

AEROTEST OPERATIONS, INC.
AEROTEST RADIOGRAPHY AND RESEARCH REACTOR
LICENSE NO. R-98
DOCKET NO. 50-228

RESPONSE TO NRC STAFF
REQUEST FOR ADDITIONAL INFORMATION
MARCH 26, 2020

REDACTED VERSION*

SECURITY-RELATED INFORMATION REMOVED

*REDACTED TEXT AND FIGURES BLACKED OUT OR DENOTED BY BRACKETS



AEROTEST OPERATIONS, INC.

3455 FOSTORIA WAY • SAN RAMON, CA 94583 • (925) 866-1212 • FAX (925) 866-1716

March 26, 2020

AEROTEST RADIOGRAPHY AND RESEARCH REACTOR
DOCKET NO. 50-228/LICENSE NO. R-98.

ATTENTION: Document Control Desk
U.S. Nuclear Regulatory Commission
White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

Subject: License and TS Amendments

Ladies and Gentlemen:

This letter and attachments are a follow up from the NRC staff's February 13, 2020 communication requesting for supplemental information.

This document presents relevant changes to the License and Technical Specifications needed to prepare for fuel storage and decommissioning activities. The Licensee proposes relevant text alterations and omissions that are needed to ensure the cessation and prevention of operation. The requested supplemental information is provided with the list of explanations, changes and justifications provided in Enclosure 1. A more extensive proposed amendments are shown in a "penciled" markup of the proposed License and TS (Enclosure 2). A Clean copy (Enclosure 3) with the changes included.

Should you have any questions or require additional information regarding this submission, please contact AO President David M. Slaughter, Ph.D. at (801) 631 5919 or dmsraven@gmail.com.

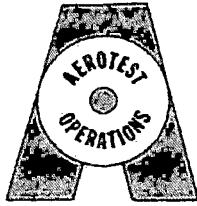
I declare under penalty of perjury that the statements above are correct and truthful.

Sincerely yours,

David M. Slaughter, Ph.D.
President, Reactor Administrator, Manager
Aerotest Operations, Inc.

Enclosures: 1. List of Explanations, Changes, and Justifications
 2. Mark-up of License and TS
 3. Clean copy of proposed License and TS

A020
NRR



AEROTEST OPERATIONS, INC.

3455 FOSTORIA WAY • SAN RAMON, CA 94583 • (925) 866-1212 • FAX (925) 866-1716

March 26, 2020

AEROTEST RADIOGRAPHY AND RESEARCH REACTOR
DOCKET NO. 50-228/LICENSE NO. R-98.

Explanation, Changes, and Justification to the text of the license R-98 are as follows:

RAI 1. The proposed decommissioning plan will be submitted on or before December 4, 2020 with the reactor license R-98 terminated December 5, 2024.

2F. Replace The amended license is effective as of the date of issuance and shall expire at midnight December 5, 2024.

Justification: Time Estimated from the draft decommissioning plan.

RAI 2 Corrections to license for consistency of status

2B.(2) Omit "in connection with operation of the reactor".

Justification: The reactor is no longer operating and in shutdown mode.

2B.(3) Omit "as may be produced by operation of the reactor".

Justification: The reactor is no longer operating and in shutdown mode.

2C.(3) Replace "10 CFR 2.790(d)" with "10 CFR 2.390." Remove "dated August 10, 1976, submitted by letter dated October 4, 1976, as revised January 16, 1976.

Justification: replace outdated regulatory reference with the current regulatory reference. Remove references to date of Security Plan, so we don't have to change license every time we change the plan.

Explanations, Changes, and Justification to the Technical Specifications:

RAI 3.0 Description of Fuel Storage

3.1 The storage of the fuel will be located at the bottom of the "core tank". The tank's construction is described in the Hazard Summary Report (SAR) page 19 and 20.

