, including its controls, safety systems and auxiliary systems, action shall be taken immediately to secure the safety of the facility and determine the cause of the abnormal behavior.

Proposed TS 10.0, "General Operating Limitations," states:

10.0 General Operating Limitations

No reactor operation shall be authorized.

By letter dated June 28, 2019, the licensee proposed changes to TS 10.0 to remove the authorization to operate the reactor and to remove limitations on reactor operation that are no longer relevant when the reactor is not operated. The licensee stated that the reactor had been declared permanently shutdown on December 6, 2018 and that, therefore, no fuel elements or reflector elements were allowed in the reactor core lattice. The NRC staff finds that these

proposed changes to TS 10.0 removing authorization to operate the reactor are consistent with the guidance provided in NUREG-1537, Part 1, Section 17.2.1.2, that states that the TSs should be based on conditions in the possession-only status, and reactor operations will not be conducted during the possession-only status. Further, the NRC staff toured the ARRR facility on December 11, 2019, and observed that the fuel had been removed from the reactor core lattice, which rendered the reactor unable to operate. Based on the above, the NRC staff concludes that proposed TS 10.0 is acceptable.

3.3.13 TS 11.0 Fuel Storage and Transfer

Current TS 11.0, "Fuel Storage and Transfer," states:

11.0 Fuel Storage and Transfer

11.1 The fuel storage pits located in the floor of the reactor room shall accommodate a maximum of 19 fuel elements (700 gm U-235) in storage racks dry or flooded with water. The fuel storage pits shall be secured with a lock and chain except during fuel transfer operations.

11.2 Additional fuel storage racks may be located in the reactor tank. Each of these storage facilities shall be so designed that for all conditions of moderation k_{eff} shall not exceed a value of 0.8.

11.3 A fuel handling tool shall be used in transferring fuel elements of low radioactivity between the storage pits and the reactor; a shielded fuel transfer cask shall be used for the transfer of highly radioactive fuel elements. The fuel handling tool shall remain in a locked cabinet under the cognizance of the Reactor Supervisor when not authorized for use.

11.4 All fuel transfers in the reactor tank shall be conducted by a minimum staff of three men, and shall include a licensed Senior Operator and a licensed Operator. The staff members shall monitor the operation using appropriate radiation monitoring instrumentation. Fuel transfers outside the reactor tank but within the facility shall be supervised by a licensed Operator.

11.5 Not more than one fuel element shall be allowed in the facility which is not in storage or in the core lattice.

Proposed TS 11.0, "Fuel Transfer and Storage," states:

11.0 Fuel Transfer and Storage

11.1 The fuel storage pits located in the floor of the reactor room shall accommodate a maximum of 19 fuel elements (700 gm U-235) in storage racks dry or flooded with water. The fuel storage pits shall be secured with a lock and chain **when fuel is present** except during fuel transfer operations.

11.2 Additional fuel storage racks may be located in the reactor tank. Each of these storage facilities shall be so designed that for all conditions of moderation k_{eff} shall not exceed a value of 0.8.

11.3 A fuel handling tool shall be used in transferring fuel elements of low radioactivity between the storage pits and the reactor; a shielded transfer cask shall be used for the transfer of highly radioactive fuel elements. The fuel handling tool shall remain in a locked cabinet under the cognizance of the **Certified Fuel ~~Handling~~** Handler **Supervisor** when not authorized for use.

11.4 **The transfer of irradiated fuel in the reactor tank, storage pits and facility shall be conducted by a minimum staff of two; a Certified Fuel Handler (CFH) and an additional person trained in radiation safety. The staff shall monitor the operation using a hand held Gamma/Beta radiation monitoring instrument. The Radiation Safety Officer or designee shall be present for irradiated fuel transfers outside of the reactor tank.**

11.5 **No** more than one fuel element **that is not in storage** shall be allowed in the facility**. The only movement of the fuel elements shall be for fuel element inspections, canister surveillances, rearrangement of fuel elements in storage, or final placement in the transportation cask.**

11.6 **CFH or CFH Supervisor does not need to be at the facility on a daily basis. They are only required when there is a transfer/movement of fuel.**

TS 11.1

By letter dated June 28, 2019, the licensee proposed to change TS 11.1 by adding the words "when fuel is present," such that the TS would require the fuel storage pits to be locked only when fuel is present. The licensee stated that there is no need to keep the pits locked when they are not being used for fuel storage. The NRC staff finds this proposed change to TS 11.1 to not require the storage pits to be locked when no SNM-bearing fuel is present to be reasonable because the purpose of locking the fuel storage pits is to ensure that the fuel that the pits are meant to store is secure. In conjunction with its LAR review, the NRC staff completed a review of the licensee's PSP. The NRC staff acknowledged the PSP as being acceptable in a letter dated January 7, 2021 (ADAMS Accession No. ML21004A079). Based on the above, the NRC staff concludes that proposed TS 11.1 is acceptable.

TS 11.3

By letter dated June 28, 2019, the licensee proposed to change TS 11.3 by replacing "Reactor Supervisor" with "Fuel Handling Supervisor," and in its April 28, 2021, response to RAI 12, the licensee further proposed to add "Certified" to the "Fuel Handling Supervisor" title. The licensee indicated that reactor operation was no longer permitted, that fuel transfers would be restricted to a single movement consisting of one element at a time, and that storage would be in racks that maintain a criticality control k-effective (k_{eff}) of less than or equal to 0.8. Given that no manipulation of reactor controls, no reactivity changes, and no core alterations are permitted for the possession-only license, the licensee indicated its plans to eliminate the TS requirement for ROs and to instead implement CFHs. The licensee stated that the proposed changes to TS 11.3 are consistent with the licensee's proposed changes in organization and staff responsibilities.

The NRC staff corrected a typographical error in proposed TS 11.3. Specifically, the NRC staff changed “Certified Fuel Handling Supervisor” to “Certified Fuel Handler Supervisor” to be consistent with the usage in the CFHTRP and other instances in the proposed TSs (e.g., TS 12.1.3). The NRC staff determined that this change to the TS was necessary for consistency purposes for the staff to find the TS acceptable.

The NRC staff notes that the licensee’s proposed CFHTRP, described in Section 3.7 of this SE, was found to be acceptable. The NRC staff finds that proposed TS 11.3 is consistent with the licensee’s proposed implementation of CFHs and its proposed staffing for its possession-only facility as described in TS 12.0, including the removal of the requirement for a Reactor Supervisor as discussed in Section 3.3.14 of this SE. The NRC staff also finds that proposed TS 11.3 continues to appropriately limit access to the fuel handing tool consistent with the guidance in NUREG-1537, Part 2, Section 9.2, “Handling and Storage of Reactor Fuel,” which states, in part, that “[p]rovisions for controlling access to fuel handling tools give reasonable assurance that only authorized persons will insert or remove fuel from the core.” Based on the above, the NRC staff concludes that proposed TS 11.3, including NRC staff changes, is acceptable.

TS 11.4

By letter dated June 28, 2019, and in its April 28, 2021, response to RAI 13, the licensee proposed changes to TS 11.4. The licensee indicated that reactor operation was no longer permitted and that facility activities would be limited to fuel transfer and storage only. The licensee also stated that given that no manipulation of reactor controls, no reactivity changes, and no core alterations were permitted, it proposed to eliminate the requirement for NRC-licensed ROs and to instead implement CFHs. As such, the licensee proposed to remove the current TS 11.4 requirement for a minimum staff of three men, with one being a licensed SRO and one being a licensed RO, and replace it with a requirement for a minimum staff of two, a CFH and an additional person trained in radiation safety. The licensee also proposed to revise this staffing requirement to make it only applicable for irradiated fuel transfers and also to make it applicable for fuel transfers in the storage pits and facility (i.e., anywhere within the ARRR facility), instead of only fuel transfers in the reactor tank. The licensee also proposed to replace the requirement for a licensed operator to supervise all fuel transfers outside the reactor tank with a requirement that the Radiation Safety Officer (RSO) or designee be present for irradiated fuel transfers outside of the reactor tank (but within the facility). Additionally, the licensee proposed to replace the current TS 11.4 requirement for ARRR staff to monitor fuel transfers using “appropriate radiation monitoring instrumentation” with a more specific requirement to use a “hand held Gamma/Beta radiation monitoring instrument.”

The NRC staff notes that the licensee’s proposed CFHTRP, described in Section 3.7 of this SE, was found to be acceptable, including its provision for CFHs to be authorized to move fuel. The NRC staff finds that proposed TS 11.4 requires a staffing level to support fuel movement of (1) a CFH and (2) a person trained in radiation safety and that this helps ensure that appropriately trained individuals move fuel and that support is available if one of the workers becomes incapacitated. The NRC staff finds that the proposed change in the staffing requirement applicability from any fuel moved in the reactor tank to irradiated fuel moved anywhere in the facility is appropriate because it helps ensure that irradiated fuel, which poses the most significant radiological risk at the facility in its permanently shutdown condition, is handled by appropriate staff regardless of where it is located in the facility. The NRC staff finds that the requirement for an RSO or designee to be present if irradiated fuel is to be moved outside the reactor tank is consistent with the guidance NUREG-1537, Part 2, Section 9.2, which provides that methods for assessing irradiated fuel radioactivity and potential overexposure rates should be adequate to avoid overexposure of the staff. The NRC staff finds that the RSO or designee is an appropriate

individual to perform radiological assessments when fuel is being moved outside the reactor pool and there is a higher potential for elevated dose rates. Finally, the NRC staff finds that the proposed requirement for the use of a hand-held gamma/beta radiation monitoring instrument is appropriate given the possession-only status of the facility and that the fuel elements have been in radioactive decay for several years. As such, many of the volatile fission products (e.g., xenon and iodine isotopes) have decayed to extremely low levels, such that the risk of an airborne release is extremely low. Based on the above, the NRC staff concludes that proposed TS 11.4 is acceptable.

TS 11.5

By letter dated June 28, 2019, in its March 26, 2020, response to RAI 3.1, in its April 28, 2021, response to RAI 14, and in its June 22, 2021, response to draft RAI 14, the licensee proposed changes to TS 11.5. The licensee proposed to change the sentence “Not more than one fuel element shall be allowed in the facility which is not in storage or in the core lattice” to “No more than one fuel element that is not in storage shall be allowed in the facility” (removing the provision to allow fuel in the core lattice) and to add “The only movement of the fuel elements shall be for fuel element inspections, canister surveillances, rearrangement of fuel elements in storage, or final placement in the transportation cask.”

The NRC staff notes that NUREG-1537, Part 1, Section 17.2.1.2, provides that TSs should be based on conditions in the possession-only status. The NRC staff finds that the proposed change to TS 11.5 maintains the current TS 11.5 limit on the movement of irradiated fuel that is not in storage to only one fuel element and adds appropriate requirements to limit the fuel movements to fuel element inspections, canister surveillances, rearrangement of fuel elements in storage, or final placement in the transportation cask. The NRC staff also finds that the proposed elimination of the core lattice fuel location is consistent with the possession-only license and the prohibition on placing fuel in the lattice in proposed TS 5.1. Therefore, proposed TS 11.5 is consistent with the guidance in NUREG-1537, Part 1, Section 17.2.1.2. Based on the above, the NRC staff concludes that proposed TS 11.5 is acceptable.

TS 11.6

In its June 22, 2021, response to draft RAI 15.2, the licensee proposed to add TS 11.6 to clarify the staffing requirement for the CFHs and CFH Supervisor, specifically, to clarify that there are no requirements for CFHs or the CFH Supervisor to be present at the facility except as specifically required by other TSs related to fuel handling and storage (e.g., proposed TS 11.4).

The NRC staff finds that the responsibilities of the CFH and CFH Supervisor, as described in the CFHTRP (see Section 3.7 of this SE) and proposed TS 12.0 (see Section 3.3.14 of this SE) are limited to fuel movement activities. The NRC staff finds that proposed new TS 11.6 clarifies the staffing requirements of the ARRR facility during its possession-only status. Further, the NRC staff finds that proposed new TS 11.6 is consistent with the guidance in NUREG-1537, Part 1, Section 17.2.1.2, that states that the TSs should be based on conditions in the possession-only status. Based on the above, the NRC staff concludes that proposed new TS 11.6 is acceptable.

3.3.14 TS 12.0 “Administrative Requirements”

Current TS 12.1, “Organization,” states:

12.1 Organization

12.1.1 The Reactor Supervisor shall have responsibility of the reactor facility. In all matters pertaining to reactor operations and to these Technical Specifications, the Reactor Supervisor shall be responsible to the President, Aerotest Operations, Inc. The President, Aerotest Operations, Inc. shall report to the Board of Directors of Aerotest Operations, Inc.

12.1.2 The Radiological Safety Officer shall review and approve all procedures and experiments involving radiological safety. He shall enforce rules, regulations and procedures relating to radiological safety, conduct routine radiation surveys and is responsible to the Manager, Aerotest Operations.

12.1.3 The Reactor Safeguards Committee shall be composed of not less than five members, of whom no more than three are members of the operating organization. The committee shall meet on call of the chairman and they shall meet at least annually. The committee shall be responsible for, but not limited to the following:

12.1.3.1 Reviewing and approving nuclear safety standards associated with the use of the facility;

12.1.3.2 Reviewing and approving all proposed experiments and procedures and changes thereto, and modifications to the reactor and its associated components;

12.1.3.3 Determining whether proposed experiments, procedures or modifications involve unreviewed safety questions; as defined in 10 CFR 50, Part 50.59(c), and are in accordance with these Technical Specifications;

12.1.3.4 Conducting periodic audits of procedures, reactor operations and maintenance, equipment performance, and records;

12.1.3.5 Reviewing all reported abnormal occurrences arid violations of these Technical Specifications, evaluating the causes of such events and the corrective action taken and recommending measures to prevent reoccurrence and;

12.1.3.6 Reporting their findings and recommendations concerning the above to the Manager, Aerotest Operations.”

12.1.4 The Reactor Supervisor shall have a Bachelor's degree in Engineering or Physical Science and shall have a minimum of 4 years experience in the operation of a nuclear facility during which he shall have demonstrated competence in supervision and reactor operations. He shall hold a Senior Reactor Operator license for the facility.

12.1.5 The Radiological Safety Officer shall have a Bachelor's degree in Biological or Physical Science and shall have a minimum of 2 years experience in personnel and environmental radiation monitoring programs at a nuclear facility. Certification as a Health Physicist by the Health Physics Society is acceptable in lieu of the education and experience requirements given above.

Proposed TS 12.1, "Organization (Figure 1) showing reporting and communication lines," states:

12.1 Organization **(Figure 1) showing reporting and communication lines**

12.1.1 **Aerotest Operations President (Level 1) shall have the responsibilities for all activities associated with obligations and processes associated with operating Aerotest Operations which includes complying with license and Technical Specifications, facility physical security and safety programs. The President of Aerotest Operations, Inc.** shall report to the Board of Directors of Aerotest Operations, Inc.

12.1.2 **The Reactor Administrator (Level 2) shall have the responsibilities of ensuring security and safety of the Aerotest facility. He/she shall enforce, review and amend procedures associated with security and safety programs. The reactor administrator shall be responsible to the President, Aerotest Operations, Inc. The Reactor Administrator shall have a minimum of 5 years of experience in reactor operations, 2 years of experience with personnel and environmental/occupational radiation monitoring programs, and 2 years of experience with complying with government regulations. Successfully completed college-level work in the nuclear and radiation related fields of study may be considered in lieu of the experience requirement.**

12.1.3 **The Certified Fuel Handler Supervisor (Level 3) is a non-licensed operator who has qualified in accordance with the ARRR CFH Training/Requalification Program and shall have the responsibility of handling fuel and in all matters pertaining to fuel handling operations and to these Technical Specifications, the Certified Fuel Handler Supervisor shall be responsible to the Reactor Administrator, Aerotest Operations, Inc. The CFH Supervisor shall have at least 5 years of experience in irradiated fuel movements and demonstrated knowledge of the relevant NRC regulations and ALARA principles. Successfully completed college-level work in the nuclear and radiation related fields of study may be considered in lieu of the experience requirement. Maintain health/medical requirements required for the CFH job. The biennial CFH Health Questionnaire will be used to assess health/medical requirements.**

12.1.4 The **Radiation** Safety Officer **(Level 3)** shall review and approve all procedures involving radiological safety. He**/she** shall enforce rules, regulations and procedures relating to radiological safety, conduct routine radiation surveys and is responsible to the **President,** Aerotest Operations**, Inc**. **The Radiation Safety Officer shall have a minimum of 2 years of experience in personnel and environmental/occupational radiation**

monitoring programs. Successfully completed college-level work in the nuclear and radiation related fields of study may be considered In lieu of the experience requirement.

