U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1556
Volume 2, Rev. 1

Consolidated Guidance About Materials Licenses

Program-Specific Guidance About Industrial Radiography Licenses

Draft Report for Comment

Office of Federal and State Materials and
Environmental Management Programs

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Manuscript Completed: November 2011
Date Published: November 2011

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COMMENTS ON DRAFT REPORT

Any interested party may submit comments on this report for consideration by the NRC staff. Comments may be accompanied by additional relevant information or supporting data. Please specify the report number, NUREG-1556, Volume 2, Revision 1, in your comments and send them by the end comment period specified in the *Federal Register* notice announcing the availability of this draft.

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ABSTRACT

This technical report contains information intended to provide program-specific guidance and assist applicants and licensees in preparing applications for materials licenses for industrial radiography. In particular, it describes the types of information needed to complete U.S. Nuclear Regulatory Commission (NRC) Form 313, "Application for Materials License." This document describes both the methods acceptable to the NRC license reviewers in implementing the regulations and the techniques used by the reviewers in evaluating the application to determine if the proposed activities are acceptable for licensing purposes.

Paperwork Reduction Act Statement

This NUREG references information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collections were approved by the Office of Management and Budget, approval numbers 3150-0014; 3150-0011; 3150-0021; 3150-0151; 3150-0155; 3150-0008; 3150-0002; and 3150-0093.

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FOREWORD

The U.S. Nuclear Regulatory Commission's (NRC's) NUREG-1556 technical report series provides a comprehensive source of reference information about various aspects of materials licensing and materials program implementation. These reports, where applicable, describe a risk-informed, performance-based approach to licensing consistent with the current regulations. The reports are intended for use by applicants, licensees, license reviewers, and other NRC personnel. The NUREG-1556 series currently includes the following volumes:

Vol. No.	*Volume Title*
1	Program-Specific Guidance about Portable Gauge Licenses
2	Program-Specific Guidance about Industrial Radiography Licenses
3	Applications for Sealed Source and Device Evaluation and Registration
4	Program-Specific Guidance about Fixed Gauge Licenses
5	Program-Specific Guidance about Self-Shielded Irradiator Licenses
6	Program-Specific Guidance about 10 CFR Part 36 Irradiator Licenses
7	Program-Specific Guidance about Academic, Research and Development, and Other Licenses of Limited Scope
8	Program-Specific Guidance about Exempt Distribution Licenses
9	Program-Specific Guidance about Medical Use Licenses
10	Program-Specific Guidance about Master Materials Licenses
11	Program-Specific Guidance about Licenses of Broad Scope
12	Program-Specific Guidance about Possession Licenses for Manufacturing and Distribution
13	Program-Specific Guidance about Commercial Radiopharmacy Licenses
14	Program-Specific Guidance about Well Logging, Tracer, and Field Flood Study Licenses
15	Guidance about Changes of Control and about Bankruptcy Involving Byproduct, Source, or Special Nuclear Materials Licenses
16	Program-Specific Guidance about Licenses Authorizing Distribution to General Licensees
17	Program-Specific Guidance about Special Nuclear Material of Less Than Critical Mass Licenses

18	Program-Specific Guidance about Service Provider Licenses
19	Guidance for Agreement State Licensees About NRC Form 241 "Report of Proposed Activities in Non-Agreement States, Areas of Exclusive Federal Jurisdiction, or Offshore Waters" and Guidance for NRC Licensees Proposing to Work in Agreement State Jurisdiction (Reciprocity)
20	Program-Specific Guidance about Administrative Licensing Procedures
21	Program-Specific Guidance about Possession Licenses for Production of Radioactive Materials Using an Accelerator
22	Reserved

The current document, NUREG-1556, Volume 2, Revision 1, "Consolidated Guidance about Materials Licenses: Program-Specific Guidance About Industrial Radiography Licenses," is intended for use by applicants, licensees, license reviewers, and other NRC personnel. This revision provides a general update to the previous information contained in NUREG-1556, Volume 2, dated August 1998. Appendix A to this report provides a list of generic communications applicable to radiography, which the NRC staff considered in the development of this NUREG report.

This report takes a risk-informed, performance-based approach to licensing the use of sources in industrial radiography. A team composed of staff from NRC Headquarters, NRC regional offices, and Agreement States prepared this document, drawing on their collective experience in radiation safety in general and as specifically applied to industrial radiography.

NUREG-1556, Volume 2, Revision 1, is not a substitute for NRC regulations. The approaches and methods described in this report are provided for information only. Methods and solutions different from those described in this report may be acceptable if they include a basis for the staff to make the determinations needed to issue or continue a license.

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ACKNOWLEDGMENTS

The working group thanks the individuals listed below for assisting in the review and update of the report. All participants provided valuable insights, observations, and recommendations.

The working group would like to thank the staff in the regional offices of the U.S. Nuclear Regulatory Commission and all of the States who provided comments and technical information, which assisted in the development of this report.

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ABBREVIATIONS

ALARA	as low as is reasonably achievable
ANSI	American National Standards Institute
Bq	becquerel
CFR	*Code of Federal Regulations*
Ci	curie
cm	centimeter
COC	certificate of compliance
cpm	counts per minute
DOT	U.S. Department of Transportation
dpm	disintegrations per minute
DU	depleted uranium
FSME	Office of Federal and State Materials and Environmental Management Programs
GPO	Government Printing Office
GPS	global positioning system
h	hour
HVL	half-value layer
IN	information notice
µCi	microcurie
MDA	minimum detectable activity
mR	milliroentgen
mrem	millirem
mrem/h	millirem per hour
mSv	millisievert
mSv/h	millisievert per hour
NIST	National Institute of Standards and Technology
NMSS	Office of Nuclear Materials Safety and Safeguards
NRC	U.S. Nuclear Regulatory Commission
NSTS	National Source Tracking System
NVLAP	National Voluntary Laboratory Accreditation Program
OMB	Office of Management and Budget
R	roentgen
RIS	regulatory issue summary
RQ	reportable quantities
RSO	radiation safety officer
SI	International System of Units (abbreviated SI from the French Le Systeme Internationale d'Unites)
SSD	sealed source and device
Sv	sievert
TEDE	total effective dose equivalent
TI	Transport Index
TLD	thermoluminescent dosimeter

1. PURPOSE OF REPORT

This report provides guidance to an applicant applying for an industrial radiography (radiography) license and provides the U.S. Nuclear Regulatory Commission (NRC) with criteria for evaluating such applications. This document uses the terms "byproduct material," "licensed material," and "radioactive material" interchangeably. The term "radiography" as used in this report means an examination of the structure of materials by nondestructive methods using ionizing radiation to make radiographic images. The radionuclides most commonly used for radiography are cobalt-60 and iridium-192; however, other radioisotopes (e.g., ytterbium-169) with unique radiological characteristics might also be used. This report does not address the research and development of radiography devices, or associated equipment, or the commercial aspects of manufacturing, distribution, and service of such devices or equipment.