A wall mounted fuel element storage rack 6 feet above the floor contains up to [REDACTED] TRIGA elements. Three floor racks with capacity of [REDACTED] TRIGA fuel elements in each rack provides [REDACTED] total spaces. There are two floor racks for the storage of canisters, the larger rack can hold a total of [REDACTED] canisters and the smaller rack [REDACTED] canisters (See Figures 1 and 2). A single canaster contains a TRIGA fuel element in its entirety. Figure 3 shows the current locations of the storage racks at the bottom of the pool. No additional storage racks are needed. For completeness, the irradiated graphite elements are stored in the thermal column adjacent to the empty core structure.

While it is not anticipated or needed, storage of the fuel can be also be stored (dry or wet) in 6-14 inch diameter, 12 feet deep aluminum lined pits.



Figure 1. Design of 24 capacity canaster rack

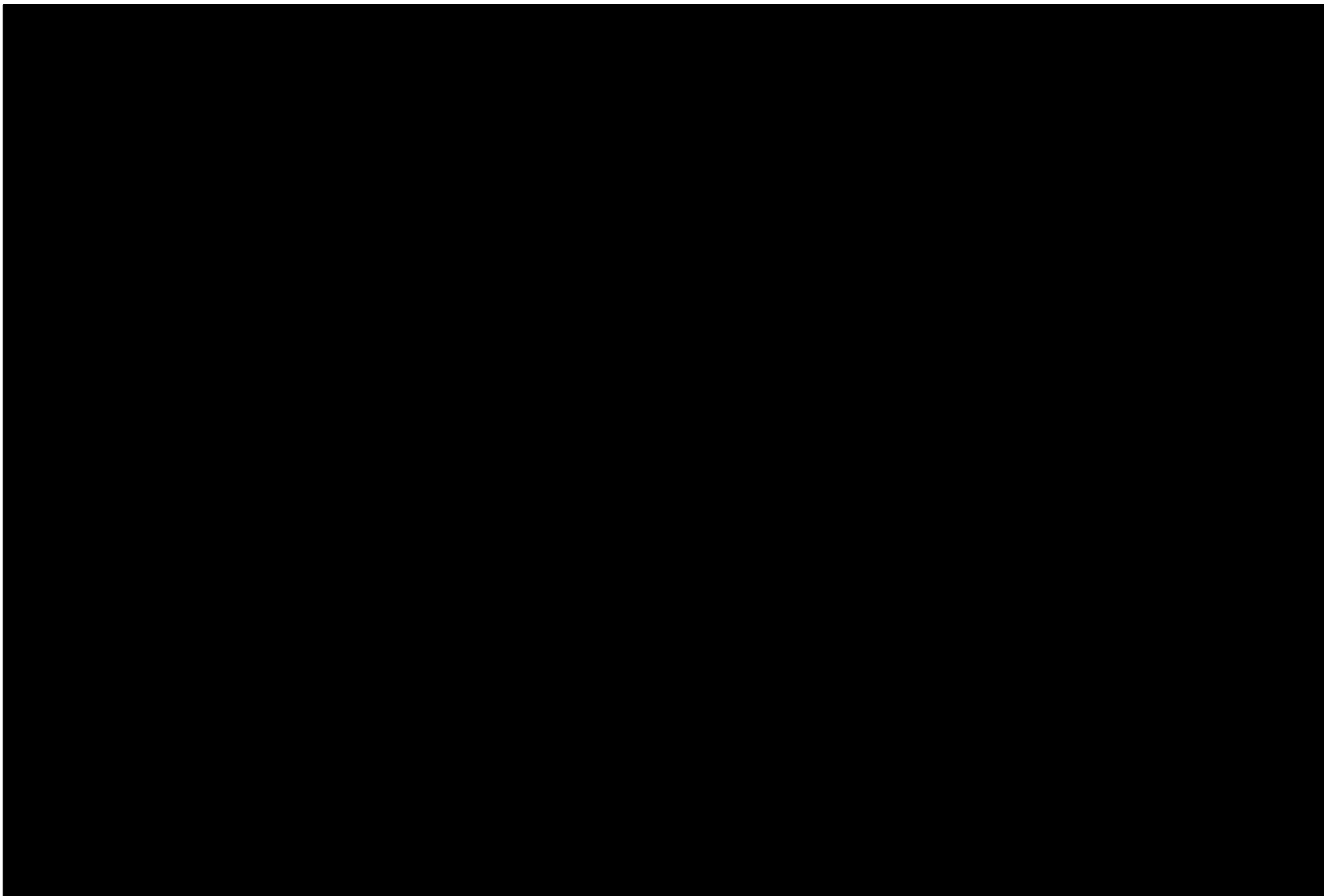


Figure 2. Design of 12 capacity canister rack

Figure 3. Location of side and floor racks

7-10-1988

TS 11.5 Replace with "No more than one fuel element shall be allowed in the facility which is not in storage. The only movement of the fuel elements are for required fuel element inspections, canister surveillances, rearrangement of fuel elements in storage, or final placement in the transportation cask." *Justification: Provided a more detailed description of type of movement and restrictions.*

3.2 The "necessary" conditions ensuring safe and secure conditions as bounded by US regulations 10 CFR 20 and 10 CFR 73. Three storage configurations were examined and evaluated. The results of the realistic scenarios meet 10 CFR 73 and 10 CFR 20 regulatory requirements; these include exposure limits for a posted Radiation Area when standing on top of the tank.

1. Water filled tank with fuel stored in bottom and shielding timber (measured 0.02 mrem/hr.)
2. Dry tank with fuel stored at bottom shielding timber. (MCNP estimated 80 mrem/hr.)
3. Dry tank with fuel stored at bottom with shielding timber with existing beam stop (MCNP estimated 50 mrem/hr.)

3.3 A safety review was performed using MCNP of the three conditions. The radiation field with the existing security natural and engineered barriers. The estimated radiation exposure was compared to those exposures allowed by regulation. The MCNP modeled results suggest that the three conditions are more conservative than necessary. Thus, either wet or dry configuration is acceptable. The MCNP analyses and findings are available for inspection by NRC staff.

The report is organized by section as follows:

Section 1 Description of models, assumptions and key parameters.