12.1.5 **The Certified Fuel Handler (~~level~~** Level **4) is a non-licensed operator who has qualified in accordance with ARRR CFH Training/Requalification Program. Fuel handling obligations include maintenance, periodic fuel inspections and/or putting the spent fuel in transportation casks for fuel shipment from facility. The CFH only handles fuel when ~~need~~** needed **and only handles 1 fuel element at a time. The CFH does not make decisions on fuel ~~handing~~** handling**, decommissioning or radiation; those are made by the Reactor Administrator or Radiation Safety Officer (RSO). The CFH shall have at least 2 years of experience in irradiated fuel movements and demonstrated knowledge of the relevant NRC regulations and ALARA principles. Successfully completed college-level work in the nuclear and radiation related fields of study may be considered in lieu of the experience requirement. Maintain health/medical requirements required for the CFH job. The biennial CFH Health Questionnaire will be used to assess health/medical requirements.**

12.1.6 The Reactor Safeguards Committee shall be composed of not less than five members, of whom no more than three are members of **Aerotest Operations, Inc**. The committee shall meet on call of the chairman and they shall meet at least annually. The committee shall be responsible for, but not limited to the following:

12.1.6.1 Reviewing and approving nuclear safety standards associated with the use of the facility;

12.1.6.2 Reviewing **ARRR facility's** procedures and modifications;

12.1.6.3 Determining whether **proposed changes to the facility or procedures are allowed without prior authorization by the NRC, as detailed in 10 CFR 50.59**;

12.1.6.4 Conducting periodic audits of procedures, maintenance, equipment performance, and records;

12.1.6.5 Reviewing all reported violations of these Technical Specifications, evaluating the causes of such events and the corrective action taken and recommending measures to prevent reoccurrence and;

12.1.6.6 Reporting their findings and recommendations concerning the above to the **President,** Aerotest Operations, **Inc.**

TS 12.1.1

In its April 28, 2021, response to RAI 15, and its June 22, 2021, response to draft RAI 35, the licensee proposed changes to TS 12.1.1, such that it would state the responsibilities of the Aerotest President (Level 1) position. These responsibilities would include the overall responsibility for complying with the ARRR license and TSs and overall responsibility for facility security and safety. The licensee proposed to delete previous requirements in TS 12.1.1, which stated that the Reactor Supervisor has the responsibility for the facility, but is also responsible to the Aerotest President. The President would continue to report to the Aerotest Board of Directors, although the licensee proposed an editorial change from "President, Aerotest Operations, Inc. shall report" to "The President of Aerotest Operations, Inc. shall report".

The NRC staff finds that the licensee's proposed deletion of the Reactor Supervisor from TS 12.1.1 is appropriate and consistent with the licensee's proposed organizational structure for the possession-only licensee since the licensee plans to implement CFHs and a CFHTRP, as is described in Section 3.7 of this SE, and the Reactor Supervisor position will be replaced by the CFH Supervisor position, as described in the discussion of proposed TS 12.1.3 below. The NRC staff finds that, with the deletion of the Reactor Supervisor position, proposed TS 12.1.1 clearly establishes the President (Level 1) as an appropriate individual with overall responsibility for the facility. The NRC staff finds that the change in the wording of the requirement for the President's reporting to the Aerotest Board of Directors is an editorial change that does not change the existing requirement.

The NRC staff also finds that proposed TS 12.1.1 is consistent with the guidance in NUREG-1537, Part 1, Appendix 14.1, "Format and Content of Technical Specifications," as well as ANSI/ANS-15.1-2007, "The Development of Technical Specifications for Research Reactors," Chapter 6, "Administrative Controls," Section 6.1, "Organization," which states that "Functions, assignments, responsibilities, and the associated training and requalification requirements, where applicable, shall be specified." Further, the NRC staff finds that proposed TS 12.1.1 is also consistent with the guidance in ANSI/ANS-15.1-2007, Section 6.1.1, "Structure," item (1), which states that "Level 1" is the individual responsible for the facility's license and is the unit or organizational head. Based on the above, the NRC staff concludes that proposed TS 12.1.1 is acceptable.

TS 12.1.2

In its April 28, 2021, response to RAI 15 and RAI 23.2, the licensee proposed to add new TS 12.1.2 to describe the functions, assignments, and responsibilities of the Reactor Administrator (Level 2) position. This position would have the responsibility to ensure the security and safety of the facility and to enforce, review, and amend procedures associated with the security and safety programs. The current TS 12.1.2 describes the responsibilities of the RSO; the licensee proposed to renumber current TS 12.1.2 to TS 12.1.4 (see discussion of proposed TS 12.1.4 below).

The NRC staff finds that proposed TS 12.1.2 clearly and appropriately defines the role of the Reactor Administrator position, which is referenced in other TSs (e.g., TSs 12.1.3, 12.1.5, and 12.2.2) and the CFHTRP. The NRC staff also finds that proposed TS 12.1.2 is consistent with the guidance in NUREG-1537, Part 1, Appendix 14.1, as well as ANSI/ANS-15.1-2007, Section 6.1, which states that "Functions, assignments, responsibilities, and the associated training and requalification requirements, where applicable, shall be specified." Further, the NRC staff finds that proposed TS 12.1.2 is also consistent with the guidance in ANSI/ANS-15.1-2007, Section 6.1.1, item (2) which states that "Level 2" is the individual responsible for the facility's

operation as the director or administrator. Based on the above, the NRC staff concludes that proposed new TS 12.1.2 is acceptable.

TS 12.1.3

By letters dated June 28 and August 14, 2019, and March 26 and June 8, 2020, and in its April 28, 2021, response to RAI 15 and RAI 20 and its June 22, 2021, response to draft RAI 15.1, the license proposed to add new TS 12.1.3 to describe the functions, assignments, and responsibilities of the CFH Supervisor (Level 3) position. The CFH Supervisor would have responsibility for matters pertaining to fuel handling operations and would report to the Reactor Administrator (Level 2). The licensee stated that the CFH Supervisor would replace the current Reactor Supervisor position, a result of the authority and technical capabilities of the position focusing on fuel handling instead of reactor operations with the possession-only status of the facility. The current TS 12.1.3 describes the responsibilities of the Reactor Safeguards Committee (RSC); the licensee proposed to renumber current TS 12.1.3 to TS 12.1.6 (see discussion of proposed TS 12.1.6 below). In addition, because the Reactor Supervisor position is proposed to be deleted from the TSs, current TS 12.1.4, which describes required qualifications for the Reactor Supervisor, would no longer be relevant and is also proposed to be deleted from the TSs; proposed TS 12.1.3 provides the required qualifications for the CFH Supervisor.

The NRC staff finds that proposed TS 12.1.3 clearly and appropriately defines the role, responsibilities, and required qualifications of the CFH Supervisor position. The NRC staff also finds that proposed TS 12.1.3 is consistent with the guidance in NUREG-1537, Part 1, Appendix 14.1, as well as ANSI/ANS-15.1-2007, Section 6.1, which states that “Functions, assignments, responsibilities, and the associated training and requalification requirements, where applicable, shall be specified.” Further, the NRC staff finds that proposed TS 12.1.3 is also consistent with the guidance in ANSI/ANS-15.1-2007, Section 6.1.1, item (3), which states that “Level 3” is the individual responsible for the day-to-day operation or shift of the facility. Specifically, the NRC staff finds that the responsibilities of the CFH Supervisor for fuel handling is consistent with the duties that would typically support operations of a possession-only facility that still has fuel present. The qualification requirements in proposed TS 12.1.3 were reviewed and discussed in Section 3.7 of this SE as part of the NRC staff review of the licensee’s CFHTRP. Further, as also stated in its review of proposed TS 12.1.1, described above, the NRC staff finds that removing the Reactor Supervisor position is acceptable based on the possession-only license status, which will remove any authorization to operate the reactor. The NRC staff also finds that current TS 12.1.4 is no longer applicable because the Reactor Supervisor position is proposed to be deleted and because proposed TS 12.1.3 describes the qualifications for the CFH Supervisor. Based on the above, the NRC staff concludes that proposed TS 12.1.3 and the deletion of current TS 12.1.4 are acceptable (however, the license proposed to renumber current TS 12.1.2 into a proposed TS 12.1.4 as discussed below).

TS 12.1.4

By letters dated June 28, 2019, and March 26, 2020, and in its April 28, 2021, response to RAI 15 and RAI 21 and in its June 22, 2021, response to draft RAI 36, the license proposed changes to TS 12.1.4 (renumbered from current TS 12.1.2, and also incorporating requirements from current TS 12.1.5, which the licensee proposed to delete; the licensee separately proposed to delete the current TS numbered 12.1.4, as discussed above under the discussion of proposed TS 12.1.3). Proposed TS 12.1.4 describes the functions, assignments, and responsibilities of the Radiation Safety Officer (RSO) (Level 3), which would include having the responsibility to review and approve all procedures involving radiological safety, enforcing rules, regulations, and procedures relating to

radiological safety, and conducting routine radiation surveys. The RSO would be responsible to the Aerotest President. Proposed TS 12.1.4 would also include minimum qualifications for the RSO.

Proposed TS 12.1.4 incorporates some requirements described in current TSs 12.1.2 and 12.1.5. With respect to current TS 12.1.2, the licensee proposed to change the RSO name from "Radiological Safety Officer" to "Radiation Safety Officer," added a "Level 3" designation to the RSO, deleted the requirement that the RSO review and approve experiments, added "/she" to "he," changed "Manager" to "President," and added "Inc." With respect to requirements in current TS 12.1.5, the licensee proposed to remove the requirement for the RSO to have a Bachelor's degree in Biological or Physical Science, to remove the requirement that the 2 years of experience in personnel and environmental radiation monitoring programs be "at a nuclear facility," and to add "/occupational" after "environmental" in the description of the required experience. Additionally, the licensee proposed to replace the current TS 12.1.5 allowance for a Certified Health Physicist certification to be used in place of the other RSO qualification requirements (education and experience) with an allowance that successfully completed college-level work in the nuclear and radiation related fields of study may be considered in lieu of the experience requirement. By letter dated June 28, 2019, and in its April 28, 2021, response to RAI 21, the licensee stated that it was proposing to modify the TS requirements for RSO qualification to be more reasonable for a possession-only license and indicated that the proposed changes in required experience and education (versus those in current TS 12.1.5) were to focus on the broader skill sets and experience in occupational and environmental radiation monitoring programs more applicable to a possession-only license.

In its June 22, 2021, response to draft RAI 36, the licensee indicated that all occurrences of "college level" were replaced with "college-level." However, the NRC staff noted that the hyphen was missing in the instance of this term in TS 12.1.4. Therefore, the NRC staff added the hyphen. The NRC staff determined that this change to the TS was necessary for consistency purposes for the staff to find the TS acceptable.

The NRC staff finds that the changes in proposed TS 12.1.4, with respect to requirements in current TS 12.1.2, are editorial in nature and clarify the TS, make the TS consistent with the licensee's revised organizational structure, or delete a requirement (for the RSO to review experiments) that is no longer applicable for the possession-only license. The NRC staff also finds that the changes in proposed TS 12.1.4, with respect to requirements in current TS 12.1.5, are reasonable for a possession-only license, given the role of the RSO at a permanently-shutdown facility and the reduced radiological hazard. The NRC staff also finds that proposed TS 12.1.4 is consistent with the guidance in NUREG-1537, Part 1, Appendix 14.1, as well as ANSI/ANS-15.1-2007, Section 6.1, which states that "Functions, assignments, responsibilities, and the associated training and requalification requirements, where applicable, shall be specified." Further, the NRC staff finds that proposed TS 12.1.4 is consistent with ANSI/ANS-15.11-2009, "Radiation Protection at Research Reactor Facilities," which states, in part, that "[a] specific, qualified individual shall be given explicit responsibility, resources, and authority to implement the radiation protection program…. The qualification and training of this individual shall be commensurate with the radiation protection considerations of the facility as established by management. Management shall specify minimum requirements of education, training, and experience." Based on the above, the NRC staff concludes that proposed TS 12.1.4, including NRC staff changes, and the deletion of current TS 12.1.5 are acceptable (however, the licensee proposed to add a new TS 12.1.5 as discussed below).

TS 12.1.5

In its April 28, 2021, response to RAI 15 and in its June 22, 2021, response to draft RAI 15.8, the license proposed to add a new TS 12.1.5 to describe the functions, assignments, and responsibilities of the CFH (Level 4), which include being certified in accordance with the CFHTRP and having the responsibility for fuel handling operations. (The licensee separately proposed to delete current TS 12.1.5, as discussed above under the discussion of proposed TS 12.1.4.)

The NRC staff identified three typographical errors in proposed TS 12.1.5, as provided in Enclosure 3 of the licensee's letter dated June 22, 2021. The NRC staff corrected the wording as follows: "level" was capitalized to "Level" consistent with proposed TSs 12.1.1, 12.1.2, 12.1.3, and 12.1.4; "need" was changed to "needed"; and "handing" was changed to "handling." The NRC staff determined that these changes to the TS were necessary for consistency and clarity purposes for the staff to find the TS acceptable.

The NRC staff finds that proposed TS 12.1.5 clearly and appropriately defines the role, responsibilities, and required qualifications of the CFH position. The NRC staff also finds that proposed TS 12.1.5 is consistent with the guidance in NUREG-1537, Part 1, Appendix 14.1, as well as ANSI/ANS-15.1-2007, Section 6.1, which states that "Functions, assignments, responsibilities, and the associated training and requalification requirements, where applicable, shall be specified." Further, the NRC staff finds that proposed TS 12.1.5 is also consistent with the guidance in ANSI/ANS-15.1-2007, Section 6.1.1, item (4), which states that "Level 4" is operating staff. Specifically, the NRC staff finds that the responsibility of the CFHs for fuel movement is consistent with the duties of operating staff at the permanently shutdown ARRR facility. The qualification requirements in proposed TS 12.1.5 were reviewed and discussed in Section 3.7 of this SE as part of the NRC staff review of the ARRR CFHTRP and found to be acceptable. Based on the above, the NRC staff concludes that proposed TS 12.1.5, including NRC staff changes, is acceptable.

TS 12.1.6

By letter dated June 28, 2019, in its April 28, 2021, response to RAIs 15 through 19, and in its June 22, 2021, response to draft RAIs 16, 18, and 33, the licensee proposed changes to TS 12.1.6 (renumbered from current TS 12.1.3), which describes the functions, assignments, and responsibilities of the RSC. The licensee stated that the proposed changes would reflect the restructuring of the RSC to meet the needs of a permanently shutdown and decommissioning facility. The licensee's proposed changes would:

- revise "the operating organization" to "Aerotest Operations, Inc." to add specificity in proposed TS 12.1.6 (renumbered from current TS 12.1.3);
- revise proposed TS 12.1.6.2 (renumbered from current TS 12.1.3.2) by removing the requirement for RSC approvals, removing reference to experiments, removing "and changes thereto," removing "to the reactor and its associated components" to make "modifications" more general, and adding "ARRR facility's" to add specificity;
- revise proposed TS 12.1.6.3 (renumbered from TS 12.1.3.3) by updating the TS wording to reflect the current regulations at 10 CFR 50.59;
- revise proposed TS 12.1.6.4 (renumbered from TS 12.1.3.4) by deleting the reference to "reactor operations";
- revise proposed TS 12.1.6.5 (renumbered from TS 12.1.3.5) by deleting "abnormal occurrences and"; and

- revise proposed TS 12.1.6.6 (renumbered from TS 12.1.3.6) by updating “Manager” to “President,” adding “Inc.,” and deleting an extraneous quotation mark.

In its June 22, 2021, response to draft RAI 18, the licensee stated that the requirement for the RSC review of “abnormal occurrences” (in current TS 12.1.3.5) is no longer necessary at the permanently shutdown ARRR facility, given that the complex dynamics of an operating reactor are no longer present and given the simple fuel storage circumstances. The licensee noted that ANSI/ANS-15.1-2007, Section 6.2.3, specifies that TSs should require safety committee reviews of “operating abnormalities having safety significance,” but stated that such “operating abnormalities” are no longer relevant for the permanently shutdown ARRR facility.

The NRC staff notes that proposed TS 12.1.6.2 (renumbered from current TS 12.1.3.2) would continue to require RSC review of facility procedures and facility modifications, but that the licensee proposed to remove from TS 12.1.6.2 the current requirement for RSC approval of procedures and the language “and changes thereto” that explicitly included changes to procedures as subject to RSC review. In accordance with the guidance in ANSI/ANS-15.1-2007, TSs should require that procedures and substantive changes to procedures generally be approved by the Level 2 and reviewed by the safety committee. Regarding the removal of the requirement for RSC approval of procedures, the NRC staff notes that having the RSC review, but not approve, procedures is consistent with the guidance in ANSI/ANS-15.1-2007. Neither the current nor the proposed ARRR TSs explicitly state that Level 2 approval is needed for all procedures. However, proposed TS 12.1.2 would require the Reactor Administrator (Level 2) to be responsible to “enforce, review, and amend” ARRR safety and security procedures. Proposed TS 12.2.2 also states that the Reactor Administrator must approve temporary procedures. The NRC staff therefore understands the proposed TSs to indicate that the Reactor Administrator is the primary approval authority for procedures and substantive changes to procedures. (Proposed TS 12.1.4 would additionally explicitly require the RSO to approve all procedures involving radiological safety.) Regarding the removal of “and changes thereto,” the NRC staff notes that the licensee did not appear to provide a specific explanation for this change in the LAR. Furthermore, proposed TS 12.2.2 requires that temporary procedures must be subsequently reviewed by the RSC. Therefore, the NRC staff understands the proposed TS 12.1.6.2 requirement for review of procedures as continuing to require RSC review of substantive changes to procedures, as well as new procedures, consistent with the guidance in ANSI/ANS-15.1-2007. (Proposed TS 12.1.6.3 would separately require RSC review of procedure changes to determine whether they may be made under 10 CFR 50.59, and proposed TS 12.1.6.4 would separately require periodic RSC audits of procedures; the NRC staff notes that these TSs would also help ensure the appropriate review of procedure changes.)

