



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

June 8, 2018

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

SUBJECT: AEROTEST OPERATIONS, INC. – REVIEW OF THE RESTART PLAN FOR  
THE AEROTEST RADIOGRAPHY AND RESEARCH REACTOR  
(EPID NO. L-2018-LLL-0012)

Dear Dr. Slaughter:

By letter dated April 3, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18096A689), Aerotest Operations, Inc. (Aerotest) submitted an Aerotest Radiography and Research Reactor (ARRR) Restart Plan to the U.S. Nuclear Regulatory Commission (NRC). The ARRR has been shut down since 2010 (except for operations needed to conduct surveillances to demonstrate compliance with the ARRR license), and was defueled in 2012. Aerotest's letter included a request that the NRC staff review the plan "for the general approach, identified outcome, and schedule."

The purpose of this letter is to (1) confirm the NRC staff's understanding of Aerotest's request and (2) provide the results of the NRC staff's preliminary review of the ARRR Restart Plan.

The NRC staff reviews applications for research reactor licensing actions using the review plan, acceptance criteria, and evaluation findings in NUREG-1537, Part 2, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors - Standard Review Plan and Acceptance Criteria" (ADAMS Accession No. ML042430048). Guidance for preparing research reactor licensing applications may be found in NUREG-1537, Part 1, "Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors - Format and Content" (ADAMS Accession No. ML042430055). Aerotest's April 3, 2018, letter requested that the NRC staff review the ARRR Restart Plan, but it did not request any licensing action. Although no licensing action has been requested, because NUREG-1537, Parts 1 and 2, each contain guidance for research reactor initial startup and restart plans in Section 12.11, "Startup Plan," and because the ARRR Restart Plan, Section I, "Plan Overview," states that the plan uses NUREG-1537 as a guide, the NRC staff used NUREG-1537, Parts 1 and 2, to help inform a preliminary review of the ARRR Restart Plan. The NRC staff performed its preliminary review, in part, by evaluating whether the ARRR Restart Plan appears to include the information needed to be generally consistent with the guidance in NUREG-1537, Part 2, Section 12.11. Given that some information provided in the ARRR Restart Plan, particularly in Section II, "Fuel Element Selection," through Section VI, "ARRR Senior Reactor Operator Re-Training Program," is outside the scope of NUREG-1537, Parts 1 and 2, Section 12.11, the NRC staff also considered the guidance in other sections of NUREG-1537, as applicable, as part of its preliminary review.

Because no licensing action has been requested, and because, as discussed below, the ARRR Restart Plan is subject to further modification by Aerotest, the NRC staff did not seek to make any regulatory findings based on its preliminary review. Instead, the NRC staff performed its preliminary review in order to identify information that the NRC staff recommends should be included in the plan to help ensure that implementation of the plan would be in conformance with the NRC's regulations and the ARRR's licensing basis, and to help inform NRC staff inspections related to the restart of the ARRR.

In its April 3, 2018, letter submitting the ARRR Restart Plan, Aerotest stated that:

As each section of the [ARRR Restart Plan] is completed, a document package associated with the specific activity will be created to support the outcome. If any part of the general plan is modified, the justification for the change will be described and also be included with the evaluation, support materials, and outcome. These documents will be held at Aerotest and be available for NRC inspection at any time.

Consistent with this statement, in addition to the preliminary review of the ARRR Restart Plan that the NRC staff has conducted as discussed in this letter, the NRC staff plans to conduct inspections at the ARRR, which would, in part, review evaluations (including, but not limited to, evaluations conducted pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59, "Changes, tests, and experiments"), modifications to the ARRR Restart Plan, and/or other documents supporting or related to the ARRR Restart Plan or ARRR restart activities. The NRC staff inspections would determine whether there are findings of significance or inspector follow-up items (IFIs) related to significant issues with the documents.