This report identifies the information needed to complete NRC Form 313 (Appendix B), "Application for Material License," for the use of sealed sources containing byproduct material in radiography devices. The Office of Management and Budget (OMB) has approved the information collection requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material"; 10 CFR Part 34, "Licenses for Industrial Radiography and Radiation Safety Requirements for Industrial Radiographic Operations"; and NRC Form 313 under OMB Clearance Nos. 3150-0017, 3150-0007, and 3150-0120, respectively.

The format within this document for each item of technical information is as follows:

- Regulations—references the regulations applicable to the item
- Criteria—outlines the criteria used to judge the adequacy of the applicant's response
- Discussion—provides additional information on the topic sufficient to meet the needs of most readers
- Response from Applicant—provides suggested response or responses, offers the option of an alternative reply, or indicates that no response is needed on that topic during the licensing process

Notes and references are self-explanatory and may not be found for each item on NRC Form 313. Appendix A includes specific NRC references used in the development of this guidance document.

NRC Form 313 does not have sufficient space for applicants to provide full responses to Items 5 through 11, as indicated on the form. Applicants should address those items on separate sheets of paper and submit them along with the completed NRC Form 313. For the convenience and streamlined handling of industrial radiography applications, Appendix C, "Suggested Format for Providing Information Requested in Items 5 through 11 of U.S. Nuclear Regulatory Commission Form 313," may be used to provide supporting information.

In this document, dose or radiation dose means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent (TEDE), as defined in 10 CFR Part 20, "Standards for Protection against Radiation." Rem and its International System of Units (SI) equivalent, sievert (Sv) (1 rem = 0.01 Sv), are used to describe units of radiation exposure or dose. This is done because

10 CFR Part 20 sets dose limits in terms of rem, rather than rad or roentgen. When the radioactive material emits beta and gamma rays, for practical reasons, 1 roentgen is assumed to equal 1 rad, which is assumed to equal 1 rem. For alpha-emitting radioactive material, 1 rad is not equal to 1 rem. Determination of dose equivalent (rem) from absorbed dose (rad) from alpha particles requires the use of an appropriate quality factor (Q) value. These Q values are used to convert absorbed dose (rad) to dose equivalent (rem); Tables 1004(b)(1) and (2) in 10 CFR 20.1004, “Units of radiation dose,” address the Q values for alpha particles.

2. AGREEMENT STATES

Certain States, called Agreement States (see Figure 2.1), have entered into agreements with the NRC that give them the authority to license and inspect byproduct, source, and special nuclear materials, in quantities not sufficient to form a critical mass, which are used or possessed within their borders. Any applicant, other than a Federal entity, who wishes to possess or use licensed material in one of these Agreement States should contact the responsible officials in that State for guidance on preparing an application. These applications should be filed with State officials, and not with the NRC. In areas under exclusive federal jurisdiction within an Agreement State, NRC continues to be the regulatory authority.