Based on the above, the NRC staff finds that the deletion of “abnormal occurrences and” from TS 12.1.6.5 (renumbered from current TS 12.1.3.5) reflects the permanently shutdown status of the ARRR facility and is, therefore, appropriate. Additionally, based on the above, the NRC staff finds that the removal of the requirement for RSC approval of procedures and the language “and changes thereto” from TS 12.1.6.2 (renumbered from current TS 12.1.3.2) is reasonable because procedure approval is typically the responsibility of the Level 2, and because proposed TS 12.1.6 continues to require RSC review of changes to procedures, as appropriate. The NRC staff finds that other proposed changes to TS 12.1.6, summarized above, are editorial and clarify the TSs, appropriately update a regulatory reference, are updates to reflect the licensee’s revised organizational structure, or remove references to reactor operation or experiments that are no longer applicable. The NRC staff also finds that proposed TS 12.1.6 is generally consistent with the guidance provided in NUREG-1537, Part 1, Appendix 14.1, as well as ANSI/ANS-15.1-2007, Section 6.2.3, “Review Function,” which provides guidance for safety committee reviews, including

the review of the facility's procedures, TS violations, changes implemented in accordance with the requirements of 10 CFR 50.59, and reporting the review results to the Level 1. Based on the above, the NRC staff concludes that proposed TS 12.1.6 is acceptable.

The NRC staff notes that, although the guidance in Section 17.2.1.5 of NUREG-1537, Parts 1 and 2, states that 10 CFR 50.59 applies only to changes under a license authorizing operation, 10 CFR 50.59 continues to apply for Aerotest, pursuant to 10 CFR 50.59(b), because Aerotest will continue to be authorized to possess fuel at the ARRR.

TS 12.2

Current TS 12.2, "Procedures," states:

12.2 Procedures

12.2.1 Detailed written procedures shall be provided and followed for the following reactor operations:

12.2.1.1 Normal startup, operation and shutdown of the complete facility and of all systems and components involving nuclear safety of the facility.

12.2.1.2 Refueling operations.

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

12.2.1.5 Preventive or corrective maintenance operations which could have an effect on the safety of the reactor.

12.2.2 Temporary procedures which do not change the intent of previously approved procedures may be utilized on approval by a licensed Senior Reactor Operator and one other qualified individual. Such procedures shall be subsequently reviewed by the Reactor Safeguards Committee.

Proposed TS 12.2, "Procedures," states:

12.2 Procedures

12.2.1 Detailed written procedures shall be provided and followed for the following operations:

12.2.1.1 **Fuel Handling operations;**

12.2.1.2. **Normal operating of all systems and components involving nuclear safety of the ARRR facility;**

12.2.1.3 Actions to be taken to correct specific and foreseen potential malfunctions of systems or components, including responses to alarms **and** suspected primary system leaks;

12.2.1.4 Preventative or corrective maintenance operations which could have an effect on the safety of the **facility**.

12.2.2 Temporary procedures which do not change the intent of previously approved procedures may be utilized on approval by **the Reactor Administrator.** Such procedures shall be subsequently reviewed by the Reactor Safeguards Committee.

By letter dated June 28, 2019, in its March 26, 2020, response to RAI 10, in its April 28, 2021, response to RAIs 22 and 23, and in its June 22, 2021, response to draft RAI 22, the license proposed changes to TS 12.2. The licensee stated that the changes reflect the permanent shutdown and possession-only status of the ARRR facility, as well as the elimination of NRC-licensed ROs. The proposed changes would:

- delete “reactor” from current TS 12.2.1;
- renumber current TS 12.2.1.2 to TS 12.2.1.1 and revise “Refueling operations” to “Fuel Handling operations”;
- renumber current TS 12.2.1.1 to TS 12.2.1.2 and revise “startup, operation and shutdown of the complete facility and” to “operating”;
- delete “and abnormal reactivity changes” and replace the second comma with an “and” in current TS 12.2.1.3;
- renumber current TS 12.2.1.5 to TS 12.2.1.4 (the current TSs skip from TS 12.2.1.3 to TS 12.2.1.5 and there is no current TS 12.2.1.4);
- revise “reactor” to “facility” in TS 12.2.1.4 (renumbered from current TS 12.2.1.5); and
- revise “a licensed Senior Reactor Operator and one other qualified individual” to “the Reactor Administrator” in current TS 12.2.2.

The NRC staff reviewed the proposed changes to TS 12.2. The NRC staff finds that the change to TS 12.2.1 to delete “reactor” is appropriate because “reactor operations” will no longer be conducted. The NRC staff finds that the TS 12.2.1.1 (renumbered from TS 12.2.1.2) change to “Fuel Handling operations” is appropriate because the reactor will no longer be operated and refueling will no longer occur. The NRC staff finds that the revision to TS 12.2.1.2 (renumbered from TS 12.2.1.1) to remove requirements for procedures for startup, operation, and shutdown of the complete facility, and to replace them with requirements for procedures for operating any other systems or components that could still affect nuclear safety, is appropriate for a possession-only license since operation of the reactor is no longer authorized. The NRC staff finds that deletion of “and abnormal reactivity changes” from TS 12.2.1.3 is appropriate because core reactivity changes will not occur in a permanently shutdown and defueled reactor. The NRC staff finds that the change from “reactor” to “facility” in TS 12.2.1.4 (renumbered from TS 12.2.1.5) is appropriate because it broadens the scope of the TS to help ensure the safety of the entire facility. The NRC staff finds that the TS 12.2.2 change to make the Reactor Administrator responsible for approving temporary procedures is appropriate because it is consistent with the ANSI/ANS-15.1-2007 guidance that minor modifications to the original procedures that do not change their original intent may be made by Level 3 or higher, but the modifications must be approved by Level 2 or designated alternate. The NRC staff finds that other changes to TS 12.2 are editorial and help

clarify the TSs and, therefore, these changes are also appropriate. Based on the above, the NRC staff concludes that proposed TS 12.2 is acceptable.

TS 12.3

Current TS 12.3, “Records,” states:

> 12.3 Records
>
> In addition to those records required under the facility license and applicable regulations, the following records shall be kept when explosive materials are to be irradiated or radiographed:
>
> 12.3.1 The type and quantity of material irradiated.
>
> 12.3.2 Date, time of day, and length of exposure.
>
> 12.3.3 Total neutron and gamma exposure level.

Proposed TS 12.3, “Records,” states:

> 12.3 Records
>
> **Records shall be maintained as required by the facility license and applicable regulations.**

By letter dated June 28, 2019, and in its April 28, 2021, response to RAI 24, the licensee proposed changes to TS 12.3 to eliminate the requirement to maintain records for the irradiation or radiography of explosive materials. The licensee stated that irradiation and radiography of explosive materials would no longer be allowed by its possession-only licensee (given its proposed changes to TS 9.0).

The NRC staff notes that the guidance in NUREG-1537, Part 1, Section 17.2.1.2, provides that TSs should be based on conditions in the possession-only status. Additionally, the guidance in ANSI/ANS-15.1-2007, Section 6.8.1, states that TSs should require that records of reactor experiments be retained for 5 years. The NRC staff notes, however, that the ARRR has been shut down for over 5 years and that no experiments have been performed. The NRC staff finds that the proposed changes to TS 12.3 to delete requirements for records of explosive materials irradiation and radiography experiments are consistent with a possession-only license and the guidance in NUREG-1537 and ANSI/ANS-15.1-2007. The NRC staff notes that records required by NRC regulations include, for example, decommissioning records (see 10 CFR 50.75, “Reporting and recordkeeping for decommissioning planning,” paragraph (g)) and records related to limiting condition for operation (LCO) TS violations (see 10 CFR 50.36(c)(2), which also requires reporting of LCO TS violations). The NRC staff notes that records required by the facility license are listed in LC E., which the licensee has not proposed to change. Based on the above, the NRC staff concludes that proposed TS 12.3 is acceptable.

TS Table 1

Current TS Table 1, “Nuclear Instrumentation,” states:

TABLE 1

NUCLEAR INSTRUMENTATION

Channel (No.)	Detector	Minimum Sensitivity	Information	Minimum Range	Information to Logic Element (Scram)
Startup (1)	BF_3 Proportional Counter	4.5 counts/sec per n/cm^2 - sec	Neutron flux, period	source level to 1 watt	Period scram;[(a)] low count rate scram
Log N (2)	Compensated ion chamber	4 x 10^{-14} amp/n/cm^2 - sec	Power level, period	10^{-2} watts to 120% full power	Period scram
Linear Level Safety (3)	Uncompensated ion chamber	4.4 x 10^{-14} amp/n/cm^2 - sec	Power level	30 watts to 120% full power	High and low level[(b)] scrams
Linear Level Safety (4)	Compensated ion chamber	4.4 x 10^{-14} amp/n/cm^2 - sec	Power level	10^{-1} watts to 120% full power	High and low level scram

(a) Scrams on Channel 1 are by-passed when signal on Channel 2 exceeds a fixed setting similarly the high voltage is removed from the detector and the detector is shorted.

(b) Low level scram is bypassed on Channel 3 and 4 when Channel 2 is below a fixed setting.

Current TS Table 2, “Safety System Functions,” states:

TABLE 2

SAFETY SYSTEM FUNCTIONS

Sensor or Trip Device	No. of Switches or Sensors	Annunciator and Scram Set Point	Annunciator and Alarm Set Point
Short Period; Chs. 1, 2	2	≥ 3 sec.	
High Neutron Flux Level; Chs. 3, 4	2	≤ 98% of full scale and not greater than 120% full power	
High Temperature of Coolant Water	1	≤ 130°F	
Low Pool Water Level	1		≤ 1 ft max decrease
Seismic Disturbance	1	IV on modified Mercalli Scale max.	
Bridge Crane Location	1		When located off storage position
Low Neutron Detector Voltage; Chs. 2, 3, 4	3	≥ 500 volts	
Low Source Level; Ch. 1	1	≥ 2 cps	
Loss of Instrument Power; Ch. 2,	1	x	
Low Neutron Flux; Ch. 3 & 4	2	≥ 5% of full scale	
Area Radiation Monitor	1		≤ 10 mr/hr
Water Radioactivity	1		≤ 20 mr/hr
Demineralizer Water Flow	1		≥ 4 gpm
Building Gas Effluent Monitor	1		≤ 2 mr/hr
Master Key Switch	1	Not on “ON” position	
Manual Scram Button	1	Button Depressed	

Proposed TS Table 1, “Safety System Functions,” states:

TABLE 1

SAFETY SYSTEM FUNCTIONS

TECH SPEC #	SENSOR OR TRIP DEVICE	NO. OF SWITCHES OR SENSORS	ANNUNCIATOR AND ALARM SET POINT
7.7	Pool Water Temperature*	1	≤ 130° F
7.7	Pool Water Conductivity*	1	≤ 5 µmho/cm
7.7	Low Pool Water*	1	≤ 1 ft max decrease
7.7	Bridge Crane Location*	1	When located off storage position
7.1	Area Radiation Monitor	1	≤ 10 mr/hr
7.3	Water Radioactivity*	1	≤ 20 mr/hr
7.7	Low Water Flow*	1	≥ 4 gpm
7.2	Gas Effluent Monitor*	1	≤ 2 mr/hr
7.4	Portable Survey Instruments (Gamma, Beta)	1	Between .01 mrem/hr and 50 rem/hr
7.5	Portable Survey Instrument (Neutron)	1	Between .01 mrem/hr and 1.0 rem/hr
7.6	Radiation Dosimeters (Gamma, Neutron)	As needed	N/A

*** Safety system instruments that are related to the safe and secure storage of the irradiated fuel shall be operable when relevant if the irradiated fuel is present in the facility.**

By letter dated June 28, 2019, the licensee stated that reactor operation would not be allowed with its possession-only license and that fuel would be in storage. No storage of fuel or reflector elements would be allowed in the core lattice. As such, the licensee proposed to delete TS Table 1, "Nuclear Instrumentation," renumber TS Table 2, "Safety System Functions," to TS Table 1, and delete the following safety system functions from TS Table 2: Short Period, High Neutron Flux, Low Neutron Detector Voltage, Low Source Level, Loss of Instrument Power, Low Neutron Flux, Master Key Switch, and Manual Scram Button. By letter dated June 22, 2021, the licensee additionally proposed to delete the Seismic Disturbance sensor, which provided a scram function to ensure a reactor shutdown as soon as a seismic event was detected (see Section 7.2.6, "Seismic Disturbance," of the updated SAR, submitted by letter dated December 20, 2017 (ADAMS Accession Nos. ML17363A303 and ML18045A571), in support of the ARRR LRA (since withdrawn)). In its June 22, 2021, response to draft RAIs 10.4.1 through 10.4.4, the license proposed other changes to TS Table 1 (renumbered from TS Table 2) to ensure that the nomenclature agreed with the instruments listed in proposed TS 7.0, including adding a reference column to the specific portion of TS 7.0 relevant to each item in proposed TS Table 1. The licensee also proposed to add Pool Water Conductivity, Portable Survey Instruments (Gamma, Beta), Portable Survey Instrument (Neutron), and Radiation Dosimeters (Gamma, Neutron), to proposed TS Table 1 for completeness and consistency with proposed TS 7.0.

The NRC staff reviewed the proposed deletion of current TS Table 1 in its entirety and the proposed changes to TS Table 1 (renumbered from TS Table 2) and finds that the deleted sensors are associated with reactor operation and, therefore, would have no purpose for a permanently shutdown reactor. NUREG-1537, Part 1, Section 17.2.1.2, provides guidance that the TSs should be based on conditions in the possession-only status. The NRC staff finds the proposed deletion of current TS Table 1 and the elimination of proposed TS Table 1 (renumbered from TS Table 2) sensors are consistent with a possession-only license and the guidance in NUREG-1537 to modify the TSs accordingly.

Additionally, the NRC staff finds that proposed TS Table 1 helps ensure that the remaining safety system functions provided in TS Table 1 remain available to help ensure that the reactor fuel remains safely stored (the NRC staff notes that all equipment in proposed TS Table 1 is required per the TS 6.0 reference to TS Table 1 and/or TS 7.0). The Pool Water Temperature monitor would help ensure notification of any unusual deviations in pool water temperature. The NRC staff notes that the fuel has not been used (irradiated) since 2012 and, thus, decay heat from fission products has been significantly reduced. The Pool Water Conductivity sensor helps ensure that the pool water chemistry is maintained to reduce the effect of corrosion on the various materials stored under the pool water. The Low Pool Water Level helps ensure that water covers the stored fuel to provide both cooling and shielding from direct radiation doses. The Bridge Crane is normally kept in its storage location to help ensure that it is protected from falling into the reactor pool as a result of an earthquake. The Bridge Crane Location monitor alarms when the crane is moved from its storage location and helps ensure that the operator is aware of the location of the crane (see Section 7.3.1, "Bridge Crane Location," of the updated SAR, submitted by letter dated December 20, 2017 (ADAMS Accession Nos. ML17363A303 and ML18045A571), in support of the ARRR LRA (since withdrawn)). The Area Radiation Monitor helps ensure that any radioactive release is noticed and that corrective actions are implemented. The Water Radioactivity sensor helps ensure that any increase in radioactivity in the primary coolant is observed. The Low Water Flow sensor helps ensure that the primary coolant demineralizer remains effective to maintain the primary coolant water chemistry to protect the fuel cladding from corrosion. The Gas Effluent Monitor helps ensure that any radioactive release from the pool is noticed. Portable Survey Instruments (Gamma, Beta, Neutron) and Radiation Dosimeters (Gamma, Neutron) are useful for monitoring various radiation levels around the ARRR facility, as needed.

The NRC staff finds that the proposed deletion of current TS Table 1 and the changes to proposed TS Table 1 (renumbered from TS Table 2) are consistent with a reactor that has been permanently shutdown and defueled, but where the fuel remains in the reactor pool. NUREG-1537, Part 1, Section 17.2.1.2, provides guidance that the licensee should consider the radiological condition of the facility and the protection of the health and safety of the public when modifying TSs for a possession-only license. The NRC staff finds that the safety system functions that remain in proposed TS Table 1 help ensure the appropriate radiological condition of the facility and the fuel and adequate protection of the health and safety of the public. Based on the above, the NRC staff concludes that proposed TS Table 1 (renumbered from TS Table 2) and the deletion of current TS Table 1 are acceptable.