Aerotest's April 3, 2018, letter submitting the ARRR Restart Plan also stated that the final two sections of the plan, Section VII, "Reactor Critical Assembly," and Section VIII, "Reactor Calibrations," "will not be initiated until the NRC indicates the Aerotest plan and evaluations are adequate." In addition, Aerotest's separate letter, also dated April 3, 2018 (ADAMS Accession No. ML18096A688), requesting closure of the NRC Confirmatory Action Letter No. NRR-2011-001, dated February 26, 2011 (ADAMS Accession No. ML103640183), related to Foreign Ownership, Control, or Domination, stated that "no movement of fuel for an approach to criticality measurement will be attempted until the necessary [Aerotest Reactor Safeguards Committee] and NRC approvals are granted." Based on these letters and the NRC's oversight process, the NRC staff's understanding is that Aerotest will not begin to reload the ARRR core or operate the ARRR until the NRC staff has (1) conducted inspections at the ARRR, which include additional review of the ARRR Restart Plan, as updated, and review of other documents related to the ARRR Restart Plan and (2) determined that, based on the results of its inspections of the documents, no findings of significance and no IFIs related to significant issues with the documents, are outstanding.

As it deems necessary, the NRC staff may also conduct additional inspections to observe Aerotest's implementation of its plans for core reloading and resumption of reactor operation.

The NRC staff requests that it be notified as soon as possible if your understanding of Aerotest's request for review of the ARRR Restart Plan, or if your understanding of Aerotest's plans not to complete certain activities related to the ARRR restart until the NRC staff has reviewed the ARRR Restart Plan, differs from the NRC staff's understanding, as outlined above (i.e., that the NRC staff is not taking a licensing action regarding the ARRR Restart Plan and restart activities, but will be overseeing the ARRR Restart Plan and restart activities in inspection space and that the core reloading and reactor restart will not proceed until NRC

inspections have determined that there are no outstanding findings of significance and no outstanding IFIs related to significant issues with the restart documents).

Based on its preliminary review of the ARRR Restart Plan, the NRC staff recommends that additional information be included in the plan to help reduce the possibility that the NRC staff's inspections will result in findings of significance or IFIs related to significant issues. This information is delineated in the enclosure to this letter.

The NRC staff further requests that, in order to facilitate the scheduling of the NRC inspections discussed above, Aerotest notify the NRC staff once it has (1) completed any revisions to the ARRR Restart Plan made after consideration of the items in the enclosure to this letter, and (2) completed any necessary evaluations associated with the ARRR Restart Plan or ARRR restart activities.

If you have any questions regarding the NRC staff's preliminary review of the ARRR Restart Plan, please contact me at 301-415-4067, or by electronic mail at [Edward.Helvenston@nrc.gov](mailto:Edward.Helvenston@nrc.gov). If you have any questions regarding NRC inspections at the ARRR, please contact Craig Bassett at 240-535-1842, or by electronic mail at [Craig.Bassett@nrc.gov](mailto:Craig.Bassett@nrc.gov).

Sincerely,

*/RA/*

Edward Helvenston, Project Manager  
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Division of Licensing Projects  
Office of Nuclear Reactor Regulation

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

Enclosure:  
As stated

cc: See next page

Aerotest Operations, Inc.

Docket No. 50-228

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SUBJECT: AEROTEST OPERATIONS, INC. – REVIEW OF THE RESTART PLAN FOR THE AEROTEST RADIOGRAPHY AND RESEARCH REACTOR DATED JUNE 8, 2018

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**ADAMS Accession No. ML18127B703**

**\*concurrence via e-mail**

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RECOMMENDED SUPPLEMENTAL INFORMATION  
REQUEST FOR REVIEW OF THE RESTART PLAN FOR  
THE AEROTEST RADIOGRAPHY AND RESEARCH REACTOR  
AEROTEST OPERATIONS, INC.

DOCKET NO. 50-228

LICENSE NO. R-98

By letter dated April 3, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18096A689), Aerotest Operations, Inc. (Aerotest) submitted a request for U.S. Nuclear Regulatory Commission (NRC) review of an Aerotest Radiography and Research Reactor (ARRR) Restart Plan.

