
INSPECTION PROCEDURE 87121

INDUSTRIAL RADIOGRAPHY PROGRAMS

Effective Date: May 16, 2024

PROGRAM APPLICABILITY: IMC 2800

87121-01 INSPECTION OBJECTIVES

- 01.01 To determine if licensed activities are being conducted in a manner that will protect the health and safety of workers and the general public.
- 01.02 To determine if licensed programs are being conducted in accordance with U.S. Nuclear Regulatory Commission (NRC) requirements using a risk-informed, performance-based regulatory approach.

87121-02 INSPECTION REQUIREMENTS

This inspection procedure (IP) contains the standard requirements and guidance for inspections of licensees authorized for the possession and use of licensed material involved in industrial radiographic programs. The review of the licensed activities will be commensurate with the scope of the licensee's program. The inspector's evaluation of a licensee's program should be based on direct observation of work activities, interviews with workers, demonstrations by workers performing tasks regulated by NRC, and independent measurements of radiation conditions at the facility, rather than exclusive reliance on a review of records. Additionally, the inspector should use a risk-informed approach to perform the inspection, such as choosing the activities that carry the highest risk to inspect first. This can help ensure that in cases of limited time with the licensee due to varying circumstances, the most risk-significant licensee activities are reviewed for each inspection. This IP does not address the implementation of the requirements in 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material." For inspections of a licensee possessing quantities above the aggregated Category 2 quantities of radioactive material, the inspector should also use IP 87137, "10 CFR Part 37 Materials Security Programs," which contains the requirements and guidance for security inspections for licensees possessing Category 1 and 2 quantities of radioactive material.

Inspection Manual Chapter (IMC) 2800 provides the number of licensee locations that should be inspected based on the total number of licensee field stations. For licensees that have multiple locations of use at field stations, the inspector should consider the following in selecting inspection locations: (1) risk significance of the operations performed at the location; (2) work location of the radiation safety officer (RSO) in order to assess the RSO's oversight of the radiation safety program; and (3) recency of inspection of the field station location. Additionally, priority should be given to inspection of new locations of use and field stations added to the license since the previous inspection. The inspector should coordinate and interface with the licensee's corporate RSO and local RSO, if any, as part of every inspection; however,

coordinating and interfacing with the local RSO (delegated) is necessary if program oversight and duties are delegated by the primary (corporate) RSO. Furthermore, the inspector should take additional steps to arrange an inspection at a temporary job site for licensees whose primary operations are conducted at temporary job sites (as opposed to permanent radiographic installations). Additional steps may include, but are not limited to, requesting the temporary job site schedule prior to the inspection, or reviewing the utilization logs at the beginning of the inspection, to determine the locations that radiography cameras were signed out to.

The inspector should identify any ongoing radiography activities that the licensee may be conducting or planning to conduct in off-shore Federal waters and identify the location and expected duration of the job(s). If any off-shore radiography activity is identified, an attempt should be made to conduct/schedule off-shore inspections. For inspections in off-shore waters, the staff should coordinate in advance with the Bureau of Safety and Environmental Enforcement (BSEE), who may facilitate transportation to off-shore facilities based on availability (as described in Letter of Agreement (LOA) between BSEE and NRC dated May 30, 2012 (ML12152A077)).

If the licensee's main office is located in an Agreement State, the NRC inspection may include the main office location to inspect its oversight of licensed activities. The inspector should determine whether a site visit to the main office is necessary to complete the inspection. If an inspection to the main office is necessary, the inspector should notify the Agreement State prior to conducting the inspection, and the inspection should be limited to the NRC licensed activities that have occurred in Federal jurisdiction. If the inspector notices an apparent violation of Agreement State licensed activities, the inspector should immediately inform the licensee and promptly notify the Agreement State through the Regional Agreement State Program Officer.

The structure and emphasis of the inspection should be on the following risk modules that describe the outcomes of an effective industrial radiography radiation protection program. Risk modules (RMs) are defined as components in the inspection procedures used to focus the inspection effort on: (1) licensed activities that present higher risk for a particular licensee type, and/or (2) radiation safety program areas that are expected to effectively reduce the risk associated with the use of radioactive material. To consider an inspection complete, the inspector should review applicable RMs based on ongoing activities at the time of the inspection. The RMs that carry the highest risk components should always be completed to the best of the inspector's ability. Additional inspection elements that carry less risk can be found as appendix A to this inspection procedure. These additional elements are not required to be reviewed as part of a risk-informed inspection approach but may be reviewed if the inspector has additional time, if the additional elements are related to safety issues identified in the RMs, or if multiple violations were identified through review of the following RMs.

02.01 RM-1: Observation of Licensed Activities at Temporary Job Sites and/or Permanent Radiographic Installations

If possible, the inspector should observe any licensed activities that may be ongoing during the inspection; this may be determined during the entrance meeting or earlier communications with the licensee. Since this is the most important aspect of an industrial radiography inspection, priority should be given to observing the licensee's work at temporary job sites whenever possible. Additionally, if the licensee is authorized to perform industrial radiography at the licensee's facility (perhaps within a permanent radiographic installation or performing source exchanges), observing these activities should also be given priority.

02.02 RM-2: Access Control for Licensed Material

The licensee shall control access to and prevent loss of licensed material in accordance with 10 CFR 20.1801 and 1802, as well as 10 CFR Part 37 for greater than Category 2 quantities of material. Although IP 87137 should be used for the inspection of these quantities of material greater than Category 2, industrial radiography licensees may also possess radiography sources that have decayed down to below Category 2 quantities, as well as other non-radiography sources such as cesium-137 calibration sources.