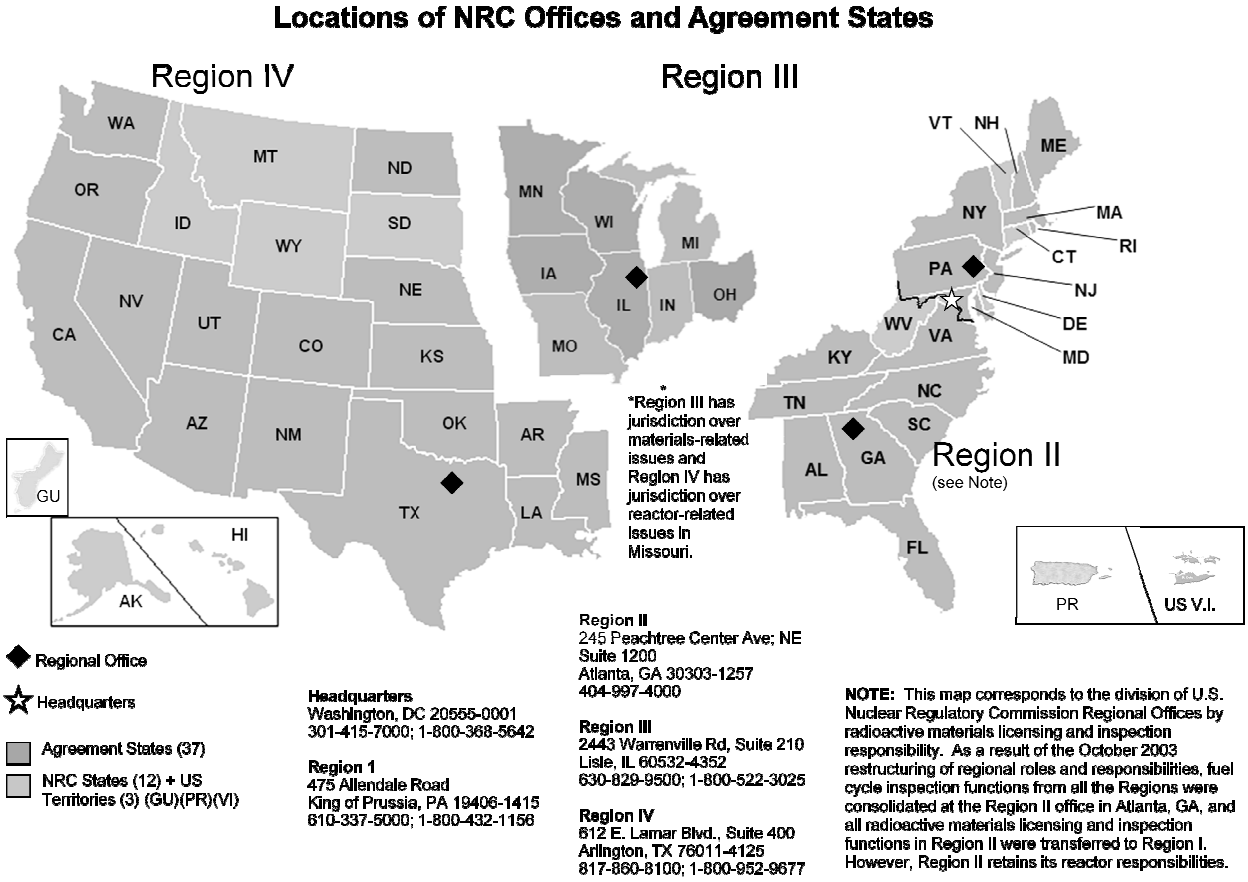


Figure 2.1 U.S. map: locations of NRC offices and Agreement States

In the special situation of work at Federally controlled sites in Agreement States, it is necessary to ascertain the jurisdictional status of the land to determine whether the NRC or the Agreement State has regulatory authority. These areas can also include tribal lands of federally recognized

Indian Tribes[1]. The NRC has regulatory authority over land determined to be "exclusive Federal jurisdiction," while the Agreement State has jurisdiction over nonexclusive Federal jurisdiction land. Applicants are responsible for determining in advance the jurisdictional status of the specific areas where they plan to conduct licensed operations. The NRC recommends that applicants contact their local office for the Federal agency controlling the site (e.g., contract officer, base environmental health officer, district office staff) for assistance in determining the jurisdictional status of the land and to provide the information in writing to ensure compliance with NRC or Agreement State regulatory requirements, as appropriate. Additional guidance on determining jurisdictional status is found in the All Agreement States letter (SP-96-022), dated February 16, 1996, which is available at http://nrc-stp.ornl.gov/. Once on the Web site, use the link for FSME Letters in the left hand column under Resources & Tools. The link will take you to another Web page where you can search for letters to the Agreement States.

Table 2.1 provides a quick way to check on whether the NRC or an Agreement State has regulatory authority.

Table 2.1 Who Regulates the Activity?

Applicant and Proposed Location of Work	Regulatory Agency
Federal agency or Federally recognized Indian Tribe[2] regardless of location (except the U.S. Department of Energy and, under most circumstances, its prime contractors are exempt from licensing, in accordance with 10 CFR 30.12, "Persons using byproduct material under certain Department of Energy and Nuclear Regulatory Commission contracts")	NRC
Non-Federal entity in non-Agreement State, District of Columbia, U.S. territory, or possession, or in offshore Federal waters	NRC
Non-Federal entity in Agreement State at non-Federally controlled site	Agreement State
Non-Federal entity in Agreement State at Federally controlled site **not** subject to exclusive Federal jurisdiction	Agreement State
Non-Federal entity in Agreement State at Federally controlled site subject to exclusive Federal jurisdiction	NRC

[1] For the purposes of this guidance, an "Indian tribe" is defined as an Indian or Alaska Native tribe, band, nation,pueblo, village, or community that the Secretary of the Interior acknowledges to exist as an Indian tribe pursuant to the Federally Recognized Indian Tribe List Act of 1994. A list of federally recognized tribes is available at www.doi.gov/bureau-indian-affairs.

[2] The NRC can exercise jurisdiction as the regulatory authority on tribal land of a Federally recognized Indian Tribe. Section 274b Agreements do not give States the authority to regulate nuclear material in these areas. However, there are few States that exercise regulatory authority over these areas. Companies owned or operated by Federally recognized Indian Tribe members or non-Indians that wish to possess or use licensed material on tribal lands should contact the appropriate NRC regional office to check the jurisdictional status of the tribal lands and request a license application from the appropriate regulatory agency.

Non-Federal entity in Agreement State at a reactor facility with an operating license subject to exclusive Federal jurisdiction	Agreement State
Non-Federal entity in Agreement State at a reactor facility under construction, prior to the issuance of an operating license subject to exclusive Federal jurisdiction.	Agreement State

Reference: A current list of Agreement States (including names, addresses, and telephone numbers of responsible officials) is available at the Office of Federal and State Materials and Environmental Management Programs (FSME) public Web site, http://nrc-stp.ornl.gov. As an alternative, a request for the list can be made to an NRC regional office.

3. MANAGEMENT RESPONSIBILITY

The NRC recognizes that effective radiation safety program management is vital to achieving safe and compliant operations. Consistent compliance with NRC regulations provides reasonable assurance that licensed activities will be conducted safely and that effective management will result in increased safety and compliance.

"Management" refers to the processes for conduct and control of a radiation safety program and to the individuals who are responsible for those processes and who have *authority to provide necessary resources* to achieve regulatory compliance.

Pursuant to 10 CFR 30.32, "Application for specific licenses," each application shall be signed by the applicant or licensee or a person duly authorized to act for and on their behalf. The person signing the application should be a duly authorized management representative. A signature by a management representative acknowledges management's commitments and responsibilities to the following:

- Radiation safety, security, and control of radioactive materials and compliance with regulations;
- Completeness and accuracy of the radiation safety records and all information provided to the NRC (10 CFR 30.9, "Completeness and accuracy of information");
- Knowledge about the contents of the license and application;
- Compliance with current NRC and U.S. Department of Transportation (DOT) regulations and the licensee's operating and emergency procedures;
- Commitment to provide adequate resources (including space, equipment, personnel, time, and, if needed, contractors) to the radiation protection program to ensure that the public and workers are protected from radiation hazards and compliance with regulations is maintained;
- Commitment to report defects, noncompliances, or reportable events in accordance with regulations;
- Selection and assignment of a qualified individual to serve as the radiation safety officer (RSO) for licensed activities and confirmation that the RSO has independent authority to stop unsafe operations and will be given sufficient time to fulfill radiation safety duties and responsibilities;
- Commitment to ensure that radiation workers have adequate training;
- Prohibition against discrimination of employees engaged in protected activities (10 CFR 30.7, "Employee protection");
- Commitment to provide information to employees regarding the employee protection and deliberate misconduct provisions in 10 CFR 30.7 and 10 CFR 30.10, "Deliberate misconduct," respectively;
- Commitment to obtain NRC's prior written consent before transferring control of the license (see Section 9.1 of this report); and

- Notification of the appropriate NRC regional administrator in writing, immediately following the filing of petition for voluntary or involuntary bankruptcy (10 CFR 30.34(h)), as discussed further in Section 8.2.1 of this report.