The NRC staff recommends that the following additional information be included in the ARRR Restart Plan to help minimize the possibility that NRC staff inspections of the ARRR Restart plan and associated documents will result in findings of significance or inspector follow-up items related to significant issues with the documents.

1. Fuel Element Selection and Fuel Handling

- The ARRR Restart Plan does not appear to describe Aerotest's plan for handling and storage of fuel elements that are rejected for use in the core, or the fuel elements that were canistered and placed in storage in the reactor pool in 2012 (see NRC Inspection Report Nos. 50-228/2012-204 and 50-228/2012-206, which may be found at ADAMS Accession Nos. ML12213A001 and ML12361A147, respectively). The ARRR Restart Plan should be supplemented to discuss Aerotest's plan for these fuel elements when the ARRR is returned to operation.

2. Evaluation of Core Locations for Fuel, Graphite, and Control Elements

- The ARRR Restart Plan does not appear to describe whether the 57 element core discussed in the ARRR Restart Plan and illustrated in the ARRR Restart Plan, Figure 1, "ARRR Core Map" (or variations on this core that may be used), would be bounded by the current licensing basis for the ARRR. The ARRR Restart Plan also does not appear to discuss whether any evaluations related to core configurations that will be used have been, or will be, conducted pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.59, "Changes, tests, and experiments." The ARRR Restart Plan should be supplemented to discuss whether potential core configurations (including, for example, the neutronic and thermal-hydraulic parameters associated with those configurations) are consistent with the ARRR licensing basis, and whether any 10 CFR 50.59 evaluations associated with the new core configurations are needed.
- The ARRR Restart Plan states that it is anticipated that 39 stainless steel and 18 aluminum (total of 57) fuel elements are needed to generate an "operational core," but it does not appear to state the acceptance criteria for the approach-to-criticality measurement, i.e., the range of the minimum number of fuel elements that are predicted to be needed to reach criticality during the measurement. The ARRR Restart Plan

Enclosure

should be supplemented to include acceptance criteria for the approach-to-criticality measurement.

- The ARRR Restart Plan does not appear to discuss Aerotest's plans if acceptance criteria for its approach-to-criticality measurement or any other reactor measurements are not met (for example, if the upper range of the expected number of fuel elements needed to make the core supercritical is reached, but the core is still subcritical). The ARRR Restart Plan should be supplemented to discuss Aerotest's plans if its acceptance criteria are not met.
- The ARRR Restart Plan does not appear to discuss the excess reactivity loading of the ARRR core, (i.e., the loading of additional fuel elements beyond the element which makes the core supercritical). The ARRR Restart Plan should be supplemented to include Aerotest's plan for excess reactivity loading, such that the ARRR can be operated at full power as discussed in the ARRR Restart Plan, Section VIII, "Reactor Calibrations."
- The ARRR Restart Plan states that "[t]he temperature profile of the fuel element placed in the A-1 position will be estimated to ensure it does not exceed the Technical Specification [(TS)] limit," but does not appear to discuss whether this will be done by calculation, measurement, or both, or which specific TS is being used as the acceptance criterion. The ARRR Restart Plan should be supplemented to discuss how the temperature of the fuel element in the A-1 position, or other position which contains the hot element (the NRC staff notes that the core discussed in the ARRR Restart Plan does not appear to include a fuel element in the A-1 position) will be estimated, and what acceptance criterion will be used for fuel temperature.

### 3. ARRR Senior Reactor Operator Retraining Program

- The ARRR Restart Plan does not appear to discuss how Aerotest plans to have its NRC-licensed senior reactor operators (SROs) complete the reactor control manipulations required by the current NRC-approved ARRR Operator Requalification Program, dated July 2000 (ADAMS Accession No. ML050660128), such that the SROs can be requalified prior to the ARRR core reloading and restart. The ARRR Restart Plan should be supplemented to discuss Aerotest's plans for its SROs to satisfy this element of the requalification program.