02.03 RM-3: Calibration and Use of Radiation Detection Instrumentation and Personnel Dosimetry

The licensee shall possess radiation instrumentation to monitor radiation levels in areas where industrial radiography devices are used and stored, in accordance with 10 CFR 20.1501, 34.25, and 34.49. If the licensee is authorized to perform instrument calibrations, the inspector should review the licensee's calibration program to ensure that these instruments are being calibrated appropriately. Additionally, industrial radiographers are required to wear pocket dosimeters, alarming rate meters, and a personnel dosimeter during radiographic operations in accordance with 10 CFR 34.47; the calibration/use of these devices should be reviewed during the inspection, with particular attention to multifunctional electronic dosimetry instrumentation. For more information on these devices, see RIS 2017-06.

02.04 RM-4: Inspections, Maintenance Program, and Physical Inventories

The inspector should review the licensee's program to perform quarterly inspection and maintenance activities regarding exposure devices, associated equipment, and source changers in accordance with 10 CFR 34.31. Additionally, the inspector should review the licensee's material control and accountability practices to include performance of quarterly physical inventories in accordance with 10 CFR 34.29.

02.05 RM-5: Training and Supervision of Industrial Radiographers and Radiographers' Assistants

The licensee should ensure that workers are knowledgeable of radiation uses and safety practices in both normal and accident conditions, in accordance with 10 CFR Parts 19 and 20, and through annual refresher safety training provided in accordance with 10 CFR 34.43(d). The inspector should review the licensee's training program to ensure that radiographers are trained in accordance with 10 CFR 34.43(a-b), and radiographer's assistants are trained in accordance with 10 CFR 34.43(c). The inspector should also ensure, generally through observations of radiographic operations, that radiographer's assistants are properly supervised by direct observation in accordance with 10 CFR 34.46.

02.06 RM-6: Management Oversight

The licensee's management system should be appropriate for the scope of licensed activities and should ensure the appropriate implementation of the radiation protection program, and that periodic audits are performed, in accordance with 10 CFR 20.1101. The periodic audits should also include the radiographer and radiographers' assistants' performance of licensed activities during actual industrial radiographic operations, in accordance with 10 CFR 34.43(e). In reviewing the licensee's performance, the

inspector's evaluation should examine the licensee activities from the date of the previous inspection. However, issues preceding the last inspection should be reviewed, if warranted by circumstances, such as incidents, repetitive violations, or excessively high radiation exposures.

87121-03 INSPECTION GUIDANCE

General Guidance

The following inspection guidance is designed to assist the inspector in evaluating the performance of the licensee's radiation safety program. The guidance is organized by the individual RMs described above. The timing and sequence of inspection activities are left to the inspector's discretion based on the circumstances and conditions at the time of the actual inspection. Furthermore, inspectors should not feel constrained by the guidance in this procedure. If an inspector obtains information that indicates that a problem may exist in an area within the NRC's jurisdiction that is not specifically addressed in this procedure, the inspector should address that problem.

Some of the requirement and guidance sections of this procedure instruct the inspector to "verify" the adequacy of certain aspects of the licensee's program. Verification should use a performance-based, risk-informed approach and be accomplished through discussions, observations, and demonstrations with qualified licensee staff.

An examination of the licensee's records should not be considered the primary part of the inspection. For example, observations of activities in progress, equipment, facilities, and use areas will be a better indicator of the licensee's implementation of the radiation safety program than a review of records. Records that are closely related to health and safety and security (such as personnel dose monitoring records, incident reports and control of material) should be examined in detail with qualified licensee staff. The inspector may randomly or selectively examine other records such as receipt and transfer of licensed materials, radiation surveys, quarterly inventory, training, utilization logs, and inspection/maintenance of the equipment, until the inspector is satisfied that the required records are maintained and complete.

Common elements to all inspections include entrance and exit meetings with appropriate licensee management, including the RSO, observations of facilities and work in progress, independent confirmatory surveys, and any special license conditions. Specific guidance regarding these common elements can be found in IMC 2800.

Specific Guidance

Each of the following areas should be reviewed, if possible, during each inspection of industrial radiography licensees:

03.01 RM-1: Observation of Licensed Activities at Temporary Job Sites and/or Permanent Radiographic Installations

If possible, the inspector should observe any licensed activities that may be ongoing during the inspection; this may be determined during the entrance meeting with the licensee. Since this is the most important aspect of an industrial radiography inspection, priority should be given to observing the licensee's work at these temporary job sites whenever possible. Additionally, if the licensee is authorized to perform industrial

radiography at the licensee's facility (such as within a permanent radiographic installation or performing source exchanges), observing these activities should be given priority.

The inspector should make every reasonable effort to perform a field inspection at a temporary job site of the licensee. If possible, this inspection should be unannounced, as the inspector should try to make some of the observations of the licensee's operations before announcing their presence. Conducting an unannounced inspection is sometimes not possible; therefore, performing an announced inspection of a TJS should be pursued rather than not performing one. The inspector should always approach a TJS with their survey meter powered on to provide immediate indication of radiation levels. Additionally, the inspector should assure that they wear their assigned personnel monitoring badge. Additional monitoring required to be used by radiographers (e.g., pocket dosimeters and alarming rate meters) may also be worn but are not required for inspectors. During the TJS/field inspection, verify the following, at a minimum.