For information on NRC inspection, investigation, enforcement, and other compliance programs, see the current version of the NRC's Enforcement Policy and Inspection Procedures available in the NRC's online library at http://www.nrc.gov/reading-rm.html.

3.1 Safety Culture

It is the NRC's expectation that individuals and organizations performing regulated activities establish and maintain a positive safety culture commensurate with the safety and security significance of their activities and the nature and complexity of their organizations and functions. This applies to all licensees, certificate holders, permit holders, authorization holders, holders of quality assurance program approvals, vendors and suppliers of safety-related components, and applicants for a license, certificate, permit, authorization, or quality assurance program approval, subject to NRC authority.

"Nuclear safety culture" is defined as *the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment*. Individuals and organizations performing regulated activities bear the primary responsibility for safely handling and securing these materials. Experience has shown that certain personal and organizational traits are present in a positive safety culture. A trait, in this case, is a pattern of thinking, feeling, and behaving that emphasizes safety, particularly in goal conflict situations (e.g., production versus safety, schedule versus safety, and cost of the effort versus safety).

The NRC, as the regulatory agency with an independent oversight role, reviews the performance of individuals and organizations to determine compliance with requirements and commitments through its existing inspection and assessment processes. However, NRC's safety culture policy statement and traits are not incorporated into the regulations. Many of the safety culture traits may be inherent to an organization's existing radiation safety practices and programs. For instance, the annual refresher training required for radiographers and radiographer assistants may correspond with the "continuous learning" safety culture trait in that the training provides an opportunity to learn about ways to ensure that safety is sought out and implemented.

Refer to Appendix P for the NRC's safety culture policy statement. More information on NRC activities relating to safety culture can be found at: http://www.nrc.gov/about-nrc/regulatory/enforcement/safety-culture.html.

4. APPLICABLE REGULATIONS

It is the applicant, licensee, or registrant's responsibility to obtain and have available up-to-date copies of applicable regulations, to read and understand the requirements of each of these regulations, and to comply with each applicable regulation. The following parts of Title 10 of the *Code of Federal Regulations* contain regulations applicable to industrial radiography. Some of these parts are specific to one type of license, while others are general and will apply to many if not all licensees.

The current versions of these parts can be found under the "Basic References" link at the NRC's online library at http://www.nrc.gov/reading-rm.html; if viewing in a browser, the following list includes a direct link to the rules:

- 10 CFR Part 2, "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders"
- 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations"
- 10 CFR Part 20, "Standards for Protection Against Radiation"
- 10 CFR Part 21, "Reporting of Defects and Noncompliance"
- 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material"
- 10 CFR Part 32, "Specific Domestic Licenses to Manufacture or Transfer Certain Items Containing Byproduct Material"
- 10 CFR Part 34, "Licenses for Industrial Radiography and Radiation Safety for Industrial Radiographic Operations"
- 10 CFR Part 40, "Domestic Licensing of Source Material"
- 10 CFR Part 71, "Packaging and Transportation of Radioactive Material"
- 10 CFR Part 73, "Physical Protection of Plants and Materials"
- 10 CFR Part 110, "Export and Import of Nuclear Equipment and Material"
- 10 CFR Part 150, "Exemptions and Continued Regulatory Authority in Agreement States and in Offshore Waters under Section 274"
- 10 CFR Part 170, "Fees for Facilities, Materials, Import and Export Licenses and Other Regulatory Services Under the Atomic Energy Act of 1954, as Amended"

- 10 CFR Part 171, "Annual Fees for Reactor Licenses, and Fuel Cycle Licenses and Materials Licenses, Including Holders of Certificates of Compliance, Registrations, and Quality Assurance Program Approvals and Government Agencies Licensed by the NRC"

Copies of the above documents may be obtained by calling the Government Printing Office (GPO) order desk toll free at (866) 512-8600, or in Washington, DC, at (202) 512-1800, or online at http://bookstore.gpo.gov.

A single copy of the above documents may be requested from the NRC's regional offices (see Figure 2.1 for addresses and telephone numbers). In addition, 10 CFR Parts 1 through 199 can be found on the NRC's Web site at http://www.nrc.gov/reading-rm/doc-collections/ under Regulations (10 CFR).

NRC regulations and amendments can also be accessed from the "NRC Library" link on the NRC's public Web site at http://www.nrc.gov. The NRC and all other Federal agencies publish amendments to their regulations in the *Federal Register*.

5. HOW TO FILE

5.1 Paper Application

Applicants for a materials license should do the following:

- Use the most recent guidance in preparing an application.
- Complete NRC Form 313 (Appendix B), Items 1 through 4, 12, and 13, on the form itself.
- Complete NRC Form 313, Items 5 through 11, on supplementary pages or use Appendix C.
- Provide sufficient detail for the NRC to determine that equipment, facilities, training, experience, and the radiation safety program are adequate to protect health and safety and minimize danger to life and property.
- For each separate sheet other than NRC Form 313 and Appendix C submitted with the application, identify and cross-reference submitted information to the item number on the application or the topic to which it refers.
- Submit all documents, typed, on 8-1/2 x 11-inch paper.
- Avoid submitting proprietary information and personally identifiable information.
- If submitted, proprietary information and other sensitive information (e.g., personal privacy and security related) should be clearly identified per 10 CFR 2.390, "Public inspections, exemptions, requests for withholding" (see Chapter 6).
- Submit an original, signed application and one copy.
- Retain one copy of the license application for future reference.