TS Figure 1 – ARRR ANSI/ANS-15.1 Organization

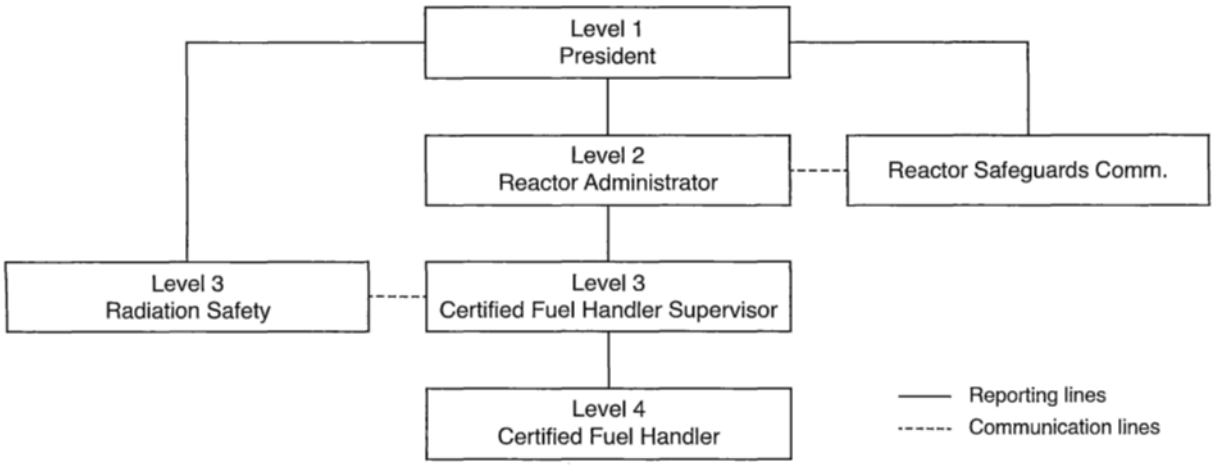

Figure 1 – ARRR ANSI/ANS-15.1 Organization

In its April 28, 2021, response to RAI 15 and in its June 22, 2021, response to draft RAI 15.1.3, the licensee proposed to add TS Figure 1 to illustrate the ARRR organization reporting and communication lines.

The NRC staff reviewed proposed TS Figure 1 and finds that it is sufficiently consistent with the guidance provided in NUREG-1537, Part 1, Appendix 14.1, as well as ANSI/ANS-15.1-2007, Chapter 6, Figure 1, “Organization Chart,” which illustrates organizational Levels 1 through 4 and their reporting and communication lines. The NRC staff also finds that proposed TS Figure 1 is consistent with the requirements and organization description in proposed TS 12.0. Based on the above, the NRC staff concludes that proposed TS Figure 1 is acceptable.

3.4 Continued Storage of Damaged Fuel at the ARRR

As discussed in Section 3.1 of this SE, 24 of the aluminum-clad TRIGA fuel elements possessed by Aerotest have damaged cladding. Of these elements, 22 are in specially designed canisters (stored in the core tank) that are currently filled with helium, such that each of the 22 elements is in a dry, inert environment within its canister. The remaining two damaged elements are also stored in the core tank, but are not in canisters.

In its response and subsequent clarification of its response to RAI 12 by letters dated March 26 and June 8, 2020, respectively, the licensee described the 22 canisters containing damaged fuel elements. The licensee stated that the canisters are constructed primarily of stainless steel and are designed to effectively provide a replacement cladding of the fuel with cracked cladding. The canisters are designed to accommodate various storage strategies of having the canisters submerged in water or stored in air and filled with either water (specifically, low conductivity and neutral pH pool water), air, or helium or another inert gas. The canisters are all currently filled with helium and stored submerged in pool water. As discussed in Section 3.2 of this SE, the licensee must keep the canisters in pool storage racks submerged in water and cannot implement dry storage of irradiated fuel in the core tank, because proposed TS 4.1 requires at least 16 feet of water depth above the top of the core structure, and this water level is well above the storage racks in the tank. Furthermore, as also discussed in Section 3.2 of this SE, although the licensee discusses the ability to fill the canisters with materials other than helium in its LAR, the NRC staff did not review any proposed change in the canister configuration (i.e., replacement of helium with another gas or water), and this amendment does not constitute NRC approval of any such change. Any future changes to the licensee's fuel storage configuration would be subject to the requirements in 10 CFR 50.59, as applicable.

In its responses to RAI 12, the licensee stated that although the canisters had a warranty lifetime of 5 years (the 22 damaged elements were originally placed in the canisters in 2012, as discussed in the NRC staff's inspection report 05000228/12-206, dated January 7, 2013 (ADAMS Accession No. ML12361A147)), the canister lifetime is significantly longer because the canisters are robustly designed and are stored in pool water with low conductivity and neutral pH and at ambient temperature (the licensee's proposed TS 4.2 requires periodic measuring of conductivity and the taking of corrective action to avoid conductivity from exceeding a specified level). The licensee stated that it does not anticipate any failure of the canisters or the need to replace the canisters due to failure or degradation because deterioration of the metal O-ring sealing the canisters is unlikely. However, as discussed below, the licensee did not consider it necessary to have all canistered damaged elements continue to be sealed in the existing canisters based on experience showing that any continued fission product release from fuel with damaged cladding is not significant, even when it is not sealed in canisters. The licensee stated in its May 19, 2021, letter that in the future, it plans to redesign the damaged element storage configuration and repackage the elements (in a way that accounts for the licensee's evaluation and determination that any significant future release from the damaged fuel elements is unlikely) due in part to the current canisters' incompatibility with transportation casks that would eventually be used to remove fuel from the ARRR facility for disposal. The NRC staff notes that it did not review any such future storage configuration change or repackaging and that such changes would be subject to the requirements in 10 CFR 50.59, as applicable.

In its responses to RAI 12 and in its May 19, 2021, response to RAI 28.3, the licensee stated that surveillance data for the canisters have shown no weight changes that would suggest water in-leakage or loss of helium gas from the canisters.

In its responses to RAI 12, the licensee stated that it will inspect each canister shell's integrity within a 5-year period and that these inspections will be similar to the cladding integrity inspections performed for uncanistered fuel elements. The licensee stated that the 5-year interval is based on the recommendations in NUREG-1537, Part 1, Appendix 14.1, Section 4.1(6), which recommends that for non-pulsing TRIGA reactors, the fuel should be inspected and measured on at least a 5-year cycle. However, in its May 19, 2021, response to RAI 28.4, the licensee stated that it is not necessary for canister and fuel element inspections to be a TS requirement, because such a TS would limit flexibility with respect to future changes in the canister design or fuel storage configuration that may have different inspection needs and because appropriate surveillances for canisters and fuel elements are included in ARRR facility procedures.

By letter dated August 15, 2013 (ADAMS Accession No. ML13247A668), the licensee stated that it had two additional canisters available for its two uncanistered damaged fuel elements, but that it did not plan to canister the two elements at that time, because it wanted to observe the elements to monitor the cracks. In its May 19, 2021, response to RAI 28.2.3, the licensee confirmed that these two elements have continued to remain in the pool uncanistered to help demonstrate that leaching of fission products into the pool is unlikely and that the observed outcome has been consistent with historical data indicating that no significant leaching of fission products should occur. Therefore, the licensee stated that it does not currently plan to canister these elements using its current canister design (i.e., its two spare canisters). However, the licensee also stated that it may use the two currently uncanistered elements to help develop and implement an integrated packaging solution for future storage and transportation of all of its damaged elements, since it plans to repackage damaged elements in the future, as discussed above.

In its responses to RAI 12 and in its May 19, 2021, response to RAI 28.5, the licensee stated that it periodically extracts water from the reactor tank and that this water is evaluated for the presence of radioisotopes, including, specifically, the fission product cesium-137 (Cs-137). The licensee stated that initially (starting in 2012, the year that the damaged fuel elements were canistered), it evaluated water samples on a monthly basis for eight different possible fission products. These samples were evaluated both by in-house analyses and by sending samples to a commercial laboratory. The licensee stated that the results from the commercial laboratory showed no detectable trace fission products, except for Cs-137 and strontium-90 (Sr-90). The licensee stated that in 2017, it reduced the frequency of both the in-house and commercial analyses to quarterly and also limited the scope of the commercial testing to Cs-137 and Sr-90. In 2019, based on its review of the consistency of water testing results, the licensee further reduced the commercial testing to annual testing for Cs-137 only, but retained the quarterly in-house testing.

In its May 19, 2021, response to RAI 28.5, the licensee provided the Cs-137 concentrations reported by the commercial testing laboratory for the last two annual measurements as 1.09 +/- 0.95 picocuries/liter (1.09E-9 +/- 0.95E-9 microcuries/milliliter) and 0.00 +/- 0.07 picocuries/liter (0.00 +/- 0.07E-9 microcuries/milliliter). The licensee stated that these concentrations were below the minimum detectable activity concentrations.

Separately from the pool sampling that the licensee performs, the licensee's proposed TS 7.3 and TS Table 1 require that there be a water radioactivity monitor attached to the process water cleanup system loop and that this monitor provide continuous indication in the control room (and an audible alarm on high pool water radiation levels). The purpose of the pool water sampling and the TS-required water radioactivity monitor is to detect fission products leaking to the pool water from damaged fuel elements in canisters or other fuel elements.

In its responses to RAI 12, the licensee stated that an accidental fission product leak from a canister containing a damaged fuel element or from an un-canistered undamaged fuel element is unlikely given the presence of cladding (either the original undamaged cladding or the replacement cladding provided by a canister). The licensee further stated that the zirconium hydride TRIGA fuel matrix, combined with the ambient storage temperatures of the fuel elements in the pool (there is minimal decay heat because the reactor has not been operated for many years), also limits any release of fission products from the fuel matrix, even when the cladding is damaged (e.g., ruptured blisters, pinhole defects, cracks) and no replacement cladding (e.g., a containment canister) is provided. The licensee stated that historically, TRIGA fuel elements with damaged cladding have been stored in pools at the ARRR and similar TRIGA reactor facilities and the elements possessed no indication of continued fission product release (although, as discussed above, the commercial testing performed for the licensee did find detectable concentrations of Cs-137 and Sr-90 in the ARRR pool water in the past). In its May 19, 2021, response to RAI 28.5.5, the licensee stated that although a significant measurable fission product release from the fuel to the pool is highly unlikely given the current storage conditions and chemical and physical circumstances, if such a release did occur, the cleanup loop resin (i.e., demineralizer) column could help address the release. The licensee stated that the resin column is designed and sized to handle possible fission product releases such as those that could be associated with loss of a canister seal or any release of contamination that could occur due to repackaging of damaged fuel elements.

As discussed in Section 3.1 of this SE, the reactor tank has no openings below the water surface. The tank is set in concrete, which adds greatly to the mechanical integrity. The exterior of the tank is treated to minimize corrosion. In its May 19, 2021, response to RAI 28.7, the licensee stated that there have been no water leaks, past or present, from the reactor tank. Water level measurements are taken monthly and measurement results have been consistent. The licensee stated that it did not need to add any water to the pool during the 12 months preceding its May 19, 2021, letter (the licensee also stated that water loss by evaporation is minimal given the low water and reactor room temperatures and the covering over the top of the tank).

The NRC staff reviewed the above information. The NRC staff finds that the licensee stores irradiated fuel (including undamaged fuel, canistered damaged fuel, and uncanistered damaged fuel) in the pool in conditions (e.g., low conductivity, neutral pH, and low temperature) that will help limit any corrosion or further degradation of the fuel cladding (aluminum or stainless steel) or the current stainless steel canisters. Proposed TS 4.2 requires the licensee to measure the pool water conductivity at least once quarterly and to take corrective action to avoid exceeding a conductivity of 5 μmho/cm. The NRC staff has previously found (see “Research and Test Reactors Pool Water – Safety Evaluation on Electrolytic Conductivity,” dated May 11, 2015 (ADAMS Accession No. ML15114A433)), that, at open pool research reactors such as the ARRR, maintaining conductivity below 5 μmho/cm will also ensure that pH, by its relationship to conductivity, will stay between 5.6 and 5.8 and that these values of pH and conductivity are appropriate to minimize any possible corrosion of aluminum or stainless steel.

The NRC staff also finds that the permanently shutdown status of the ARRR limits the likelihood for additional damage or degradation of the fuel because the fuel is not being used in reactor operation, which imposes stresses on the fuel that are not applicable when the fuel is not used for operation. Although, as discussed above, the licensee stated that it periodically inspects the canisters and the undamaged, uncanistered fuel, it does not currently have, and does not propose to add, TSs requiring fuel or canister inspection. The NRC staff finds that this allows appropriate flexibility and is also consistent with other possession-only licenses for TRIGA reactors that maintained fuel on site (see, for example, License Amendment No. 35 issued to General Atomics (GA) for its Mark I TRIGA Research Reactor on October 29, 1997 (ADAMS Accession

No. ML20212G407), which eliminated an existing requirement for periodic fuel inspections). The NRC staff notes that, consistent with standard practice, the main purpose of TRIGA fuel inspections is normally to detect damage or degradation caused by reactor operation. Inspections are no longer needed for this purpose if the reactor is permanently shutdown. The NRC staff notes that unnecessary fuel movements, for inspections or other purposes, could also increase the risk of a fuel mishandling accident.

Because most fuel elements at the ARRR either have intact cladding or are in canisters that provide an alternate cladding, because the TRIGA fuel matrix is designed to inhibit fission product release even when cladding is damaged (especially at the current low temperatures of the stored ARRR fuel), because the licensee has a demineralizer that can help remove any fission products from the pool, and because the recent fission product measurements provided by the licensee were below the minimum detectable activity concentration, the NRC staff finds that the likelihood of fission product release from the fuel that could cause significant pool contamination is low. The NRC staff finds that if fission product concentrations in the pool become elevated, the periodic sampling that the licensee performs (the NRC staff notes that although this sampling is not required by TSs, any changes that the licensee makes to the scope or frequency of this sampling would be subject to the requirements of 10 CFR 50.59, as applicable) and the TS 7.3 required fission product water monitor (for a more severe fission product release) help ensure that the licensee can detect the elevated concentrations and take appropriate action.

The NRC staff further finds that, even if a significant fission product release that contaminated the pool were to occur, any immediate consequences of the release would likely be low. Since the fuel has not been used for reactor operation for many years, the NRC staff notes that volatile fission products (i.e., noble gases and iodine isotopes) are mostly decayed and that other fission products would mostly be scrubbed by the pool water instead of being released to the air where they could pose a hazard to ARRR staff or the public. The NRC staff also finds that significant longer-term consequences would be unlikely, given the robust design of the reactor pool and that there have been no historical leaks from the pool that could result in a direct release to the environment. As discussed in Section 3.4 of the ARRR Environmental Report submitted by letter dated December 20, 2017 (ADAMS Accession Nos. ML17363A303 and ML18045A571), in support of the ARRR LRA (since withdrawn), any liquid radioactive waste, including pool water, that is intentionally released from the ARRR is first sent to storage tanks, where it is monitored to ensure that any radionuclide concentrations are within regulatory limits, before being discharged to the sanitary sewer system. Any contaminated liquid waste that does not meet criteria for disposal to the sanitary sewer system is stored for ultimate disposal by a licensed waste disposal company. Even if a pool leak that could result in a direct release of pool water to the environment were to occur, the NRC staff notes that the licensee's reported Cs-137 pool water concentrations for its last two annual measurements, while below minimum detectable concentrations, were also significantly below the 10 CFR Part 20, Appendix B, concentration limits for direct releases to the environment (1E-6 microcuries/milliliter) and releases to sanitary sewerage (1E-5 microcuries/milliliter).

As discussed above, the licensee stores fuel in conditions that are appropriate to help prevent degradation. The NRC staff finds that the likelihood of fission product release from the fuel that could cause significant pool contamination is low; and even if pool contamination from fuel were to occur, the radiological consequences to ARRR staff or the public would likely be minimal. Based on the above, the NRC staff concludes that there is reasonable assurance that the licensee can continue to maintain, store, and control its irradiated TRIGA fuel in a safe condition during the possession-only license period, in accordance with 10 CFR 50.51(b)(1).

3.5 Radiological Dose Assessment of Fuel Storage

By letter dated June 8, 2020, Enclosure 4, "MCNP [Monte Carlo N-Particle Transport] Analysis on Dose Rates from Fuel during Storage and Transfer," the licensee provided the results of its MCNP analyses of the radiation fields produced by the stored fuel. In Section 2.4, "Results," item 2.4.1, "Wet Storage," the licensee indicated that in the MCNP calculations, due to the effectiveness of water as a gamma shield, the incidence rate of gammas was so low that a statistically significant dose rate could not be determined. Instead, the contribution to dose rates above the pool from the fuel elements in storage under water was found to be several orders of magnitude below expected background radiation, which the licensee estimated as approximately 0.01 mrem/hr. The licensee stated that this result supports recent experience at the ARRR, as no elevated dose rate has been measured either above or within the pool enclosure during the last decade.

The NRC staff notes that the licensee also provided calculations for dry storage (pool void of water shielding) and dry storage with additional lead shield. In Enclosure 4 of its letter dated June 8, 2020, Section 2.4, item 2.4.2, "Dry Storage," and item 2.4.3, "Dry Storage with Additional Lead Shield," the licensee provides calculated dose rates of 2.5 rem/hr and 21 mrem/hr one meter above the top of the pool enclosure for dry storage without shielding and with a 2-inch (approximately 5-centimeter)-thick lead shield on the roof of the pool enclosure, respectively. The NRC staff finds that these calculations are useful for understanding bounding situations, but that these configurations cannot be implemented as TS 4.1 requires a minimum of 16 feet of water above the top of the core structure.

