AUDIT REPORT

Audit of NRC's Oversight of Industrial Radiography

OIG 12-A-15 June 28, 2012

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

OFFICE OF THE
INSPECTOR GENERAL

June 28, 2012

MEMORANDUM TO: R. William Borchardt
Executive Director for Operations

FROM: Stephen D. Dingbaum
Assistant Inspector General for Audits

SUBJECT: AUDIT OF NRC'S OVERSIGHT OF INDUSTRIAL RADIOGRAPHY (OIG-12-A-15)

Attached is the Office of the Inspector General's (OIG) audit report titled, *Audit of NRC's Oversight of Industrial Radiography.*

The report presents the results of the subject audit. Agency comments provided at the June 8, 2012, exit conference have been incorporated, as appropriate, into this report.

Please provide information on actions taken or planned on each of the recommendations within 30 days of the date of this memorandum. Actions taken or planned are subject to OIG followup as stated in Management Directive 6.1.

We appreciate the cooperation extended to us by members of your staff during the audit. If you have any questions or comments about our report, please contact me at 415-5915 or Sherri Miotla, Team Leader, Nuclear Materials and Waste Safety Team, at 415-5914.

Attachment: As stated

EXECUTIVE SUMMARY

BACKGROUND

The Nuclear Regulatory Commission (NRC) regulates the use of ionizing radiation for nondestructive examination of the structure of materials in its jurisdiction. This process is known as industrial radiography. Radiographers use radiography devices, or cameras, to produce images used in the examination of structures such as pipelines. The cameras contain radioactive sealed sources. When the source is exposed, radiation penetrates the material and produces a shadow image on film or some other detection medium.

Radiography cameras use high activity sources that, if unshielded, are dangerous. The typical radioactive sources used in industrial radiography are iridium-192 and cobalt-60. As an example of how dangerous these sources can be, an unshielded 50-curie iridium-192 radioactive source could cause severe injury if the source is within a few inches of a person for an hour. Significant unplanned and excessive exposures to radiation, including radiation injuries, have occurred during radiography operations when personnel fail to properly use survey meters and other safety equipment, and fail to follow regulatory requirements and safety procedures.

NRC's regulatory requirements for industrial radiography are provided in Title 10, Code of Federal Regulations, Part 34, "Licenses for Industrial Radiography and Radiation Safety Requirements for Industrial Radiographic Operations." These regulations require radiographers to perform radiography in a safe manner. For example, radiographers are required to post radiation and high-radiation boundaries when performing radiography. Also, the regulations require radiographers to wear radiation monitoring equipment to track the radiation dose to the radiography workers and use radiation monitoring equipment to warn workers when radiation is present.

OBJECTIVE

The audit objective was to determine the adequacy of NRC's processes for overseeing licensee activities addressing the safety and control of radiography sources. The report appendix contains information on the audit scope and methodology.

RESULTS IN BRIEF

Generally, NRC's oversight of industrial radiography is effective, and the agency has taken steps to improve its oversight by updating some guidance for radiography and stressing the importance of safety culture during radiography inspections. However, the Office of the Inspector General identified the following areas that could be improved:

- Clarity and consistency of radiography licenses.
- Routine inspection program for licensees.
- Temporary job site inspections.
- Approach to inspecting NRC licensees located in Agreement States.

Radiography Licenses Are Not Clear or Consistent

Radiography licenses do not clearly or consistently indicate what activities licensees are authorized to conduct or where the licensees may conduct them because NRC management does not require such information in the license. As a result, (1) some licensees have unknowingly performed unauthorized activities, (2) inspectors could miss inspecting activities or expend resources attempting to inspect activities no longer authorized by NRC, and (3) license reviewers could make future licensing decisions based on inaccurate information.

NRC's Routine Inspection Program for NRC Radiography Licensees Could Be Improved

During routine inspections, NRC does not always inspect the location where the licensee's Radiation Safety Officer (RSO) works to verify the

RSO is adequately overseeing the licensee's radiation safety program. Additionally, inspectors use various, inconsistent factors to select which field stations to inspect for licensees with multiple field stations. NRC's inspection guidance lacks language defining which licensee location should be visited for each routine inspection, and lacks a methodology to ensure that field station selection is reliable. As a result, (1) future inspectors might not inspect the location where the RSO is for each routine inspection and (2) radiography licensee field stations may go significant periods of time without an inspection, or never get inspected.

NRC Could Improve Temporary Job Site Inspections

Some NRC licensees' temporary job sites have not been inspected for several consecutive routine inspections because NRC management has not formally defined when inspectors should take additional steps to arrange for a temporary job site inspection. Additionally, NRC is not inspecting radiography at temporary job sites on offshore platforms or lay-barges because the agency has not secured transportation to offshore platforms and lay-barges and NRC has not established a means to be aware of when and where its licensees conduct radiography at these temporary job sites. As a result, NRC does not know whether licensees conducting radiography at these temporary job sites are in compliance with NRC regulations.

Inconsistent Approach To Inspecting NRC Licensee Facilities in Agreement States

Some NRC inspectors do not know what they can require of an NRC licensee during an inspection when that licensee's facility is located in an Agreement State because there is no guidance for NRC inspectors conducting inspections of NRC licensees in Agreement States. Therefore, inspectors risk (1) missing violations that fall within NRC jurisdiction and (2) encroaching on Agreement State jurisdiction.

Recommendations

This report makes eight recommendations to improve the agency's oversight of industrial radiography. A consolidated list of these recommendations appears in Section IV of this report.

AGENCY COMMENTS

An exit conference was held with the agency on June 8, 2012. At this meeting, agency management provided supplemental information that has been incorporated into this report as appropriate. As a result, agency management stated their general agreement with the findings and recommendations in this report and opted not to provide formal comments for inclusion in this report.

ABBREVIATIONS AND ACRONYMS

BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
Ci	curie
IMC	Inspection Manual Chapter
LOA	Letter of Agreement
MMS	Minerals Management Service
NRC	Nuclear Regulatory Commission
OIG	Office of the Inspector General
RSO	Radiation Safety Officer

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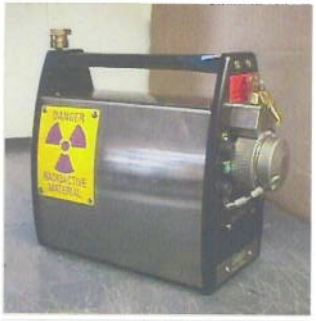
APPENDIX

I. BACKGROUND

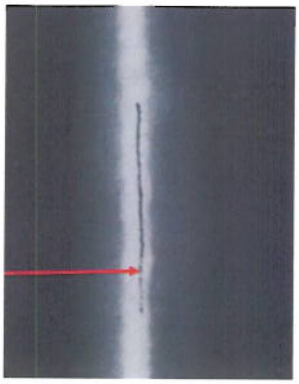
Industrial radiography is the use of ionizing radiation for nondestructive examination of the structure of materials. Radiographers use radiography devices, or cameras (see Figure 1), to produce images used in the examination of structures such as pipelines. The cameras contain radioactive sealed sources. When the source is exposed, radiation penetrates the material and produces a shadow image on film or some other detection medium. Differences in the blackening of the image show the structure of the material and may suggest flaws in the material (see Figure 2). When the source is in the shielded position in the camera, very little radiation is emitted from the camera. Radiography cameras typically use depleted uranium for shielding (see Figure 3).