Applications must be signed by the applicant, licensee, or a person duly authorized as required by 10 CFR 30.32 (c) (see Section 8.13).

5.2 Where to File

Applicants wishing to possess or use licensed material in any State, U.S. territory, or U.S. possession subject to NRC jurisdiction must file an application with the NRC regional office for the locale in which the material will be possessed or used. Figure 2.1 identifies NRC's four regional offices, and their respective areas for licensing purposes, and the Agreement States. Note that all materials applications are submitted to Regions I, III, or IV. All applicants for materials licenses located in the Region II geographical area should send their applications to Region I.

In general, applicants wishing to possess or use licensed material in Agreement States must file an application with the Agreement State and not with the NRC. However, if work will be conducted at Federally controlled sites, or federally recognized Indian Tribal lands, in Agreement States, applicants must first determine the jurisdictional status of the land in order to

determine whether the NRC or the Agreement State has regulatory authority. See Chapter 2 for additional information.

5.3 Transfer to Electronic Format

Paper applications received by the NRC are scanned through an optical character reader and converted to an electronic format. To ensure a smooth transfer to an electronic format, applicants should do the following:

- Submit printed or typewritten—not handwritten—text on smooth, crisp paper that will feed easily into the scanner.
- Choose typeface designs that are sans serif, such as Arial, Helvetica, Future, or Univers (the text of this document is in the Arial font).
- Use 12-point or larger font.
- Avoid stylized characters, such as script or italics.
- Ensure that the print is clear and sharp.
- Ensure that there is high contrast between the ink and paper (black ink on white paper is best).

It is anticipated that the NRC may provide mechanisms for filing applications through the Internet. If this occurs, the NRC will provide additional filing instructions as the agency implements these new mechanisms.

6. IDENTIFYING AND PROTECTING SENSITIVE INFORMATION

All licensing applications, except for portions containing sensitive information, will be made available for review in the NRC's Public Document Room and electronically at the NRC Library. For more information on the NRC library, visit www.nrc.gov.

The licensee should identify, mark, and protect sensitive information against unauthorized disclosure to the public. Licensing applications that contain sensitive information should be marked as indicated below, in accordance with 10 CFR 2.390, before the information is submitted to the NRC. Key examples are as follows:

- Proprietary Information/Trade Secrets: If it is necessary to submit proprietary information or trade secrets, follow the procedure in 10 CFR 2.390(b). Failure to follow this procedure could result in disclosure of the proprietary information to the public or substantial delays in processing the application.
- Personal Privacy Information: Personal information about employees or other individuals should not be submitted unless specifically requested by the NRC. Examples of private information are social security number, home address, home telephone number, date of birth, and radiation dose information. If private information is submitted, it should be separated from the public portion of the application and clearly marked: "Privacy Act Information—Withhold under 10 CFR 2.390." For further information, see Regulatory Issue Summary (RIS) 2007-04, "Personally Identifiable Information Submitted to the U.S. Nuclear Regulatory Commission," dated March 9, 2007, which can be found on the NRC's Generic Communications webpage under Regulatory Issue Summaries: http://www.nrc.gov/reading-rm/doc-collections/gen-comm/.
- Security-Related Information: Following the events of September 11, 2001, the NRC changed its procedures to avoid release of information that terrorists could use to plan or execute an attack against facilities or citizens in the United States. As a result, certain types of information are no longer routinely released and are treated as sensitive unclassified information. For example, certain information about the quantities and locations of radioactive material at licensed facilities, and associated security measures, are no longer released to the public. Therefore, sensitive security-related information in an application should be marked: "Security Related—Withhold under 10 CFR 2.390." For further information, see RIS 2005-31, "Control of Security-Related Sensitive Unclassified Non-Safeguards Information Handled by Individuals, Firms, and Entities Subject to NRC Regulation of the Use of Source, Byproduct, and Special Nuclear Material," dated December 22, 2005, which can be found on the NRC's Generic Communications webpage under Regulatory Issue Summaries: http://www.nrc.gov/reading-rm/doc-collections/gen-comm/.
  Additional information on procedures and any updates is available at http://www.nrc.gov/reading-rm/sensitive-info.html.

7. APPLICATION AND LICENSE FEES

Each application for which a fee is specified must be accompanied by the appropriate fee. Refer to 10 CFR 170.31, "Schedules of fees for materials licenses and other regulatory services, including inspections, and import and export licenses," to determine the amount of the fee. The NRC will not issue a license until the fee is received. Consult 10 CFR 170.11, "Exemptions," for information on exemptions from these fees. Once the technical review has begun, no fees will be refunded; application fees will be charged regardless of the NRC's disposition of the application or the withdrawal of the application.

Most NRC licensees are also subject to annual fees; refer to 10 CFR 171.16, "Annual fees: Materials licensees, holders of certificates of compliance, holders of sealed source and device registrations, holders of quality assurance program approvals, and government agencies licensed by the NRC." Consult 10 CFR 171.11 for information on exemptions from annual fees and 10 CFR 171.16(c) on reduced annual fees for licensees that qualify as "small entities."

Direct all questions about the NRC's fees or completion of Item 12 of NRC Form 313 to the Office of the Chief Financial Officer at NRC Headquarters in Rockville, MD, (301) 415-7554. Information about fees may also be obtained by calling NRC's toll free number, (800) 368-5642, extension 415-7554. The e-mail address is Fees.Resource@nrc.gov.

8. CONTENTS OF AN APPLICATION

The following comments apply to the indicated items on NRC Form 313 (Appendix B).

All items in the application should be completed in enough detail for the NRC to determine that the proposed equipment, facilities, training and experience, and the radiation safety program satisfy regulatory requirements and are adequate to protect health and minimize danger to life and property. Consideration shall be given, when developing the application, to the concepts of keeping exposure as low as reasonably achievable (ALARA) and minimizing contamination.

In 10 CFR 20.1101(b), the NRC states: “The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA).” Regulatory Guide 8.10, “Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Reasonably Achievable,” discusses the ALARA concepts and philosophy. The application should document ALARA considerations, including establishing administrative action levels and monitoring programs.

