



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
1600 EAST LAMAR BOULEVARD
ARLINGTON, TEXAS 76011-4511

April 20, 2026

EAF-RIV-2025-0169
NMED Item 240089

Col. John R. Smith
Col. Robbie L. Wheeler
The Department of the Air Force
Air Force Medical Command (AFMEDCOM)
7700 Arlington Blvd; AFMEDCOM/A4/10R
Falls Church, Virginia 22042

SUBJECT: NRC REACTIVE INSPECTION REPORT 030-28641/2024-001 AND
INVESTIGATION REPORT OI-RIV-2024-0013

Dear Col. Smith and Col. Wheeler:

This letter refers to the U.S. Nuclear Regulatory Commission's (NRC's) reactive inspection that commenced on March 7, 2024, at Kirtland Air Force Base (KAFB) in Albuquerque, New Mexico, and continued with in-office review through April 10, 2026. The reactive inspection evaluated the circumstances related to an event that was reported by the Department of the Air Force (DAF) to the NRC on March 5, 2024, under NRC Event Number 57007. The event involved a panoramic irradiator at KAFB that contained a category 1 cobalt-60 sealed source. The source became stuck in an unshielded position and actions taken by the staff were unable to return the source to the shielded position. The reactive inspection examined activities conducted under your license as they relate to public health and safety to confirm compliance with the NRC rules and regulations and the conditions of your license. Within these areas, the inspection consisted of an examination of selected procedures and representative records, observation of facilities and activities, independent radiation measurements, and interviews with personnel.

This letter also refers to an investigation by the NRC's Office of Investigations (OI). The investigation was initiated on July 1, 2024, and completed on July 31, 2025. The purpose of the investigation was to determine whether individuals working under the DAF's NRC Master Materials License engaged in willful misconduct in violation of NRC rules and regulations and the conditions of your license.

The final inspection and investigation results were discussed with you and your staff during an exit meeting held both in person and via videoconference on April 17, 2026. Lt. Col. Adam G. Pfannenstien participated in person while Col. Wheeler, Col. John Smith, Col. Brad Butler, Major John Wang, Adam Stefankiewicz, and Steven Loertscher joined via videoconference.

Enclosures 2 and 3 contain Sensitive Unclassified Non-Safeguards Information – Security-Related Information. When separated from Enclosures 2 and 3, this cover letter and Enclosure 1 with its attachments become decontrolled.

Based on the results of this inspection and investigation, apparent violations were identified and are being considered for escalated enforcement action in accordance with the NRC Enforcement Policy. The current Enforcement Policy is available at the NRC website <http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>. Four apparent violations were identified involving the licensee's failure to: (1) have and follow written operating and emergency procedures for the panoramic irradiator; (2) have and follow written procedures for inspections and maintenance checks for the panoramic irradiator; (3) have a fire extinguishing system capable of extinguishing a fire without personnel entry into the irradiator building; and (4) provide complete and accurate information to the NRC related to the causal factors analysis for the stuck irradiator source event. Additional apparent violations related to the NRC's security requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material," were also identified and are being considered for escalated enforcement action in accordance with the NRC Enforcement Policy. Apparent violations 1 through 4 are described in Enclosure 1, which is publicly available. The apparent violations related to NRC's security requirements are described in Enclosure 2, which contains Security-Related information and is not publicly available.

Before the NRC makes a final enforcement decision, we are providing you with an opportunity to: (1) request alternative dispute resolution (ADR), or (2) request a predecisional enforcement conference (PEC).

Based on preliminary discussions, the NRC understands that the DAF may be considering ADR. By letter dated December 23, 2025, Roberto Guerrero, Deputy Assistant Secretary of the Air Force, and Brigadier General Jason Lennen, Director, Policy and Resources, contacted Bo Pham, Director, NRC Office of Enforcement, to request the NRC to release its Report of Investigation (ROI) so that the DAF could be informed in its preparations for discussions in a resolution forum with the NRC.

While it is not the NRC's normal policy to release a ROI before final enforcement decisions are made, the Director, Office of Enforcement, in consultation with the Director, Office of Investigations, agreed to the request and determined that it was in the best interests of both parties to provide the ROI at this time. Therefore, to support effective and efficient conduct of an anticipated ADR mediation session, the NRC staff is providing a copy of the redacted ROI to facilitate your understanding of all of the issues associated with the investigation. Enclosure 3, the redacted ROI, contains Security-Related information and is not publicly available.

Please note that there is additional information in the ROI that is not discussed in the enclosed NRC inspection report. This additional information may enable you to better identify the causes of the event and the circumstances surrounding the licensee's actions that resulted in the source being stuck in the unshielded position and the licensee's actions to respond to the event. Furthermore, there is not a one-to-one relationship between the apparent violations identified in the ROI and the apparent violations as described and enumerated in the NRC inspection report. This is because the NRC's enforcement process is deliberative and considers all information and context developed from both the inspection and the ROI. This process enables NRC staff to better focus its enforcement actions on the most significant issues that need to be addressed and corrected by the licensee. Accordingly, the NRC inspection report in Enclosure 1 (publicly available) and Enclosure 2 (non-publicly available) represent the NRC's focus on the most significant issues that warrant further discussion with the licensee.

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Please have your counsel contact the NRC counsel, Sara Kirkwood (Sara.Kirkwood@nrc.gov) to further discuss the relationship between the ROI and the apparent violations contained in this letter to ensure that we have the same understanding of the violations that the NRC is pursuing in anticipation of beginning the ADR process.

The circumstances surrounding the apparent violations, the significance of the issues and concerns, and the need for lasting and effective corrective actions to prevent recurrence were discussed during the exit meeting on April 17, 2026.

Please contact Lizette Roldán-Otero, PhD, Chief, Materials Inspection Branch, at (817) 200-1455 or by email at Lizette.Roldan-Otero@nrc.gov within 10 days of the date of this letter to notify the NRC of your decision whether to (1) request ADR or (2) request a PEC. An ADR session should be held within 45 days of the date of this letter, and a PEC should be held within 30 days of the date of this letter.

If you request ADR with the NRC in an attempt to resolve these issues, note that ADR is a general term encompassing various techniques for resolving conflicts using a neutral third party. The technique that the NRC employs is mediation. Mediation is a voluntary, informal process, in which a trained neutral mediator works with parties to help them reach resolution. If the parties agree to use ADR, they select a mutually agreeable neutral mediator who has no stake in the outcome and no power to make decisions. Mediation gives parties an opportunity to discuss issues, clear up misunderstandings, be creative, find areas of agreement, and reach a final resolution of the issues.

Additional information concerning the NRC's ADR program can be obtained at <http://www.nrc.gov/about-nrc/regulatory/enforcement/adr.html> and NRC brochure NUREG/BR 0317, "Enforcement Alternative Dispute Resolution Program," Revision 2, found under ADAMS (Agencywide Documents Access and Management System) Accession number [ML18122A101](#). The Institute on Conflict Resolution at Cornell University has agreed to facilitate the NRC's program as a neutral third party. Please contact the Institute on Conflict Resolution by phone at (877) 733-9415 within 10 days of the date of this letter if you are interested in pursuing resolution of this issue through ADR.

If you request a PEC, it will be closed to public observation because information related to an OI report will be discussed and the ROI has not been made public. However, the NRC may issue a press release to announce the time and date of the PEC. The conference will afford you the opportunity to provide your perspective on these matters and any other information that you believe the NRC should take into consideration before making an enforcement decision. The decision to hold a PEC does not mean that the NRC has determined that a violation has occurred or that enforcement action will be taken. The conference would be conducted to obtain information to assist the NRC in making its enforcement decisions. The topics discussed during the conference may include information to determine whether a violation(s) occurred, information to determine the significance of a violation(s), information related to the identification of a violation(s), and information related to any corrective actions taken or planned.