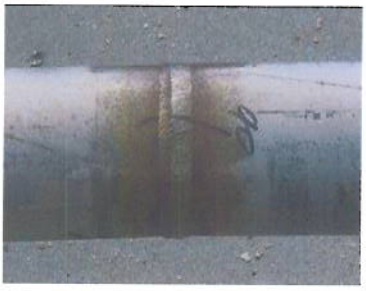
Figure 1. Examples of Radiography Cameras



Source: NRC

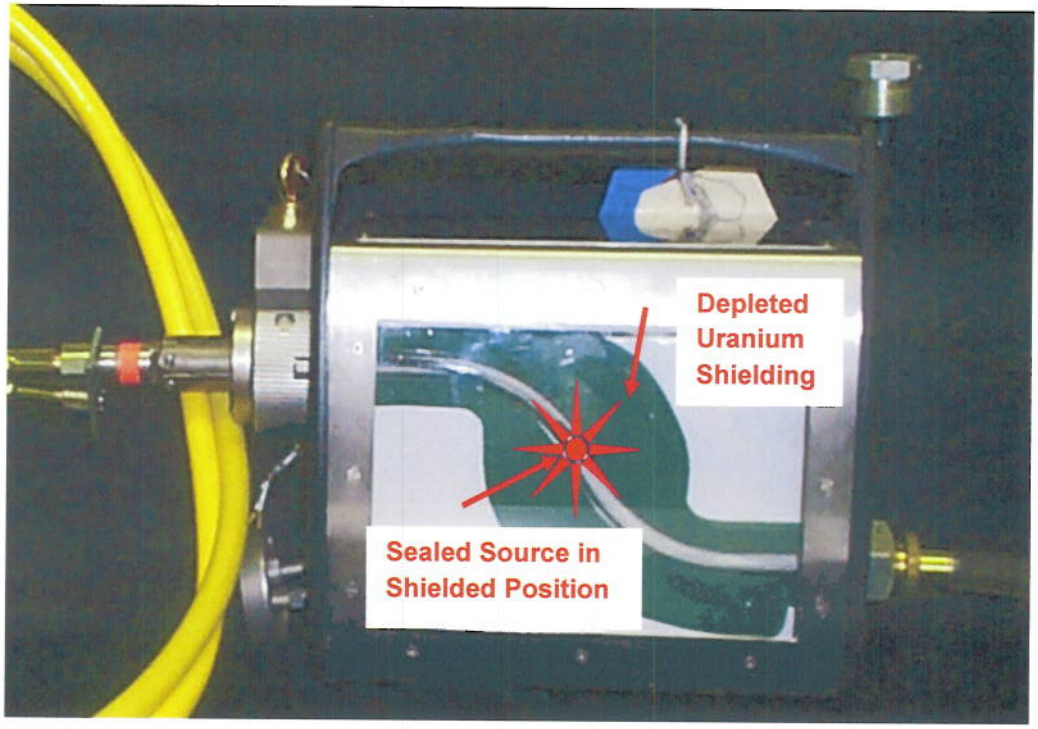
Figure 2. Example of a Radiography Image





Source: NRC

Figure 3. "Cutaway" of a Radiography Camera



Source: NRC

The U.S. Nuclear Regulatory Commission (NRC) and Agreement States[1] regulate industrial radiography. Agreement States are responsible for regulating the safety of radiography within their jurisdiction. NRC is responsible for licensing and inspecting radiography in non-Agreement States, areas of exclusive Federal jurisdiction in Agreement States, and offshore waters.[2] In addition to an NRC license, some NRC radiography licensees maintain one or more Agreement State radiography licenses. As of April 2012, there were 78 NRC radiography licensees (see Table 1).

[1] Agreement States are States that have entered into an agreement assuming regulatory authority from NRC. In accordance with Section 274 of the *Atomic Energy Act*, as amended, NRC may relinquish its authority to regulate byproduct, source, and limited quantities of special nuclear material to States. These States must first demonstrate that their regulatory programs are adequate to protect public health and safety and are compatible with NRC's program.

[2] An area of exclusive Federal jurisdiction is an area that is federally controlled, such as some military bases, over which the Federal Government exercises legal control without interference from the jurisdiction and administration of State law. NRC defines offshore waters as that area of land and water, beyond Agreement States' *Submerged Lands Act* jurisdiction, on or above the U.S. Outer Continental Shelf.

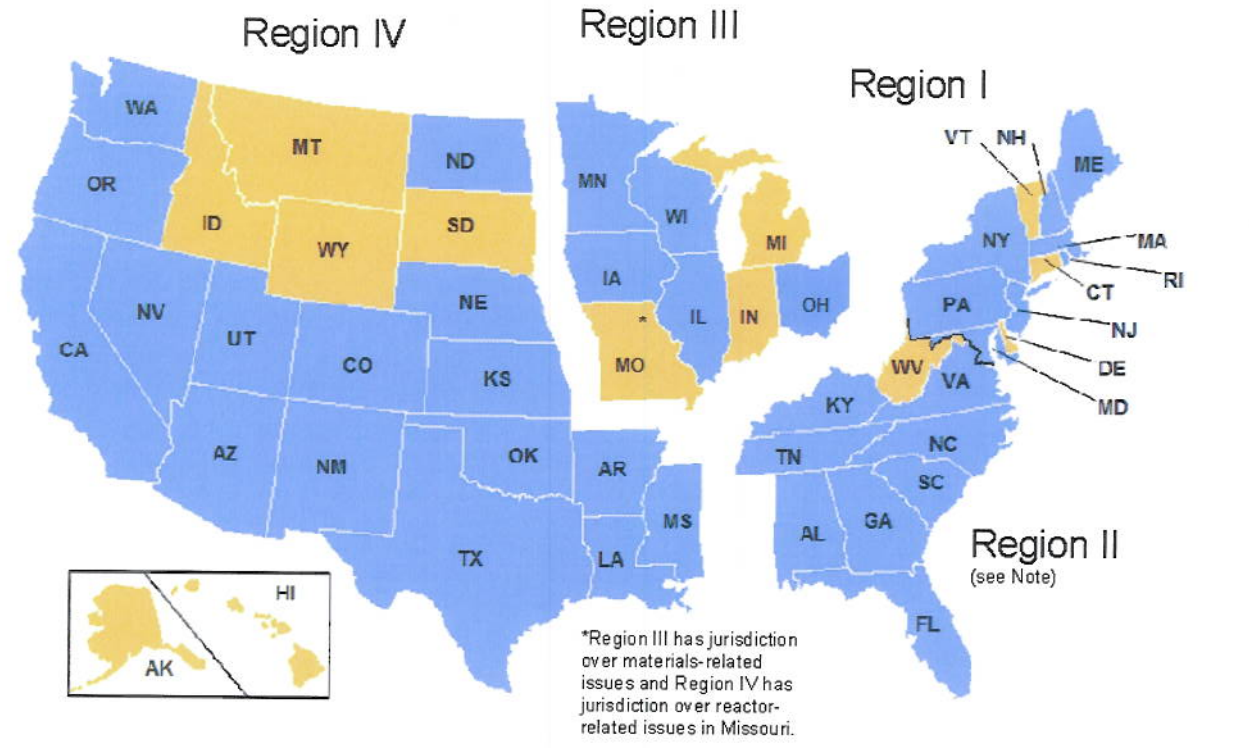
Three NRC regional offices are responsible for nuclear materials oversight in areas under NRC jurisdiction (see Figure 4). Region I has jurisdiction over non-Agreement States in the eastern part of the United States and Puerto Rico and the U.S. Virgin Islands; Region III covers non-Agreement States in upper-midwestern United States; and Region IV is responsible for the western United States, including Alaska, Hawaii, and Guam.