Section 2 Confirmation of pervious storage rack analyses. ($k_{eff} < 0.8$)

Section 3 Storage strategies in pool and generated radiation fields

Section 4 Radiation field produced with a single element out of pool with and without transport cask

Section 5 Summary of all findings

3.4 An unlikely credible accident would be an element dropping from the transfer cask a few feet in air to the floor. The result of accidental releases in the pool will have a negligible impact. If accidentally released outside the pool during a transfer process, the affect will be an elevated radiation field until retrieved.

RAI 4. The Emergency and Security Plans include the changes associated with the requested possession-only status. The emergency plan was submitted under separate cover following 10 CFR 50.54. q(3) while the Security Plan was submitted under 10 CFR 50.54 p(2).

RAI 5.0 Changes to Facility Without License Amendment.

Design functions for Possession-Only-Status are to provide a radiation exposure that meets the regulatory personnel safety limits that is outlined in 10 CFR 20 and to maintain reasonable the security barriers for fuel storage in fulfillment of 10 CFR 73.

Add TS "1.10 Changes

Changes means a modification or addition to or removal from, the facility or procedures that affects a design functions, and method of performing or controlling the function."

Add TS “12.2.1.4 Changes to Facility Without License Amendment.”

The licensee shall make changes to the facility without NRC approval when a change to license/technical specification is not required.

Changes can be made without RSC approval to procedures and methods which does not reduce the existing effectiveness of the design functions.

Changes that may, in their implementation, reduce the effectiveness of the design functions are considered unreviewed and shall be reviewed and approved by RSC.

Changes shall be documented and retained by the licensee and made available upon inspection by the NRC. Records should be held as required by appropriate regulations.

RAI 6.0 Criticality of Storage Racks

The criticality assessment of the floor storage racks was obtained From General Atomics Division with the analysis documented in a report written by General Atomics, F.C. Foushee, “Storage of TRIGA Elements” General Atomics Division, La Jolla, Ca 1966. Two of the storage floor racks were manufactured near the time of the publication. A third of similar design was fabricated in 1981. At that time, additional storage was needed to accommodate fuel elements from a vacated core. Developing current storage strategies, MCNP modeling of the storage racks confirm the validity of General Atomics’ design.