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In presenting any corrective actions to the NRC, you should be aware that the promptness and comprehensiveness of your corrective actions will be considered in assessing any civil penalty for the apparent violations. The guidance in NRC Information Notice 96-28, "Suggested Guidance Relating to Development and Implementation of Corrective Action," found at ADAMS Accession No. [ML101100750](#), may be helpful in preparing your response.

In addition, please be advised that the number and characterization of apparent violations described in the enclosed inspection reports may change as a result of further NRC review. You will be advised by separate correspondence of the results of our deliberations on this matter.

In accordance with 10 CFR 2.390 of the NRC's "Agency Rules of Practice and Procedure," a copy of this letter and Enclosure 1 will be made available electronically for public inspection in the NRC Public Document Room or in the NRC's ADAMS, accessible from the NRC website at <http://www.nrc.gov/reading-rm/adams.html>. However, Enclosures 2 and 3 contain Security-Related Information in accordance with 10 CFR 2.390(d)(1), and their disclosure to unauthorized individuals could present a security vulnerability. Therefore, Enclosures 2 and 3 will not be made available electronically for public inspection in the NRC Public Document Room or from the NRC's ADAMS.

If you have any questions concerning this matter, please contact Dr. Lizette Roldán-Otero of my staff at (817) 200-1455.

Sincerely,



Signed by Rollins, Jesse
on 04/20/26

Jesse M. Rollins, Director (Acting)
Division of Radiological Safety & Security

Docket No. 030-28641

License No. 42-23539-01AF

Enclosures:

1. NRC Inspection Report 030-28641/2024-001
(Public)
2. NRC Inspection Report 030-28641/2024-001
Security-Related Information (Non-Public)
3. Report of Investigation OI-RIV-2024-0013
(Redacted) Security-Related Information
(Non-Public)

cc w/Enclosure 1:

Srikanth Paladugu, Bureau Chief
New Mexico Environment Department
Radiation Control Bureau
P.O. Box 5469
Santa Fe, NM 87502-5469

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NRC INSPECTION REPORT 030-28641/2024-001 AND INVESTIGATION REPORT
OI-RIV-2024-0013 – DATED APRIL 20, 2026

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ADAMS ACCESSION NUMBER:
ML26100A144

PACKAGE NUMBER:
ML26068A026

E-CONCURRENCE CASE:
20251230-40015

**U.S. NUCLEAR REGULATORY COMMISSION
REGION IV**

Docket No.: 030-28641

License No.: 42-23539-01AF

Inspection Report No.: 030-28641/2024-001

EA No.: EAF-RIV-2025-0169

NMED Item No.: 240089

Licensee: The Department of the Air Force (USAF)
Air Force Medical Command (AFMEDCOM)

Location Inspected: Kirtland Air Force Base (KAFB), Irradiator facility
Albuquerque, New Mexico

Inspection Dates: March 7; April 21-25; June 4-6; July 1-2; and October 7-10, 2024;
and March 24-27, 2025

Exit Meeting Date: April 17, 2026

Inspectors: Jason Dykert, Lead Inspector and Project Manager
Health Physicist, Materials Inspection Branch (MIB)
Division of Radiological Safety & Security (DRSS), Region IV

Mohanned Kawasmi
Health Physicist, MIB, DRSS, Region IV

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Health Physicist, MIB, DRSS, Region IV

Leonardo Wardrobe
Health Physicist, MIB, DRSS, Region IV

Accompanied by: Lizette Roldán-Otero, PhD
Chief, MIB, DRSS, Region IV

Approved by: Lizette Roldán-Otero, PhD
Chief, MIB, DRSS, Region IV

Attachments: 1. Supplemental Inspection Information
2. NRC Reactive Inspection Charter

EXECUTIVE SUMMARY OF NRC INSPECTION REPORT 030-28641/2024-001
and
FACTUAL SUMMARY OF NRC INVESTIGATION REPORT OI-RIV-2024-0013

The Department of the Air Force (USAF)
Air Force Medical Command (AFMEDCOM or licensee)

The Department of the Air Force (USAF), Air Force Medical Command (AFMEDCOM or licensee), was authorized under NRC Master Materials License (MML) No. 42-23539-01AF to issue byproduct, source, and special nuclear material permits throughout the U.S. for civilian use of radioactive materials in USAF operations. The Air Force Research Laboratory (AFRL) Space Vehicles Directorate is a permittee at Kirtland Air Force Base (KAFB). The permit authorized the use of a panoramic irradiator that contained a category 1 cobalt-60 sealed source. The day-to-day activities of the permit are managed by a Permit Radiation Safety Officer (PRSO) and an Alternate PRSO (APRSO). (Section 1)

On March 5, 2024, the licensee notified the NRC of a reportable event, Event Number (EN) 57007, due to the panoramic irradiator source at KAFB being stuck in an unshielded position. The irradiator operators attempted several different methods to return the source to the shielded position, which included using the control panel in the irradiator control building, and using the emergency cable system to pull the source into the shielded position, but these efforts were unsuccessful. An onsite reactive inspection was commenced by the NRC on March 7, 2024. (Section 2.2)

On March 18, 2024, the licensee informed the NRC that the source had been returned to its fully shielded position through actions taken by the irradiator staff at the irradiator control panel. The NRC was informed that all safety and security systems associated with the irradiator would be evaluated for functionality and repaired/replaced as appropriate before the irradiator returned to operation. (Section 2.2)

On April 18, 2024, the licensee informed the NRC that the irradiator source had again become stuck in the unshielded position. The NRC was not made aware that any repairs or other activities were authorized to be performed by the licensee or any contractor, or that the licensee would allow the irradiator to be operated. (Section 2.2)

On July 1, 2024, NRC Region IV, OI, initiated an investigation to determine whether individuals working under the USAF NRC MML engaged in deliberate misconduct in violation of NRC regulations. (Section 2.2)

In October 2024, multiple organizations, including the manufacturer of the panoramic irradiator, engaged in a complex, coordinated effort to return the source to its shielded position. On October 10, 2024, the source was able to be lowered to its shielded position. (Section 2.2)

Based on information developed during the inspection and investigation, four apparent violations (AV) were identified. The apparent violations include:

- (1) The licensee's failure to have and follow written operating and emergency procedures for the irradiator. This apparent violation includes two examples, both involving willfulness.

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- (2) The licensee's failure to have and follow written procedures for inspections and maintenance checks for the irradiator. This apparent violation includes two examples, the second of which involves willfulness.
- (3) The licensee's failure to have a fire extinguishing system capable of extinguishing a fire without personnel entry into the irradiator building.
- (4) The licensee's failure to provide complete and accurate information to the NRC related to the licensee's causal factors analysis for the stuck source event. This apparent violation involves willfulness.

Other apparent violations involving the NRC's security requirements are discussed in a separate, non-public enclosure. (Section 3)

The irradiator manufacturer determined that the direct cause of the event was related to a component inside of the irradiator that corroded and broke into pieces. The pieces became lodged within the irradiator and prevented free movement of the radioactive source during both occasions that the source was stuck in an unshielded position. (Section 4.1)

The NRC did not perform a formal root cause analysis as it was beyond the scope of the inspection and investigation. The NRC did however identify that degraded equipment reliability, inadequate response to events, inadequate oversight of the irradiator operations, and the licensee's safety culture contributed to the event. (Section 4.2)

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REPORT DETAILS

1 Program Overview (Inspection Procedure (IP) 87103, 87122)

The Department of the Air Force (USAF), Air Force Medical Command (AFMEDCOM), also referred to as the licensee, was authorized under NRC Master Materials License (MML) No. 42-23539-01AF to issue byproduct, source, and special nuclear material permits throughout the U.S. for civilian use of radioactive materials in USAF operations. As an MML, the licensee centralized control over its radioactive materials program through the USAF Radioisotope Committee (RIC). The RIC was responsible for providing oversight of the USAF's implementation of its licensed activities. The RIC delegated authority to manage the day-to-day operations of the radioactive materials program to the Radioisotope Committee Secretariat (RICS) and inspection oversight to the Air Force Inspection Agency (AFIA).