Table 1. NRC Radiography Licensees

Region	Number of Licensees
I	28
III	15
IV	35
Total	**78**

Source: NRC

Figure 4. NRC Regional Jurisdiction



NOTE: This map corresponds to the division of U.S. Nuclear Regulatory Commission Regional Offices by radioactive materials licensing and inspection responsibility. As a result of the October 2003 restructuring of regional roles and responsibilities, fuel cycle inspection functions from all the Regions were consolidated at the Region II office in Atlanta, GA, and all radioactive materials licensing and inspection functions in Region II were transferred to Region I. However, Region II retains its reactor responsibilities.

Source: NRC

Region IV is responsible for offshore inspections in the western Gulf of Mexico and the Pacific Ocean. For any radiography in the eastern Gulf of Mexico, and the Atlantic Ocean, which is rare according to NRC staff, Region I sends a request to Region IV to conduct the inspection. For fiscal year 2011, these three NRC regions devoted approximately 3 full-time equivalent staff to radiography oversight, including licensing and inspections. At headquarters, the NRC Office of Federal and State Materials and Environmental Management Programs is the program office responsible for materials, including radiography, inspection and licensing policy.

NRC Radiography Licensing and Inspections

NRC regions oversee radiography licensees through licensing and inspections. NRC license reviewers who work in the regional offices review applications and license amendment requests for the use of NRC-regulated materials. After license reviewers are satisfied that the applicants have met NRC regulatory requirements, the license reviewers issue the licenses. The primary guidance for licensing industrial radiography is NUREG 1556, Volume 2, "Program-Specific Guidance About Industrial Radiography Licenses." Additionally, NUREG 1556, Volume 20, "Guidance About Administrative Licensing Procedures," has guidance applicable to licensing industrial radiography.

NRC Inspection Manual Chapter (IMC) 2800, "Materials Inspection Program," provides the policy for the materials inspection program, including industrial radiography. Per IMC 2800, the relative risk of radiation hazard determines how often a radioactive material licensee is inspected. IMC 2800 requires that licensed activities that represent the greatest risk to the health and safety of workers, members of the public, and the environment be inspected most frequently. Industrial radiography conducted at temporary job sites[3] is considered the most risky licensed activity and is therefore inspected on an annual basis, with a plus-or-minus 25-percent grace period. As such, the interval for routine radiography inspections is every 9 to 15 months. NRC materials inspectors who work in the regional offices conduct radiography

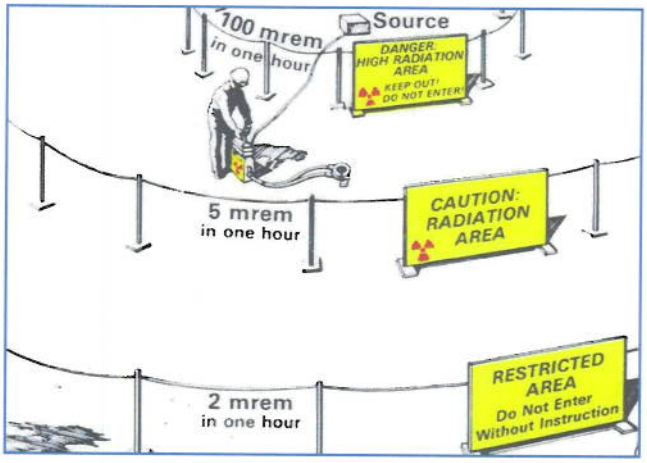
[3] Temporary job sites are locations not specifically listed on the license where licensees conduct radiography operations.

inspections according to Inspection Procedure 87121, "Industrial Radiography Programs."

NRC Regulatory Requirements for Industrial Radiography

NRC's regulatory requirements for industrial radiography are provided in Title 10, Code of Federal Regulations (CFR), Part 34, "Licenses for Industrial Radiography and Radiation Safety Requirements for Industrial Radiographic Operations." The regulations include a requirement that licensees conducting radiography must post the radiation and high-radiation boundaries. In addition, licensees typically post the restricted area boundary around temporary job sites at a distance so that any member of the public at the boundary would receive a dose of radiation no more than 2 millirem[4] in any 1 hour (see Figure 5). Also, the regulations require radiographers to wear radiation monitoring equipment such as personnel dosimetry to track the radiation dose to the radiography workers and use radiation monitoring equipment to warn workers when radiation is present (see Figure 6).

Figure 5. Radiography Posting Requirements



Source: NRC

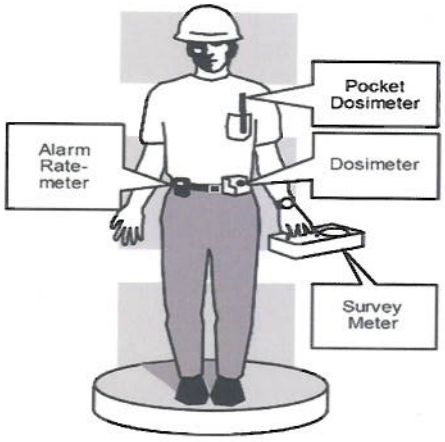
Risks Associated with Industrial Radiography Operations

Radiography cameras use high activity sources that, if unshielded, are dangerous. The typical radioactive sources used in industrial radiography are iridium-192 and colbalt-60. During one NRC radiography inspection that the Office of the Inspector General (OIG) observed, the licensee had

[4] A millirem is a unit of radiation dose. One millirem is one thousandth of a rem. The rem is a standard unit used to measure the dose equivalent (or effective dose), which combines the amount of energy (from any type of ionizing radiation that is deposited in human tissue), along with the biological effects of the given type of radiation.

34 cameras with iridium-192 sources ranging from 4 to 94 curies.[5] As an example of how dangerous these sources can be, an unshielded 50-curie iridium-192 radioactive source could cause severe injury if the source is within a few inches of a person for an hour. Significant unplanned and excessive exposures to radiation, including radiation injuries, have occurred during radiography operations when personnel fail to properly use survey meters and other safety equipment, and fail to follow regulatory requirements and safety procedures. For example, a radiographer working under an NRC license received radiation exposures beyond the NRC occupational dose limits when the source failed to fully retract into the shielded position. In another instance, an employee of an NRC licensee working in an Agreement State received radiation burns when a radiography source failed to fully retract into the shielded position in the radiography device and the individual handled the guide tube where the source was located.