As for the stainless-steel canisters, the design, analysis and manufacture were performed by Secured Transportation Services, LLC, (STS). The stainless-steel canister and accompanying aluminum storage rack design evaluated the criticality limit in order to ensure the use of the canister and storage rack did not affect, alter or invalidate the current licensed condition. At 2012, their analysis was reviewed by AO operating staff, RSC members and, as a courtesy, NRC staff. (No TS changes were required.) The current MCNP evaluation of storage configuration confirmed STS’s claim that criticality limits for storage was met. In addition, NRC staff reviewed procedures and was present for the fuel inspection and canning processes.

RAI 7

TS 6.0 Reactor Safety System *Insert* “Safety systems functions described in Table 1 will be performed as long as fuel is being stored.”

Justification: to clarify safety systems still in place.

RAI 8

TS 12.1.2 Remove “and experiments”

Justification: not doing experiments as the reactor is in shutdown mode.

RAI 9

TS 12.1.3.5 Remove “abnormal occurrences and”

Justification: clarification of what is being reviewed.

RAI 10

TS12.2.2 Replace "a qualified individual" with "Reactor Administrator"

Justification: clarification of who would do the approval.

RAI 11.0 Punctuation and Mathematical Notations

The AO document that we have includes the decimals at the appropriate locations. AO sent WORD files as requested by an August 5, 2019 email a two WORD files were submitted August 8, 2019. Reviewing the submitted Word files by AO, the electronic documents does not contain the omissions as detailed in Sections 11.1-11.5. It is not clear why the discrepancy exists.

While the proposed amended TS format is not consistent to the *guidance* document NUREG-1537, the current format contains all the relevant information. This current format allows for the direct comparison of the changes to the previously approved License and ARRR Technical Specifications. The inclusion or elimination of information from these documents and accompanying justification can easy be tracked.

RAI 12.0 Canister Design and Implementation

12.1 The canister was designed to encapsulate a cracked aluminum TRIGA fuel element under several possible dry/wet storage strategies. The environmental circumstance currently employed has the fuel element in dry storage under helium in the canister submerged in water. A drawing of the basic design is shown in Figure 4. The element is placed in the can underwater, the water is removed by back filling with inert gas (i.e., He, N₂ or air).

12.2 The basic material of the body and valving is 304 stainless-steel. The material list is provided on the drawing (Figure 4). The warranty lifetime was five years the canister lifetime is extensively longer given the robust design and the good water quality (low conductivity, neutral PH, and ambient temperature) for wet storage and low-humidity and temperature for dry storage. There is no anticipation for a canister failure or exchange; the deterioration of the metal O-ring is unlikely. The surveillance data for the canisters during the last 6 years have shown no signs of loss of the helium gas. The design allows for the replacement of inert gas with low conductivity, neutral PH pool water if desired.

In addition, studies by M.T. Simnad* show the U-ZrHx alloy encapsulates the fission products with its metallic matrix at lower temperature consistent with our storage conditions. (Our empirical data of water quality and radiation measurements from the pool water support that conclusion.)

* Simnad, M.T., "U-ZrHx Allow: Its Properties and Use in TRIGA Fuel," General Atomics, August 1980.

12.3 For wet storage, the only surveillance needed is to measure the weight of the canister containing the element and compare it to pervious measurements. Each canned element will be inspected within a 5-year period as suggested in NUREG 1537 guidance. For wet storage with water-filled canister, radiation measurements of water will be conducted and correlated, For dry storage, air sample measured above the pool will be conducted. (The water and air quality measurements are already part the current surveillance obligations.)