The Air Force Research Laboratory (AFRL) Space Vehicles Directorate is a permittee at Kirtland Air Force Base (KAFB) under Permit No. NM-30470-04, issued by the MML. The permittee's activities focus on space science and technology, and research and development related to military space missions. The permit authorized the use of two irradiators for the irradiation of electronics and other materials for space applications. The day-to-day activities of the permit are managed by a Permit Radiation Safety Officer (PRSO) and an Alternate Permit Radiation Safety Officer (APRSO).

One of the irradiators under the permit is a US Nuclear Corporation Model SDF-34-M1 custom-built device, housing a category 1 cobalt-60 sealed source. The device is referred to as a "panoramic irradiator." The irradiator was used in what was referred to by the permittee as the "Cobalt Facility," which consisted of perimeter fencing surrounding the building that housed the irradiator. The building that the irradiator was housed in, referred to by the permittee as the "Test Cell" or "irradiator building" was a metal building covered with high-density concrete, sitting below grade for the purpose of radiation shielding. The access points to the irradiator building were equipped with safety interlock systems, and the interior of the building was equipped with radiation monitors and fire protection equipment.

The panoramic irradiator could only be controlled via a control panel that was in what the permittee referred to as the "control shack" or "control building," located outside of the inner perimeter fence. The device is considered a dry source storage irradiator because the source is stored in a large stationary lead shield, as opposed to being shielded by water. The device is considered to be a panoramic irradiator because during operations, the source is raised out of the shield to perform irradiation in air, from an elevated position, allowing 360 degrees of irradiation. Items that are studied or tested with the irradiator are typically placed in the horizontal plane of the radiation source. When the source is in the unshielded "irradiate" or "operate" position, radiation dose rates inside of the irradiator building constitute a very high radiation area, with significant dose rates of hundreds of Roentgen per hour (R/h) in the vicinity of the source. Such radiation levels pose a danger to humans, and this is why the irradiator is controlled from a separate control building rather than from inside the irradiator building. The Bioenvironmental Engineering (BE) Flight at KAFB provided radiation safety support to the permittee,

including the performance of required leak tests of the radioactive source and radiation surveys of the irradiator and the irradiator building.

Using the control panel at the irradiator control building, the radioactive cobalt-60 sealed source can be moved from the fully shielded position to the irradiate position, above the shield. Within the irradiator, the source was positioned within a source drawer, similar to a moving canister or cylinder. The cylindrical drawer contained lead plugs above and below the radiation source in the central portion of the drawer. These lead plugs provide vertical radiation protection in the stored, shielded position inside the lead shield. The source drawer could be raised from the shield by a powerful drive motor and electromagnetic clutch that engaged a rack and pinion gear. The rack is similar to a steel rod that has teeth which are aligned to the pinion gear. The rack is attached to, and moves with, the source drawer.

During normal operation, the irradiator mechanical controls move the source from the shielded position into the “irradiate” or “operate” position, and then back down to the shielded position. However, in an emergency situation if the source does not safely return to the fully shielded position, the drive motor and clutch were designed for de-energization from the control panel, which would allow the source drawer to fall to its fully lowered and shielded position via gravity. The irradiator also had an emergency cable system, for a situation where the source drawer did not fully fall into the shielded position. The emergency cable system ran from the irradiator to the control building, where it could be manually pulled to retract the source, resulting in the source drawer being pulled into the fully shielded position.

2 Event Chronology (IP 87103)

2.1 Inspection Scope

The inspectors performed multiple onsite inspection activities, during which they reviewed records, procedures, and documents maintained by the licensee, interviewed licensee personnel, observed licensee activities, and performed independent radiation measurements. Following the onsite inspection activities, the inspectors reviewed additional records, procedures, and documents that were provided by the licensee.

2.2 Inspection Observations

The sequence of events that follows represents what the NRC knew in real time as the event was in progress, obtained through inspection activities and discussions with licensee personnel. It does not include information that was learned after the fact through the OI investigation. The information gathered through the OI investigation is put into context in Section 3 of the report, which also discusses the apparent violations.

On March 5, 2024, the licensee notified the NRC Headquarters Operations Office of a reportable event, Event Number (EN) 57007, due to the panoramic irradiator source at KAFB being stuck in an unshielded position. The licensee related that during irradiator operator training, the irradiator control panel was used to return the sealed source containing a category 1 quantity of cobalt-60 from the “irradiate” position to the shielded position, but the source only traveled from an indicated height of 100 percent to 88 percent height and then stopped, leaving the source in an unshielded position. The

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irradiator operators attempted to return the source to the shielded position using the irradiator control panel following standard operating techniques but were unsuccessful. They then de-energized the drive system to enable the source to drop by gravity into the shield, which was also unsuccessful. Finally, they attempted to use the emergency cable system to pull the source drawer down into the shield, but these efforts were also unsuccessful because the emergency cable separated at a connection point.

Based on information provided by the licensee during a video conference with the NRC on March 6, 2024, the licensee's AFIA inspector went to the irradiator facility to begin an onsite reactive inspection of the event. The NRC informed the RICS that it dispatched NRC inspectors to the facility to commence an onsite reactive inspection on March 7, 2024.

On March 11, 2024, during a videoconference meeting with the RICS, the NRC was informed that it was not unusual for the source to be in the fully raised "operate" position for extended periods of time, for weeks to months, during normal operations. The NRC was also informed that the licensee would obtain the services of an NRC or Agreement State licensed service provider to perform any repairs associated with the irradiator event, and that obtaining the contracts for such service would take time. The NRC was also informed that the required fire extinguishing and fire detection systems for the irradiator building were not functional because they were disabled due to radiation damage from the unshielded source.

On March 18, 2024, the licensee informed the NRC that the source had been returned to its fully shielded position and that all safety and security systems associated with the irradiator would be evaluated for functionality and repaired/replaced as appropriate before the irradiator returned to operation. The NRC was informed that the source was able to be returned to the shielded position through actions taken by the irradiator staff at the control panel but did not have further details. The NRC was assured by the RICS that the irradiator components would be preserved, and that the PRSO and irradiator staff would perform only visual inspections of the irradiator. The visual inspections would consist of a panel that would be removed to observe underneath the irradiator, but no physical repairs would occur. A contract would be signed for a licensed service provider to come onsite to make any repairs and seek to identify the cause(s) that led to irradiator source being stuck in the unshielded position. Additionally, the licensee identified an individual at KAFB with AFRL with expertise to perform a causal analysis of the circumstances that resulted in the irradiator source becoming stuck in the unshielded position.

On March 19, 2024, the NRC inquired with the licensee as to whether ambient radiation surveys and surveys for removable contamination would be performed upon entry into the irradiator building and prior to any handling of irradiator panels and were informed that KAFB BE personnel had performed ambient radiation surveys at the outer perimeter fence line. On March 20, 2024, the NRC was informed that KAFB BE personnel performed ambient radiation surveys and removable contamination surveys inside of the irradiator building.

On April 9, 2024, the RICS and the NRC met through videoconference for an update and to discuss details about the lowering of the source that occurred on March 18, 2024. The RICS stated that the irradiator was still in a "look, don't touch" status and the licensed

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service provider was expected to perform any repairs. The NRC staff verbally requested to be notified prior to any repair work being performed to allow the inspectors an opportunity to be onsite to perform inspection activities. The RICS agreed to notify NRC prior to any repair work being authorized. The RICS also provided the initial cause analysis report from the AFRL expert. The initial draft USAF root cause analysis report for the event identified the cause of the stuck source as a loose cable from the irradiator's emergency cable system.