Figure 6. Radiographer Personnel Radiation Monitoring Equipment



Source: NRC

[5] A curie (Ci) is a unit used to measure the intensity of radioactivity. It refers to the amount of ionizing radiation released when an element spontaneously emits energy as a result of the radioactive decay (or disintegration) of an unstable atom. Radioactivity is also the term used to describe the rate at which radioactive material emits radiation, or how many atoms in the material decay (or disintegrate) in a given time period. One Ci is equal to 37 billion (3.7×10^{10}) disintegrations per second.

II. OBJECTIVE

The audit objective was to determine the adequacy of NRC's processes for overseeing licensee activities addressing the safety and control of radiography sources. The report appendix contains information on the audit scope and methodology.

III. FINDINGS

Generally, NRC's oversight of radiography is effective, and the agency has taken steps to improve its oversight. For example, NRC has an online industrial radiography licensee toolkit to help licensees find key information easily. Additionally, NRC is in the process of updating guidance for radiography licensing. Moreover, the agency has been emphasizing the importance of safety culture during radiography inspections. However, OIG identified areas in licensing and inspections that could be improved. For example, (1) NRC could improve its radiography licenses by making them clearer as to what activities radiography licensees are authorized to conduct and where they are authorized to conduct them. Furthermore, NRC could improve its program for radiography inspections by (2) clearly defining the licensee locations that should be inspected during routine inspections, (3) resuming inspections of radiography licensees conducting radiography operations offshore, and (4) providing guidance for NRC inspectors conducting inspections of licensees located in Agreement States.

A. NRC Radiography Licenses Are Not Clear or Consistent

Radiography licenses do not clearly or consistently indicate what activities licensees are authorized to conduct or where the licensees may conduct them because NRC management does not require such information in the license. As a result, (1) some licensees have unknowingly performed unauthorized activities, (2) inspectors could miss inspecting activities or expend resources attempting to inspect activities no longer authorized by NRC, and (3) license reviewers could make future licensing decisions based on inaccurate information.

NRC Strives for Clarity and Consistency In Licensing

NRC strives for clarity and consistency in licensing by adhering to principles of good regulation and agency guidance. NRC uses its principles of good regulation to focus on ensuring safety and security while appropriately balancing the interests of NRC's stakeholders, including the public and licensees. The clarity principle provides that agency positions should be readily understood and easily applied. NRC license reviewers use NUREG 1556 Volumes 2 and 20 as guidance for licensing industrial radiography. Volume 2 contains a template for how radiography licenses should look when issued by NRC. Volume 20 contains NRC Office of the General Counsel-approved standard license conditions that pertain to locations where materials are used and stored. NRC staff is in the process of revising both volumes.

Unclear and Inconsistent Authorized Use

Radiography licenses do not clearly or consistently identify what activities licensees are authorized to conduct or where licensees are authorized to perform NRC-licensed activities. One component of a materials license is a section titled "Authorized use." The purpose of this section is to show NRC-approved uses of radiological materials and devices listed in the license. OIG selected a judgmental sample of 10 radiography licenses to proportionally represent the total number of NRC radiography licenses in each region. In seven licenses, it is unclear whether or not licensees are authorized to conduct offshore or lay-barge[6] radiography. These seven licenses authorize licensees to perform "industrial radiography," but given

[6] A lay-barge is a floating vessel used for laying pipe on the ocean floor.

NRC's definition of "industrial radiography,"[7] the licenses could be read as authorization to conduct radiography anywhere, including on offshore platforms and lay-barges (see Table 2). NRC regulations require licensees to have NRC-approved procedures to conduct radiography on offshore platforms and lay-barges. Radiography performed on offshore platforms or lay-barges presents unique risks that, if not addressed by a procedure developed ahead of time and approved by NRC, could adversely affect the health and safety of the radiography workers and members of the public. For example, there may be specific physical or space configurations the licensee needs to consider to comply with the limit of 2 millirem in any 1 hour period. Also, if a source disconnect were to occur on a platform or a lay-barge, expertise to deal with the emergency may not be readily available. None of those seven licensees had NRC-approved procedures. The only way to determine whether these seven licensees are not authorized to conduct offshore or lay-barge radiography is to review hundreds of pages of tiedowns[8] and verify that the tiedowns do not include NRC-approved procedures for offshore or lay-barge radiography.

Some licenses in OIG's sample use non-standard language that more clearly indicates whether or not the licensee is authorized to conduct offshore and lay-barge industrial radiography. Two of these licenses explicitly authorize "onshore" industrial radiography, although this term is not defined in NRC regulations. One license explicitly prohibits the licensee from performing industrial radiography on lay-barges or oil and gas platforms (see License J in Table 2). While these licenses use language that more clearly identifies what activities licensees are and are not authorized to perform, this language is not contained in NUREG 1556, Volume 2, or in NRC regulations.

[7] NRC regulations define "industrial radiography" as an examination of the structure of materials by nondestructive methods, utilizing ionizing radiation to make radiographic images.

[8] Tiedowns are documents "tied down to the license." Tiedowns can consist of documents such as license applications; maintenance, operating, and emergency procedures; and training records. These documents are part of the license as they are incorporated by reference in it.

Table 2. Authorized Use Section in Sample Radiography Licenses

Licenses A, B, C, D, E, F, and G	License H	License I	License J
"industrial radiography and replacement of sources"	"industrial radiography and replacement of sources" "industrial radiography in lay-barges, and offshore oil and gas platforms"	"onshore industrial radiography and replacement of sources." "**not** for use in industrial radiography in lay-barges, and offshore oil and gas platforms"	"onshore industrial radiography and replacement of sources." "industrial radiography in lay-barges, and offshore oil and gas platforms"

Source: OIG analysis of NRC licenses. Bolded emphasis added by OIG.

Furthermore, the authorized use language found in OIG's sample does not indicate whether licensees are authorized to perform other types of radiography. For example, it is unclear whether licensees in OIG's sample are authorized to conduct radiography on offshore structures other than oil and gas platforms or vessels other than lay-barges.[9] Moreover, there is no indication, in any of the licenses in OIG's sample, whether the licensees are authorized to perform radiography underwater, even though underwater radiography is specifically defined in NRC regulations.

Location of Use and Storage License Conditions Are Unclear and Inconsistent

Radiography licenses do not clearly or consistently identify where licensees are authorized to perform NRC-licensed activities, including temporary job sites and field stations. Under NRC regulations, temporary job sites are locations (other than locations specifically listed on the license) where radiography is conducted and where licensed materials may be stored. NRC regulations define field stations as facilities where

[9] Although not contemplated in NRC's radiography regulations, it is conceivable that NRC licensees, and Agreement State licensees operating under reciprocity, could conduct radiography in NRC areas of jurisdiction on floating vessels that are not lay barges and offshore structures that are not oil and gas platforms. For example, a draft NRC procedure for offshore inspections mentions the possibility of radiography being conducted on "liftboats." A liftboat is an offshore supply vessel with moveable legs capable of raising its hull above the surface of the sea.

licensed material may be stored or used. Field stations are listed on the licenses. Radiography licensees dispatch equipment from field stations to temporary job sites.