- Verify that the boundaries of the restricted area are controlled and posted, and the radiation levels at the boundary of the restricted area do not exceed 2 mrem in any 1 hour. Ask the licensee how they ensure that the radiation level limits (2 mrem in any 1 hour) are complied with and make an assessment of the adequacy of the methods. The inspector may ask the licensee to spot-check radiation levels in selected areas, using the licensee's own instrumentation. However, the inspector should use NRC's instruments for independent verification of the licensee's measurements. The inspection should verify that the radiation area and high radiation area are posted in accordance with 10 CFR 20.1902. This is important, because events have occurred where both inspectors and members of the public were unnecessarily exposed to radiation from industrial radiographic operations where the radiation area and high radiation areas were not appropriately posted.
- Verify that the radiographer or radiographer's assistant performs a survey of the exposure device and guide tube after each exposure of the source. The survey must be sufficient to confirm that the source has returned to its fully shielded position.
- Verify that operations are conducted by at least two qualified individuals (in accordance with 10 CFR 34.41), and that the individuals are maintaining constant surveillance of the restricted area at all times.

Awareness: Commission interpreted the requirements in 10 CFR 34.41(a) on June 1, 2021¹. NRC interprets § 34.41(a) such that the requirements contained in the sentence, “[t]he additional qualified individual shall observe the operation and be capable of providing immediate assistance to prevent unauthorized entry” are met if the second qualified individual is in sufficiently close proximity to the operation and sufficiently aware of the ongoing activities to be capable of providing immediate assistance to prevent unauthorized entry.

1. On June 1, 2021, the NRC issued a Notification of Interpretation about the requirements in 10 CFR 34.41 (a) regarding industrial radiographic operations at temporary radiography jobsites. (86 FR 29173). Note: This reinterpretation does not relieve licensees to meet the requirements in 10 CFR 34.46 and 34.51.

Therefore, there could be circumstances where the second radiographer may rely on active surveillance or communication tools to monitor operations in real-time to both prevent unauthorized entry at the boundaries of a TJS and render immediate assistance to the primary radiographer, as needed. Licensee assignment for the second person should be such that they are staged at a location that would enable the second individual to immediately assist the primary qualified radiographer to prevent unauthorized entry to controlled areas, take control of the radiography camera, if needed, and maintain access controls, all in accordance with operating and emergency procedures.

- Verify that the high radiation area is under **continuous direct visual surveillance, by the radiographer, or the other second individual present**, as required by 10 CFR 34.51.
- Verify that each radiographer and/or assistant radiographer is wearing an operable alarming rate meter, direct reading dosimeter, and a personal dosimeter, in accordance with 10 CFR 34.47. The inspector should ask the radiographer/assistant how they ensured that their rate meter and direct reading dosimeter were operable prior to beginning their shift, and that “start” readings for the pocket dosimeters were recorded at the beginning of the shift.
- Verify that the radiography crew has at least one operable and calibrated radiation detection instrument on hand, and that it is being used appropriately, in accordance with 10 CFR 34.49.

Inspectors have identified that most industrial radiography overexposures can be attributed to either the failure to have a survey meter or the improper use of a survey meter (e.g., not conducting surveys, not looking at the readings).

At job sites where other workers are present, the inspector should interview them to determine their understanding of the licensee's access controls. Although these workers may not have or need any knowledge of the licensee's operations, if they were informed of the licensee's operations, this would be an indication of the licensee's good safety practices. Inspectors should keep in mind that, as non-licensees, such persons have no obligation to cooperate with the NRC or answer questions.

Through direct observation, verify that the licensee properly transports radiographic devices. Examine packages (including overpacks) for proper labeling and review associated certification documentation, as appropriate. Examine vehicles for proper blocking and bracing of shipping containers. Verify that shipping papers are complete and available. Survey packages and vehicles to verify compliance with 10 CFR Part 71 and U. S. Department of Transportation (DOT) regulations for transportation of radioactive materials.

It should be noted that, in many instances, the inspector is required to obtain the permission of the property owner or site/location manager to enter the property in order to perform the TJS inspection. Since the property owner is often not an NRC licensee, then they are under no obligation to allow the inspector onto the property. In these limited circumstances, it may be possible to still observe licensed activities of the radiography crew without entering the property on which the licensed activities are being performed.

The inspector should be prepared to possess/use personal protective equipment (e.g., hard hat, fire retardant clothing, safety glasses, steel toe boots) to enter many temporary job sites. If the inspector does not have the appropriate PPE, the licensee is under no obligation to allow the inspector to enter the TJS.

If there are no licensed activities ongoing at the time of inspection to observe, the inspector should interview radiographers and radiographer assistants to ascertain their level of knowledge of radiation safety practices and industrial radiography requirements. For instance, the inspector could ask for a demonstration of how the licensee performs radiation surveys, or how alarming rate meters are checked for proper operation prior to use. The inspector could also ask the licensee to demonstrate how they recharge their pocket dosimeter prior to beginning radiographic operations. It should be noted that the inspector should refrain from asking the licensee to crank out a source merely for demonstration purposes, as this could lead to inadvertent safety issues such as a source disconnect. A possible exception to this statement could involve a request for the licensee to demonstrate the alarms and interlocks at a permanent radiographic installation, which would require cranking out the source.

Through direct observation and licensee staff interviews, verify that any permanent radiographic installation is configured in accordance with the design and performance requirements found in 10 CFR Part 34. Specifically, verify that the facility has an operable independent entrance control or visible audible alarm system pursuant to 10 CFR 34.33. Observe staff tests of the entrance controls and/or radiation warning signals, to confirm operability during the inspection.

Through the performance of radiation surveys, if the inspector identifies areas around the permanent radiographic installation that exceed 2 millirem per hour, the inspector should verify that the licensee has posted/restricted access to that area as appropriate. Alternatively, the licensee may have performed calculations based on occupancy factors that demonstrate that no member of the public would exceed 2 millirem in any 1 hour. Either way, the inspector should ask the licensee to explain their rationale for these situations.

Posting and Labeling

- Verify that proper caution signs are being used at access points to areas containing licensed materials, radiation areas, and high radiation areas; licensees sometimes combine the radiation area and the restricted area with respect to posting signs. (Note: the exemptions under 10 CFR 20.1903 do not apply to radiographic operations). The inspector should spot-check labeling on packages or other

containers to determine that proper information (e.g., radionuclide, quantity, and date of measurement) is recorded.