The licensee additionally provided calculations for dose rate for the highest-activity fuel element in a transfer cask. The licensee considered a normal scenario in which the element would be fully contained in the cask during a transfer, as well as an abnormal/accident scenario involving a cask failure during a transfer, in which the element fell partly out of the bottom of the cask and 12 inches (30.48 cm) of the bottom of the element because exposed (the licensee stated that the cask mechanism is never lifted more than one foot above the floor and, therefore, this bottom portion of the element would be exposed but the element would not completely separate from the cask). In Enclosure 4 of its letter dated June 8, 2020, Section 3.3, "Results," the licensee provided calculated dose rates of 392 mrem/hr for a worker 10 feet from the cask and 16.4 mrem/hr for a potential member of the public located 50 feet from the cask at the closest site boundary (assuming no shielding from the facility walls). The licensee stated that the estimated 10-minute doses (based on an assumption that it would take 10 minutes to rectify the dropped element situation) would be 65 mrem for the radiation worker and 2.74 mrem for the member of the public. The licensee did not provide specific dose rates for the normal scenario, but the heat-map diagram in Figure 9 of its Enclosure 4 illustrates that doses for this scenario would be much lower than for the dropped element scenario (heat-map diagram provided in Figure 10 of the licensee's Enclosure 4).

NRC staff review

The NRC staff review of the licensee's Enclosure 4 involved understanding the assumptions, descriptions of components, and methodology used in the MCNP analysis in order to determine its adequacy. Given that the fuel has not been irradiated or used in the reactor for a decade, the NRC staff understands that many of the radioactive fission products have decayed and thus determined that it was not necessary for the staff to perform independent MCNP calculations to validate the licensee's results. Rather, the NRC staff's review of the Enclosure 4 was sufficient to ensure that the licensee has described enough information that would be used within MCNP and to verify that the methodology and assumptions made by the licensee were reasonable. Additionally,

measurements of the radiation fields above and around the reactor pool were consistent with the calculated results provided by the licensee's MCNP analysis.

The NRC staff finds that Enclosure 4, Section 2, "Fuel Storage Model," accurately describes the geometry of the pool and the floor storage racks containing the fuel elements. Likewise, the NRC staff finds that Enclosure 4, Section 3, "Transfer Cask Model," provides details related to the transfer cask model sufficient to perform an MCNP analysis. In Enclosure 4, Sections 2.1, "Physical Description," and 2.2, "Burnup Analysis," the NRC staff finds that the licensee described the fuel racks as being made from aluminum plates and posts and provided the measurements for the fuel storage racks. In Enclosure 4, Section 3.1, "Physical Description," the NRC staff finds that the licensee also provided the geometry of the transfer cask as well as the materials of the cask. Based on the descriptions provided in these sections, the NRC staff finds that the licensee has an adequate understanding of the geometries needed for an accurate MCNP model, and has appropriately modeled its geometries for use in MCNP calculations.

The NRC staff finds that the licensee appropriately leveraged documentation of recorded flux factors, as well as information from Idaho National Laboratory (INL) reports that was comparable to the burnup and decay time of the licensee's fuel, in order to determine the MCNP source terms needed for the analysis. The NRC staff finds that the licensee provided the source activity after 10 years of decay in Tables 1 and 2, "Activity after 10 years decay (Ci)," of Enclosure 4, for aluminum and stainless steel cladded fuel elements, respectively. The NRC staff also finds that the licensee appropriately used linear interpolation to determine the activities per nuclide within the data presented in Tables 1 and 2.

The licensee stated that for 24 elements the burnup was higher than the maximum burnup for which data was provided in the INL reports, but that it could still use linear interpolation since the activity of these elements was linearly related to the burnup. The NRC staff reviewed several of the isotopes provided in Tables 1 and 2 and finds that the licensee's assessment appears correct that the burnup rate follows a linear trend and that the assumptions used to interpolate the specific activities was appropriate for determination of activities for use in MCNP because of the linearity. The NRC staff also finds that the information referenced to determine the nuclide specific energies and fission product yields also appears consistent with typical nuclear reactor fission information and data. The licensee provided information on its source definition stating that each fuel element modeled in the pool had a source term definition tailored specifically to that element, since some fuel elements had higher burnup when compared to other fuel elements stored in the pool. The NRC staff finds that the licensee's use of specific fuel activities (for each individual element) dependent on burnup is a reasonable methodology, given the licensee's historical information on fuel burnup rates over various core configurations and exposure times.

In conclusion, the NRC staff finds that the licensee used appropriate assumptions and methods to evaluate the dose rates from its fuel and that the methodology used by the licensee to calculate dose rates in the scenarios discussed is reasonable and acceptable. Based on its review of the results of the licensee's MCNP dose rate calculations, discussed above, the NRC staff concludes that there is reasonable assurance that the licensee can maintain any external doses to workers and members of the public within 10 CFR Part 20 limits (5 rem per year for workers, in accordance with 10 CFR 20.1201, "Occupational dose limits for adults," and 100 mrem per year for members of the public, in accordance with 10 CFR 20.1301, "Dose limits for individual members of the public") from storage of fuel in the pool in accordance with TS 4.1 and cask transfers of fuel in accordance with TS 11.

3.6 Criticality Analysis of Fuel Storage

In its letter dated June 8, 2020, the licensee stated that the TRIGA fuel is stored in one of three configurations: (1) in the original floor storage racks (for the un-encapsulated fuel elements); (2) in the wall-mounted racks located on the side of the pool walls (for the un-encapsulated fuel elements); and (3) in storage racks designed only to store the canisters encapsulating damaged aluminum-clad elements.

The original criticality assessment of the original floor storage racks was performed by GA with the analysis documented in a report written by GA (F.C. Foushee, "Storage of TRIGA Elements," General Atomics Division, La Jolla, CA 1966). The floor storage racks were manufactured near the time of the cited publication. A third rack of similar design was fabricated in 1981. At that time, additional storage was needed to accommodate fuel elements from a vacated core. In developing current storage strategies, the licensee performed MCNP modeling of the storage racks which it stated confirm the validity of the GA design. The licensee discussed its MCNP modeling in its letter dated June 8, 2020, and also provided a report, "ARRR Fuel Storage Criticality Analyses," discussing these analyses and the results as Enclosure 5 to its June 8, 2020, letter.

As for the stainless-steel canisters encapsulating damaged fuel elements, their design, analysis, and manufacture were performed by Secured Transportation Services, LLC (STS). In the design of the stainless-steel canisters and the accompanying aluminum storage racks, the licensee stated that the criticality limit was evaluated by STS to ensure that the use of the canister and storage rack did not affect, alter, or invalidate the current licensed condition (current TS 11.2, which the licensee has not proposed to change, requires that fuel storage racks in the reactor pool be designed such that for all conditions of moderation, k_{eff} shall not exceed a value of 0.8). The licensee stated that in 2012, the STS analysis was reviewed by Aerotest operating staff and its RSC members. The licensee stated that no TS changes were necessary for it to use the new STS canisters and racks. The licensee stated that its current MCNP evaluation of storage configurations confirms STS' original determination that criticality limits for storage are met.

The k_{eff} values calculated by the licensee for each of the three storage configurations are listed below:

1. Floor fuel storage rack – k_{eff} = 0.66
2. Wall-mounted fuel storage rack – k_{eff} = 0.31
3. Damaged fuel canister rack – k_{eff} = 0.22.

The NRC staff's review of the licensee's MCNP fuel storage criticality analyses for each of these three storage configurations is described below.

3.6.1 Floor Fuel Storage Racks

The ARRR used two types of TRIGA fuel: 8.5/20 and 12/20. The 8.5/20 TRIGA fuel nomenclature means that the fuel is composed of 8.5 weight percent (wt%) uranium (U) enriched to slightly less than 20 percent in the isotope U-235. Similarly, the 12/20 TRIGA fuel is 12 wt% U enriched to slightly less than 20 percent U-235. The NRC staff finds that the ARRR MCNP analysis for the floor fuel storage racks used only the more reactive 12/20 TRIGA fuel elements (i.e., no 8.5/20 TRIGA fuel elements). The NRC staff finds that the use of all 12/20 TRIGA fuel elements results in a higher, more conservative, and bounding k_{eff}. The MCNP analysis results in a higher k_{eff} because the 12/20 fuel is more reactive than the 8.5/20 fuel, and the analysis is more conservative because the licensee stores a mixture of both the less reactive 8.5/20 as well as the more reactive 12/20

TRIGA fuel. Thus, the calculated k_{eff} represents a bounding limit (i.e., maximum k_{eff}) since the licensee's TRIGA fuel inventory is fixed and will not change over time.

In addition, the licensee's MCNP analysis assumed that the floor fuel storage racks were completely full of TRIGA fuel (i.e., no empty storage locations), with a pitch between fuel elements of 3 inches (7.62 cm). The licensee's spent fuel inventory is fixed and will not increase, and the licensee does not need to use all the storage locations in the floor fuel storage racks. Thus, the licensee has empty storage locations in the floor fuel storage racks. With the conservative assumptions that all the floor fuel storage racks only contained the more reactive 12/20 TRIGA fuel and that the floor fuel storage racks were completely full of TRIGA fuel, the licensee's calculated k_{eff} was 0.66.

The licensee also performed two bounding MCNP calculations: an Infinite Planar Array and an Infinite Rack Lattice. The Infinite Planar Array is a configuration modeled by MCNP for the fuel storage racks by simply reflecting any tracked particles trying to escape the fuel rack back into the fuel rack without any loss of energy (i.e., a mirror). The pitch between fuel elements was 3 inches (7.62 cm), except at the edge, where it was 2 inches (5.08 cm). The licensee indicated that this configuration would be considered the most limiting case, and the calculated k_{eff} was 0.81. The Infinite Rack Lattice configuration differs slightly in that the rack configuration is replicated outward infinitely from the original rack. The pitch between fuel elements is 4 inches (10.16 cm), which is greater than the Infinite Planar Array, because the tracked particles are not reflected back into the rack at the boundary edge (at 2 inches (5.08 cm), as noted above), but continue into the adjacent fuel rack for another 2 inches (5.08 cm) before contacting with another fuel element. The k_{eff} for this case was 0.75. The NRC staff reviewed both model configurations and finds the assumptions to be conservative and the results (k_{eff} values) to be acceptable.

The NRC staff finds that the licensee used conservative assumptions in the ARRR MCNP analysis, as described above. Additionally, the NRC staff finds that the k_{eff} was calculated using appropriate methods (i.e., MCNP) and that the resulting k_{eff} value appears reasonable based on experience with similar research reactors. The NRC staff finds that the calculated k_{eff} is well below the k_{eff} value provided in the guidance in NUREG-1537 and in ANSI/ANS-15.1-2007 (i.e., $k_{eff} < 0.90$). Based on the above, the NRC staff concludes that the licensee's floor fuel storage rack criticality analysis is acceptable.

3.6.2 Wall-Mounted Fuel Storage Rack

The licensee described the wall-mounted storage rack as an annular ring that can hold up to 21 TRIGA fuel elements, with a pitch of approximately 4 inches (10 cm). The licensee's MCNP analysis assumed all locations contained the more reactive 12/20 TRIGA fuel elements. Given the unique geometry of the ring-shaped rack, the licensee indicated that extending the geometry was not possible, and the MCNP calculated k_{eff} for the fully loaded rack was 0.31. The NRC staff reviewed the MCNP calculation and results for the wall storage rack and finds that the assumptions were conservative and that the k_{eff} results were reasonable for the configuration. Based on the above, the NRC staff concludes that the licensee's wall-mounted fuel storage rack criticality analysis is acceptable.

3.6.3 Damaged Fuel Canister Racks

The licensee has 22 damaged fuel elements encapsulated in canisters to prevent the potential release of radioactive fission products from the fuel elements' damaged cladding. These canisters are essentially 0.065 inch (1.651 millimeter) thick, 2.5 inch (6.35 cm) outer diameter stainless steel

tubes, capped on both ends, with valves that facilitate the removal of water from inside, allowing the elements to be stored in a dry cavity. The canisters themselves are housed within one of two storage racks that rest on the floor of the pool. One damaged fuel canister storage rack can hold up to 24 canisters and the other can hold up to 12 canisters.

The licensee's MCNP analysis used the 24-canister storage rack, since it would contain more canisters than the 12-canister rack and thus would provide a larger k_{eff}. Further, the licensee assumed that the 24-canister storage rack was completely filled with canisters containing fuel with no burnup. The resulting k_{eff} was 0.21. The license also calculated an Infinite Rack Lattice geometry, similar to the floor fuel storage rack analysis discussed above, and the calculated k_{eff} was 0.46.

The NRC staff reviewed the MCNP calculation and results for the damaged fuel canister racks and finds that the assumptions were conservative and that the k_{eff} results were reasonable for the configuration. Based on the above, the NRC staff concludes that the licensee's damaged fuel canister rack criticality analysis is acceptable.

3.7 The Proposed ARRR Certified Fuel Handler Training and Requalification Program

This section documents the NRC staff's evaluation of the acceptability of the licensee's proposed replacement of NRC-licensed ROs with CFHs that are not NRC-licensed, and the licensee's proposed CFHTRP that would replace the current NRC-approved ORP, dated July 13, 2000 (ADAMS Accession No. ML003735364), for the ARRR. Section 3.7.1 of this SE provides background information and the NRC staff's evaluation of the acceptability, in principle, of the licensee's proposed use of CFHs and a CFHTRP. Section 3.7.2 of this SE provides the NRC staff's detailed technical evaluation of the acceptability of the information in each section of the licensee's proposed CFHTRP, submitted by letter dated March 31, 2021 (ADAMS Accession No. ML21098A157). Section 3.7.3 of this SE summarizes the NRC staff's conclusions on its review of Aerotest's CFHTRP and the elimination of NRC-licensed operators.

3.7.1 Background Information and Aerotest's Use of Certified Fuel Handlers

In its LAR, Aerotest requested a possession-only license for the ARRR, but did not request the removal of its authorization to possess fuel. As discussed in Section 3.1 of this SE, Aerotest would continue to have fuel in storage at the ARRR following the issuance of a possession-only license. Aerotest stated in its LAR that NRC-licensed operators (pursuant to 10 CFR Part 55) would no longer be needed or relevant to Aerotest's mission and, instead, Aerotest proposed to replace its NRC-licensed ROs and SROs with CFHs. Aerotest provided a proposed CFHTRP as an enclosure to its LAR.

In its LAR, Aerotest proposed LCs and TSs that would prohibit operation of the reactor, prohibit reactor fuel from being placed in the reactor lattice (core), require that all fuel be in storage and in a subcritical configuration, and require that reactor control rods be disabled and fully inserted. Aerotest's proposed TSs would permit fuel transfers and movement outside the reactor core, although such transfers would be limited to one element at a time. Aerotest stated that as a result of these conditions, there would no longer be any manipulation of reactor controls, reactivity changes, or core alterations at the ARRR that would require NRC-licensed operators.

In its letter dated June 28, 2019, Aerotest stated that the 10 CFR Part 55 requirements related to NRC-licensed operators, and associated ORPs, are primarily focused on the safe control and operation of a reactor. Aerotest also stated that because the ARRR will no longer be operated,

and fuel will no longer be located in the reactor core, it is appropriate for its staff responsible for fuel handling to be trained and qualified by an alternative approach. Aerotest referenced Nuclear Energy Institute (NEI) 15-04, "Guidelines for a Certified Fuel Handler Training and Retraining Program" (ADAMS Accession No. ML15350A129; the NRC staff notes that this is a draft document designated as "Revision 0"), which Aerotest stated provides relevant guidance when reactor staff activities are focused on fuel handling and storage in fuel storage pools, outside of a reactor vessel. Aerotest stated that its proposed CFHTRP, which would replace its current ORP and NRC-licensed operators, would serve the purpose of ensuring that Aerotest has adequately trained staff to handle fuel, understand fuel and water chemistry, and perform activities related to radiological safety.

The definition of "certified fuel handler" in 10 CFR 50.2, "Definitions," states:

> *Certified fuel handler* means, for a nuclear power reactor facility, a non-licensed operator who has qualified in accordance with a fuel handler training program approved by the Commission.

The regulation at 10 CFR 50.54(i) states:

> Except as provided in [10 CFR 55.13], the licensee may not permit the manipulation of the controls of any facility by anyone who is not a licensed operator or senior operator as provided in [10 CFR Part 55].

The regulation at 10 CFR 50.54(i-1) states, in part:

> the licensee shall have in effect an [ORP]. The [ORP] must, as a minimum, meet the requirements of [10 CFR 55.59(c)].

The regulation at 10 CFR 50.54(j) states:

> Apparatus and mechanisms other than controls, the operation of which may affect the reactivity or power level of a reactor shall be manipulated only with the knowledge and consent of an operator or senior operator licensed pursuant to [10 CFR Part 55] present at the controls.

The regulation at 10 CFR 50.54(k) states:

> An operator or senior reactor operator licensed pursuant to [10 CFR Part 55] shall be present at the controls at all times during the operation of the facility.

The regulation at 10 CFR 50.54(l) states:

> The licensee shall designate individuals to be responsible for directing the licensed activities of licensed operators. These individuals shall be licensed as senior operators pursuant to [10 CFR Part 55].

The regulation at 10 CFR 50.54(m)(1) states:

> A senior operator licensed pursuant to [10 CFR Part 55] shall be present at the facility or readily available on call at all times during its operation, and shall be present at the facility during initial start-up and approach to power, recovery from an

> unplanned or unscheduled shut-down or significant reduction in power, and refueling, or as otherwise prescribed in the facility license.