On April 17, 2024, the NRC formally chartered a reactive inspection in response to the event (EN 57007). The Reactive Inspection Charter is included as Attachment 2.

On April 18, 2024, the RICS informed the NRC that the irradiator source had again become stuck in the unshielded position. The NRC was unaware of any repairs or other activities performed by the licensee or any contractor that would allow the irradiator to be operated, so it was unclear as to how the irradiator source became stuck in an unshielded position again. The RICS explained that verbal permission had been granted to the PRSO on April 11, 2024, to perform physical repairs "as long as it was done in accordance with the manufacturer."

From April 21-25, 2024, NRC inspectors performed onsite inspection activities at KAFB, consistent with the Reactive Inspection Charter. On May 14, 2024, the NRC sent the RIC Chairman an "Information Request for NRC Reactive Inspection 2024-001." The purpose of the request was for the licensee to provide the NRC with the information that had been requested during the onsite reactive inspection activities, but had not been provided to the inspectors.

On May 20, 2024, the licensee measured radiation dose rates at the exterior personnel door of the irradiator building to be between 1.4 to 2.6 R/h.

From June 4-6, 2024, an NRC inspector performed additional onsite inspection activities. The inspector observed activities occurring in the control building. The emergency cable system that had been rebuilt by irradiator staff after the source returned to the shielded position was pulled on by several licensee personnel simultaneously in an attempt to pull the source into the shielded position. However, the emergency cable system broke apart at a licensee-modified connection, and the source remained stuck in an unshielded position.

On July 1, 2024, the NRC Office of Investigations (OI) initiated Case No: OI-RIV-2024-0013; but onsite OI activity and information requests were not made until the source was able to be returned to the fully shielded position. Also on July 1, 2024, an NRC inspector was onsite at KAFB to continue the reactive inspection activities. The inspector observed the use of tools such as LiDAR to create 3D models and maps of the interior of the irradiator building, and the use of a drone and robot to create radiation dose rate maps of the interior of the irradiator building. Measured radiation dose rates near the irradiator ranged from 7 R/h to 245 R/h.

On July 24, 2024, the NRC received the licensee's final responses to the NRC's May 14, 2024, information request.

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On July 30, 2024, the PRSO and other irradiator staff attempted to lower the source by modifying the control panel circuit and increasing the current to the electromagnetic clutch that drives the source through rack and pinion, to attempt to bump the source down using an external variable power supply. These activities failed to return the source to the shielded position.

From October 7-10, 2024, an NRC inspector continued onsite reactive inspection activities at KAFB. Multiple organizations were onsite to support the source recovery efforts including, the KAFB Nuclear Emergency Support Team, Los Alamos National Laboratory, KAFB 377th Air Base Wing Explosive Ordnance Division, Sandia National Laboratory, and J.L. Shepherd & Associates (JLSA), an Agreement State licensed service provider. A large robot from Los Alamos National Laboratory was utilized to enter the irradiator building and deploy a depleted uranium shield around the exposed unshielded source. A small robot was used to place cameras and lights inside the irradiator building. A drone was used by Sandia National Laboratory to view the inside of the irradiator building and take radiation measurements. After the depleted uranium shielding materials were put in place around the stuck and exposed source, technicians from JLSA entered the irradiator building and removed the pinion gear and the associated bearings below the irradiator, in order for the rack to be free from any gear/motor related obstructions. With the pinion gear removed, the source would still not fall by gravity into the shielded position. Various other mechanical means and application of force were used to attempt to lower the source to the shielded position. On October 10, 2024, JLSA technicians used a crowbar to leverage the rack teeth to lower the source into the fully shielded position. Once the source was fully shielded, radiation dose rates in all areas of the irradiator building were less than 2 millir/h, wipe tests confirmed the absence of radiological contamination.

From March 25-27, 2025, an NRC inspector performed continued onsite reactive inspection activities at KAFB to observe JLSA personnel disassemble the irradiator. The JLSA technicians removed the radioactive source from the irradiator shield and placed it in a temporary shield. This allowed JLSA to safely examine the irradiator components. The JLSA technicians identified that a snap-ring at the top of the source drawer had corroded and broken into pieces, with some pieces migrating from the top portion of the irradiator and becoming lodged between the movable source drawer and non-movable irradiator shielding. The snap-ring is a component that was used to secure the moveable lead plug and the radioactive source in place within the moveable source drawer. It was concluded that the lodged metal pieces of the snap-ring had caused the source drawer to become stuck in the unshielded position in both instances. The snap-ring was made of carbon steel, and the components it was in contact with inside of the irradiator source drawer assembly were made of stainless steel, a dissimilar metal. The snap-ring pieces were later examined through electron microscopy, and it was determined that an intergranular failure occurred, and was most likely attributable to stress corrosion cracking.

3 Inspection and Investigation Findings (IP 87103, 87122)

3.1 Inspection and Investigation Scope

The NRC reactive inspection sought to develop a sequence of events and assess differences between normal irradiator operations and the event. The inspection

evaluated whether irradiator staff followed operating procedures, emergency procedures, and inspection and maintenance procedures, and whether oversight procedures were met by RICS staff. Inspectors reviewed the maintenance and testing program for the irradiator as well as other irradiator operation procedures, and records for annual irradiator routine maintenance and for the emergency cable system. The inspectors reviewed the event, including the initial and final cause analysis reports conducted by the USAF, and identified contributing causes to the event.

On July 1, 2024, NRC Region IV, OI, initiated an investigation to determine whether individuals working under the USAF NRC MML engaged in deliberate misconduct in violation of NRC regulations. The investigation was completed on July 31, 2025.

Based on information developed during the inspection and investigation, four apparent violations (AV) were identified. Three of these apparent violations are associated with deliberate misconduct on multiple occasions on the part of the PRSO, a licensee employee. The four apparent violations involved the licensee's failure to: (1) have and follow written operating and emergency procedures for the irradiator; (2) have and follow written procedures for inspections and maintenance checks for the irradiator; (3) have a fire extinguishing system capable of extinguishing a fire without personnel entry into the irradiator building; and (4) provide complete and accurate information to the NRC related to the causal factors analysis for the event.

3.2 Failure to Have and Follow Required Operating and Emergency Procedures

On March 18, 2024, the first effort to free the stuck source included the PRSO modifying or directing others to modify the irradiator control panel in order to override the safety interlocks. The inspection and investigation identified that the PRSO, without notifying or gaining approval from the RIC and/or RICS or having submitted any written procedures for approval, caused irradiator staff to perform these non-routine operations. The non-routine operations included modifying the irradiator control circuit to bypass safety interlocks, increasing the power to the clutch, and remotely manipulating the source drive clutch mechanism at the control panel. These actions were not included in an approved operating, emergency, or maintenance procedure, nor were irradiator staff authorized under the permit to perform the non-routine operations.

During the investigation, the PRSO testified that prior to March 18, 2024, he informed the RICS and requested authorization to modify the irradiator's control panel and operate the irradiator. However, other testimony contradicted this claim. Irradiator staff testified that there was no work plan or procedure to perform the modifications to the control panel. The PRSO also testified that he had coordinated the modifications with JLSA. The Vice President of JLSA testified that they were unaware of the details of what was done to the control panel and was surprised to learn that the licensee had operated the irradiator on March 18, 2024. The RICS staff testified that they were unaware of the modifications made to the control panel until after the source had been returned to the fully shielded position and were not provided with procedures for the actions taken.