- Verify that storage areas, radiation areas, and high radiation areas at temporary job sites are conspicuously posted as required. Depending on the associated hazard and licensing requirements, controls may include tape, rope, or structural barriers to prevent access into the restricted area.
- Examine locations where notices to workers are posted. Applicable documents, notices, or forms should be posted in a sufficient number of places to permit individuals engaged in licensed activities to observe them on the way to or from any particular licensed activity location to which the postings would apply.

03.02 RM-2: Access Control for Licensed Material

The licensee shall control access to and prevent loss of licensed material in accordance with 10 CFR 20.1801 and 1802, as well as 10 CFR Part 37 for greater than Category 2 quantities of material. Although IP 87137 should be used for the inspection of these quantities of material greater than Category 2, industrial radiography licensees may also possess radiography sources that have decayed down to below Category 2 quantities, as well as other non-radiography sources such as cesium-137 calibration sources.

Upon arrival at the licensee's facility, the inspector should verify that there are no unsecured radiography cameras or other licensed material in the parking lot. Events have occurred where radiography cameras were left on the tailgate of a truck by workers that are preparing to leave for a job site. Additionally, source changers have been discovered near the front door of licensees' facilities after being dropped off by a common carrier or after being placed outside by the licensee for pickup.

Through direct observation and licensee staff interviews, determine that all entrances to radiographic facilities are normally closed, locked, or otherwise secured to prevent unauthorized entry. This should include main facility gates, main building entrances, and doors to radiographic storage facilities.

- If any entrances or areas are found to be unsecured, determine, through interviews with licensee workers, the reason for the area or entrance being unsecured. Determine if the licensee failed to follow established procedures in securing the area or if additional training of staff is needed. Determine if the licensee's facility is configured to separate unrestricted workstations from unrestricted areas.
- If entrances or other areas are found to be unsecured, examine areas where radioactive materials are used and/or stored. Storage areas should be locked and have limited and controlled access. Radioactive material use areas should be under constant surveillance or physically secured. If the licensee possesses any licensed material that is below the Category 2 quantity for that isotope, ensure that it is secured in accordance with 10 CFR 20.1801 and 1802; this could include cesium-137 calibration sources and decayed radiography sources. All other licensed material that is greater than the Category 2 quantity for that radionuclide should be secured in accordance with 10 CFR Part 37, and IP 87137 should be used to complete that portion of an industrial radiography inspection.

03.03 RM-3: Calibration and Use of Radiation Detection Instrumentation and Personnel Dosimetry

The licensee shall possess radiation instrumentation to monitor radiation levels in areas where industrial radiography devices are used and stored, in accordance with 10 CFR 20.1501, 34.25, and 34.49. If the licensee is authorized to perform calibrations, the inspector should review the licensee's calibration program to ensure that these instruments are being calibrated appropriately. Additionally, industrial radiographers are required to wear pocket dosimeters, alarming rate meters, and a personal dosimeter during radiographic operations in accordance with 10 CFR 34.47; the calibration and use of these devices should be reviewed during the inspection, with particular attention to multifunctional electronic dosimetry instrumentation, as described in RIS 2017-06.

Area Surveys

- Verify that radiation levels at the boundary of any storage area do not exceed 0.02 mSv (2 mrem) in any one hour. The inspector may ask the licensee to check radiation levels in these areas, using the licensee's own instrumentation. However, the inspector should use NRC's instruments for independent verification of the licensee's measurements. Ensure that the licensee's survey meters are operational and have been calibrated within the last 6 months.
- Verify that an evaluation has been performed that demonstrates that the use and storage of sealed sources will not likely result in exposures to members of the public or radiation levels in unrestricted areas that are in excess of the regulatory limits (2 millirem in any one hour, 100 millirem in a year). For storage areas that are located adjacent to unrestricted areas, licensees must ensure (through measurement or calculation) that doses in the unrestricted areas do not exceed 2 millirem (mrem) in any one hour or 100 mrem in a year to the maximally exposed member of the public.

Survey Meters/Instruments

- Verify that survey instrumentation has the appropriate range of use, as required by 10 CFR 34.25; most survey meters used by radiography crews have a range of zero to 2,000 mR/hour.
- Verify that the survey meters are properly calibrated at 6-month intervals and are currently calibrated. The technical adequacy of calibration procedures at facilities that perform their own calibrations should be examined (IP 87143, "Self-shielded Irradiator and Calibrator Devices," may be helpful, as this procedure discusses how to review various calibration programs). Verify that the licensee performs an appropriate battery/operability check before use on each day that the equipment is used.

Alarming Rate Meters and Pocket Dosimeters

- Verify that direct reading dosimeters (pocket dosimeters) and alarming rate meters are worn by appropriate personnel while performing radiographic operations. Note that alarming rate meters are not required to be worn when radiography is being performed at permanent radiographic installations.

- Verify that alarming rate meters and pocket dosimeters are calibrated at 12-month intervals, as required by 10 CFR 34.47(c) and (g). As previously stated, at facilities that perform their own calibrations, the adequacy of these calibrations should be reviewed through interviews with employees directly involved in the calibration of this equipment.
- The inspector should be aware that recently-approved equipment exists, and is sometimes used by licensees, to meet the requirements for the alarming rate meters and pocket dosimeters. The functions of a survey meter, alarming rate meter, and pocket dosimeter are sometimes combined into a single instrument; however, the only functions that are allowed to be used in a single instrument are the alarming rate meter and pocket dosimeter functions. There must be an independent device to provide the survey meter function, as this provides redundancy to the reliability of these devices.
- Alarming rate meters should be set to alarm at 500 millirem/hour, as required by 10 CFR 34.47(g)(2). Additionally, pocket dosimeters should have a range of 0-200 millirem, as required by 10 CFR 34.47(a)(1).