The stated purpose of NEI 15-04, Rev. 0, is to describe a "standard program, developed using NRC guidance and recent precedents, which may be approved by the NRC for use by nuclear power reactor licensees in developing a training and retraining program for the CFH." The document states that "[l]icensees may use the standard program, upon approval by NRC, to develop licensee specific CFH training program documents and procedures in order to implement the CFH training program." The document also states that the CFH is intended to replace NRC-licensed ROs and SROs and that the "qualification, training and retraining of the CFH provides an appropriate level of on-shift oversight for a nuclear power reactor during decommissioning, commensurate with the reduced risks and relative simplicity of the facility systems needed for safe storage of spent fuel, for safely conducting decommissioning-related activities, including the safe handling and storage of spent fuel, and response to plant emergencies."

The NRC staff notes that NEI 15-04, Rev. 0, is a draft document which has not been endorsed by the NRC. However, since the Final Rule, "Decommissioning of Nuclear Power Reactors" (published in the *Federal Register* on July 29, 1996 (61 FR 39278)), became effective, the NRC staff has on multiple occasions approved the use of CFH training programs and the elimination of NRC-licensed operators for nuclear power reactor licensees that have certified that their reactors are permanently shut down and defueled. These precedents were used in the development of NEI 15-04, Rev. 0, as discussed above. NEI 15-04, Rev. 0, also references SECY-00-145, "Integrated Rulemaking Plan for Nuclear Power Plant Decommissioning" (ADAMS Accession No. ML003721626), dated June 28, 2000, in which the NRC staff discusses the regulatory framework concerning nuclear power reactor operator and fuel handler staffing as follows:

> The operator staffing regulations in 10 CFR 50.54(m) specify the minimum licensed operator staffing levels for operating reactors (e.g., minimum staff per shift for licensed operators and senior operators) but do not provide any alternatives for licensees that have certified that they are permanently shutdown and defueled under 10 CFR 50.82(a)(1). For decommissioning plants, the NRC has been approving license amendments that discontinue the requirements for licensed operators and allow shift staffing consisting of a certified fuel handler (certified by an NRC-approved training program) and an additional non-licensed operator. However, there are no regulatory requirements that mandate these staff-approved staffing levels. Similarly, 10 CFR 50.54(i), (i-1), (k), and (l) all contain licensed operator requirements that do not apply to decommissioning plants….
>
> In August 1996, a major decommissioning rule became effective that made a number of changes to 10 CFR Part 50 to simplify the decommissioning regulations. One of the changes involved the adoption of a definition of "certified fuel handler" in 10 CFR 50.2. The certified fuel handler is intended to be the on-shift licensee representative who is not only responsible for safe fuel handling operations at a decommissioning plant, but is always present on shift to ensure the safe maintenance and storage of spent fuel and the overall safety of any decommissioning-related activities at the facility. However, there are no regulations that specify substantive requirements for the presence and regulatory responsibilities of a certified fuel handler during decommissioning.

> In addition, the certified fuel handler must be qualified in accordance with a certified fuel handler training program approved by the Commission. However, there are no regulations besides the definition that specifies the training requirements for the certified fuel handler.

Considering the definition of CFH in 10 CFR 50.2 and the background provided by the Final Rule, "Decommissioning of Nuclear Power Reactors," which added the definition, plus the insights provided in SECY-00-145, the NRC staff has determined, when approving the use of CFH training programs (and the elimination of NRC-licensed operators) for nuclear power reactor licensees, that an acceptable CFH training program should ensure that the trained individual has requisite knowledge and experience in spent fuel handling and storage and reactor decommissioning, and is capable of evaluating plant conditions and exercising prudent judgement for emergency action decisions. In evaluating the use of CFH training programs for nuclear power reactor licensees, the NRC staff has also used the criteria in 10 CFR 50.120, "Training and qualification of nuclear power plant personnel," and assessed the program against the elements of a systems approach to training (SAT) provided in the definitions section of 10 CFR 55.4, "Definitions."

With a simplified operating configuration in the permanently shut down and defueled condition, licensed operators have been replaced with CFHs following NRC approval of a CFH training program. Consistent with these changes, the training and requalification programs (i.e., ORPs) required by 10 CFR Part 55 have been modified to reflect the reduced staffing levels and responsibilities of the operations staff. As recent examples, the NRC approved proposed CFH training programs for nuclear power reactors for Pilgrim Nuclear Power Station, by letter dated April 12, 2017 (ADAMS Accession No. ML17058A325); Fort Calhoun Station, Unit 1, by letter dated June 21, 2017 (ADAMS Accession No. ML17144A246); Three Mile Island Nuclear Station, Unit 1, by letter dated December 29, 2017 (ADAMS Accession No. ML17228A729); and Beaver Valley Power Station, Unit Nos. 1 and 2, Davis-Besse Nuclear Power Station, Unit No. 1, and Perry Nuclear Power Plant, Unit No. 1, by letter dated April 11, 2019 (ADAMS Accession No. ML19028A030).

The NRC staff notes that the precedents discussed above relate to CFH training and qualification programs for nuclear power reactors that have been certified to be permanently shut down and defueled (i.e., fuel removed from the reactor vessel) in accordance with 10 CFR 50.82(a)(1), but that the ARRR is a non-power reactor. Non-power reactor licensees are not subject to the 10 CFR 50.82(a)(1) requirement to certify that they are permanently shut down and defueled. However, by letter dated June 28, 2019, Aerotest confirmed that it had permanently ceased ARRR operation as of December 6, 2018. The NRC staff acknowledged this certification in a letter dated July 30, 2019 (ADAMS Accession No. ML19193A077). Additionally, as discussed above, Aerotest's proposed LCs and TSs for its possession-only license would prohibit reactor operation or fuel being placed in the reactor lattice (core). Therefore, the NRC staff finds that, upon issuance of the proposed possession-only license, the permanently shut down and defueled status of the ARRR will be comparable to a nuclear power reactor that has been certified to be permanently shut down and defueled in accordance with 10 CFR 50.82(a)(1).

NUREG-1537, Part 2, Section 17.2.1.3, states that NRC-licensed operators are no longer required and that the ORP may be eliminated if fuel has been removed from the facility and possession of the fuel is no longer authorized, but NRC-licensed operators (or NRC-licensed fuel handlers, i.e., SROs limited to fuel handling) are needed if fuel is present and will be moved. Following the issuance of a possession-only license, Aerotest will still be authorized to possess fuel and will have fuel onsite, but the fuel will be in storage in the reactor pool. Aerotest will be prohibited by TSs from placing any fuel in the reactor core. The ARRR does not have a reactor vessel and a spent fuel pool like a typical nuclear power reactor. Instead, the ARRR, similar to many other non-power

reactors, has a reactor pool that contains both the reactor core and fuel storage racks. The NRC staff finds that, although Aerotest's situation following issuance of the proposed possession-only license will be different than that of a nuclear power reactor, it will be substantively analogous to that of a nuclear power reactor with an approved CFH program because the reactor will not be operated, the core will not contain fuel, the fuel will be stored in racks outside of the reactor core but within the reactor pool, and any fuel handling will occur outside of the core. Additionally, the fuel storage racks are designed to maintain a subcritical configuration for all of the ARRR TRIGA fuel elements (i.e., k_{eff} less than 0.8).

As discussed in SECY-00-145 and referenced above, for nuclear power reactors that have been certified to be permanently shut down and defueled, the NRC has granted license amendments that discontinue the requirements for NRC-licensed operators, provided that nuclear power reactor licensees have NRC-approved CFH programs and have appropriate CFH staffing. Additionally, for nuclear power reactors that have been certified to be permanently shut down and defueled, the regulations at 10 CFR 50.54(i), (i-1), (k), (l), and (m) have been considered to be not applicable. Because Aerotest's situation will be substantively analogous to such nuclear power reactors, including that the ARRR will no longer be operated (including reactor startup, reactivity or control manipulations, or power level changes) or refueled (including adding or removing core fuel or moving fuel within the core), the NRC staff finds that 10 CFR 50.54(i), (k), (l), and (m), which require NRC-licensed ROs and SROs, will no longer apply for the ARRR. Furthermore, because the ARRR, like similarly-situated nuclear power reactors, will no longer have NRC-licensed ROs or SROs, the NRC staff finds that 10 CFR 50.54(i-1), which requires an ORP, will no longer apply for the ARRR. Although NUREG-1537 states that NRC-licensed operators (or NRC-licensed fuel handlers) are required if fuel is present and will be moved, the NRC staff finds that because the ARRR fuel will not be present in or moved within the reactor core lattice, NRC-licensed operators or fuel handlers are not required The regulation at 10 CFR 50.54(m)(1) requires an SRO for reactor operations, refueling, or as otherwise prescribed in the facility license, but does not require an SRO or RO for fuel movements outside the reactor core.

The NRC staff notes that the CFH definition in 10 CFR 50.2 is specific to nuclear power reactor facilities. However, because the regulations requiring NRC-licensed operators will no longer apply for the ARRR, similarly to a permanently shut down and defueled nuclear power reactor, the NRC staff finds that Aerotest's proposed alternative approach of staffing the ARRR with CFHs trained and qualified using an NRC-approved qualification program, similar to nuclear power reactors, is reasonable.

As discussed above, for nuclear power reactors, the NRC staff has determined that an acceptable CFH training program should ensure that the trained individual has requisite knowledge and experience in spent fuel handling and storage and reactor decommissioning, and is capable of evaluating plant conditions and exercising prudent judgement for emergency action decisions. The NRC staff has also used the criteria in 10 CFR 50.120 (which are applicable, in part, to the training of non-licensed operators at operating nuclear power reactors) and the elements of a SAT in 10 CFR 55.4. The regulation at 10 CFR 50.120 does not apply to non-power reactor facilities, including the ARRR. The elements of a SAT in 10 CFR 55.4 are used to meet the requirements in 10 CFR 50.120 for power reactors (and, in accordance with 10 CFR 55.59(c), also represent an optional approach to satisfy the specific requirements for ORPs for both power reactors and non-power reactors in 10 CFR 55.59(c)(2) through (4)). Because, like nuclear power reactors, there are no regulatory requirements that would specify the contents of a CFHTRP program for the ARRR, the NRC staff similarly reviewed Aerotest's proposed CFHTRP to ensure that trained CFHs will have appropriate knowledge in fuel handling and storage, reactor decommissioning, and handling emergencies. In its review of the ARRR CFHTRP, the NRC staff additionally considered

the requirements for ORPs for operating reactors in 10 CFR 55.59(c)(1-5), acknowledging the differences between the knowledge and skills needed at operating and decommissioning reactors; the significantly reduced risk (compared to either a typical operating non-power reactor or a permanently-shutdown power reactor), based on considerations such as fission product inventory, decay heat, and typical radiation levels, posed by a non-power reactor that is not operating and is permanently shut down; and that ORPs typically only cover retraining, while the ARRR CFHTRP is both an initial training and a retraining program. The NRC staff also considered the elements of a SAT in 10 CFR 55.4, and the regulation at 10 CFR 55.59(c)(7), which provides some flexibility in the conformance of ORPs for operating non-power reactors to the other requirements in 10 CFR 55.59(c). The NRC staff considers the use of 10 CFR 55.59(c) and the SAT in 10 CFR 55.4 (which is referenced in 10 CFR 55.59(c) as an acceptable alternative to certain parts of 10 CFR 55.59(c)), with the considerations discussed above, to be a reasonable and appropriate alternative to using 10 CFR 50.120 for review of the ARRR CFHTRP, because 10 CFR 55.59(c) is applicable for (and used to review) ORPs for NRC-licensed operators at operating non-power reactors. NRC-licensed operators, like CFHs, should have appropriate knowledge in fuel handling and storage, handling emergencies, and topics such as reactor facility design, TSs, and radiation protection, which remain applicable during decommissioning.

As discussed in SECY-00-145 and referenced above, there are no regulatory requirements that mandate staffing levels when nuclear power reactors are permanently shut down and defueled and NRC-licensed ROs and SROs are no longer required. There are similarly no such requirements for non-power reactors. For nuclear power reactors, the NRC has allowed shift staffing consisting of a CFH and an additional individual. In its LAR, Aerotest provided proposed TS 11.4, which states:

> The transfer of irradiated fuel in the reactor tank, storage pits and facility shall be conducted by a minimum staff of two; a Certified Fuel Handler (CFH) and an additional person trained in radiation safety. The staff shall monitor the operation using a hand held Gamma/Beta radiation monitoring instrument. The Radiation Safety Officer or designee shall be present for irradiated fuel transfers outside of the reactor tank.

Further, proposed TS 11.6 states:

> CFH or CFH Supervisor does not need to be at the facility on a daily basis. They are only required when there is a transfer/movement of fuel.

The proposed ARRR TSs do not include any specific requirements for facility staffing during any other time (i.e., when fuel is not being moved). However, proposed TS 12.1.1 states:

> Aerotest Operations President (Level 1) shall have the responsibilities for all activities associated with obligations and processes associated with operating Aerotest Operations which includes complying with license and Technical Specifications, facility physical security and safety programs. The President of Aerotest Operations, Inc. shall report to the Board of Directors of Aerotest Operations, Inc.

Additionally, proposed TS 12.1.2 states, in part:

> The Reactor Administrator (Level 2) shall have the responsibilities of ensuring security and safety of the Aerotest facility.

Proposed TSs 12.1.1 and 12.1.2 require that the President and Reactor Administrator have responsibility for ensuring the safety and security of the ARRR facility at all times, regardless of facility status.

3.7.2 Detailed Technical Evaluation of the Proposed ARRR Certified Fuel Handler Training and Requalification Program

As discussed above in Section 3.7.1 of this SE, there are no regulatory requirements that would specify the contents of a CFH training and qualification program for the ARRR. Additionally, there is no guidance specific to preparing and reviewing a CFHTRP for permanently shutdown non-power reactors with non-licensed operators. As a result, while not directly applicable, the following regulations, guidance, and standards were considered in the NRC staff's evaluation of the ARRR CFHTRP:

- 10 CFR 55.4, "Definitions"
- 10 CFR 55.53, "Conditions of licenses"
- 10 CFR 55.59, "Requalification"
- NUREG-1537, Part 1, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Format and Content," dated February 1996 (ADAMS Accession No. ML042430055)
- NUREG-1537, Part 2, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Standard Review Plan and Acceptance Criteria," dated February 1996 (ADAMS Accession No. ML042430048)
- American National Standards Institute/American Nuclear Society (ANSI/ANS)-15.4-2007, "Selection and Training of Personnel for Research Reactors"

Given that there are no specific regulations for a non-power reactor CFHTRP, the NRC staff also conducted its review of the ARRR CFHTRP based on the following broad-scope objectives, which are similar to those that have been used in evaluating the use of CFH programs for permanently shutdown and defueled nuclear power reactors:

(1) Ensuring that trained individuals have requisite knowledge and experience in spent fuel handling and storage.

(2) Ensuring that trained individuals have requisite knowledge and experience in reactor decommissioning.

(3) Ensuring that trained individuals are capable of evaluating plant conditions and exercising prudent judgement for emergency action decisions.

Each ARRR CFHTRP section is provided below in italic font, followed by the NRC staff's evaluation of that section.

CFHTRP Section 1, "Purpose," states:

1.1 A permanently shut down and defueled reactor, no longer requires licensed reactor (RO) or senior reactor operators (SRO) and are replaced by the Certified Fuel Handler (CFH) and the Certified Fuel Handler Supervisor. The qualification, training and retraining of the CFH and CFH Supervisor provides an appropriate level of oversight commensurate with the reduced risks and relative simplicity of the facility

systems needed for safe storage of spent fuel, including the safe handling and storage of spent fuel, and response to plant emergencies. The work responsibilities of the CFH are restricted to those outlined in Tech Spec 11.0 Fuel Transfer and Storage. CFH must follow relevant and approved transfer procedures. The CFHs are obligated to know, practice, and follow when necessary the facility safety and security programs. When the fuel elements are located in the fuel storage racks as specified in Tech Spec 11.1, the CFH is to follow the direction of the president/reactor administrator and radiation safety officer in all other matters.

1.2 The CFH training/requalification program is based on systematic approach to training (SAT).

1.2.1. Systematic analysis of the jobs to be performed.
1.2.2. Learning objectives derived from the analysis which describe accepted performance after training.
1.2.3. Training design and implementation based on the learning objectives.
1.2.4. Evaluation of trainee mastery of the objectives during training.
1.2.5. Evaluation and revision of the training based on the performance of trained personnel in the job setting.

1.3 The CFH training/requalification program is to be reviewed biennially at the end of the training cycle by the Reactor Safeguards Committee (RSC). Aerotest Operations, Inc. (AO) may make changes to CFH Training/Requalification Program without NRC approval if the following are applicable:

1.3.1 Suitable proficiency in the performance of the program's activities is maintained, and
1.3.2 Changes are documented and will be available during an NRC inspection to verify the adequacy of the program.

1.4 After Initial CFH training, the qualification program shall be conducted biennially over a period not to exceed 24 months, followed by successive 24-month periods. (Preference will be given to CFH candidates which maintained successfully an SRO license from an NRC Licensed research reactor or had 2 years fuel handling experience at Aerotest Operations Inc.)

