

September 26, 2012

Ms. Sandra Warren, General Manager  
Aerotest Operations, Inc.  
3455 Fostoria Way  
San Ramon, CA 94583

SUBJECT: AEROTEST OPERATIONS, INC. – NRC NON-ROUTINE INSPECTION  
REPORT NO. 50-228/2012-205

Dear Ms. Warren:

On September 10 - 12, 2012, the U.S. Nuclear Regulatory Commission (NRC or the Commission) completed an inspection at your Aerotest Radiography and Research Reactor facility (Inspection Report No. 50-228/2012-205). The enclosed report documents the inspection results which were discussed on September 12, 2012, with you and other members of your staff.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspector reviewed selected procedures and records and interviewed personnel. Based on the results of this inspection, no findings of significance were identified. No response to this letter is required.

In accordance with Title 10 of the *Code of Federal Regulations*, Section 2.390, "Public inspections, exemptions, and requests for withholding," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (Agencywide Documents Access and Management System (ADAMS)). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Should you have any questions concerning this inspection, please contact Craig Bassett at (301) 466-4495 or by electronic mail at [Craig.Bassett@nrc.gov](mailto:Craig.Bassett@nrc.gov).

Sincerely,

**/JNguyen for RA/**

Gregory T. Bowman, Chief  
Research and Test Reactors Oversight Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

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

Enclosure: NRC Inspection Report No. 50-228/2012-205  
cc w/encl: See next page

Aerotest Operations, Inc.

Docket No. 50-228

cc w/encl:

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U.S. NUCLEAR REGULATORY COMMISSION  
OFFICE OF NUCLEAR REACTOR REGULATION

Docket No: 50-228

License No: R-98

Report No: 50-228/2012-205

Licensee: Aerotest Operations, Inc.

Facility: Aerotest Radiography and Research Reactor

Location: 3455 Fostoria Way  
San Ramon, CA 94583

Dates: September 10-12, 2012

Inspector: Craig Bassett

Accompanied by: Gregory T. Bowman, Chief

Approved by: Gregory T. Bowman, Chief  
Research and Test Reactors Oversight Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

## EXECUTIVE SUMMARY

Aerotest Operations, Inc.  
Aerotest Radiography and Research Reactor  
Report No: 50-228/2012-205

The primary focus of this non-routine, announced inspection was the onsite review of Aerotest Operations, Inc. (the licensee's) fuel handling and inspection program and activities. The licensee's program was acceptably directed toward the protection of public health and safety, and in compliance with the U.S. Nuclear Regulatory Commission (NRC) requirements.

### Fuel Inspection and Handling

- Fuel inspections were completed and documented in accordance with the requirements specified by procedure.
- Following inspection of the fuel elements, 21 Al clad elements were found with cracked cladding and 1 with the beginning of a crack.

### Conformance to the Security Plan Requirements

- Security facilities, equipment, and procedures satisfied the Physical Security Plan requirements.

## REPORT DETAILS

### **Summary of Plant Status**

Aerotest Operations, Inc. (Aerotest or the licensee) had ceased to operate their TRIGA Conversion research reactor on October 15, 2010. Prior to that time the reactor had been operated for neutron radiography, to complete surveillance requirements, and for reactor operator training. During this inspection, the reactor remained shut down and all of the fuel and graphite elements, which had previously been removed from the core, remained in the appropriate storage rack locations.

#### **1. Background Information**

During December 5-12, 2011, the licensee attempted to complete an inspection of all the fuel to comply with their commitment to the U.S. Nuclear Regulatory Commission (NRC) of inspecting all the fuel elements every five years. After removing all the elements that they could, the licensee found that there were 27 aluminum (Al) clad elements and 11 graphite elements that were stuck in place and could not be removed from the core. The licensee then used their underwater video camera to conduct an inspection of those fuel elements. The licensee found that, of those elements that remained in the core, there were 4 that had signs of cracks in the cladding. At that point the licensee noted that they apparently had 5 Al fuel elements that had cracks in the cladding; 1 had been found previously in 2007.

On January 9, 2012, the licensee notified the NRC about the cracks that had been noted in the fuel elements. The licensee submitted a letter documenting the problems that same day. (The NRC had been notified of the cracked element removed from the core in 2007 by a phone conversation between the licensee and Project Manager on September 19, 2011.) On January 17-18, 2012, the NRC completed an inspection at the Aerotest Radiography and Research Reactor (ARRR) (see NRC Inspection Report No. 50-228/2012-201).