Personal Dosimeters

- Through observation, verify that personnel dosimetry devices (film badges, TLDs, or OSLs) are worn by appropriate licensee personnel, including all radiographers and radiographer's assistants. Dosimetry devices appropriate to the type, energy of emitted radiation, and the anticipated radiation fields, must be issued to licensee personnel. Verify that any dosimeters, that require processing to determine the radiation dose, are processed by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited processor. Film badges should be replaced at least monthly, and TLD and OSL badges should be replaced at least quarterly, as required by 10 CFR 34.47(a)(3).
- Alternatively, the licensee may provide Direct Ion Storage devices as personal dosimeters; if these are used, the licensee is required to develop and implement procedures to demonstrate the process for using these devices, such as how often the badges should be read. The inspector should interview personnel to determine how they operate and read the device, if training was performed on the use of these devices and was sufficient to ensure their proper use. For more information on Direct Ion Storage devices, see RIS 2018-04.
- Verify that, pursuant to 10 CFR 19.13(b), the licensee advises each worker annually of the worker's dose as shown in records maintained by the licensee pursuant to the provisions of 10 CFR 20.2106, "Records of individual monitoring results." Verify that this has been done by asking workers and management if the written report requiring this information has been provided to each of them within the last year. The report must include external doses from routine operations, accidents, and emergencies. The report to the individual must contain all of the information required in 10 CFR 19.13(a).

03.04 RM-4: Inspection and Maintenance Program; Physical Inventories

The inspector should review the licensee's program to perform quarterly inspection and maintenance activities regarding exposure devices, associated equipment, and source changers in accordance with 10 CFR 34.31. Additionally, the inspector should review the licensee's material control and accountability practices to include performance of quarterly physical inventories in accordance with 10 CFR 34.29.

Equipment. Through interviews with licensee personnel, verify that the types and quantities possessed by the licensee are within any applicable license limits and that the licensee is using approved combinations of sources and devices. Verify that all sealed sources (source assemblies), radiography devices (cameras), and source changers used by the licensee (unless specifically exempted) meet 10 CFR 34.20 requirements. Confirm that licensees are aware that associated equipment needs to comply with 10 CFR 34.20. Refer to Regulatory Issue Summary 2005-10, "Performance-Based Approach for Associated Equipment in 10 CFR 34.20," (ML051590049) for additional information about acceptable methods to demonstrate that associated equipment complies with 10 CFR 34.20.

If the associated equipment appears to be modified or defective (defective equipment may be an indication of a modification), the inspector should verify whether or not the licensee had developed and implemented a testing program to demonstrate that modified components meet the performance criteria in 10 CFR 34.20. The expectation is that the design safety features of the industrial radiography system were not compromised by a replacement component of associated equipment that was modified by the licensee, or that was provided to the licensee by a company that manufactures third-party associated equipment. Before using a modified system, the licensee is required to demonstrate that the replacement component meets the performance criteria in 10 CFR 34.20(a)(1) and (2), (b)(3), (c)(5) and (8), and (e).

Routine and Non-Routine Maintenance. Through direct examination, assess the condition of licensee equipment, i.e., cameras, drive cables, and source changers. The examination should be sufficiently thorough to detect any of the following conditions: excessive or uneven wearing, fraying, unraveling, nicks, kinks or bends, loss of flexibility (abnormal stiffness), excessive grit or dirt, and stretching. The inspector may refer to Appendix O, "Daily Maintenance Check of Radiographic Equipment," NUREG-1556, Volume 2, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Industrial Radiography Licenses."

It should be noted that guide tubes sometimes become kinked or unravel on the inside of the tube, with little to no evidence of this on the outside of the guide tube. One method of checking the inside diameter of the guide tube, as observed in past inspections, was observing the licensee drop a Number 2 pencil down through one end of the guide tube and see if it comes out the bottom end of the tube without obstruction. Since a Number 2 pencil is approximately the same diameter as a typical pigtail (radiography sealed source assembly), this can identify obstructions within the guide tube that could reasonably be expected to cause a sealed source assembly to become stuck during radiographic operations.

Should a defect, such as a damaged cable, be found in use, notify an appropriate licensee representative and then expand the scope of the examination. Monitor actions,

if any, taken by the licensee in response to this discovery. Should the licensee elect to not take action, the inspector should consult with regional management.

Verify that the licensee has an inspection and maintenance program that complies with 10 CFR 34.31(a) and provides for visual and operability checks of radiographic equipment, survey meters, transport containers, associated equipment, and source changers before use and quarterly to ensure that the equipment is in good working condition. Verify that the licensee's inspection and maintenance program ensures that the sources are adequately shielded, and that the required labeling is present.

The inspector should verify that the licensee is aware of the requirements contained in 10 CFR Part 21 and 10 CFR 34.101(a), and has procedures in place for reporting defects and certain equipment failures.

Physical Inventory. In reviewing physical inventories, the inspector should refrain from simply looking at inventory records. Instead, the inspector could ask the licensee to demonstrate how they perform physical inventories and request a record of the latest physical inventory performed, and check that record against the licensee's actual inventory on hand. If the latest physical inventory had been performed within the past 3 months (10 CFR 34.29 (a)), then the inspector can consider the inventory review complete. If it had not been performed within the past 3 months, then the inspector may choose to review records of previous physical inventories to see if this was an isolated occurrence. If the licensee possesses a large quantity of inventoried items, the inspector may choose to randomly select certain items from the list and ask the licensee to demonstrate the location of those particular items.