The NRC staff reviewed the proposed CFHTRP Section 1. The NRC staff finds that Section 1.1 provides an appropriate summary of the roles and responsibilities of CFHs and the CFH supervisor in CFHTRP Section 3 and proposed ARRR TS 12.1 and that it is, therefore, acceptable.

The NRC staff finds that Section 1.2, which states that the CFHTRP is based on a SAT, includes all five of the required elements of a SAT-based program consistent with the 10 CFR 55.4 definition of SAT and that it is, therefore, acceptable.

The NRC staff finds that Section 1.3, which specifies that the CFHTRP must be reviewed by the RSC and allows Aerotest to make certain changes to the CFHTRP without NRC approval, is acceptable because it helps ensure appropriate RSC oversight of the CFHTRP (in conjunction with proposed TS 12.1.3, which requires RSC audits of ARRR records) and because it provides a change process that is similar to that in previous NRC-approved CFHTRPs for permanently shutdown and defueled nuclear power reactors.

The NRC staff finds that Section 1.4, which sets the CFH retraining program duration at 24 months and states that preference in choosing CFH trainee candidates will be for individuals with previous SRO licenses or fuel handing experience, is acceptable because it provides an interval that is consistent with 10 CFR 55.59(a)(1) and helps ensure that CFH trainee candidates have prior relevant experience, when practicable.

Based on the above, the NRC staff concludes that CFHTRP Section 1 is acceptable.

CFHTRP Section 2, “Experience/Qualifications,” states:

> *2.1. CFH Supervisor - shall have at least 5 years of experience in irradiated fuel movements and demonstrated knowledge of the relevant NRC regulations and ALARA principles. Successfully completed college-level work in the nuclear and radiation related fields of study may be considered in lieu of the experience requirement. Maintain health/medical requirements required for the CFH job. The biennial CFH Health Questionnaire will be used to assess health/medical requirements.*
>
> *2.2. CFH - shall have at least 2 years of experience in irradiated fuel movements and demonstrated knowledge of the relevant NRC regulations and ALARA principles. Successfully completed college-level work in the nuclear and radiation related fields of study may be considered in lieu of the experience requirement. Maintain health/medical requirements required for the CFH job. The biennial CFH Health Questionnaire will be used to assess health/medical requirements.*
>
> *2.3. President - shall have at least 7 years of experience in irradiated fuel movements and demonstrated knowledge of the relevant NRC regulations and ALARA principles. Successfully completed college-level work in the nuclear and radiation related fields of study may be considered in lieu of the experience requirement. Maintain health/medical requirements required for the CFH job. The biennial CFH Health Questionnaire will be used to assess health/medical requirements.*

The NRC staff reviewed the proposed CFHTRP Section 2. The NRC staff finds that Section 2.1 provides a description of the CFH Supervisor experience and qualification requirements that is reasonable given the role of the CFH Supervisor; helps ensure that the CFH Supervisor has experience and/or education that is relevant to the role; generally exceeds the guidance in ANSI/ANS-15.4-2007 for background qualifications for the Level 3 position (i.e., Reactor Supervisor) at an operating research reactor; and is consistent with proposed ARRR TS 12.1.3. In addition, the NRC staff finds that CFHTRP Section 2.1, in conjunction with Section 7, provides requirements that will help ensure that CFH Supervisors are medically qualified. Therefore, the NRC staff finds that CFHTRP Section 2.1 is acceptable.

The NRC staff finds that Section 2.2 provides a description of the CFH experience and qualification requirements that is reasonable given the role of the CFH; helps ensure that the CFH has experience and/or education that is relevant to the role; generally exceeds the guidance in ANSI/ANS-15.4-2007 for background qualifications for the Level 4 position (i.e., SROs and ROs) at an operating research reactor; and is consistent with proposed ARRR TS 12.1.5. In addition, the NRC staff finds that CFHTRP Section 2.2, in conjunction with

Section 7, provides requirements that will help ensure that CFHs are medically qualified. Therefore, the NRC staff finds that CFHTRP Section 2.2 is acceptable.

The NRC staff finds that Section 2.3 provides a description of the experience and qualifications required for the Aerotest president that exceeds the experience and qualification requirements for a CFH or CFH Supervisor in the proposed ARRR TSs (as indicated in CFHTRP Section 3.3, the President may be a CFH or CFH Supervisor, but the ARRR TSs do not include any separate experience or qualification requirements for the President) and that it is, therefore, acceptable.

Based on the above, the NRC staff concludes that CFHTRP Section 2 is acceptable.

CFHTRP Section 3, “Duties,” states:

> *3.1. CFH Supervisor - The CFH Supervisor is a non-licensed operator who has qualified in accordance with a fuel handler training program approved by the NRC. They will supervise other CFHs and perform CFH duties.*
>
> *3.2. CFH - The certified fuel handler is a non-licensed operator who has qualified in accordance with a fuel handler training program approved by the NRC.*
>
> > *3.2.1. The CFH does not make decisions on fuel handing, decommissioning or radiation. Those are made by the Reactor Administrator or Radiation Safety Officer (RSO).*
> > *3.2.2. The CFH only handle fuel when need and only handle 1 fuel element at a time.*
> > *3.2.3. Fuel handling obligations include maintenance, periodic fuel inspections and/or putting the spent fuel in transportation caskets for fuel shipment from facility.*
>
> *3.3. President - He may hold the title CFH and/or CFH Supervisor. Will oversee CFH training, testing and evaluate/scores on Written Test and Job Performance Measures.*
>
> *3.4. Reactor Safeguards Committee-Designated member of committee who is not an Aerotest Operations Inc. member (employee) will oversee president’s CFH training, testing and evaluate/scores on his Written Test and Job Performance Measures.*

The NRC staff reviewed the proposed CFHTRP Section 3. The NRC staff finds that Section 3.1 provides an appropriate description of the CFH Supervisor duties that is consistent with proposed ARRR TS 12.1.3 and that it is, therefore, acceptable.

The NRC staff finds that Section 3.2 provides an appropriate description of the CFH duties that is consistent with previous NRC-approved CFH training and retraining programs for permanently shutdown and defueled nuclear power reactors and the proposed ARRR TSs and that it is, therefore, acceptable.

The NRC staff finds that Section 3.3 designates an appropriate individual, the Aerotest President, to oversee CFH training and testing. The NRC staff also finds that, since Section 3.3 states that the President may be a CFH and/or CFH Supervisor, Section 3.4

appropriately designates another individual to oversee the President's training and testing if the President is a CFH and/or CFH Supervisor. Therefore, the NRC staff finds that Sections 3.3 and 3.4 are acceptable.

Based on the above, the NRC staff concludes that CFHTRP Section 3 is acceptable.

CFHTRP Section 4, "Initial Training Program," states:

> *The initial training phase of the Certified Fuel Handler Training Program consists of lecture, and/or self-study of topics appropriate to the monitoring, handling, storage, and cooling of nuclear fuel, and includes training on CFH tasks as well as required fundamental topics.*
>
> *4.1. Lectures and Self Study Topics to be covered include.*
>
> *4.1.1. Design, function, and operation of systems used in handling, storage, cooling, monitoring of nuclear fuel, and auxiliary support systems.*
> *4.1.2. Purpose and operation of the radiation monitoring systems.*
> *4.1.3. Radiological safety principles and procedures including radiation hazards that may arise during normal and maintenance activities. . [sic]*
> *4.1.4. Conditions and limitations of facility license, including content, basis, and importance of Technical Specifications.*
> *4.1.5. Assessment of facility condition and selection of appropriate procedures during normal, and emergency situations.*
> *4.1.6. Fuel handling facilities and procedures.*
>
> *4.2 On the Job CFH Training*
>
> *4.2.1 Understand annunciators; valve, pump, and breaker status indicators; and instrument readings as necessary to determine/perform appropriate remedial actions.*
> *4.2.2 Manipulate the fuel handling tool to obtain desired results during normal, and emergency conditions.*
> *4.2.3 Understand radiation monitoring system readings, including alarm conditions, to determine appropriate actions.*
> *4.2.4 Understand emergency conditions and remedial actions to be implemented according to the emergency plan for the facility.*
>
> *4.3 A comprehensive final examination shall be administered at the end of the initial training program to provide assurance of mastery of the skills, knowledge, and abilities required for successful performance of Certified Fuel Handler tasks. The comprehensive examination shall include a written examination and an operating examination. Areas examined are described in 4.1 and 4.2.*
>
> *4.3.1 The written examination requires a minimum score of 80 percent to pass.*
> *4.3.2 The operating examination will consist of Job Performance Measures (JPMs). Passing criteria for an individual JPM is that the examinee successfully completes the assigned task in accordance with the governing procedure without missing any critical steps. Missed or incorrectly performed critical steps are the bases for JPM failure.*

4.3.3 An individual who fails to pass either the written or operating examination shall not perform Certified Fuel Handler duties independently until he/she has completed a remedial training program and passes an appropriate reexamination. Only those portions of the original examination that were failed need to be reexamined (i.e., written, or operating exam).

The NRC staff reviewed the proposed CFHTRP Section 4. Per ANSI/ANS-15.4-2016, Section 5.2, an initial training program should be established at each reactor facility based on the knowledge and skill required for ROs and SROs to perform their functions safely and effectively. The guidance states that training methods may include both classroom, self-study, and on-the-job training, and training should include both general training (e.g., general nuclear, reactor technology, and radiation protection principles) and specific training (e.g., training relevant to the individual facility and its systems, design, and operation).

The regulation at 10 CFR 55.59(c)(2) describes topics for lectures during requalification programs for ROs and SROs, stating that:

> The requalification program must include preplanned lectures on a regular and continuing basis throughout the license period in those areas where operator and senior operator written examinations and facility operating experience indicate that emphasis in scope and depth of coverage is needed in the following subjects:
>
> i. Theory and principles of operation.
> ii. General and specific plant operating characteristics.
> iii. Plant instrumentation and control systems.
> iv. Plant protection systems.
> v. Engineered safety systems.
> vi. Normal, abnormal, and emergency operating procedures.
> vii. Radiation control and safety.
> viii. Technical specifications.
> ix. Applicable portions of title 10, chapter I, Code of Federal Regulations.

The regulation at 10 CFR 55.59(c)(3) states that the requalification program must also include on-the-job training such that operators perform appropriate plant control manipulations during the term of the operator's license, demonstrate satisfactory understanding of the operation of the apparatus and mechanisms associated with the control manipulations, have appropriate knowledge of operating procedures, are cognizant of facility design, procedure, and license changes, and review the content of abnormal and emergency procedures on a regularly scheduled basis.

Although the guidance in ANSI/ANS-15.4-2016, Section 5, and the requirements in 10 CFR 55.59(c)(2) and 10 CFR 55.59(c)(3) are not applicable for ARRR CFH initial training, the NRC staff reviewed the information in ARRR CFHTRP Sections 4.1 and 4.2 in consideration of this guidance and these requirements. The NRC staff finds that CFHTRP Sections 4.1 and 4.2 require lecture or self-study, and on-the-job training, as part of the initial CFH training program, consistent with ANSI/ANS-15.4-2016 recommendations for initial training of ROs. Additionally, the NRC staff finds that the CFHTRP includes lecture or self-study, and on-the-job training, topics and areas that are both general and facility-specific and are appropriately consistent with ANSI/ANS-15.4-2016, 10 CFR 55.59(c)(2), and 10 CFR 55.59(c)(3) (considering the role of the CFH and the characteristics of and types of activities conducted at the permanently shutdown ARRR). The NRC staff finds that the CFH experience and qualification requirements in CFHTRP Section 2, in conjunction with the initial

training requirements in CFHTRP Section 4, will help ensure that CFHs have appropriate general nuclear and radiological safety knowledge. Furthermore, the NRC staff finds that the topics listed in Sections 4.1 and 4.2 help ensure that CFHs will have appropriate knowledge and experience such that the three broad-scope objectives, discussed earlier in this section of this SE, are appropriately met, considering the characteristics of and types of activities conducted at the permanently shutdown ARRR (although the ARRR CFHTRP does not explicitly discuss "familiarity with decommissioning," the NRC staff notes that the CFHTRP includes other topics such as familiarity with emergency planning, TSs, facility design, and radiation protection, that are appropriate knowledge for the staff at a facility undergoing decommissioning). The NRC staff also finds that, based on the information in CFHTRP Section 1.2, the CFH initial training described in CFHTRP Sections 4.1 and 4.2 will be appropriately based on a SAT. Therefore, the NRC staff finds that the CFH initial training described in Sections 4.1 and 4.2 is acceptable.

The guidance in ANSI/ANS-15.4-2016, Sections 5 and 6, states that initial training and requalification programs for ROs or SROs should include written, operating, and oral examinations. Additionally, 10 CFR 55.59(c)(4) requires that requalification programs for ROs and SROs including written and operating tests.

Although the guidance in ANSI/ANS-15.4-2016, Sections 5 and 6, and the requirements in 10 CFR 55.59(c)(4) are not applicable for ARRR CFH initial training, the NRC staff reviewed the information in ARRR CFHTRP Section 4.3 in consideration of this guidance and these requirements. The NRC staff finds that CFHTRP Section 4.3 requires successful completion of written and operating tests at the completion of initial CFH training, before a CFH candidate can independently perform CFH duties, appropriately consistent with ANSI/ANS-15.4-2016 recommendations for ROs (although ANSI/ANS-15.4-2016 states that written and operating tests should be conducted by "the responsible authority," e.g., the NRC, the ARRR CFHTRP specifies that these tests are conducted by Aerotest). The NRC staff finds that the minimum 80 percent score to pass the written examination is consistent with the guidance in ANSI/ANS-15.4-2016, Section 5.5 (which specifies a minimum 70 percent score). The NRC staff understands that in order to pass the operating exam as stated in ARRR CFHTRP Section 4.3.2, all Job Performance Measures (JPMs) have to be successfully completed. The NRC staff also finds that the CFHTRP requirement for remedial training and reexamination of CFH candidates that do not pass either the written or operating exam is appropriately consistent with ANSI/ANS-15.4-2016, Section 5.5, and 10 CFR 55.59(c)(4) and that it helps determine areas where additional training is needed and helps ensure that any specific knowledge deficiencies are resolved before CFH duties are independently performed. The NRC staff additionally finds that, based on the information in CFHTRP Section 1.2, the CFH evaluations described in CFHTRP Section 4.3 will be appropriately based on a SAT. Therefore, the NRC staff finds that the examination requirements described in Section 4.3 are acceptable.

Based on the above, the NRC staff concludes that CFHTRP Section 4 is acceptable.

CFHTRP Section 5, "Retraining Program," states:

> *All certified fuel handlers will participate in the biennial retraining program. The Certified Fuel Handler Retraining Program consists of lectures and/or self-study of topics appropriate to the monitoring, handling, storage, and cooling of nuclear fuel. The content of the retraining program will be based upon the tasks selected during program development for the retraining cycle. A retraining plan will be developed and will be*

approved by the President. The training plan will be developed utilizing the systematic approach to training (SAT). Certified Fuel Handlers (CFH) will spend a minimum of 8 hours biennially on preplanned lectures and/or self-study.

5.1. Lectures and Self Study Topics to be covered include:

5.1.1. Design, function, and operation of systems used in handling, storage, cooling, monitoring of nuclear fuel, and auxiliary support systems.
5.1.2. Purpose and operation of the radiation monitoring systems.
5.1.3. Radiological safety principles and procedures including radiation hazards that may arise during normal and maintenance activities.
5.1.4. Conditions and limitations of facility license, including content, basis, and importance of Technical Specifications.
5.1.5. Review of facility condition and procedures during normal and emergency situations.
5.1.6. Fuel handling facilities and procedures.

5.2 On the Job CFH Training

5.2.1 Understand annunciators; valve, pump, and breaker status indicators; and instrument readings as necessary to determine/perform appropriate remedial actions.
5.2.2 Manipulate the fuel handling tool to obtain desired results during normal, and emergency conditions.
5.2.3 Understand radiation monitoring system readings, including alarm conditions, to determine appropriate actions.
5.2.4 Understand emergency conditions and remedial actions to be implemented according to the emergency plan for the facility.

5.3 A comprehensive final examination shall be administered at the end of the retraining program to provide assurance of mastery of the skills, knowledge, and abilities required for successful performance of Certified Fuel Handler tasks. The comprehensive examination shall include a written examination and an operating examination. Areas examined are described in 5.1 and 5.2.

5.3.1 The written examination requires a minimum score of 80 percent to pass.
5.3.2 The operating examination will consist of Job Performance Measures (JPMs). Passing criteria for an individual JPM is that the examinee successfully completes the assigned task in accordance with the governing procedure without missing any critical steps. Missed or incorrectly performed critical steps are the bases for JPM failure.
5.3.3 An individual who fails to pass either the written or operating examination shall not perform Certified Fuel Handler duties independently until he/she has completed a remedial training program and passes an appropriate reexamination. Only those portions of the original examination that were failed need to be reexamined (i.e., written, or operating exam).

The NRC staff reviewed the proposed CFHTRP Section 5. Per ANSI/ANS-15.4-2016, Section 6, a program for the requalification of ROs and SROs should be established to refresh in areas of infrequent operation, to review facility and procedural changes, to address subject matter not reinforced by direct use, and to improve in areas of performance weakness. The

guidance states that the requalification program should include refresher training, reactivity manipulations, a written examination (once during a 24-month requalification period), and operating tests. As discussed above, 10 CFR 55.59(c)(2) and 10 CFR 55.59(c)(3) also provide requirements for requalification programs for ROs and SROs, including requirements for lectures and on-the-job training, and 10 CFR 55.59(c)(4) requires that requalification programs for ROs and SROs including written and operating tests. Both ANSI/ANS-15.4-2016 and 10 CFR 55.59(c)(4) specify annual operating tests (i.e., two tests conducted during the 2-year requalification program duration).