The licensee subsequently made the decision to remove the stuck fuel elements from the core. They decided to hire a contractor who would develop a project plan to remove all the elements and submit that proposed project plan to the licensee for approval. The contractor was also to develop reactor work instructions (RWIs) for the project. A company, Secured Transportation Services (STS), was chosen for the work.

During the period of July 16 - 26, 2012, licensee and contractor personnel were able to remove all the stuck fuel elements from the core and conduct an initial examination of the elements. The licensee then proceeded to examine all the Al clad elements and all of the Stainless Steel (SS) clad elements that were stored in the pool. During this fuel examination, the results were recorded using digital versatile discs (DVDs or an optical disc storage format system), so that the images could be reviewed in more detail at a later date. It was the intention of the licensee to place the fuel elements with cracks in the cladding in specially designed and fabricated canisters. Two elements were canned and placed in a designated storage rack. However, when it was determined that there were more fuel elements than had been anticipated with cladding problems, the licensee contracted to have more canisters and a much larger storage rack fabricated. All the

elements were placed in appropriate storage to await the opportunity to have the STS personnel return and assist in the canning of all the fuel elements with crack cladding. During that period the NRC completed an inspection at the ARRR (see NRC Inspection Report No. 50-228/2012-204).

On August 10, 2012, the licensee submitted a letter to the NRC documenting the fact that the inspection of the fuel elements at the facility indicated that there were a total of 22 fuel elements with cracks in the cladding. Also, further review of the DVD video documentation of the entire inventory of elements was scheduled to be conducted during the week of September 10, 2012.

## **2. Fuel Handling and Inspection Including Defueling Operations**

### **a. Inspection Scope (IP 69001)**

The inspector reviewed selected aspects of the following to verify that fuel inspection was being conducted as required by Technical Specifications (TS) Sections 5.1.1 and 11 and by procedure:

- Current Fuel Element Storage Location Map
- Selected Operational Log Sheets for the past three months
- Core Configuration Map for the period prior to December 2012
- Fuel Element Storage Location Map prior to December 2012
- Various current records and data sheets related to fuel movement
- Reactor Safeguards Committee (RSC) meeting minutes for 2011 and to date in 2012
- Fuel inspection and examination records including video of fuel inspection
- Listing of the Cracked Fuel Elements including the location of each

In addition, the inspector reviewed various DVDs showing the inspection of all the AI and SS clad fuel elements at the facility.

### **b. Observations and Findings**

#### **(1) Fuel Inspection**

During the fuel inspection activities that occurred in July, licensee and contractor personnel had placed an inspection stand in the pool to facilitate element inspection. Fuel element inspection was accomplished by placing each element vertically in the inspection stand and, using an underwater camera, observing the cladding along the length of the element. The element was then rotated one-sixth of a full rotation and the cladding along that portion of the element was observed. The process continued until all surfaces of each element were viewed. As noted above, all the visual observations of the fuel elements were documented and recorded on DVDs so that a closer examination could be conducted at a later time. Written notes were also taken to document the condition of each element. After the element inspection was complete, the licensee determined that there were 21 AI clad fuel elements which exhibited some

type of cracks – most had longitudinal crack but at least two had circumferential cracks toward the upper portion of the elements. One other fuel element appeared to have the beginning of a crack which raised the total number of elements with cracked cladding to 22. At that time, no cracks were noted in any of the SS clad elements.

During this inspection, the inspector verified that the fuel inspections were conducted in compliance with procedure. The inspector, along with various licensee personnel, carefully viewed the DVDs which contained the results of the fuel inspections completed in July. The condition of each element was noted including discoloration (if any), status of the tip of the element, any pits or other marks, any bowing, and the presence of any type of cladding cracks. The cracks in the cladding were readily visible in most instances but at times it was not readily apparent whether an element was cracked or whether it was just the lighting that made it appear as though there was a crack in the cladding. The inspector verified that there appeared to be 21 Al clad fuel elements with cracks in the cladding and 1 which appeared to have the beginning of a crack.

In addition to the 22 elements noted above, there were 2 other Al clad elements which had questionable marks on them. Upon viewing the DVDs of the all SS clad fuel elements, it appeared that there could be 2 with possible cracks in the cladding. The licensee agreed that 2 of the SS clad elements and 2 of the Al clad elements may need to be reexamined at a later date to determine whether or not they would need to be placed in canisters.