The inspector should verify that the inventory includes radiographic exposure devices and storage containers containing depleted uranium and calibration source used for calibrating survey instruments.

03.05 RM-5: Training and Supervision of Industrial Radiographers and Radiographers' Assistants

The licensee should ensure that workers are knowledgeable of radiation uses and safety practices in both normal and accident conditions, in accordance with 10 CFR Parts 19 and 20, and through annual refresher safety training provided in accordance with 10 CFR 34.43(d). The inspector should review the licensee's training program to ensure that radiographers are trained in accordance with 10 CFR 34.43(a-b), and radiographer's assistants are trained in accordance with 10 CFR 34.43(c). The inspector should also verify, through observations of radiographic operations, that radiographer's assistants are properly supervised by direct observation in accordance with 10 CFR 34.46.

Transportation. Verify that each employee transporting licensed material has been trained in accordance with 49 CFR 172.602. Verify that the licensee's procedures and documentation are sufficient to ensure that licensed material is transported in accordance with 10 CFR Part 71 and U.S. Department of Transportation (DOT) regulations for transport of radioactive materials. For example, the person driving the vehicle should have within reach of the driver, a bill of lading and emergency response paperwork required by 49 CFR 172.602.

Certification. Verify that radiographers are certified by, for example, asking to see the radiographer's certification card, or verify through other appropriate means that all

radiographers, observed performing in that role are, in fact, certified (10 CFR 34.43). Through review of records, verify that radiographers are certified by a recognized certifying entity, such as the American Society of Nondestructive Testing (ASNT), or the State of Texas. Verify that at least one radiographer has an active certification on site when inspecting temporary job sites.

General Training. Interview one or more radiographers and/or radiographer assistants to determine that they possess the adequate knowledge and understanding of the licensee's operating and emergency procedures. The interviews should include discussions about actual or hypothetical emergency conditions in order to assess the worker's response to such conditions. Whenever practical, observe licensed activities in progress to assess the worker's understanding of the radiation protection requirements associated with their assigned activities.

The training of radiographer assistants is a critical part of any inspection, because a high number of events involving industrial radiography are caused by either improper training or inadequate supervision of radiographer assistants. During the inspection, through interviews with any radiographer assistants present, the inspector should:

Verify that radiographer assistants have been trained in accordance with 10 CFR 34.43(c)(1) for the following:

- the requirements of 10 CFR Parts 19, 20, 30, 34, and applicable DOT regulations;
- the NRC license under which the radiographer's assistants will perform industrial radiography; and,
- the licensee's operating and emergency procedures.

Verify that the radiographer's assistant has developed competence to use, under the personal supervision of a radiographer, radiographic exposure devices, sealed sources, associated equipment, and radiation survey instruments in accordance with 10 CFR 34.43(c)(2).

Verify that the radiographer's assistant has demonstrated understanding of the instructions provided in (c)(1) above by successfully completing a written test on the subjects covered in accordance with 10 CFR 34.43(c)(3).

Verify that the radiographer's assistant has demonstrated competence in the use of the hardware described in (c)(2) above by successful completion of a practical examination on the use of such hardware, in accordance with 10 CFR 34.43(c)(3).

Note: The requirement to successfully complete a practical examination in the use of hardware/equipment cannot be accomplished while the radiographer's assistant is operating as part of the two-person crew in an actual radiographic operation. This has been identified as a violation in numerous inspections at temporary job sites in the past. The practical exam can be performed in the presence of two certified radiographers if conducted during actual radiographic operations or can be performed at the licensee's facility as a demonstration only, and not during an actual radiographic operation.

Observe related activities (i.e., transportation of licensed materials, surveys and equipment checks, and maintenance activities) and interview personnel to assure that appropriate training was actually received by these individuals. Note that if a radiographer or radiographer's assistant has not participated in an industrial radiographic operation for more than 6 months, they must demonstrate knowledge of training requirements by a practical examination, before these individuals can participate in a radiographic operation. Verify that radiographers understand that they must directly supervise radiographic operations and that radiographers' assistants are aware that they can operate radiographic equipment only under the direct supervision (direct observation) of certified radiographers.

Verify that licensees are performing refresher training, for radiographers and radiographer assistants, at least every 12 months.

Operating and Emergency Procedures. Through interviews with staff, as stated previously, verify that licensee personnel are knowledgeable of and implementing the licensee's approved operating and emergency procedures. Confirm that the licensee has not made changes to these procedures without prior NRC approval, and that any changes made do not diminish the effectiveness of the licensee's radiation safety program.

03.06 RM-6: Management Oversight

The licensee's management system should be appropriate for the scope of licensed activities and should ensure the appropriate implementation of the radiation protection program, and that periodic audits are performed, in accordance with 10 CFR 20.1101. The periodic audits should also include the radiographer and radiographer assistant performance of licensed activities during actual industrial radiographic operations, in accordance with 10 CFR 34.43(e).

The NRC holds the licensee responsible for the radiation protection program; therefore, it is essential that strong management controls and oversight exist to ensure that licensed activities are conducted properly.

Radiation Safety Officer (RSO). In order to assess the RSO's oversight of the program, the work location of the responsible RSO (primary or delegated) should be identified and an interview should be conducted. Especially with larger radiography companies, there may be a corporate RSO that oversees the big-picture aspects of the company's safety oversight (such as maybe annual audits of the licensee's radiation safety program), and then there may be local RSO's appointed by the corporate RSO to oversee the day-to-day operations at each field station listed on the license. The inspector should ascertain the level of communication between the corporate and local RSO's, and that the local RSO's have the authority to implement corrective actions for health and safety issues that arise at the local level. Through interviews of the RSO and any locally-appointed RSO's, verify that the RSO has been appointed by licensee management, identified on the license, and is responsible for implementing the radiation safety program. Determine, through interviews, that this individual is knowledgeable about the program, and ensures that activities are being performed in accordance with approved procedures and the regulations. Determine that, when deficiencies are identified, the RSO has sufficient authority, without prior approval of licensee

management, to implement corrective actions, including termination of operations that pose a threat to health and safety of the public or to workers. For situations where the RSO may be in another state or NRC Region, refer to Inspection Manual Chapter (IMC) 2800 for further guidance.