In 10 CFR 20.1406, “Minimization of contamination,” the NRC requires applicants for licenses to describe how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste. As with ALARA considerations, applicants should address concerns for all aspects of their programs.

All information submitted to the NRC during the licensing process may be incorporated as part of the license and will be subject to review during inspection.

8.1 Item 1: License Action Type

This is an application for (check appropriate item):

Type of Action	License No.
[ ] A. New License	Not Applicable
[ ] B. Amendment	XX-XXXXX-XX
[ ] C. Renewal	XX-XXXXX-XX

Check box A for a new license request.

Check box B for an amendment to an existing license, and provide license number.

Check box C for a renewal of an existing license, and provide license number.

8.2 Item 2: Applicant's Name and Mailing Address

List the legal name of the applicant's corporation or other legal entity with direct control over use of the radioactive material; a division or department within a legal entity may not be a licensee. An individual may be designated as the applicant only if the individual is acting in a private capacity and the use of the radioactive material is not connected with employment in a corporation or other legal entity. Provide the mailing address where correspondence should be sent. A post office box number is an acceptable mailing address.

Notify the NRC of changes in the mailing address; these changes do not require a fee.

Note: The NRC must be notified before control of the license is transferred (see Section 9.1) or when bankruptcy proceedings have been initiated. See Section 8.2.1 below for more details.

8.2.1 Notification of Bankruptcy Proceedings

Regulation: 10 CFR 30.34(h)

Criteria: Immediately following the filing of a voluntary or involuntary petition for bankruptcy for or against a licensee, the licensee must notify the appropriate NRC regional administrator, in writing, identifying the bankruptcy court in which the petition was filed and the date of filing.

Discussion: Even though a licensee may have filed for bankruptcy, the licensee remains responsible for all regulatory requirements. The NRC must know when licensees are in bankruptcy proceedings in order to determine whether all licensed material is accounted for and adequately controlled and whether there are any public health and safety concerns (e.g., contaminated facility). The NRC shares the results of its determinations with other involved entities (e.g., trustee), so that health and safety issues can be resolved before bankruptcy actions are completed.

Response from Applicant: None required at the time of application for a new license. Licensees must immediately notify in writing the NRC following the filing of a voluntary or involuntary petition for bankruptcy for or against the licensee.

Reference: See NUREG-1556, Volume 15, "Guidance About Changes of Control and About Bankruptcy Involving Byproduct, Source, or Special Nuclear Materials Licenses."

8.3 Item 3: Address(es) Where Licensed Material Will Be Used or Possessed

Specify the street address, city, and State or other descriptive address (e.g., on Highway 10, 5 miles east of the intersection of Highway 10 and State Route 234, Anytown, State). In addition, global positioning system (GPS) coordinates, as appropriate, may be provided for each permanent storage or use facility and field station located in a remote area. A field station is a location where licensed material may be stored or used and from which the applicant will dispatch equipment to jobsites. The descriptive address should be sufficient to allow an NRC inspector to find the facility location. If devices will not be stored at a dispatch site or field station, the applicant should indicate this. The applicant should also state whether a location will be used to perform radiographic operations or only for storage of sources and devices.

A post office box address is not acceptable (see Figure 8.1). Documents that give exact location of use should be marked "Security-Related Information—Withhold under 10 CFR 2.390."

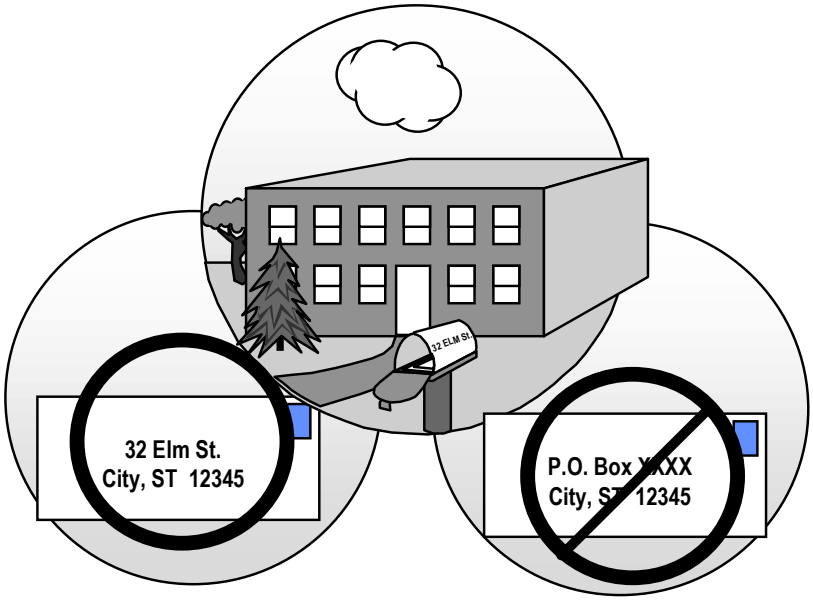


Figure 8.1 Location of use. An acceptable location of use specifies street address, city, State, and zip code and does not include a post office box number.

An NRC-approved license amendment is required before receiving, using, and storing licensed material at an address or location not listed on the license (10 CFR 30.3, "Activities requiring license").

Being granted an NRC license does not relieve a licensee from complying with other applicable Federal, State, or local regulations (e.g., local zoning requirements).

Response from Applicant:

- If a device will be used in a permanent radiographic installation, give the specific address of each location. If applicable, describe the locations outside of the installation where radiographic operations will be conducted.
- If radiography equipment will be stored or used at a field station, give the specific address of each field station (and the GPS coordinates, if available).
- If radiography operations will be conducted at temporary jobsites (i.e., locations where work is conducted for limited periods of time), specify "temporary jobsites anywhere in the United States where NRC maintains jurisdiction."

Note: Locations where licensed material may be stored or used and from which equipment is dispatched are considered field facilities which, as specified in 10 CFR 34.13(j), must be identified in the application.

Note: If radiography operations are expected to exceed 180 days at a temporary jobsite, then provide written notification to the appropriate NRC regional office before exceeding the 180 days (a license amendment or authorization by the NRC regional office is not required).