It was noted that the STS contractor personnel were tentatively scheduled to return the Aerotest facility during the week of December 10, 2012, to assist in the canning operation for all the elements with cracked cladding. Also, the licensee was planning on conducting a Root Cause or fault tree analysis concerning what might have caused the cladding to crack. The licensee was informed that the completion of a Root Cause or fault tree analysis concerning the cladding cracks would be tracked by the NRC as an Inspector Follow-up (IFI) item and would be reviewed during a future inspection (IFI 50-228/2012-205-01).

(2) TS Section 11 – Fuel Storage

TS Section 11 required that the licensee store fuel in specific locations. As in previous inspections, the inspector verified through direct observation that the licensee was not storing fuel in the floor of the Reactor Room although such storage was allowed. All fuel was stored in a locked vault or in the reactor pool/tank.

c. Conclusion

Fuel inspections were completed and documented in accordance with the requirements specified by standard procedure. There are 21 Al clad elements that were found with cracked cladding and 1 with the beginning of a crack.

**3. Conformance to Security Plan Requirements**

a. Inspection Scope (IPs 81401, 81402, 81431, 81810)

The inspector reviewed the following to verify compliance with Section 3.2 of the TS and with the licensee's NRC-approved Physical Security Plan (PSP) entitled, "Aerotest Radiography and Research Reactor Security Plan," last revised January 7, 2005:

- Access controls currently in effect
- Monthly Alarm Check List forms for 2012
- Emergency detection devices and physical barriers
- "Emergency Plan for the Aerotest Radiography and Research Reactor," last revised January 14, 2005, and last reviewed May 16, 2011
- Section III of the ARRR Procedures Manual entitled, "General Emergency Procedures," Permanent Change Notice (PCN) Number (No.) 4, RSC approval dated January 28, 2005
- Section V of the ARRR Procedures Manual entitled, "Security Procedures," PCN No. 3, RSC approval dated February 11, 2005

b. Observations and Findings

The inspector conducted an inspection of the PSP and response in June 2012 (refer to NRC Inspection Report No. 50-228/2012-203). During that inspection the inspector verified that the licensee was maintaining adequate security and control over the facility. As noted during the June 2012 inspection, the PSP in use by the licensee was the same as the version approved by the NRC. That version was dated January 7, 2005, and had last been reviewed on May 16, 2011.

During this inspection the inspector verified that the physical protection system, consisting of barriers, alarms, equipment, and instrumentation, remained in place and was as stipulated in the PSP. The system was being maintained and tested periodically as required by procedure. During the inspection the inspector observed a test of specific alarms at the facility.

c. Conclusion

Security facilities, equipment, training, and procedures satisfied PSP requirements.

**4. Exit Interview**

The inspection scope and results were summarized on September 12, 2012, with members of licensee management. The inspector described the areas inspected and discussed the inspection findings. Proprietary information was reviewed during the inspection however no material is included in this report.

## **PARTIAL LIST OF PERSONS CONTACTED**

### Licensee Personnel

C. Bauman	Research and Development Manager
A. Meren	Reactor Supervisor and Reactor Operations Manager
T. Richey	Neutron Radiography Manager
S. Warren	General Manager and Radiological Safety Officer
M. Wilkinson	Quality Assurance Manager

## **INSPECTION PROCEDURES USED**

IP 69001      Class II Non-Power Reactors

## **ITEMS OPENED, CLOSED, AND DISCUSSED**

### Opened

IFI	50-228/2012-205-01	Review the licensee's actions to complete a Root Cause or fault tree analysis concerning the fuel element cracked cladding problem.
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### Closed

None

## **PARTIAL LIST OF ACRONYMS USED**

10 CFR	Title 10 of the <i>Code of Federal Regulations</i>
ADAMS	Agencywide Documents Access and Management System
Al	Aluminum
ARRR	Aerotest Radiography and Research Reactor
DVDs	digital versatile discs
IFI	Inspector Follow-up Item
IP	Inspection Procedure
No.	Number
NRC	U.S. Nuclear Regulatory Commission
PCN	Permanent Change Notice
PSP	Physical Security Plan
RSC	Reactor Safeguards Committee
SS	Stainless steel
STS	Secured Transportation Services
TS	Technical Specification