Based on the evidence developed during the investigation, on March 18, 2024, the PRSO engaged in deliberate misconduct in violation of 10 CFR 30.10(a)(1), by causing the irradiator staff to modify the irradiator controls and operate the irradiator in a manner not described in existing irradiator procedures. Specifically, 10 CFR 36.53(a)(1) and

10 CFR 36.53(b)(1) require the licensee to have and follow written operating and emergency procedures, respectively, for the irradiator. The modifications made to the control circuits overrode safety interlocks and increased power to the clutch in an attempt to free the stuck source. The PRSO did this knowing that: operating and emergency actions must be performed using approved procedures; there were no approved written procedures for the activities performed; and that an exception was needed from the RIC and/or the RICS to deviate from the existing procedures.

On April 11, 2024, the RICS granted verbal permission to the PRSO to perform physical repairs to the irradiator, “as long as it is done in accordance with the manufacturer.” Between April 11-17, 2024, the PRSO and other irradiator staff performed non-routine repairs to the emergency cable system. On April 18, 2024, the PRSO “exercised” the irradiator, and the source became stuck in the unshielded position again. The PRSO then directed the irradiator staff to again disable and/or bypass the safety interlocks in the irradiator control panel, to attempt to unstick the source in the same manner as before. When it was clear that the source was stuck for the second time, the PRSO contacted the RICS and requested that written authorization be given for the non-routine repairs that he had already made. These activities were still not addressed in the procedures and were not authorized by the RIC and/or RICS to be performed.

Based on the evidence developed during the investigation, on April 18, 2024, when the irradiator source became stuck in an unshielded position for a second time, the PRSO again engaged in deliberate misconduct, in violation of 10 CFR 30.10(a)(1), by causing irradiator staff to modify the irradiator control circuit again and to operate the irradiator in a manner not described in procedures. The evidence gathered during the investigation shows that the PRSO knew the operation of the irradiator was not performed in accordance with the irradiator’s existing procedures. Furthermore, the PRSO knew that he was required to obtain a written exception from the RICS prior to taking action.

Testimony shows that the PRSO did not discuss the proposed actions with the manufacturer JLSA, or with the RICS, for the actions he directed on March 18 and April 18, 2024, and that RIC staff were unaware of the modifications to the control circuits until after those actions were taken.

3.2.1 Apparent Violation of 10 CFR 36.53(a)(1) and 10 CFR 36.53(b)(1)

Title 10 CFR 36.53(a)(1) requires, in part, that the licensee shall have and follow written operating procedures for operation of the irradiator.

Title 10 CFR 36.53(b)(1) requires, in part, that the licensee shall have and follow emergency procedures for sources stuck in the unshielded position.

Radiation Safety Plan Tab 10, “Cobalt-60 Panoramic Irradiator,” dated March 2022, in Section 10.1.6, “Operating Procedures,” Subsection B, “Non-Routine Operations,” requires, in part, that “The irradiator manufacturer (JLSA) or other person authorized by the NRC will perform non-routine operations such as source loading, unloading, and repositioning, clearing stuck source drawer, investigating/remediating removeable contamination sources and other critical operations requiring special skills or having potential for radiation exposures.”

Contrary to the above, the licensee failed to have and follow written operating procedures for operation of the irradiator or emergency procedures for a source stuck in the unshielded position, as evidenced by the following two examples:

- Specifically, on March 18, 2024, the licensee performed actions that were not authorized in the existing written operating or emergency procedures, including modifying the control panel circuit and bypassing safety interlocks to operate the irradiator in attempts to clear a stuck source drawer. This caused actions to be performed by the irradiator staff that were reserved by the Radiation Safety Plan for the irradiator manufacturer or other person authorized by the NRC.
- Specifically, on April 18, 2024, the licensee performed actions that were not authorized in the existing written operating or emergency procedures, including testing repairs in a manner that was not authorized in written operating procedures. When the test resulted in the source becoming stuck for a second time, the licensee again performed actions to modify the irradiator's control panel circuit, bypass safety interlocks, and operate the irradiator in attempts to clear the stuck source drawer. This caused actions to be performed by the irradiator staff that were reserved by the Radiation Safety Plan for the irradiator manufacturer or other personnel authorized by the NRC.

The licensee's failure to have and follow written operating procedures for operation of the irradiator, and failure to have and follow emergency procedures for sources stuck in the unshielded positions is an apparent violation of 10 CFR 36.53(a)(1) and 10 CFR 36.53(b)(1). (030-28641/2024-001-01)

3.3 Failure to Have and Follow Required Inspection and Maintenance Procedures

As previously described, the irradiator's emergency cable system is designed to allow the irradiator operator in the control building to manually pull the source into the shielded position during an emergency, such as if the source is unable to be returned to the fully shielded position. The emergency cable is connected to the source drawer and has pulleys and a tensioning and retraction device, called a tensioner, that moves the cable each time the source drawer is raised or lowered. This tensioner system allows for source drawer movement without placing slack in the emergency cable so that the emergency cable does not snag or impede source movement during routine operation. As originally designed and configured, the emergency cable system, consisting of braided metal wire cable, had two sections that were connected by metal wire rope clamps. One section of the emergency cable was connected to the source drawer and was joined to the other section of the emergency cable that goes approximately 150 feet through a conduit to the irradiator control building. These two cable sections were connected in the irradiator building near the point where the cable enters the conduit to the irradiator control building. At the irradiator control building, the cable terminated at a pull handle at the control panel, so that the irradiator operator can manually pull the source into the shielded position.

Although the exact date is unknown, the NRC investigation established that between February 2012 and November 2023, before the first stuck source event, the connection that joined the two sections the emergency cable system was altered by the PRSO.

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However, the modifications to the connection were not documented and no procedure or record of the modifications exists. The manner in which the two cable sections were re-connected by the PRSO was weaker and less reliable than the manufacturer's design.

On March 5, 2024, when the source first became stuck in the unshielded position, the PRSO attempted to use the emergency cable to manually pull the source into the shielded position. However, the emergency cable system pulled apart at the connector. Accordingly, the altered and reconfigured cable connection had rendered the emergency cable system incapable of performing its intended safety function when called upon to do so in an actual emergency.

After the source was returned to the shielded position on March 18, 2024, the PRSO performed repairs to the emergency cable system. Between April 11-17, 2024, the emergency cable system was rebuilt with a new tensioner, a redesigned cable stop, and other modifications, but the existing braided metal wire cable sections were reused. The PRSO performed these activities without allowing any independent examination of the as-found condition of the emergency cable system. The repaired or replaced components were also not maintained for inspection or evaluation to assess what role, if any, they played in the source becoming stuck in the unshielded position. The NRC was not notified that these repairs were taking place until after the repairs had been completed and the source was stuck in the unshielded position for the second time. Therefore, the NRC was unable to examine the as-found condition of the emergency cable system and other irradiator components.

During sworn testimony, the PRSO demonstrated that he knew what was considered to be routine maintenance, and that modifications to the emergency cable system were non-routine. None of the irradiator's operating procedures addressed or allowed for the disconnection or reconnection of the two cable sections in the emergency cable system by irradiator staff. The PRSO confirmed that non-routine maintenance required authorization from the RIC and/or RICS. The Radiation Safety Plan for the irradiator requires that the irradiator manufacturer (JLSA) perform non-routine operations.

The PRSO admitted that he did not consult any reference material or consult with JLSA on how to properly connect the two cable sections. Unlike the method used by PRSO to connect the two cable sections, JLSA technicians stated that they always use an Occupational Safety and Health (OSHA)-approved method to connect the two cables sections. The connection method used by the PRSO likely resulted in the failure of the emergency cable system when it was pulled on March 5, 2024.

After the source was returned to its shielded position following the first stuck source event, the PRSO made repairs to the damaged emergency cable system. Based on the evidence developed during the investigation, the PRSO engaged in deliberate misconduct in violation of 10 CFR 30.10(a)(1), by causing irradiator staff to repair and rebuild the emergency cable system between April 11-17, 2024, without having and following a written procedure for the work. Specifically, 10 CFR 36.53(a)(6) requires the licensee to have and follow written operating procedures for conducting inspection and maintenance checks required by 10 CFR 36.61. Title 10 CFR 36.61(a)(12) includes inspection and maintenance of the functioning and wear of the system, and mechanisms and cables used to raise and lower sources.