Temporary Job Sites

Several licenses in OIG's sample of 10 radiography licenses do not clearly or consistently identify whether or not licensees are authorized to use and store materials at temporary job sites. Based on the language in the licenses, it is unclear whether five licensees in OIG's sample are authorized to merely use NRC-licensed materials at temporary job sites or are authorized to use and store materials at these sites (see licenses A, B, C, D, and E in Table 3).

Table 3. Authorization at Temporary Job Sites in Sample Radiography Licenses

License A	License B	License C and D	License E	License F	License G	License H	License I	License J
"may be **used** at the licensee's temporary job sites"	"may be **used** at temporary job sites of the licensee"	"may be **used** only at the temporary job sites of the licensee"	"may be **used** at the temporary job site located at [LOCATION REDACTED] and at temporary job sites of the licensee"	"shall be stored, used (temporary job site) and dispatched from the licensee's facilities located at [LOCATION REDACTED]." "shall be **used** at temporary job sites of the licensee"	"may be **stored or used** at the licensee's facilities located at the following: [LOCATION REDACTED]." "Temporary job sites..."	"shall be **stored or used** only at the following locations:... [LOCATION REDACTED]... TEMPORARY JOB SITES..."	"shall be **stored only** at the following:... [LOCATION REDACTED] ... TEMPORARY JOB SITE: shall be **stored and/or used** only at temporary jobsites"	"shall be **stored or used only** at the following:... [LOCATION REDACTED] ... TEMPORARY JOB SITE..."

Source: OIG analysis of NRC licenses. Bolded emphasis and bracketed redactions added by OIG.

NRC radiography licenses do not consistently contain standard license conditions. NUREG 1556 Volume 20 provides six standard license conditions for location of use. The guidance encourages license reviewers to use standard license conditions, to the maximum extent possible, to maintain consistency. However, license reviewers do not consistently apply standard license conditions to radiography licenses regarding where licensees are authorized to use and store materials. Only 2 licenses, out of OIG's sample of 10, contain conditions identical to 1 of the standard license conditions in the guidance. The other eight

licenses do not contain standard license conditions for location of use. As an example, two licenses contain part of a standard license condition, but language restricting use of materials only at temporary job sites within NRC jurisdiction was omitted. In addition, one license authorizes storage only at licensee facilities listed in the license. This license also contains a sentence fragment about NRC's authority at temporary job sites with no apparent connection to authorizing either use or storage of materials at the licensee's temporary job sites.

Field Stations

Some licenses in OIG's sample do not clearly or consistently identify whether licensees are authorized to use and store materials at field stations, which are facilities listed in the license. Three licenses in OIG's sample do not contain standard license conditions for these locations. Each of these licenses contains parts of one standard license condition, and includes additional language not found in any standard license condition.

Additionally, some licenses in OIG's sample contain errors. One license references a field station that does not exist. In another case, NRC approved a licensee's request to remove a field station from its license and made this request part of the license, but the field station remained on the license for nearly 3 more years.

NRC Does Not Require Licenses To Clearly and Consistently Indicate Specific Activities Authorized by NRC

NRC's licenses for industrial radiography are unclear and inconsistent because NRC does not require licenses to clearly and consistently identify specific activities authorized by NRC and where those activities may be performed. NUREG 1556 Volumes 2 and 20 contain guidance for writing radiography licenses, but they are not requirements. License reviewers determine most structure and content of licenses based on various factors such as NRC regulations, parts of the guidance, individually developed checklists, personal experience or preference, and licensee requests. Although license reviewers have taken steps to increase clarity in some radiography licenses, these improvements have not been made consistently and, in some cases, have made licenses less clear.

NRC Risks Increased Licensee Non-Compliance and Hindered Oversight

Licensees authorized for "industrial radiography" have and could continue to perform radiography offshore without meeting additional NRC requirements. For example, a licensee was authorized for "industrial radiography," as indicated on the license, but the licensee was found in violation of NRC regulations for conducting industrial radiography on an offshore platform. The licensee conceded its error was a result of a failure to notice or consider part of the regulation requiring additional NRC-approved procedures for radiography conducted offshore. Other licensees authorized for "industrial radiography" might also not consider that NRC differentiates industrial radiography from radiography performed offshore. Furthermore, unclear and inconsistent licenses might contribute to licensees violating NRC regulations at temporary job sites and licensee facilities such as field stations.

NRC inspectors could also miss inspecting certain authorized activities or expend resources attempting to inspect activities no longer authorized and license reviewers could make future licensing decisions based on inaccurate information in licenses. Because current licenses may contain information that should have been removed from the license, such as authorized field stations, inspectors might spend resources planning or trying to inspect facilities that are no longer used. Alternatively, when information is absent from licenses, NRC inspectors could miss inspecting licensed activities. Additionally, license reviewers could make licensing decisions based on inaccurate or incomplete information on previous licenses.

Recommendation

OIG recommends that the Executive Director for Operations:

1. Require license reviewers to write radiography licenses in a manner that clearly and consistently specifies whether or not licensees are authorized to conduct certain activities (such as offshore, lay-barge, or underwater radiography).

B. NRC's Routine Inspection Program for NRC Radiography Licensees Could Be Improved

For routine NRC radiography licensee inspections, NRC does not always inspect the location where the Radiation Safety Officer (RSO) works to verify whether the RSO is adequately ensuring that the licensee's radiation safety practices are being conducted according to regulations and approved procedures. Additionally, for licensees with multiple field stations, inspectors use various, inconsistent factors to select which field stations to inspect. NRC's inspection guidance lacks language that defines which licensee location an inspector should visit for each routine inspection, and lacks a methodology to ensure that selection of radiography licensees' field stations for inspection is reliable. As a result, (1) future inspectors might not inspect the location where the RSO is for each routine inspection and (2) radiography licensee field stations may go significant periods of time without an inspection, or never get inspected. Thus, NRC is not fully assured that licensees are performing activities in a manner that protects the health and safety of radiography workers and the public.

Regulatory Actions Should Lend Stability and Reliability

NRC endeavors to adhere to its principles of good regulation – independence, openness, efficiency, clarity, and reliability. These principles focus NRC on ensuring safety while appropriately balancing the interests of NRC stakeholders, including the public and licensees. Specifically, the principle of reliability requires that once a regulation is established, it should be perceived to be reliable and not unjustifiably in a state of transition. Reliability also requires that regulatory actions should always be fully consistent with written regulations and should be promptly, fairly, and decisively administered so as to lend stability to the nuclear operational and planning processes.

Current NRC Radiography Inspection Practices

Routine Inspection

When a routine inspection is due per IMC 2800, NRC inspectors typically go unannounced to the location where the RSO works. However, sometimes the NRC inspector does not inspect the location where the RSO works. Rather, NRC inspectors go to the mailing address listed on the license, regardless of whether or not the RSO works there. OIG observed 10 routine inspections of NRC radiography licensees, interviewed NRC inspectors in the regions, and reviewed additional NRC radiography inspection reports to determine whether NRC routine radiography inspections included inspection of the RSO's location. The RSO is an individual listed by name in the license who is responsible for ensuring that the licensee's radiation safety activities are being performed in accordance with approved procedures and regulatory requirements on a day-to-day basis. Among other things, the RSO is responsible for auditing the licensee's radiation safety program on an annual basis and ensuring that temporary job site audits of the licensee's radiographers are conducted. In one example indentified by OIG, the RSO works at a location about 600 miles from the mailing address location. Yet, for this particular licensee, NRC routinely conducts inspections at the licensee's mailing address. In another example, the RSO works at a location more than 1,000 miles from the mailing address. For that particular licensee, NRC routinely inspects the location where the RSO works.