Verify that the RSO, or designee, is performing audits of the job performance of each radiographer and assistant radiographer during actual radiographic operations at intervals not exceeding 6 months.

Audits. Through reviews of audit records and interviews, verify that the radiation safety program content and implementation is reviewed at least annually. The results of all audits must be documented in accordance with 10 CFR 20.2102(a)(2). Examine these records with particular attention to deficiencies identified by the licensee's auditors, and note any corrective actions taken as a result of deficiencies found. If no corrective actions were taken, determine why the licensee disregarded deficiencies identified during audits. Determine if the lack of corrective actions caused the licensee to be in non-compliance with regulatory requirements. The inspector could use this opportunity to discuss the benefits of a licensee identifying issues and correcting them prior to the inspection (i.e., potentially resulting in non-cited violations).

Incidents and Unusual Occurrences. Review and evaluate any incident or unusual occurrence that took place since the last inspection. Verify if incidents were required to be reported, and, if so, that proper reporting procedures were followed. For incidents or unusual occurrences not required to be reported, determine that the licensee performed sufficient investigation to identify the cause of the incident, and took appropriate corrections to prevent recurrence of the situation leading to the incident or unusual occurrence. Verify that all industrial radiography personnel understand the mechanism for raising safety concerns and the proper response to warnings made in the event of any unusual occurrence or malfunction that may involve exposure to radiation and radioactive material. The workers should also be informed of the pertinent provisions of NRC regulations and the license, and the requirement to notify management of conditions observed that may, if not corrected, result in a violation of NRC requirements.

87121-04 RESOURCE ESTIMATE

The length of time necessary for a typical industrial radiography licensee's inspection will depend on the number of radiographic exposure devices possessed by the licensee, as well as the number of locations these devices are used and/or stored. The typical onsite industrial radiography inspection may be approximately 4 to 8 hours, with additional time possibly necessary for travel to multiple locations of use and/or storage and observations of licensed activities at various temporary jobsites. This estimate only applies to the health and safety inspection and does not include the review of the licensee's compliance with 10 CFR Part 37 requirements; the time estimate for the security portion of the inspection can be found in IP 87137, "Materials Security Programs."

87121-05 REFERENCES

NRC, June 1, 2021, Notification of Interpretation, "Industrial Radiographic Operations and Training," [86 FR 29173](#)

Office Procedure SA-500, "Jurisdiction Determinations"

IMC 2800, "Materials Inspection Program"

IP 87137, "10 CFR Part 37 Materials Security Programs"

Letter of Agreement (LOA) dated 5/30/2012, "Letter of Agreement between BSEE and NRC"
(ML12152A077)

NUREG-1556, Volume 2, "Consolidated Guidance About Materials Licenses: Program-Specific
Guidance About Industrial Radiography Licenses," Revision 1

NUREG-2155, "Implementation Guidance for 10 CFR Part 37, "Physical Protection of
Category 1 and Category 2 Quantities of Radioactive Material"

NUREG-2166, "Physical Security Best Practices for the Protection of Risk-Significant
Radioactive Material "

END

Appendix:

Appendix A: Additional Inspection Elements

Attachment:

Revision History for IP 87121

Appendix A: Additional Inspection Elements

87121A-01 PURPOSE

The guidance in this appendix is intended to supplement inspection requirements and associated guidance provided in this procedure. The additional inspection guidance provided herein may be used as time allows or to assist in completing a rounded performance-based inspection.

87121A-02 BACKGROUND

Risk modules (RMs) are defined as components in the inspection procedures used to focus the inspection effort on: (1) licensed activities that present higher risk for a particular licensee type, and/or (2) radiation safety program areas that are expected to effectively reduce the risk associated with the use of radioactive material. The risk profile for each licensed program could be different and some programs may need more in-depth review. Therefore, the additional inspection elements included herein may be used to expand the scope inspection effort and/or supplement the risk modules in this procedure.

87121A-03 GUIDANCE

03.01 Reports

Verify that, pursuant to 10 CFR 20.2206(c), the licensee submits annual reports of individual monitoring, on or before April 30 of each year (covering the previous year) to the REIRS Project Manager by an appropriate method listed in 10 CFR 20.1007 or via REIRS Web site at <http://www.reirs.com>.

03.02 Leak Tests

Through interviews with licensee staff and review of records, verify that required leak tests are performed at the required interval. Determine if the licensee exchanges or returns their radiographic sealed sources to the vendor less than 6 months from the date that they were received, negating the need to perform periodic (6 month) leak tests.

1. If the licensee performs leak tests, verify that the wipe of a sealed source is taken from the nearest accessible surface to the sealed source where contamination might accumulate (i.e., the point on the camera or source exchanger where the guide tube or transfer tube connects) and at intervals not to exceed 6 months.
2. Verify that devices containing depleted uranium are leak tested annually, to verify the integrity of the "s" tube.
3. Verify that the licensee's leak test analyses (or that of its leak test services vendor) has sufficient sensitivity to measure 185 Becquerels (0.005 microcurie) for each type of isotope present on its license, as required in 10 CFR 34.27. Through discussions with licensee personnel and/or review of pertinent records, determine if the licensee had a leaking source or indication that the integrity of any "s" tubes was compromised. If leak test results show contamination in excess of the regulatory

limits, verify that the licensee made appropriate notifications, evaluations, and removed the source and/or device from service.