Although the guidance in ANSI/ANS-15.4-2016, Section 6, and the requirements in 10 CFR 55.59(c) are not applicable for ARRR CFH retraining, the NRC staff reviewed the information on retraining in ARRR CFHTRP Section 5 in consideration of this guidance and these requirements. The NRC staff finds that the lecture, self-study, and on-the-job training topics and requirements, and the requirements for written and operating exams, are substantially similar to those in CFHTRP Section 4 for initial training, which the NRC staff found appropriate and acceptable as discussed above. The NRC staff finds that the on-the-job training during the 2-year retraining cycle, in conjunction with the CFHTRP Section 6.1 requirement to actively perform CFH duties during the retraining cycle, is an appropriate substitute for periodic reactivity manipulations typically required for ROs and SROs because reactivity manipulations are not applicable for the permanently shutdown ARRR. The NRC staff also finds that although regulations and guidance for ROs and SROs specify annual operating tests for requalification programs, the biennial interval for operating exams for ARRR CFHs is sufficient, considering the role of the CFH, the characteristics of and types of activities conducted at the permanently shutdown ARRR, and the CFHTRP Section 6.1 requirement to actively perform CFH duties each year during the retraining cycle. Although the topics in CFHTRP Section 5 do not specifically address review of facility and procedural changes during the retraining period, the NRC staff finds that CFHTRP Section 6.3 requires CFH review of changes and that this helps ensure that CFHs are appropriately aware of changes in the facility, procedures, or requirements that could affect CFH activities. The NRC staff finds that the topics listed in Sections 5.1 and 5.2 help ensure that CFHs will have appropriate knowledge and experience such that the three broad-scope objectives, discussed earlier in this section of this SE, are appropriately met, considering the characteristics of and types of activities conducted at the permanently shutdown ARRR. The NRC staff additionally finds that, based on the information in CFHTRP Section 1.2, and because CFHTRP Section 5 states that the retraining plan will be developed using a SAT, the retraining described in Sections 5.1 and 5.2 and the evaluations described in Section 5.3 will be appropriately based on a SAT. Based on the above, the NRC staff concludes that CFHTRP Section 5 is acceptable.

CFHTRP Section 6, “Active/Inactive Status,” states:

> *6.1 To maintain active status, each CFH shall "actively" perform 10 hours per year of CFH activities. If a CFH does not perform 10 hours of CFH activities per year he/she shall not perform Certified Fuel Handler duties independently until he/she has completed 5 hours of supervised CFH activities*
>
> .
>
> *6.2 Maintain health/medical requirements required for the CFH job. The biennial CFH Health Questionnaire will be used to assess health/medical requirements.*
>
> *6.3 Each CFH shall be cognizant of any changes to any part of the requirements and obligations for safe and secure fuel handling. Changes made in procedures*

and the facility and shall be reviewed before any scheduled activity that fuel is to be handled.

6.4 Each CFH shall participate in the biennial emergency drill. The drill and applicable alterations to emergency procedures shall be reviewed with all CFH within 30 days of the completed drill.

The NRC staff reviewed the proposed CFHTRP Section 6. The regulation at 10 CFR 55.53(e) specifies requirements for ROs and SROs to maintain active status. At a minimum, research and test reactor operators are required to actively perform the functions of a reactor operator or senior operator for 4 hours per calendar quarter. The regulation at 10 CFR 55.53(f) discusses requirements for inactive operators to return to active status. At a minimum, research and test reactor operators must actively perform the functions of a reactor operator or senior operator for 6 hours, under the direction of an active reactor operator or senior operator as appropriate, before returning to active status.

The NRC staff finds that CFHTRP Section 6.1 provides an appropriate description of the ARRR CFH Active/Inactive Status requirements that is consistent with the general intent of 10 CFR 55.53. Although the hours required (10 hours per year to maintain active status and 5 hours of supervised CFH activities (the NRC staff understands the term “supervised CFH activities” to mean CFH activities supervised by any active CFH) to return to active status) are less than the hours required by 10 CFR 55.53 for ROs and SROs (4 hours per quarter to maintain active status, and 6 hours of supervised activities to return to active status), the NRC staff finds that the required hours for ARRR CFHs are appropriate, considering the role of the CFH and the characteristics of and types of activities conducted at the permanently shutdown ARRR. Based on the above, the NRC staff finds that CFHTRP Section 6.1 is acceptable.

The NRC staff finds that CFHTRP Section 6.2, in conjunction with Section 7, provides requirements that will help ensure that CFHs are medically qualified and that CFHTRP Section 6.2 is, therefore, acceptable.

The NRC staff finds that CFHTRP Section 6.3, in conjunction with Section 5, provides requirements that will help ensure that CFHs are aware of applicable changes in the facility and procedures, consistent with the intent of guidance in ANSI/ANS-15.4-2016, Section 6, and that CFHTRP Section 6.3 is, therefore, acceptable.

The NRC staff finds that CFHTRP Section 6.4, in conjunction with Section 5, provides requirements that will help ensure that CFHs are adequately familiar with procedures for handling emergencies and that CFHTRP Section 6.4 is, therefore, acceptable.

Based on the above, the NRC staff concludes that CFHTRP Section 6 is acceptable.

CFHTRP Section 7, “Certified Fuel Handlers Heath [sic] Questionnaire and Review,” states:

7.1. All CFH applicants must fill out Aerotest Operations, Inc's CFH health questionnaire when they apply to become a CFH and biennially thereafter.

7.2. The President or his designate, will review the Health Questionnaire to determine that the candidate's medical condition is not such that it might cause operational errors that could endanger other plant personnel or the public health.

The NRC staff reviewed the proposed CFHTRP Section 7, which requires that the CFH applicants complete a Health Questionnaire initially at the time of their application and biennially thereafter. The President or designee is responsible to determine whether the candidate's medical condition is acceptable, using the Health Questionnaire. The NRC staff finds that the initial and biennial health review is generally consistent with the intent of the guidance in ANSI/ANS-15.4-2016, Section 7, which states that medical examinations should be conducted prior to initial licensing and no less than every 2 years thereafter and that the physical condition and general health of ROs and SROs should be such that they are capable of properly carrying out their duties under normal, abnormal, and emergency conditions. The NRC staff finds that the licensee has committed to performing the medical review using the President or designee to make the ultimate determination whether a CFH's medical condition is acceptable and that this is acceptable because of the limited role of the CFH as described above, because of the low risk-significance of the activities of the CFH for a possession-only facility, and because TS 11.4 requires a second person (in addition to the CFH) trained in radiation safety to be present during any fuel transfers. Based on the above, the NRC staff concludes that CFHTRP Section 7 is acceptable.

CFHTRP Section 8, "Records," states:

> *Records of the training requalification program will be maintained to document each CFH in the program. A summary document (log) will be maintained for each CFH that includes entries to support the CFH active-duty status, attendance dates for biennial lectures, and references for any on-the-job training activities. Records will also include copies of the written examination with the answers given by each CFH. Also, any additional training given in areas where CFH exhibited deficiencies. Records will be maintained until all fuel is shipped out of the facility and CFHs/CFH Supervisor are no longer needed.*

The NRC staff reviewed the proposed CFHTRP Section 8. The regulation at 10 CFR 55.59(c)(5) and the guidance in ANSI/ANS-15.4-2016, Section 9, provide requirements and recommendations related to documentation and records for requalification programs for ROs and SROs. Although these requirements and guidance are not applicable for the ARRR CFHTRP, the NRC staff reviewed the information in the ARRR CFHTRP in consideration of these regulations and guidance. The NRC staff finds that the information in CFHTRP Section 8 (and the attached "Checklist for CFH Training/Requalification Program") is appropriately consistent with 10 CFR 55.59(c)(5) and ANSI/ANS-15.4-2016, Section 9, and will help ensure that the licensee appropriately documents and maintains appropriate records of its CFHTRP. The NRC staff also finds that CFHTRP Section 8 requires CFHTRP records to be maintained for an appropriate period because the records will need to be maintained as long as fuel is present at the facility and the CFHTRP remains in place (as required by proposed ARRR LC 2.C.4). Therefore, based on the above, the NRC staff concludes that CFHTRP Section 8 is acceptable.

3.7.3 Conclusion on the Proposed ARRR Certified Fuel Handler Training and Requalification Program

Based on the discussion in Sections 3.7.1 and 3.7.2 of this SE, the NRC staff finds that Aerotest is not required to have NRC-licensed operators or an NRC-approved ORP following issuance of the proposed possession-only license and that Aerotest has proposed a reasonable alternative approach of designating CFHs and using an NRC-approved CFHTRP to ensure that it has appropriately trained and qualified staff to conduct fuel transfers in the reactor tank at the ARRR. Additionally, as discussed in Section 3.3 of this SE, the NRC staff has found that Aerotest has

proposed an acceptable CFHTRP and acceptable TSs that designate appropriate requirements related to CFHs. Therefore, based on the above, the NRC staff concludes that Aerotest's proposed elimination of NRC-licensed operators and replacement with CFHs is acceptable.

4.0 ENVIRONMENTAL CONSIDERATION

The amendment relates, in part, to changes in recordkeeping, reporting, or administrative procedures or requirements; changes in the position and titles of officers of the licensee; and changes in the format of the license and other editorial, corrective, or minor revisions. The amendment also relates, in part, to changing requirements with respect to the installation or use of facility components located within the restricted area as defined in 10 CFR Part 20. Pursuant to 10 CFR 51.22(b), no environmental assessment or environmental impact statement is required for any action within the category of actions listed in 10 CFR 51.22(c), for which the Commission has declared to be a categorical exclusion by finding that the action does not individually or cumulatively have a significant effect on the human environment.

The regulation at 10 CFR 51.22(c)(10) states, in part, that issuance of an amendment that "(ii) Changes recordkeeping, reporting, or administrative procedures or requirements; … (iv) Changes the name, position, or title of an officer of the licensee or permit holder, including but not limited to the radiation safety officer or quality assurance manager; or (v) Changes the format of the license or permit or otherwise makes editorial, corrective or other minor revisions, including the updating of NRC approved references" meets the definition of a categorical exclusion.

The regulation at 10 CFR 51.22(c)(9) states, in part, that issuance of an amendment that changes a requirement with respect to "installation or use of a facility component located within the restricted area," as defined in 10 CFR Part 20, meets the definition of a categorical exclusion, provided that the proposed change satisfies each of the following criteria:

(i) The amendment or exemption involves no significant hazards consideration; [10 CFR 51.22(c)(9)(i)]

Pursuant to 10 CFR 50.92, "Issuance of amendment," paragraph (c), the Commission may make a determination that a license amendment involves no significant hazards consideration if operation of the facility, in accordance with the amendment, would not:

(1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or [10 CFR 50.92(c)(1)]

The proposed changes to the ARRR Facility Operating License No. R-98 and the Appendix A, Technical Specifications, will amend the operating license to a possession-only license. In its letter dated June 28, 2019, the licensee declared the ARRR to be permanently shut down as of December 6, 2018, and proposed changes to the facility operating license consistent with a possession-only license, including the elimination of the authority to operate the reactor. In preparation for its possession-only license, the licensee removed all of the SNM-bearing fuel elements from the reactor and placed them in storage racks located in the reactor pool. The fuel elements will only be moved out of the storage racks, one fuel element at a time, for inspection or shipment out of the facility.

Most postulated accident scenarios previously evaluated assume that the reactor is operating at the time of the accident initiation; therefore, these accidents are no longer

applicable since reactor operation will be prohibited. However, a mishandling or malfunction of fuel accident is still applicable to the proposed possession-only status of the facility. This accident assumes a cladding breach and loss of fission products from the fuel. However, the facility has been shut down and not operated since 2012, and most of the significant fission products from the fuel that could become airborne have decayed and thus the consequences of a mishandling or malfunction of fuel accident are significantly less. Further, the licensee does not plan to handle fuel elements except for necessary purposes such as for performing inspections, if needed, or to load into a shipping container for final transport from the facility. Thus, the probability of a mishandling or malfunction of fuel accident is significantly less. Based on the above, the NRC staff finds that the proposed amendment would not increase the probability or consequences of an accident previously evaluated.

(2) *Create the possibility of a new or different kind of accident from any accident previously evaluated; or* [10 CFR 50.92(c)(2)]

The proposed possession-only license does not create the possibility of a new or different kind of accident from any accident previously evaluated because the fuel will remain in storage, with little expected movement, while the licensee awaits final disposition of the fuel and removal from the facility. Any activity associated with movement of the fuel will be done with existing procedures, which were approved and used while the facility was in an operating status and fuel movement was necessary to maintain the reactor operational. No new devices or equipment will be introduced relative to fuel movement. The licensee did procure and use 22 canisters to store damaged fuel elements identified in 2012. However, those canistered fuel elements will also remain in storage racks until eventual removal from the facility. The canisters provide an additional barrier to help ensure that any radioactive material remains contained and thus limits the potential for a release of radioactive effluents.

(3) *Involve a significant reduction in a margin of safety.* [10 CFR 50.92(c)(3)]

The proposed possession-only license will remove the authorization to operate the reactor and will require the licensee to maintain the fuel elements in storage until final removal from the facility. Elimination of reactor operation significantly reduces the fission product inventory in the stored fuel elements (through radioactive decay) and thus reduces any consequences from any postulated release of radioactive material. Given that the facility will not operate and that the fuel will be maintained in storage, moved only for limited and necessary purposes, the margin of safety as provided in the current TSs (for operation) is not significantly reduced (but, rather, greatly increased in the proposed possession-only TSs) as a result of the possession-only license.

Based on the above, the NRC staff concludes that the amendment authorizing the possession-only license amendment involves no significant hazards consideration.

(ii) *There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite; and* [10 CFR 51.22(c)(9)(ii)]

The ARRR ceased routine operations in 2010, and all operation after 2012. Therefore, the fuel has undergone several years of radioactive decay and the fission products in the fuel are significantly reduced. The release of fission products from the fuel is significantly less likely since the facility will no longer be authorized to operate and the stored fission

products in the fuel elements have decayed significantly over the shut down time period. Furthermore, the release of radioactive argon-41, generated from activation of stable argon-40 in air during the operation of the reactor, is no longer possible. Also, given that the possession-only license will not allow operation, and that no experiments will be authorized, there are no new types of effluents that can be created and potentially released from the facility.

(iii) *There is no significant increase in individual or cumulative occupational radiation exposure.* [10 CFR 51.22(c)(9)(iii)]

The possession-only license will authorize the storage of the fuel elements. The fuel elements will only be moved for inspection and transfer to the shipping cask for final removal from the facility. The fuel elements have decayed significantly since the reactor was last operated in 2012 and no experiments will be authorized in the possession-only license. Thus, the possession-only license should not cause any significant increase in individual or cumulative occupational exposure.

Based on the above, the proposed changes to requirements with respect to the installation or use of facility components located within the restricted area are subject to categorial exclusion pursuant to 10 CFR 51.22(c)(9). The changes to recordkeeping, reporting, or administrative procedures or requirements; changes in the position and titles of officers of the licensee; and changes in the format of the license and otherwise editorial, corrective, or other minor revisions are subject to categorial exclusion pursuant to 10 CFR 51.22(c)(10)(ii), (iv), and (v), respectively. Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment is required to be prepared in connection with the issuance of this amendment.

5.0 CONCLUSION

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

In order to reach this conclusion, the NRC staff determined that some of the proposed LCs and TSs could only be approved with minor changes. The NRC staff has included these changes in License Amendment No. 6 to Facility Operating License No. R-98 to allow for the approval of these proposed LCs and TSs. Specifically, the NRC staff made additional changes to proposed LCs 2.B.(2), 2.B.(3), and 2.C.(3) that were necessary for accuracy and clarity to allow for the approval of the LCs; the NRC staff made additional editorial changes to proposed LCs 2.C.(2), 2.C.(4), and 2.F that were necessary for clarity to allow for the approval of the LCs; and the NRC staff made additional editorial changes to proposed TSs 4.2, 7.2, 7.3, 7.7, 8.5.1, 11.3, 12.1.4, and 12.1.5 that were necessary for clarity and consistency purposes to allow for the approval of the TSs.

The Commission has also concluded, in part, that it cannot approve the licensee's proposed changes to TSs 2.2 and 2.3 because they would constitute a partial site release, because the licensee has not provided sufficient information supporting these changes, and because the changes are inconsistent with a possession-only license amendment. As a necessary conforming change associated with the Commission denial of the licensee's proposed changes to TSs 2.2 and

2.3, and the Commission approval of other proposed LC and TS changes, the NRC staff also deleted current TS 2.3 in License Amendment No. 6 to Facility Operating License No. R-98, because it is not applicable for the proposed possession-only license.

Principal Contributors: G. Wertz, NRR
E. Helvenston, NRR
E. Reed, NRR
P. Torres, NRR
Z. Gran, NRR
J. Goedjen, NRR

Date: December 6, 2021