Field Station Inspections

NRC inspectors use various inconsistent factors to choose field stations for inspection. IMC 2800 requires NRC inspectors to inspect some field stations for larger radiography licensees with a certain number of field stations. Field stations are locations listed on the radiography license where licensees can use and store material and from which radiographers and radiography equipment are dispatched to temporary job sites. NRC inspects field stations to assess licensee performance and determine whether the licensee is using radioactive material safely.

Many radiography licensees have multiple locations at which or from which they are authorized to store or use radioactive material. For licensees with four or more permanent locations, IMC 2800 requires regional inspectors to select one or more field stations to inspect. Inspectors use various factors to make these selections. For example, some inspectors review past inspection reports to determine which field stations were previously inspected, but the number of past inspection reports an inspector will consider varies. Other inspectors are assigned particular field stations to inspect by a senior inspector or regional management. Table 4 depicts the number of licensee facilities that must be inspected each inspection interval, per IMC 2800, depending upon the total number of licensee facilities.

Table 4. Number of Licensee Facility Inspections Required by IMC 2800

Total Number of Licensee Permanent Facilities	Number of Licensee Facilities That Must be Inspected
2 or 3	1 location
4 to 10	At least 2 locations
More than 10	About 20% of the locations

Source: OIG analysis of NRC IMC 2800.

Improvements to IMC 2800 Are Needed

IMC 2800 Lacks a Definition of Which Location an Inspector Should Visit

NRC inspectors do not always inspect the location where the RSO works because IMC 2800 lacks language to define which licensee location an inspector should visit for each routine inspection. Some inspectors assume they are supposed to inspect the location where the RSO works, but inspectors do not always do this. Although inspectors assume they are supposed to inspect the RSO's activities for each routine inspection, IMC 2800 actually does not require that verification of the licensee's radiation safety audit program occurs every routine inspection.

IMC 2800 Lacks a Methodology To Ensure Reliable Selection of Licensee Field Stations for Inspection

The selection of radiography licensee field stations is inconsistent because IMC 2800 lacks a methodology to ensure that selection of the radiography licensee's field stations for inspection is reliable. The number of permanent facilities listed on the license determines the number of field station inspections that should be conducted. While IMC 2800 provides that inspection of various field stations should be rotated to assess the licensee's entire program over several inspections, it does not provide for how the rotation should occur or what factors should be considered in making the selection of one facility over another.

NRC Is Not Fully Assured that Licensees Are Performing Activities Safely

Most, but not all, routine inspections of NRC radiography licensees are conducted at the location where the RSO works to assess the RSO's oversight of the radiation safety program. However, IMC 2800 does not require inspectors to do this every routine inspection. Also, because IMC 2800 lacks a reliable methodology for selection of field stations for inspection, radiography licensee field stations may go several inspection intervals without an inspection; some might never be inspected. When NRC routine inspections do not verify the RSO's management of the radiation safety program and NRC's selection of field stations lacks reliability, NRC is not fully assured that licensees are performing licensed activities in a manner that protects the health and safety of radiography workers and the public.

Recommendations

OIG recommends that the Executive Director for Operations:

2. Revise NRC inspection guidance to define the NRC radiography licensees' location that must be inspected each inspection cycle.

3. Revise NRC inspection guidance to include a reliable methodology to select NRC radiography licensee field stations for inspection.

C. NRC Could Improve Temporary Job Site Inspections

The temporary job sites of some NRC licensees have not been inspected for several consecutive routine inspections because NRC management has not formally defined when inspectors should take additional steps to arrange for a temporary job site inspection. Additionally, NRC is not inspecting radiography at temporary job sites on offshore platforms or lay-barges because the agency has not secured transportation to offshore platforms and lay-barges and NRC has not established a means to be aware of when and where its licensees conduct radiography at these temporary job sites. As a result, NRC does not know whether licensees conducting radiography at these temporary job sites are in compliance with NRC regulations. Therefore, NRC is not fully assured that licensees are performing activities in a manner that protects the health and safety of radiography workers and the public.

Temporary Job Site Inspections Are of the Utmost Importance

NRC's inspection guidance emphasizes inspecting actual NRC-licensed activities in progress. Temporary job site inspections of NRC radiography licensees are conducted according to IMC 2800. Although IMC 2800 emphasizes that it is of the utmost importance to inspect licensed activities at temporary job sites, temporary job site inspections of NRC licensees are not required.

In contrast to NRC licensees, NRC inspections of Agreement State licensees performing radiography in areas of NRC jurisdiction under NRC-granted reciprocity[10] are conducted according to IMC 1220.[11] Under IMC 1220, temporary job site inspections are conducted for 20 percent of eligible Agreement State licensees that have been granted reciprocity by NRC. These eligible licensees include some materials licensees that have been designated higher risk by NRC, such as radiography.

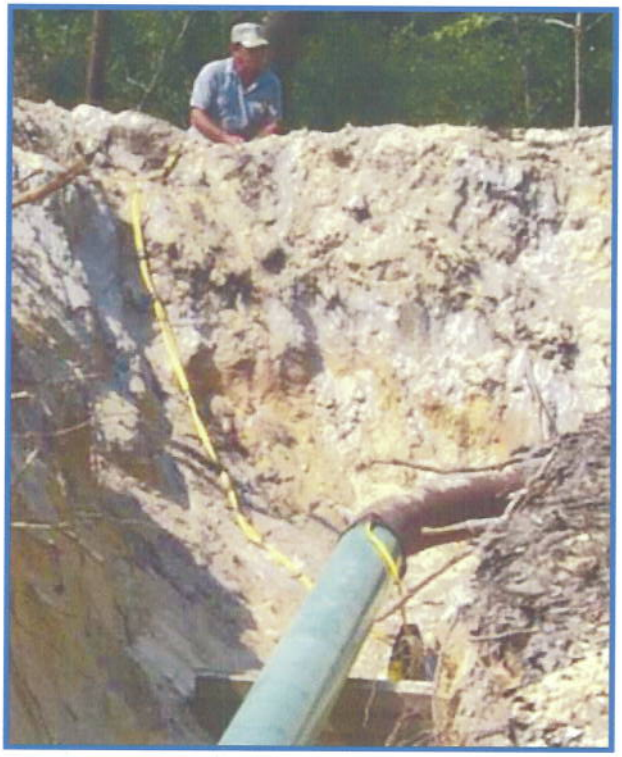
[10] Agreement State licensees that do not maintain an NRC license can apply for reciprocity to work in areas of NRC jurisdiction, which includes offshore waters. If NRC approves the reciprocity request, the Agreement State licensee is authorized to work in areas of NRC jurisdiction.

[11] IMC 1200 is titled, "Processing of NRC Form 241, 'Report of Proposed Activities in Non-Agreement States, Areas of Exclusive Federal Jurisdiction, and Offshore Waters,' and Inspection of Agreement State licensees operating under 10 CFR 150.20."