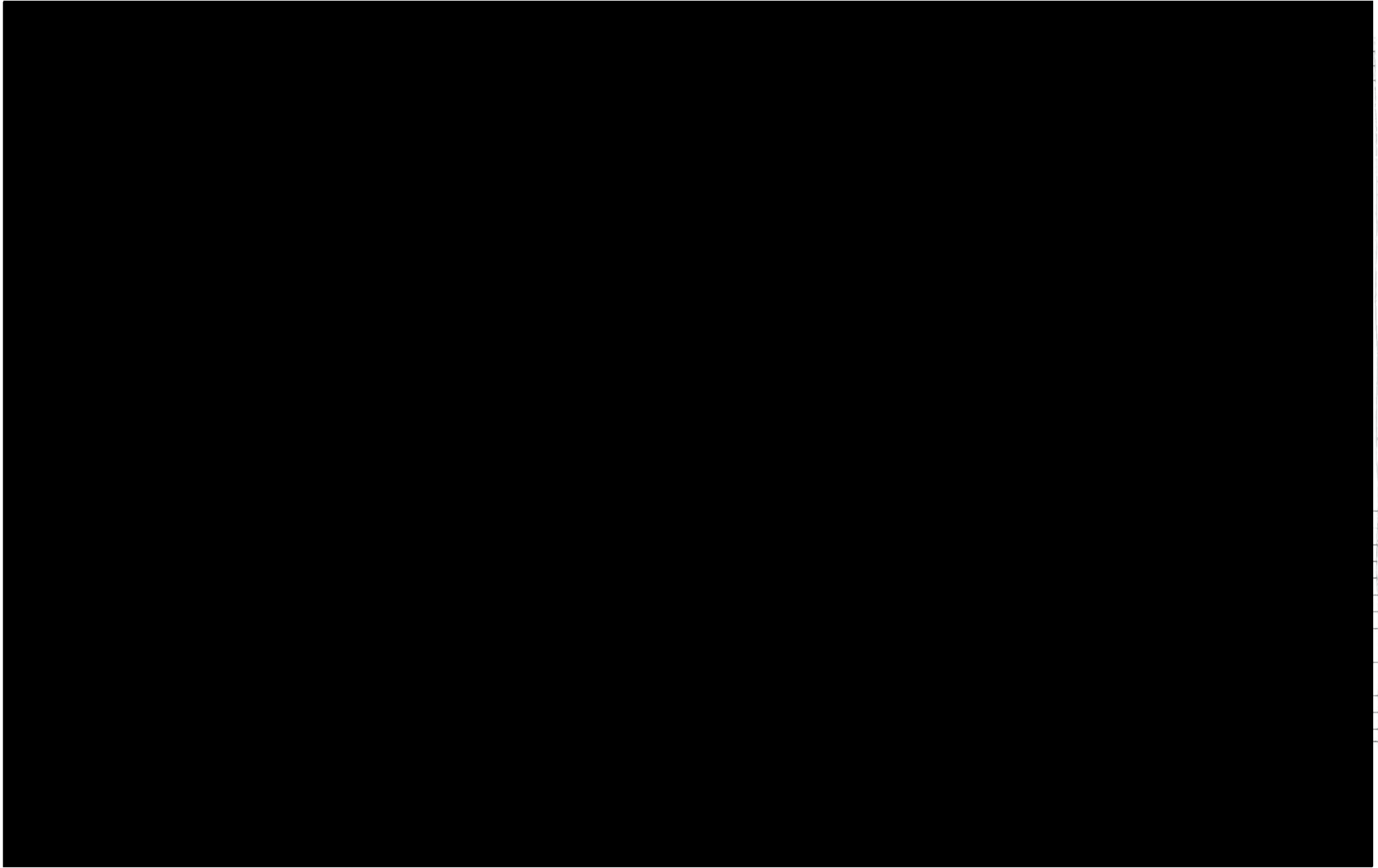


Figure 4. Design of canaster

AEROTEST OPERATIONS, INC.