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On April 11, 2024, the RICS verbally authorized the PRSO to perform repairs to the irradiator’s emergency cable system, “provided that the irradiator staff were executing the repairs in accordance with JLSA.” The PRSO caused those repairs to be performed between April 11-17, 2024, which were called “Emergency Pull Cable/Tensioning System Upgrade.” These repairs included: (1) modifying the emergency cable system; (2) replacing the tensioner with a “modern device”; (3) adding a cable stop to the emergency cable; and (4) adding a counterweight to the emergency cable system. The modifications to the emergency cable system included cutting off and replacing a section of emergency cable that was attached to the bottom of the source drawer and attaching the new cable to the existing cable with crimped oval swage sleeves, also called crimped swage lock connections. These modifications resulted in the emergency cable system being altered from two sections of connected cable to three sections of connected cable. Testimony and investigative evidence show that there were no work instructions provided by JLSA to the PRSO, nor were work instructions created or provided by the PRSO to the RICS for approval.

The irradiator maintenance procedures, “Facilities, Equipment and Maintenance – TAB 9” and “Maintenance Work Card – TAB 9a,” provide the scope and directions for the performance of maintenance on the irradiator. Reviews of those procedures show that none of the repairs performed to the emergency cable system under the direction of the PRSO between April 11-17, 2024, were within the scope of those procedures.

The evidence developed during the investigation shows that there were no written procedures for the repairs that were performed to the irradiator’s emergency cable system between April 11-17, 2024. The evidence also shows that the PRSO knew there were no written procedures for the repairs and that he was required to obtain a written exception from the RIC and/or RICS in order to deviate from the existing irradiator procedures.

3.3.1 Apparent Violation 10 CFR 36.53(a)(6) and 10 CFR 36.61(a)(12)

Title 10 CFR 36.53(a)(6) requires, in part, that the licensee shall have and follow written operating procedures for inspection and maintenance checks required by 10 CFR 36.61.

Title 10 CFR 36.61(a)(12) requires, in part, that the licensee shall perform inspection and maintenance checks that include the functioning and wear of the system, mechanisms, and cables used to raise and lower sources.

USAF Radioactive Material Permit NM-30470-05/00AFP, issued under authority of NRC License 42-23539-01AF to comply with the NRC license and associated regulations, requires that permit conditions be followed.

Permit Condition 21 requires, in part, “The following services shall not be performed by the Permittee: . . . non-routine maintenance or repair of components related to the radiological safety of the device. These services shall be performed only by persons specifically licensed by the NRC or an Agreement State to perform such services. Specific services may be approved by the RICS on a case-by-case basis.”

Permit Condition 23 requires, in part, that “procedures contained in the permit renewal application dated Mar 20, 2022, and subsequent amendments shall be followed.

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Exceptions to those procedures must be approved in writing and official signed memorandums documenting RICS approved exceptions become tie-down documents and must be maintained in permit records.”

Contrary to the above, the licensee failed to have and follow written operating procedures for inspection and maintenance checks for the functioning and wear of the system and cables used to raise and lower the source, as evidenced by the following two examples:

- Specifically, between February 2012 and November 2023, the licensee performed non-routine maintenance that was not authorized in existing procedures for the emergency cable system, by disconnecting and reconnecting the two cable sections without any exceptions to the permit renewal procedures having been approved in writing as required by Permit Condition 23. The modified connection failed on March 5, 2024, when an attempt to use the emergency cable system to lower the stuck source resulted in the connection coming apart and as a result, the only method to lower the stuck source from outside the irradiator building was rendered incapable of performing its safety function.
- Specifically, from April 11-17, 2024, the licensee performed repairs and rebuilt the emergency cable system without procedures, which was a non-routine maintenance activity. The verbal permission to perform services under Permit Condition 21 was not approved in writing when the work occurred, and no specific license authorized the PRSO to perform the non-routine maintenance on the emergency cable system.

The licensee’s failure to have and follow written operating procedures for inspection and maintenance checks for the functioning and wear of the system and cables used to raise and lower the source is an apparent violation of 10 CFR 36.53(a)(6) and 10 CFR 36.61(a)(12). (030-28641/2024-001-02)

3.4 Failure to Have a Fire Extinguishing System Capable of Extinguishing a Fire

Panoramic irradiators are required to have fire protection systems, which include heat and smoke detectors, and a fire extinguishing system that is capable of extinguishing a fire without the need for personnel entry into the irradiator building. The KAFB irradiator building was equipped with heat and smoke detectors and had a fire extinguishing system that was designed to extinguish a fire without any entry into the irradiator building.

After an extended period of time with the source stuck in the unshielded position, the heat and smoke detection systems in the irradiator building stopped working due to damage from the radiation. Although the heat and smoke detection systems had failed due to radiation damage, the fire extinguishing system could have functioned properly if it had not been disabled.

The manner in which the fire extinguishing system was disabled prevented normal manual actuation of fire extinguishing system and also configured the supervisory fire control panel to show that the extinguishing system was in a “normal” status. This gave a false indication of functionality and availability of the fire extinguishing system to the

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KAFB fire department. The PRSO did not notify the KAFB fire department that the fire extinguishing system was disabled. A watch-stander individual would not have been able to activate the fire extinguishing system using standard procedures or easily turn it back on without an ample amount of time and expertise.

Based on the evidence developed during the investigation, during both times the irradiator source was stuck in the unshielded position, from March 11-21, 2024, and again from April 20 through October 10, 2024, the PRSO caused irradiator staff to disable the fire extinguishing system such that it was not capable of extinguishing a fire when it was required to be able to perform its safety function.

The PRSO admitted under oath that he directed the fire extinguishing system to be disabled by turning off the AC power and removing the battery backup. Due to the PRSO's configuration of the fire extinguishing system it could not have been discharged in a timely manner if someone attempted to activate it.

3.4.1 Apparent Violation of 10 CFR 36.27(b)

Title 10 CFR 36.27(b) requires that the radiation room at a panoramic irradiator must be equipped with a fire extinguishing system capable of extinguishing a fire without the entry of personnel into the room.

Contrary to the above, from March 11-21, 2024, and April 20 to October 10, 2024, the radiation room at the panoramic irradiator was not equipped with a fire extinguishing system capable of extinguishing a fire without the entry of personnel into the room. Specifically, the PRSO, a USAF employee, caused the fire extinguishing system to be disabled and configured the system so that it was not capable of extinguishing a fire.

The licensee's failure to equip the radiation room at a panoramic irradiator with a fire extinguishing system capable of extinguishing a fire without the entry of personnel into the room is an apparent violation of 10 CFR 36.27(b). (030-28641/2024-001-03)

3.5 Failure to Provide the NRC With Complete and Accurate Information

The inspection and investigation identified multiple occasions when incomplete or inaccurate information was provided to the NRC and the licensee. One example involved the PRSO's failure to provide complete and accurate information to both the NRC and licensee that resulted in the licensee's initial causal analysis report to be erroneous and flawed.

In March 2024, the licensee assigned an individual with AFRL at KAFB with expertise to perform an independent causal analysis of the circumstances that resulted in the irradiator source becoming stuck in the unshielded position. This independent evaluator had no prior experience with irradiators but had experience with mechanics, systems, and with the performance of causal evaluations. The independent evaluator relied on the PRSO to provide certain information and details regarding the event and the irradiator design to help support the causal evaluation.

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Based on the evidence developed during the investigation, the PRSO deliberately provided information to the independent evaluator that he knew to be inaccurate and incomplete. As a result, the licensee's initial causal factors analysis report was erroneous and flawed.