Note: As discussed later in Section 8.5.2, "Financial Assurance and Recordkeeping for Decommissioning," licensees must maintain permanent records describing where licensed material was used or stored while the license was in effect. This is important for making future determinations about the release of these locations for unrestricted use (e.g., before the license is terminated). Acceptable records are sketches, written descriptions of the specific locations or room numbers where licensed material is used or stored, and any records of spills or other unusual occurrences involving the spread of contamination in or around the licensee's facilities.

8.4 Item 4: Person To Be Contacted about This Application

Identify the individual who can answer questions about the application, and include his or her telephone number. This individual, usually the RSO, will serve as the point of contact during the review of the application and during the period of the license. If this individual is not a full-time employee of the licensed entity, his or her position and relationship should be specified. The NRC should be notified if the person assigned to this function changes or if his or her telephone number changes. Notification of a contact change is for information only and would not be considered an application for license amendment, unless the notification involves a change in the contact person who is also the RSO.

As indicated on NRC Form 313 (Appendix B), Items 5 through 11 should be submitted on separate sheets of paper. Applicants may use Appendix C for this purpose and should note that using the suggested wording of responses and committing to use the model procedures in this report will expedite the NRC's review.

8.5 Item 5: Radioactive Material

8.5.1 Sealed Sources and Devices

Regulation: 10 CFR 30.32(g), 10 CFR 30.33(a)(2), 10 CFR 32.210, 10 CFR 34.20

Criteria: Applicants must provide the manufacturer's (or distributor's) name and model number for each requested source assembly (the sealed source and a connector that attaches the source to the control cable), exposure device, and source changer. Licensees will only be authorized for radiographic exposure devices, source assemblies, or sealed sources containing byproduct material meeting NRC performance requirements and specifically approved or registered by the NRC or an Agreement State. In addition, identify any depleted uranium that is used as shielding material (radiographic exposure devices, source changers, and some collimators contain depleted uranium).

Discussion: The NRC or an Agreement State performs safety evaluations of radiography source assemblies, exposure devices, and source changers before distribution of these sources and devices to specific licensees. The safety evaluation is documented in a sealed source and device (SSD) registration certificate issued to the manufacturer (or distributor). Therefore, if the NRC or an Agreement State agency approves the source assemblies, exposure devices, or source changers for use, the applicant must note the manufacturer's (or distributor's) name and the model number of the sources and devices in its license application to demonstrate that the requirements are met. Manufacturers and distributors of industrial radiography equipment may voluntarily include the items of associated equipment that were used in the industrial radiography system with their sealed sources and devices that are registered. To include associated equipment in the certificate of registration, the manufacturer's or distributor's application must include information that demonstrates the associated equipment meets the minimum criteria in 10 CFR 34.20, "Performance requirements for individual radiography equipment."

Consult with the proposed supplier to ensure that sources and devices conform to the sealed source and device designations registered with the NRC or an Agreement State. To ensure that they use radiographic equipment in accordance with registration certificates, licensees may want to review the certificate, discuss with the manufacturer, or obtain a copy of the certificate. Licensees may not make modifications to exposure devices, source changers, source assemblies, and associated equipment unless the design of any replacement component, including source holder, source assembly, controls, or guide tubes, would not compromise the design safety features of the system.

Consult with the manufacturer of the associated equipment (i.e., equipment that is used in conjunction with the exposure device that drives, guides, or comes in contact with the source) to be sure that the associated equipment is compatible with the sources and devices. Licensees must demonstrate that associated equipment meets the performance requirements in 10 CFR 34.20. RIS 2005-10, "Performance-Based Approach for Associated Equipment in 10 CFR 34.20," dated June 10, 2005, alerts licensees to the difference between items of equipment that are considered to be associated equipment and items of equipment that are not. For example, the portion of the connector that is attached to the end of the control cable is actually a component of the source assembly and is subject to the safety evaluation that must be completed by the NRC or an Agreement State before the source assembly may be specifically authorized for use by a licensee. RIS 2005-10 also contains a number of ways that

licensees can demonstrate that their associated equipment meets the performance requirements stated in 10 CFR 34.20.

Radiography sources are usually at or above Category 2 quantities. Applicant/licensee information on manufacturers, model numbers, and possession limits is sensitive and should be marked accordingly (see Chapter 6). Category 1 and Category 2 sources regulated by the NRC and Agreement States must be tracked in the National Source Tracking System (NSTS).

Response from Applicant:

- Identify each radionuclide that will be used. Identify the manufacturer (or distributor) and model number of each sealed source, source assembly, exposure device, or source changer to be possessed. Identify any depleted uranium that is used as shielding material.
- For each source model, identify the radionuclide, maximum activity per source, and total possession limit.
- Confirm that each sealed source, device, and source/device combination possessed is registered as an approved sealed source or device by the NRC or an Agreement State and will be possessed and used in accordance with the conditions specified in the registration certificate. Obtain from the manufacturer/distributor a copy of the SSD certificate and provide the SSD registry number with the application.
- Confirm that associated equipment is compatible with the exposure devices, source changers, and sealed sources containing byproduct material.
- Identify by radionuclide and manufacturer (or distributor) and model number any other sealed sources containing byproduct material (i.e., any source that will not be used for performing radiography).
- Confirm that all radiographic exposure devices, source assemblies, or sealed sources, and all associated equipment which meet the requirements specified in 10 CFR 34.20, will be used in radiographic operations.

Mark the section related to possession of sealed sources and devices with manufacturers, model numbers, and possession limits as follows: "Security-Related Information—Withhold under 10 CFR 2.390."

8.5.2 Financial Assurance and Recordkeeping for Decommissioning

Regulations: 10 CFR 30.34(b), 10 CFR 30.35, 10 CFR 34.13(k)

Criteria: Industrial radiography licensees authorized to possess sealed sources containing byproduct material in excess of the limits specified in 10 CFR 30.35, "Financial assurance and recordkeeping for decommissioning," must provide evidence of financial assurance for decommissioning.