DOCKET NO. 50-228

AEROTEST RADIOGRAPHY AND RESEARCH REACTOR (ARRR)

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 6

License No. R-98

1. The Nuclear Regulatory Commission (NRC or the Commission), having previously made the findings set forth in Amended Facility Operating License No. R-98 issued on January 28, 1981, has now found that:
 - A. The application for indirect transfer of license and conforming amendments to Amended Facility Operating License No. R-98, filed by Aerotest Operations, Inc., and Nuclear Labyrinth, LLC, dated May 30, 2012, and supplemented on July 19 and October 15, 2012; January 10, 2013; and April 21, June 16, August 22, and October 10, 2016, complies with the standards and requirements of the Atomic Energy Act of 1954 (the Act), as amended, and the rules and regulations of the Commission as stated in Title 10, Chapter I, "Nuclear Regulatory Commission," of the *Code of Federal Regulations* (10 CFR Chapter I).
 - B. Construction of the facility has been substantially completed in conformity with Construction Permit No. CPRR-86, and the application, as amended, the provisions of the Act and the rules and regulations of the Commission;
 - C. The facility will operate in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission;
 - D. There is reasonable assurance: (i) that the activities authorized by this operating license can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the rules and regulations of the Commission;
 - E. Aerotest Operations, Inc. is technically and financially qualified to possess, use, and operate the facility in accordance with the rules and regulations of the Commission;

- 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 issued 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 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 possess, and 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.

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 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.

10 CFR 2.390

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

F. This amended license is effective as of the date of issuance and shall expire at midnight on

DECEMBER 5, 2024

APPENDIX A

LICENSE NO. 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 with the fuel elements stored in storage racks that maintain a criticality of equal to or less than $0.8 k_{eff}$.

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.

1.10 Changes

2.0 Reactor Site

Changes mean a modification or addition to or removal from the facility or procedures that affects a design function and method of performing or controlling a function.

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.

2.3 The principal activities carried on within the exclusion area shall be those associated with the decommissioning of the ARRR reactor and the use of machine shop, electrical shop and chemistry laboratory.

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 in 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.

3.2 An alarm system shall be installed to detect unauthorized entry into the reactor building. The alarm system shall be monitored constantly and its annunciation shall be tested monthly.

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 $\mu\text{mho/cm}$.

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 Reactor Safety Systems

Reactor operations sequences, interlock and safety systems need not be operable since no fuel and/or reflector elements shall be allowed in the core lattice.

Safety System Functions in Table 1 will ~~be~~ still be performed as long as fuel is being stored.

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 fuel movement in reactor pool, a gas sample shall be continuously withdrawn from the roof vent above the reactor, or from the vicinity of the reactor bridge over the core structure, 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 in the control room. 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 analysis.
- 7.7 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. 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 reactor core.

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 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 Fuel Handling Supervisor when not authorized for use.

11.4 Transfer of irradiated fuel in the reactor tank shall be conducted by a minimum of staff of two, a Certified Fuel Handler (CFH) and an additional person trained in radiation safety. The staff shall monitor the operation using the appropriate radiation monitoring instrument. A RSO or designee shall be present for irradiated fuel transfers outside of the reactor tank but within the facility. Under no circumstances is fuel to be transferred to or stored in the core lattice.

11.5 ^{no} ~~Not~~ more than one fuel element shall be allowed in the facility which is not in storage.

The only movement of the Fuel elements are for Required fuel element Inspections, Canister Surveillance, Rearrangement of Fuel elements in Storage, OR Final placement in the transportation Cask.

12.0 Administrative Requirements

12.1 Organization

12.1.1 The Certified Fuel Handler Supervisor shall have the responsibility of the reactor facility. In all matters pertaining to fuel handling operations and to these Technical Specifications, the Certified Fuel Handler 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 President, Aerotest Operations, Inc.

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 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:

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

12.1.3.2 Reviewing facilities procedures and significant modifications;

12.1.3.3 Determining whether proposed 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, maintenance, equipment performance, and records;

12.1.3.5 Reviewing all reported abnormal occurrences and 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 President, Aerotest Operations, Inc.

12.1.4 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. Classroom education in the nuclear and radiation related fields of study may be considered in lieu of the experience requirement.