Specifically, the PRSO provided input to the licensee's independent evaluator in an email on April 10, 2024, stating: "Your evaluation is spot on and will go a long way to getting us back up and operating...It is important that we get this to [the Air Force Inspection Agency (AFIA) inspector], the RIC, and finally to the NRC so we can close the investigatory phase out and move on to documenting corrective actions." The PRSO went on to write, in part, "In my opinion, the following statement should be added somewhere. As the emergency pull handle in the control building had no resistance, it is assumed that sometime during the raising and lowering of the source, the tensioning cable system somehow got bound while the spring tensioner was fully extended, and the drive mechanism pulled the emergency pull cable and tensioning system cables apart where they were connected...."

Testimony obtained by the NRC from other witnesses contradicted the PRSO's claim that the emergency cable offered no resistance when he pulled it on March 5, 2024, indicating it initially offered resistance, but then came apart when increasing force was applied. When confronted with the contrary testimony from other witnesses, the PRSO admitted that there was initial resistance when he pulled the emergency cable, which he characterized as a "small amount," and later as a "moderate amount." This is the same emergency cable discussed in Section 3.3 that the PRSO had disassembled and reconnected in a less reliable configuration at some point prior to the first time the source became stuck.

The PRSO stated in writing to the independent evaluator, regarding the possibility of a set screw binding the source movement, that "by bringing it up in the report, it just adds a potential layer of confusion for debate by an inspector." The incomplete and inaccurate information was placed into the initial cause analysis report prior to April 8, 2024, and was referenced as supporting information by the PRSO when requesting the RICS give verbal permission to make repairs to the emergency cable system on April 11, 2024.

The independent evaluator testified that the PRSO's statement quoted above was a key factor in his initial conclusion about the cause of the stuck source event, and that if he had known that the emergency cable system had initially offered resistance on March 5, 2024, it would have changed the outcome of the cause analysis. The independent evaluator testified that this led to his conclusion that the connection between the two cable sections had parted prior to the event and that the loose emergency cable had contributed to the source drawer becoming stuck. He confirmed that had he known the emergency cable sections were connected when the source got stuck, he would have instead focused on the source drawer and the bushings for the cause of the stuck source. Foreign material intrusion, such as the snap-ring pieces or a set screw from the brass bushings that kept the source drawer centered, was not examined by the independent evaluator in the initial failure mode analysis.

Evidence from the investigation indicates that the PRSO intended to provide inaccurate information regarding the cause of the major malfunction of the panoramic irradiator to the AFIA inspector, to the licensee, and to the NRC. By providing incomplete and

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inaccurate information to the independent evaluator, the PRSO influenced the initial cause analysis report, while actively steering the independent evaluator away from other possible failure modes, and created the appearance of strengthening his own narrative of the cause of the failure. The initial root cause analysis report was provided to the NRC in April 2024. The NRC utilized the initial conclusions in the independent evaluator's report in making decisions about how to proceed with the reactive inspection.

3.5.1 Apparent Violation of 10 CFR 30.9(a) and 10 CFR 36.81(j)

10 CFR 30.9(a) requires, in part, that information provided to the Commission by a licensee shall be complete and accurate in all material respects.

10 CFR 36.81(j) requires, in part, that the licensee maintain records at the irradiator of major malfunctions, significant defects, operating difficulties or irregularities, and major operating problems that involve required radiation safety equipment.

Contrary to the above, in April 2024, information provided to the Commission by the licensee was not complete and accurate in all material respects pertaining to the major malfunction and stuck source of the irradiator. Specifically, the PRSO, a USAF employee, provided inaccurate information used in the initial cause analysis report for the stuck irradiator source, and that information was provided to the NRC and was material to the NRC's evaluation and response to the event. The cause analysis report was relied upon by the RICS to approve specific repairs that did not correct the actual cause of the event. Then post-repair testing occurred with the source still installed and resulted in a repeat failure, causing the source to become stuck again and remain in an unshielded position for more than 5 additional months.

The licensee's failure to provide information to the NRC that was complete and accurate in all material respects is an apparent violation of 10 CFR 30.9(a) and 10 CFR 36.81(j). (030-28641/2024-001-04)

4 Causal Evaluation

4.1 Licensee Causal Evaluation

The direct cause of the stuck source events was determined by JLSA to be the snap-ring at the top of the source drawer that had corroded and broken into pieces, with some pieces migrating from the top portion of the irradiator and becoming lodged between the moving drawer and non-movable irradiator shielding. The snap-ring had been used to secure the shielding and the radioactive source in place within the moveable source drawer.

The licensee performed failure analysis and electron microscopy on the broken snap-ring pieces. It was determined that the snap-ring material was carbon steel, while the components surrounding it were stainless steel. Dissimilar metal corrosion, likely through stress corrosion cracking, caused the snap-ring to break. The pieces fell between the source drawer and irradiator shield during operation, causing the source drawer to become stuck.

4.2 NRC Causal Evaluation

The NRC did not perform a formal root cause analysis as it was beyond the scope of the inspection and investigation. The NRC did, however, identify several issues that contributed to: the conditions that led to the irradiator source being stuck in the unshielded position the first time; the improper actions taken to return the source to its shielded position; the improper modifications and repairs made to irradiator components; the conditions that led to the irradiator source being stuck in the unshielded position for a second time; and other relevant aspects of the event.

These causal factors can be grouped into four categories: (1) degraded equipment reliability; (2) inadequate response to events, (3) inadequate oversight of the irradiator operations; and (4) safety culture challenges.

4.2.1 Degraded Equipment Reliability

The KAFB panoramic irradiator is the most risk-significant permit issued by the MML and supports the reliability of components intended for critical space applications. However, the maintenance program for the panoramic irradiator was not given a commensurate priority. The maintenance that was performed annually by the PRSO was not well documented and not well supported by appropriate procedures. When the source was initially stuck, critical questions arose about the design of the irradiator, and about modifications that had been made in the past by the PRSO, but documentation of those changes and prior maintenance activities could not be produced. Because of the inherent danger associated with the category 1 cobalt-60 source, multiple redundant safety features are relied upon to be able to return the source to the fully shielded position. Therefore, due consideration needs to be given to the reliability of equipment associated with the safety functions for the irradiator so that these systems are maintained and are highly reliable. Due consideration was not given by the licensee to monitor and trend the reliability of the irradiator and equipment necessary for its safe operation.

4.2.2 Inadequate Response to the Event

The stuck source event should have been given high priority by the licensee and provided with the right resources (i.e. equipment, personnel, technical expertise) to allow a prompt and safe resolution. When the event occurred, the licensee did not appear to assign a high priority to event response. The licensee's response relied heavily on the PRSO and the irradiator staff to develop plans to resolve the event, although the situation was outside their training, procedures, and technical expertise.

The licensee had an emergency procedure required by 10 CFR 36.53(b)(1) for sources stuck in the unshielded position. When the source became stuck the first time, the irradiator staff proceeded through the steps of the emergency procedure. The irradiator staff attempted to lower the source by multiple methods described in the procedure. The last method employed was to pull the emergency cable, which did not return the source to the shielded position. Since all of the methods failed to return the source to its shielded position, the next step in the emergency procedure instructed irradiator operators to contact JLSA and request assistance. Although the PRSO was communicating with JLSA, these communications were informal and did not result in the

licensee promptly obtaining the necessary expertise or assistance from JLSA to resolve the situation.

Appropriate and reasonable steps were not taken by the licensee to properly understand the cause of the first stuck source event. The licensee did not obtain an evaluation or review of the irradiator condition by the manufacturer or another NRC or Agreement State licensed service provider. Such an evaluation would have identified the direct cause of the stuck source and resulted in appropriate and sound repairs being made to the irradiator system components to prevent recurrence.