Limited NRC Licensee Temporary Job Site Inspections

Ideally, a temporary job site inspection is supposed to be conducted during the course of a routine unannounced inspection of the licensee. However, temporary job site locations, if any, are not known until the inspector arrives at the licensee's facility. Figure 7 depicts an example of a temporary job site. To conduct a routine inspection, typically, an NRC inspector will arrive at a licensee's facility and ask if the licensee has any radiography work occurring at a temporary job site. If the temporary job site is in reasonable proximity, the inspector will typically travel to inspect the radiography work. If there are no temporary job sites in reasonable proximity, inspectors sometimes leave the routine inspection open for weeks or months until the inspector can arrange a temporary job site inspection. Alternatively, NRC inspectors may close the inspection without conducting an inspection at a temporary job site.

Figure 7: Radiography Temporary Job Site



Source: NRC

Some NRC licensees have not had a temporary job site inspection for several consecutive routine inspections. OIG analyzed the five most recent routine inspections for a judgmental sample of 15 NRC radiography licensees. OIG chose licensees to represent each region proportionally based on the total number of licensees in each region. Based on OIG analysis, NRC routine inspections of radiography licensees include a temporary job site

inspection about 37 percent of the time. Furthermore, out of OIG's sample of 15 radiography licensees,

- Two licensees had three consecutive inspections without a temporary job site inspection.
- Three licensees had four consecutive inspections without a temporary job site inspection.
- One licensee had five consecutive inspections without a temporary job site inspection.

NRC Is Not Inspecting Radiography at Temporary Job Sites Offshore

Although NRC inspects some NRC licensee temporary job sites on land, NRC is not currently inspecting radiography at temporary job sites on offshore platforms or lay-barges. NRC maintains regulatory jurisdiction over radiography conducted offshore.[12] However, according to NRC staff, the agency is not currently conducting any offshore radiography inspections (of either its licensees or Agreement State licensees) and has not since shortly after the Deepwater Horizon oil spill occurred in April 2010. According to NRC documents and staff, most radiography licensees that conduct radiography in the Gulf of Mexico are Agreement State licensees from Gulf Coast States, mostly Louisiana and Texas, working under reciprocity. Prior to April 2010, NRC only inspected offshore radiography of Agreement State licensees conducting work offshore under reciprocity.

NRC Has Not Established Temporary Job Site Inspection Requirements

Some NRC licensees have not had a temporary job site inspection for several consecutive routine inspections because NRC management has not formally defined when inspectors should take additional steps to arrange for a temporary job site inspection. Although IMC 2800 emphasizes that temporary job site inspections are of the utmost importance, this guidance does not require NRC to conduct these inspections.

[12] NRC also has regulatory jurisdiction over activities conducted in Louisiana State waters, per the Agreement between NRC and the State of Louisiana. Also, NRC has jurisdiction over activities conducted in the State waters of non-Agreement States.

NRC Has Not Secured Transportation Offshore

NRC Has Not Secured Transportation to Offshore Oil and Gas Platforms and Lay-Barges

Figure 8. Example of an Offshore Platform

Source: NRC

Since July 2010, NRC has not conducted any radiography inspections offshore because the agency had not secured transportation to offshore platforms and lay-barges. Prior to the Deepwater Horizon oil spill, NRC was able to secure transportation to offshore platforms and lay-barges through a Letter of Agreement (LOA) with the Minerals Management Service (MMS), the Federal agency that regulated offshore oil and gas exploration and development. That LOA provided for air transportation arrangements to NRC inspectors to offshore facilities by MMS-contracted helicopters at no charge to NRC. According to NRC staff, the Deepwater Horizon oil spill made it difficult for MMS to provide NRC staff transportation. In May 2010, MMS was abolished and became the Bureau of Ocean Energy Management, Regulation and Enforcement. Later, that bureau was replaced by two independent entities: the Bureau of Ocean Energy Management and the Bureau of Safety and Environmental Enforcement (BSEE). Among other things, BSEE is responsible for offshore regulatory oversight and enforcement to promote safety and protect the environment. As of April 2012, NRC had completed a draft LOA with BSEE to secure transportation to offshore oil and gas platforms and lay-barges. NRC Region IV staff have also drafted a procedure for offshore inspections.

NRC Has Not Established a Means To Be Aware of When and Where its Licensees Are Working Offshore

Prior to April 2010, NRC was conducting offshore inspections only of Agreement State licensees working under reciprocity because NRC had not established a means to be aware of when and where its licensees conduct radiography on offshore platforms or lay-barges. Unlike Agreement State licensees, NRC licensees do not have to report their temporary job site locations. Agreement State radiography licensees working under reciprocity must inform NRC 3 days in advance of where their temporary job sites will be, including offshore temporary job sites. NRC radiography licenses provide that licensed material may be used or stored at temporary job sites anywhere in the United States where NRC maintains jurisdiction, which includes areas offshore.

Figure 9. Example of a Lay-Barge

Source: NRC

NRC Does Not Know Whether Licensees Are Performing Radiography in a Manner that Protects Public Health and Safety

When NRC licensees' temporary job sites are not inspected for several consecutive routine inspections, the agency is not fully assured that licensees are performing licensed activities in compliance with NRC regulations. Also, because NRC is not conducting inspections of temporary job sites offshore, the agency does not know whether its licensees or Agreement State licensees working under reciprocity, are conducting radiography at these sites in compliance with NRC regulations. When radiography licensees do not meet the requirements, NRC is not fully assured that the licensees are conducting operations in a manner that protects radiography workers and public health and safety.

Recommendations

OIG recommends that the Executive Director for Operations:

4. Revise NRC inspection guidance to require NRC inspectors to take additional steps to arrange a temporary job site inspection for an NRC licensee that has not had a temporary job site inspection for a defined minimum number of consecutive routine inspections.

5. Establish a means to secure transportation and access to conduct radiography inspections on offshore platforms.

6. Establish a means to secure transportation and access to conduct radiography inspections on lay-barges.

7. Establish a means to increase awareness of when and where NRC licensees are conducting radiography in NRC jurisdiction offshore.

D. Inconsistent Approach To Inspecting NRC Licensee Facilities in Agreement States

Some NRC inspectors do not know what they can require of an NRC licensee during an inspection when that licensee's facility is located in an Agreement State because there is no guidance for NRC inspectors conducting inspections of NRC licensees in Agreement States. Therefore, inspectors risk (1) missing violations that fall within NRC jurisdiction and (2) encroaching on Agreement State jurisdiction.

Principles of Good Regulation and NRC Inspections

NRC strives to adhere to the principles of good regulation. NRC's clarity principle provides that agency positions should be readily understood and easily applied. NRC's reliability principle provides that regulatory actions should always be fully consistent with written regulations and should be promptly, fairly, and decisively administered so as to lend stability to the nuclear operational and planning process.