12.1.5 The Radiation Safety Officer shall have a minimum of 2 years of experience in personnel and environmental radiation monitoring programs. Classroom education in the nuclear and radiation related fields of study may be considered in lieu of the experience requirement.

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

12.2.1.3 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 a qualified individual. Such procedures shall be subsequently reviewed by the Reactor Safeguards Committee.

Reactor Administrator

12.3 Records

Maintain records required under the facility license and applicable regulations.

12.2.1.4

Changes to facility Without License Amendment.

The licensee shall make changes to the facility without NRC approval when a change to the license/technical specification is not required.

Changes can be made without RSC approval to procedures and methods which does not reduce the existing effectiveness of the design functions.

Changes that may, in their implementation, reduce the effectiveness of the design function are considered unreviewed and shall be reviewed and approved by RSC.

Changes shall be documented and retained by the licensee and made available upon inspection by the NRC. Records should be held as required by appropriate regulations

TABLE 1

SAFETY SYSTEM FUNCTIONS

SENSOR OR TRIP DEVICE	NO. OF SWITCHES OR SENSORS	ANNUNCIATOR AND ALARM SET POINT
High Temperature of Coolant Water	1	$\leq 130^{\circ} \text{ F}$
Low Pool Water Level	1	$\leq 1 \text{ ft max decrease}$
Seismic Disturbance	1	IV on Modified Mercalli Scale
Bridge Crane Location	1	When located off storage position
Area Radiation Monitor	1	$\leq 10 \text{ mr/hr}$
Water Radioactivity	1	$\leq 20 \text{ mr/hr}$
Demineralizer Water Flow	1	$\geq 4 \text{ gpm}$
Building Gas Effluent Monitor	1	$\leq 2 \text{ mr/hr}$

AEROTEST OPERATIONS, INC.

DOCKET NO. 50-228

AEROTEST RADIOGRAPHY AND RESEARCH REACTOR (ARRR)

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 6

License No. R-98

1. The Nuclear Regulatory Commission (NRC or the Commission), having previously made the findings set forth in Amended Facility Operating License No. R-98 issued on January 28, 1981, has now found that:
 - A. The application for indirect transfer of license and conforming amendments to Amended Facility Operating License No. R-98, filed by Aerotest Operations, Inc., and Nuclear Labyrinth, LLC, dated May 30, 2012, and supplemented on July 19 and October 15, 2012; January 10, 2013; and April 21, June 16, August 22, and October 10, 2016, complies with the standards and requirements of the Atomic Energy Act of 1954 (the Act), as amended, and the rules and regulations of the Commission as stated in Title 10, Chapter I, "Nuclear Regulatory Commission," of the *Code of Federal Regulations* (10 CFR Chapter I).
 - B. Construction of the facility has been substantially completed in conformity with Construction Permit No. CPRR-86, and the application, as amended, the provisions of the Act and the rules and regulations of the Commission;
 - C. The facility will operate in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission;
 - D. There is reasonable assurance: (i) that the activities authorized by this operating license can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the rules and regulations of the Commission;
 - E. Aerotest Operations, Inc. is technically and financially qualified to possess, use, and operate the facility in accordance with the rules and regulations of the Commission;
 - 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 issued 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 up to 5.0 kilograms of contained uranium 235, and
 - (3) Pursuant to the Act and 10 CFR Part 30, "Licensing of Byproduct Material,"
 - (1) to possess, and 2 curie americium-beryllium neutron startup source, and
 - (2) to possess, but not to separate, such byproduct material..
 - 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 2.390, entitled "Aerotest Operations, Inc. Security Plan" dated August 10, 1976, submitted by letter dated October 4, 1976, as revised January 16, 1979.

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

F. This amended license is effective as of the date of issuance and shall expire at midnight December 5, 2024.

APPENDIX A

LICENSE NO. 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 with the fuel elements stored in storage racks that maintain a criticality of equal to or less than $0.8 k_{eff}$.

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.

1.10 Changes

Changes means a modification or addition to or removal from, the facility or procedure that affects a design functions and method of performing or controlling the function.