The licensee utilized an independent cause evaluator to examine the cause of the first stuck source event. However, the irradiator staff made repairs and proceeded forward with operating the irradiator before the causal analysis report had even been finalized. A thorough cause evaluation process would have necessitated preserving the as-found conditions for analysis, inspecting the source movement path for obstructions, and allowed for sufficient time for oversight personnel to review the conclusions before authorizing the irradiator to return to operation. However, the as-found conditions were not preserved, the resultant cause evaluation was flawed, and the actual cause was not corrected before the source was raised to an unshielded position.

4.2.3 Inadequate Oversight of the Irradiator Operations

An MML is a license issued to a federal organization allowing the use of radioactive material at multiple sites. The MML authorizes the licensee to issue permits for the possession and use of licensed material and provides a framework for oversight and internal licensee inspection of its permittees. To be granted an MML, a federal organization must demonstrate that it has a regulatory program that can safely issue permits for the possession and use radioactive material at multiple sites and has a program for independent oversight and inspection of its permittees.

During the event, several key decisions were not made at the RIC or at the RICS level, but at a much lower level in the organization than would be expected given the potential radiation safety impacts or consequences of the decisions. The RIC has delegated broad authority to run the day-to-day oversight of the MML to the RICS. However, the delegation of authority did not contain clear guidance regarding specific situations, such as event response or non-routine operations, that would necessitate the RICS to consult with or obtain approval from the RIC prior to making decisions. Among RIC and RICS leaders there was limited technical knowledge of the irradiator design and operation, which may have contributed to decision-making occurring at lower levels. As a result, the irradiator staff were allowed to proceed with actions that did not receive adequate technical review and were performed without required procedures.

During the event, the AFIA inspector, who also serves as a voting member of the RIC and who is stationed at KAFB, initiated a reactive inspection and provided a physical presence onsite during many event-related activities. As an inspector performing a reactive inspection, their oversight role was to inspect compliance with the terms and conditions of the permit, the MML, and with NRC regulatory requirements, to issue violations, and take enforcement actions, as appropriate. However, because the RIC and/or RICS did not promptly assign oversight roles to other individuals to provide an onsite presence at KAFB, the AFIA inspector stepped in to facilitate communications

between the permittee and the RIC/RICS. As a result, there was a bifurcation of accountability and a diffusion of responsibility when the AFIA inspector served two roles with competing interests—performing a reactive inspection and oversight of the permittee while simultaneously assisting the permittee with navigating the complex event and restoring compliance.

Additionally, there were challenges associated with the licensee communicating event status with NRC in order for NRC to fulfil its oversight role. After the source was returned to the shielded position for the first time, the NRC requested that they be notified in advance of any repair work being performed to allow NRC inspectors to perform oversight and observe those activities as part of the ongoing reactive inspection. The RICS did not notify the NRC that permission had been granted to the PRSO to proceed with the repairs to the emergency cable system and other irradiator components until after the irradiator source became stuck a second time. As a result, the NRC missed opportunities to perform oversight of the licensed activities.

4.2.4 Safety Culture Challenges

The NRC defines safety culture as the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment. Information regarding the Safety Culture Policy Statement, which sets forth the NRC’s expectation that individuals and organizations establish and maintain a positive safety culture commensurate with the safety and security significance of their activities, can be found at <https://www.nrc.gov/about-nrc/safety-culture/sc-policy-statement>.

Key safety culture traits include: leadership safety values and actions; problem identification and resolution; personal accountability; work processes; continuous learning; environment for raising concerns; effective safety communication; respectful work environment; and a questioning attitude. Several key personnel working under the panoramic irradiator permit, which was the licensee’s most risk-significant permit, failed to demonstrate behaviors consistent with these safety culture traits as evidenced by the actions taken in response to the event. The circumstances of the KAFB irradiator stuck source event revealed that the existing culture at the irradiator facility appeared to prioritize restoring the irradiator to operation over radiation safety, failed to detect and prevent significant failures, and did not enforce following procedures necessary to meet regulatory requirements.

Priority was given to restore the irradiator to operation instead of focusing on safety. The RICS provided approval of actions without informing the RIC, the Permittee, or the NRC. This created missed opportunities for dialogue and questions to be raised regarding the planned actions. The irradiator was operated before the cause evaluation was completed and approved, and before a plan for returning the irradiator to operation was developed and approved, which was a significant causal factor in the source getting stuck in an unshielded position a second time.

Having quality procedures and following those procedures is a fundamental element of a positive safety culture. There were multiple examples of the irradiator staff operating under direction of the PRSO to perform work that was not addressed in any procedure and was in violation of the permit, the MML, or NRC regulatory requirements. The irradiator staff did not question or object to the performance of work without a procedure.

The permitting process by the RICS under the MML also did not focus on quality irradiator procedures. Information from the investigation revealed that the RICS did not perform a detailed review of irradiator procedures during its permit renewal reviews. The RICS authorized the permit renewal without ensuring that irradiator procedures were finalized and technically adequate before the renewal was authorized. For example, some of the procedures submitted by the Permittee as part of the renewal application were still in draft form with comments and revisions pending acceptance. Additionally, the annual maintenance procedures did not address essential maintenance activities, such as routine lubrication of the source drawer. Although annual irradiator maintenance required two people to complete the work; the procedure allowed one person to sign off as having completed the work.

5 Corrective Actions

To correct the direct cause of the stuck source, a new snap ring made of stainless steel was installed, and a new design was implemented to prevent a broken snap-ring from falling in between the source drawer and shield. A licensed service provider rebuilt and refurbished the irradiator, including the emergency cable system. The licensed service provider rebuilt the emergency cable system using two cable sections. The two sections of cable used more robust wire cable, and were connected using an OSHA-approved method. The OSHA-approved method used multiple clamps in 90-degree offsets and thimble end to end terminations. The licensed service provider successfully tested the operation of the irradiator and the emergency cable system without a source in the source drawer. The licensed service provider reinstalled the source and successfully tested operation of the irradiator and the emergency cable system. The licensee then put the irradiator back into operation.

Using information provided by the licensed service provider regarding the design of the irradiator, a safety evaluation document was created to identify and describe the components that comprise the irradiator's safety design features. The licensee was in the process of updating and revising the irradiator's operating, emergency, and security procedures, and making the new procedures and the safety evaluation document part of the conditions of the irradiator permit.

Irradiator staff have been provided with updated annual safety review training that included a discussion of this event, and training continues to be updated with resulting changes to procedures or permit conditions as they occur. Training regarding the expected response to unusual conditions observed during operation of the irradiator was provided to irradiator operators. Irradiator staff now have greater awareness of how to address unusual conditions that occur during irradiator operations. For example, in November 2025, during irradiator operations, an unusual noise was heard, and irradiator operations were stopped. The irradiator operators contacted appropriate levels of management who assisted with arranging for the licensed service provider to come out to the site and evaluate.

6 Conclusions

Four apparent violations were identified involving the licensee's failure to: (1) have and follow written operating or emergency procedures as required by 10 CFR 36.53(a)(1) and (b)(1); (2) have and follow written procedures for inspections and maintenance checks as required by 10 CFR 36.53(a)(6) and 10 CFR 36.61(a)(12); (3) have a fire extinguishing system capable of extinguishing a fire without personnel entry into the room as required by 10 CFR 36.27(b); and (4) provide complete and accurate information to the NRC related to the causal factors analysis, as required by 10 CFR 30.9 and 10 CFR 30.81(j).

7 Exit Meeting

On April 17, 2026, a final exit meeting was conducted in person with Lt. Col. Adam and by videoconference with Col. Wheeler, Col. John Smith, Col. Brad Butler, Major John Wang, Adam Stefankiewicz, and Steven Loertscher to discuss the inspection and investigation findings. The NRC representatives discussed the content of the inspection report, described the NRC's enforcement process, and described the options for the licensee to: (1) request ADR, or (2) request a PEC.