03.03 Waste Storage and Disposal

Determine if the licensee possesses any industrial radiographic sources or other licensed sources that have been removed from service. Verify that the sources are stored and controlled in a secure and safe manner, and that radiation levels in unrestricted areas surrounding the storage area do not exceed the limits of 10 CFR 20.1301, "Dose Limits for Individual Members of the Public."

In the rare case where a licensee may have transferred a source to a burial site for offsite disposal, review the licensee's procedures and records to verify that each shipment is accompanied by a shipment manifest that includes all the required information. Also review the licensee's procedures and records to verify that each package intended for shipment to a licensed land disposal facility is labeled, as appropriate, to identify it as Class A, B, or C waste in accordance with the classification criteria of 10 CFR 61.55 [Subsection III.A.2 of Appendix G to Part 20].

The inspector should be attentive to potential industrial safety hazards, for referral to the U.S. Department of Labor's Occupational Safety and Health Administration (see IMC 1007). The focus should be on potential non-radiological hazards personally observed or brought to the inspector's attention by licensee staff.

03.04 Operational Limits

Verify that industrial radiography devices (and sources) are used in accordance with any operational limits described in the applicable SS&D sheet. Through observation and discussions with the licensee, assess that: (1) storage conditions for the devices should be protected from explosion and fire, (2) package integrity is appropriately maintained, and that (3) controls are in effect to minimize the risk from other hazardous materials.

03.05 Temporary Job Site Hazards

During inspections of licensed activities at temporary job sites, verify that licensee personnel ensure that devices are protected from heavy construction equipment, welding equipment, high voltage lines, and other industrial hazards.

03.06 Fire Protection

Materials licensees are not required by NRC regulations to implement a fire protection program. However, in many cases, the risk posed to radiological safety by fires is comparable to or exceeds the risk from other events involving licensed activities. Determine if licensees have a plan in place for preventing fires and combating fires that might occur. Any perceived problems/deficiencies (i.e., improper storage of combustible or flammable material, fire extinguishers out of service, lack of fire alarm or detection system, lack of fire suppression system) noted by the inspector should be brought to the licensee's attention and discussed with regional management. Proper fire protection systems can be evidenced by the licensee's involvement with the local fire department.

Through interviews of licensee staff, determine if there were any incidents required to be reported to the DOT. For further inspection guidance, refer to IP 86740, "Inspection of

Transportation Activities.” Inspectors should also refer to “Hazard Communications for Class 7 (Radioactive) Materials.” These field reference charts, related to hazard communications for transportation of radioactive materials, are useful field references for determining compliance with the transportation rules on labeling, placarding, shipping papers, and package markings. They also contain references to the DOT regulatory requirements.

03.07 Receipt and Transfer of Licensed Material

Through observation and interviews, verify that the licensee receives packages and makes transfers of licensed material in accordance with NRC requirements in 10 CFR 20.2207, and applicable U.S. Department of Transportation (DOT) regulations and license conditions. Through discussions with licensee personnel, determine how the licensee ensures that transfers are made to authorized recipients. Focus on how the licensee receives packages, opens packages, and how and when package radiation surveys are performed (including wipe tests). Also determine what actions the licensee takes (or should take) when surveys reveal packages that are contaminated in excess of specified limits, and/or radiation levels that are higher than expected. If packages arrive during the course of an inspection, the inspector should, when practical, observe personnel performing the package receipt surveys.

Through observations, interviews, and the review of selected records, if necessary, determine that senior licensee management is fulfilling its responsibility of ensuring the effective operation of the radiation safety program. The inspector’s evaluation could cover the following activities:

- Maintaining awareness of significant events such as the loss or theft of licensed materials.
- Committing adequate resources (including space, equipment, personnel, time, and, if needed, contractors) to the radiation protection program to ensure that members of the public and workers are adequately protected from radiation hazards and that compliance with regulations is maintained.
- Obtaining the NRC's prior written consent before transferring control of the license;
- Notifying the appropriate NRC regional administrator in writing, immediately following filing of petition for voluntary or involuntary bankruptcy (10 CFR 30.34(h)).
- Assuring the appropriate response, when applicable, to generic communications from the NRC.
- Notifying the NRC of defects or other radiation safety equipment malfunctions in accordance with the requirements of 10 CFR, Part 21.

END

Attachment 1: Revision History for IP 87121

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment Resolution and Feedback Form Accession Number (Pre-Decisional, Non-Public)
N/A	ML030290229 12/31/2002	IP incorporates inspection guidance for 10 CFR Part 34.	N/A	Not specified.
N/A	ML052430169 8/22/2005	Not specified.	N/A	Not specified.
N/A	ML14307A686 12/17/14 CN 14-030	The updates to IP 87121 address various recommendations of the Audit Report OIG-12-A-15. The update also reflects the current regulation requirements of 10 CFR Part 37.	N/A	ML14307A755
N/A	ML23328A053 12/21/23 CN 23-039	Revised in its entirety. Specific changes include: (1) divided inspection guidance into risk-modules; (2) included inspectors' observations; (3) updated inspection guidance; (4) added an estimated level of effort to complete an inspection; and (5) developed new appendix titled "Additional inspection elements."	N/A	ML23328A054
N/A	ML24128A234 05/16/24 CN 24-015	Revised to include guidance regarding Commission interpretation on the requirements of 10 CFR 34.41 (a) issued on June 1, 2021. Guidance in section 03.01 was expanded. The references section was revised to include the reference to the Federal Register Notice regarding the Notification of Interpretation.	N/A	ML24128A233