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.

2.3 The principal activities carried on within the exclusion area shall be those associated with the decommissioning of the ARRR reactor and the use of machine shop, electrical shop and chemistry laboratory.

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 in 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.

3.2 An alarm system shall be installed to detect unauthorized entry into the reactor building. The alarm system shall be monitored constantly and its annunciation shall be tested monthly.

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 $\mu\text{mho/cm}$.

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 Reactor Safety Systems

Reactor operations sequences, interlock and safety systems need not be operable since no fuel and/or reflector elements shall be allowed in the core lattice. Safety System Functions table 1 will be performed as long as fuel is being stored in the pool

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 fuel movement in reactor pool, a gas sample shall be continuously withdrawn from the roof vent above the reactor, or from the vicinity of the reactor bridge over the core structure, 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 in the control room. 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 analysis.
- 7.7 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. 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 reactor core.

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 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 Fuel Handling Supervisor when not authorized for use.

11.4 Transfer of irradiated fuel in the reactor tank shall be conducted by a minimum of staff of two, a Certified Fuel Handler (CFH) and an additional person trained in radiation safety. The staff shall monitor the operation using the appropriate radiation monitoring instrument. A RSO or designee shall be present for irradiated fuel transfers outside of

the reactor tank but within the facility. Under no circumstances is fuel to be transferred to or stored in the core lattice.

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

12.0 Administrative Requirements

12.1 Organization

- 12.1.1 The Certified Fuel Handler Supervisor shall have the responsibility of the reactor facility. In all matters pertaining to fuel handling operations and to these Technical Specifications, the Certified Fuel Handler 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 involving radiological safety. He shall enforce rules, regulations and procedures relating to radiological safety, conduct routine radiation surveys and is responsible to the President, Aerotest Operations, Inc.
- 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 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:
- 12.1.3.1 Reviewing and approving nuclear safety standards associated with the use of the facility;
 - 12.1.3.2 Reviewing facilities procedures and significant modifications;
 - 12.1.3.3 Determining whether proposed procedures or modifications involve unreviewed safety questions, and are in accordance with these Technical Specifications;
 - 12.1.3.4 Conducting periodic audits of procedures, maintenance, equipment performance, and records;
 - 12.1.3.5 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;

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

12.1.4 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. Classroom education in the nuclear and radiation related fields of study may be considered in lieu of the experience requirement.

12.1.5 The Radiation Safety Officer shall have a minimum of 2 years of experience in personnel and environmental radiation monitoring programs. Classroom education in the nuclear and radiation related fields of study may be considered in lieu of the experience requirement.

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

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

12.2.1.4 Changes to facility Without License Amendment.
The licensee shall make changes to the facility without NRC approval when a change to the license/technical specification is not required.
Changes can be made without RSC approval to procedures and methods which does not reduce the existing effectiveness of the design functions.
Changes that may, in their implementation, reduce the effectiveness of the design function are considered unreviewed and shall be reviewed and approved by RSC.
Changes shall be documented and retained by the licensee and made available upon inspection by the NRC. Records should be held as required by appropriate regulations.

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

Maintain records required under the facility license and applicable regulations.

TABLE 1

SAFETY SYSTEM FUNCTIONS

<u>SENSOR OR TRIP DEVICE</u>	<u>NO. OF SWITCHES OR SENSORS</u>	<u>ANNUNCIATOR AND ALARM SET POINT</u>
High Temperature of Coolant Water	1	$\leq 130^{\circ} \text{ F}$
Low Pool Water Level	1	$\leq 1 \text{ ft max decrease}$
Seismic Disturbance	1	IV on Modified Mercalli Scale
Bridge Crane Location	1	When located off storage position
Area Radiation Monitor	1	$\leq 10 \text{ mr/hr}$
Water Radioactivity	1	$\leq 20 \text{ mr/hr}$
Demineralizer Water Flow	1	$\geq 4 \text{ gpm}$
Building Gas Effluent Monitor	1	$\leq 2 \text{ mr/hr}$