Extent of Inspections Is Unclear for Inspections of NRC Licensees in Agreement States

Some NRC inspectors do not know what they can require of an NRC licensee during an inspection when that licensee's facility is located in an Agreement State. Agreement States are States that have entered into an agreement assuming regulatory authority from NRC. Per the agreement between NRC and the State, NRC relinquishes its authority to regulate certain nuclear materials activities within the jurisdiction of the Agreement States, including industrial radiography. Some radiography companies have one or more Agreement State licenses and an NRC license. The NRC license authorizes the licensee to use materials at temporary job sites in areas of NRC jurisdiction, such as in non-Agreement States. As part of NRC's oversight of these licensees, the agency conducts inspections at licensee facilities in Agreement States to, among other things, review records and interview employees to determine whether the licensee is using materials in areas of NRC jurisdiction in compliance with NRC regulations and license conditions.

Many staff expressed concern that they are unclear on what NRC can and cannot require of its licensees at facilities located in Agreement States. For example, some staff contended it is appropriate to require licensees to demonstrate the type of work the licensee performed while working in areas of NRC jurisdiction. However, it is unclear whether NRC can cite licensees for violations observed during these demonstrations. Other staff explained that NRC lacks jurisdiction in Agreement States, so inspections of NRC licensees located in Agreement States must be limited to a records review of radiography performed in an area where NRC has jurisdiction.

The extent to which NRC staff can inspect radiography vehicles and devices at licensee facilities in Agreement States is also unclear. Radiographers use these vehicles to transport NRC-licensed materials and devices to temporary job sites. Figure 10 provides a picture of a typical radiography vehicle. Some staff explained that they inspect radiography vehicles and devices that had been used in areas of NRC jurisdiction only. Other staff contended all vehicles and devices are off limits when they are in Agreement States.

Figure 10: Example of a Radiography Vehicle

Source: NRC

NRC inspectors' ideas of what they can and cannot inspect at licensees' facilities in Agreement States come from a variety of sources. Several inspectors explained they obtained this knowledge through on-the-job training with more experienced inspectors. Other inspectors maintained they became aware of what is either allowed or prohibited through trial and error or because of previous employment with an Agreement State.

No Guidance for Inspections in Agreement States

NRC inspectors are not clear on what they can require of an NRC licensee during an inspection when that licensee's facility is located in an Agreement State because there is no guidance for conducting inspections of NRC licensee facilities located in Agreement States. IMC 2800 provides some guidance for coordinating inspections with Agreement State officials, but it lacks guidance on what inspectors can and cannot require of NRC licensees located in Agreement States.

NRC Risks Missing Violations That Occur Within its Jurisdiction and Encroaching On Agreement State Jurisdiction

When NRC inspectors are not clear on what they can require of NRC licensees during inspections of licensee facilities in Agreement States, NRC risks missing violations that occur in areas of NRC jurisdiction. For example, if requiring licensees to demonstrate how they perform radiography in areas of NRC jurisdiction is appropriate, NRC inspectors who do not require these demonstrations might not discover potential violations of NRC regulations. If requiring demonstrations is not appropriate, NRC risks encroaching on Agreement State jurisdiction.

Recommendation

OIG recommends that the Executive Director for Operations:

8. Revise NRC inspection guidance to include guidance for inspectors conducting inspections when the NRC licensee's facility is located in an Agreement State.

IV. CONSOLIDATED LIST OF RECOMMENDATIONS

OIG recommends that the Executive Director for Operations:

1. Require license reviewers to write radiography licenses in a manner that clearly and consistently specifies whether or not licensees are authorized to conduct certain activities (such as offshore, lay-barge, or underwater radiography).

2. Revise NRC inspection guidance to define the NRC radiography licensees' location that must be inspected each inspection cycle.

3. Revise NRC inspection guidance to include a reliable methodology to select NRC radiography licensee field stations for inspection.

4. Revise NRC inspection guidance to require NRC inspectors to take additional steps to arrange a temporary job site inspection for an NRC licensee that has not had a temporary job site inspection for a defined minimum number of consecutive routine inspections.

5. Establish a means to secure transportation and access to conduct radiography inspections on offshore platforms.

6. Establish a means to secure transportation and access to conduct radiography inspections on lay-barges.

7. Establish a means to increase awareness of when and where NRC licensees are conducting radiography in NRC jurisdiction offshore.

8. Revise NRC inspection guidance to include guidance for inspectors conducting inspections when the NRC licensee's facility is located in an Agreement State.

V. AGENCY COMMENTS

An exit conference was held with the agency on June 8, 2012. At this meeting, agency management provided supplemental information that has been incorporated into this report as appropriate. As a result, agency management stated their general agreement with the findings and recommendations in this report and opted not to provide formal comments for inclusion in this report.

Appendix

OBJECTIVE, SCOPE, AND METHODOLOGY

OBJECTIVE

The audit objective was to determine the adequacy of NRC's processes for overseeing licensee activities addressing the safety and control of radiography sources.

SCOPE

The audit focused on reviewing the oversight of radiography licensing and inspections. We conducted this performance audit at NRC headquarters, NRC regional offices, and at licensee facilities and temporary job sites in Regions I, III, and IV from September 2011 through April 2012. Internal controls related to the audit objective were reviewed and analyzed. Throughout the audit, auditors were aware of the possibility or existence of fraud, waste, or misuse in the program.

METHODOLOGY

OIG reviewed relevant Federal legislation pertaining to NRC's regulatory authorities to oversee radiography, including the *Atomic Energy Act of 1954*, as amended. OIG also reviewed Federal regulations, agency guidance including inspection manual chapters, inspection procedures, NUREGs, and office instructions that pertain to radiography licensing and inspection. OIG also obtained training on the uses and operation of radiography devices, and reviewed NRC reports related to radiography oversight.

OIG also reviewed samples of licensing and inspection records. Specifically, the audit team selected a judgmental sample of radiography licenses and associated tiedown documents. Ten licensees were selected to proportionally represent each region based on the number of licenses in each region (Region I, 28; Region III, 15; and Region IV, 35). This sample was analyzed to determine clarity and consistency of NRC radiography licensing. OIG also selected a judgmental sample of inspection reports for

15 radiography licensees based on a proportional representation for each region based on the number of licensees in each region. For each licensee, OIG reviewed the 5 most recent inspection reports for a total of 75 to determine the frequency of licensee facility and temporary job site inspections.

OIG interviewed NRC staff at NRC headquarters (Rockville, Maryland) and NRC inspectors, license reviewers, and managers at three NRC regions (Region I, King of Prussia, Pennsylvania; Region III, Lisle, Illinois; and Region IV, Arlington, Texas) responsible for overseeing radiography licensing and inspection.

The audit team also observed NRC radiography inspections, as follows:

- NRC safety inspection of one licensee's facilities in Cranford and Carneys Point, New Jersey.
- NRC safety inspections of three licensees' facilities in Blairsville, Cheswick, Pittsburgh, and Washington, Pennsylvania, and three temporary job sites in West Virginia.
- NRC safety inspections of three licensees' facilities and two temporary job sites in Casper, Wyoming.
- NRC safety inspections of two licensees' facilities in Cataño and San Juan, Puerto Rico.
- NRC safety inspection of one licensee's facility and a temporary job site in Griffith, Indiana.

We conducted this performance audit in accordance with generally accepted Government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

The audit work was conducted by Sherri Miotla, Team Leader; Michael Zeitler, Audit Manager; Kevin Nietmann, Senior Technical Advisor; Levar Cole, Senior Management Analyst; and Kristen Lipuma, Senior Management Analyst.