### 4. Reactor Critical Assembly

- The ARRR Restart Plan does not appear to discuss Aerotest's license amendment request (LAR), dated March 29, 2018 (ADAMS Accession No. ML18093A385), and supplemented on April 30, 2018 (ADAMS Accession No. ML18127A075), that would delete current ARRR TS 6.6, which requires Aerotest to obtain subcritical multiplication plots from at least three instrumentation channels during a critical experiment. The ARRR Restart Plan should be supplemented to discuss the relationship between this LAR and the ARRR Restart Plan, specifically, whether NRC approval of this LAR is needed for Aerotest to proceed with activities in the ARRR Restart Plan.
- The ARRR Restart Plan states that "[p]rior to critical assembly, the integrity of all mechanical and electrical components shall be inspected and demonstrated," and that

“[t]he nuclear scram and annunciator circuits that are to remain operative are listed in [the ARRR Restart Plan, Table 2, ‘Scram and Annunciator Circuits Operative During Critical Assembly’].” However, the ARRR Restart Plan, Table 2, does not appear to include the master key switch and manual scram button scram circuits that are required by ARRR TS 6.2. Additionally, it is not clear whether “all mechanical and electrical components” refers to all ARRR components or only TS-required components. The ARRR Restart Plan should be supplemented to discuss testing and operability of the master key switch and manual scram button scram circuits that are required by ARRR TS 6.2, and to clarify which “mechanical and electrical components” shall be inspected and demonstrated to be operable.

- The ARRR Restart Plan states that the graphite elements in the “west side of ring F” will be loaded in the core after some fuel elements are loaded, but does not appear to describe at what point during core loading these graphite elements will be loaded. The ARRR Restart Plan should be supplemented to include a discussion of when these graphite elements will be loaded.
- The ARRR Restart Plan, Table 3, “ARRR Fuel Loading Sequence,” and Figure 1 appear to contain inconsistencies and/or typographical errors. The ARRR Restart Plan should be supplemented to include a fuel loading sequence and core map that are consistent within and with each other and the discussions in the text of the plan (for example, the statement that the regulating rod will not be relocated to the D ring during the reactor restart).

## 5. Reactor Measurements and Calibrations

- The ARRR Restart Plan does not appear to provide acceptance criteria for control rod worth measurements. The ARRR Restart plan should be supplemented to provide the acceptance criteria that will be used for these measurements (of differential and integral worth).
- The ARRR Restart Plan does not appear to include a reference for the statement that over the range of pool temperatures from 70 degrees Fahrenheit (F) to 90 degrees F, “with no cooling, the temperature will rise at an average rate of 8.14 [degrees] F per hour when operating at 250 [kilowatts thermal].” The ARRR Restart Plan should be supplemented to include a reference for this statement.
- The ARRR Restart Plan does not appear to include acceptance criteria for the calorimetric or reactivity loss to power (i.e., power coefficient of reactivity) measurements. The ARRR Restart Plan should be supplemented to include acceptance criteria for these measurements.
- The ARRR Restart Plan does not appear to discuss measurement of, or acceptance criteria for, shutdown margin. The ARRR Restart Plan should be supplemented to discuss these measurements and include appropriate acceptance criteria.
- The ARRR Restart Plan does not appear to discuss measurement of, or acceptance criteria for, area radiation fields and radioactive effluents following the commencement of reactor operation. The ARRR Restart Plan should be supplemented to discuss these measurements and include appropriate acceptance criteria.



- The ARRR Restart Plan does not discuss any specific surveillances or measurements that will be performed following the ARRR's return to operation to verify that the cladding of the fuel elements used in the operational core remains intact and no additional fuel damage results from the irradiation of the fuel elements. The ARRR Restart Plan should be supplemented to discuss any such surveillances or measurements that will be performed.

6. Restart Report

- The ARRR Restart Plan does not appear to discuss the contents and timing of a restart report to be submitted to the NRC summarizing the ARRR restart activities and tests. The ARRR Restart Plan should be supplemented to discuss the contents and timing of a restart report.