Licensees are required to maintain, in an identified location, decommissioning records related to structures and equipment where devices are used or stored, as well as records related to leaking sources. Licensees must transfer these records important to decommissioning either to an NRC or Agreement State licensee before licensed activities are transferred or assigned in

accordance with 10 CFR 30.34(b) or to the appropriate NRC regional office before the license is terminated.

Discussion: The requirements for financial assurance are specific to the types and quantities of byproduct material authorized on a license. Most industrial radiography applicants and licensees do not need to comply with the financial assurance requirements because the thresholds for sealed sources containing byproduct material are 3.7×10^5 becquerels (Bq) (10,000 curies (Ci)) of cobalt-60 and 3.7×10^6 Bq (100,000 Ci) of cesium-137 or byproduct material with half-lives less than 120 days (e.g., iridium-192). Thus, a licensee would need to possess hundreds of sources before the financial assurance requirements would apply. Applicants and licensees desiring to possess sources exceeding the threshold amounts should submit evidence of financial assurance. Licensees may follow the guidance provided in NUREG-1757, Volume 3, "Consolidated NMSS Decommissioning Guidance—Financial Assurance, Recordkeeping and Timeliness."

NRC regulations also require that licensees maintain records important to decommissioning in identified locations other than at any temporary jobsite. All industrial radiography licensees need to maintain records of structures and equipment where devices are used or stored. As-built drawings showing modifications to structures and equipment fulfill this requirement. If drawings are not available, licensees may substitute appropriate records (e.g., a sketch of the room or building or a narrative description of the area) concerning the areas and locations. In addition, industrial radiography licensees who have experienced unusual occurrences (e.g., leaking sources or other incidents that involve spread of contamination, such as S-tube breakthrough) also need to maintain records about contamination that remains after cleanup or contamination that may have spread to inaccessible areas. Leak-test results are part of the decommissioning records.

Response from Applicants: State the following: "Pursuant to 10 CFR 30.35(g), we shall maintain drawings and records important to decommissioning and to transfer these records to an NRC or Agreement State licensee before licensed activities are transferred, or to assign the records to the appropriate NRC regional office before the license is terminated."

AND

If financial assurance is required, submit evidence of financial assurance following the guidance of NUREG-1757, Volume 3.

Reference: NUREG-1757, Volume 3, "Consolidated NMSS Decommissioning Guidance—Financial Assurance, Recordkeeping and Timeliness."

8.6 Item 6: Purpose(s) for Which Licensed Material Will Be Used

Regulations: 10 CFR 30.33(a)(1), 10 CFR 34.1

Criteria: Sources and devices will be used only for the purposes for which they were designed and in accordance with the manufacturer's recommendations for use as specified in an approved SSD registration certificate.

Discussion: The typical license authorizes persons to perform source exchanges and to conduct industrial radiography at temporary jobsites, field stations, or permanent radiographic installations. Unusual uses will be evaluated on a case-by-case basis, and the authorized use

condition will reflect approved uses. Applicants who plan to perform radiographic operations on lay-barges, on offshore platforms, or underwater must specifically request these operations.

Response from Applicant:

- Check off on Appendix C that the equipment will only be used for industrial radiography.

OR

- Specify the purposes for which the source(s) and device(s) will be used other than those included in the manufacturer's recommendations, as specified on the SSD registration certificate.

AND

- In addition, specify any plans to perform radiography under water, on lay-barges, or on offshore platforms. Refer to Appendix D.

8.7 Item 7: Individuals Responsible for Radiation Safety Program and Their Training and Experience

8.7.1 Radiation Safety Officer

Regulations: 10 CFR 34.13(f), 10 CFR 34.13(g), 10 CFR 34.42, 10 CFR 34.43

Criteria: RSOs and potential designees responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures must have adequate training and experience.

Discussion: The person responsible for the radiation protection program is called the RSO. The NRC believes the RSO is the key to overseeing and ensuring safe operation of the licensee's radiography program. The RSO needs independent authority to stop operations that he or she considers unsafe. He or she must have sufficient time and commitment from management to fulfill certain duties and responsibilities to ensure that radioactive materials are used in a safe manner.

The RSO may delegate certain day-to-day tasks of the radiation protection program to other responsible individuals (potential designees). For example, a large testing company with multiple field stations may appoint individuals designated as "site RSOs" who assist the RSO and are responsible for the day-to-day activities at the field stations. Licensees may also appoint other individuals who may "step in" as an emergency contact when the RSO is unavailable. The potential designees do not need to meet the required RSO qualifications; however, these individuals should be qualified, experienced radiographers who have adequate knowledge of the activities to which they are assigned. Designees should have management support and decisionmaking authority necessary to manage daily program activities. Applicants do not have to identify other responsible individuals if day-to-day tasks will not be delegated.

Figure 8.2 illustrates typical RSO duties. The NRC requires the name of the RSO on the license to ensure that licensee management has always identified a responsible, qualified person and that the named individual knows of his or her designation as RSO. Provide the NRC with a copy of an organizational chart showing the RSO (and other designated responsible individuals) to demonstrate that he or she has sufficient independence and direct

communication with responsible management officials. Also, show in the organizational chart the position of the certifying officer who signs the application in Item 13 of NRC Form 313.

To be considered eligible for the RSO position, an individual must be a qualified radiographer, have a minimum of 2,000 hours (1 year full-time field experience) of hands-on experience as a qualified radiographer, and have formal training in establishing and maintaining a radiation protection program. This should be a course specifically designed to provide training in managing and implementing a radiation safety program; a basic radiation safety course is not acceptable. While a course particular to industrial radiography would be highly encouraged, this is not required. Acceptable training programs would be a classroom course typical of those provided through universities or commercial training facilities. Hands-on experience means experience in all areas considered to be directly involved in the radiography process. This includes taking radiographs, surveying device and radiation areas, transporting the radiography equipment to temporary jobsites, securing the material, posting work sites with necessary warning signs, conducting radiation area surveillance, completing and maintaining records, and other tasks. Excessive time spent in only one or two of these operations (film development or area surveillance) should not be counted toward the 2,000 hours. Experience with radiography using x-rays can be included; however, the majority of experience should be in isotope radiography.

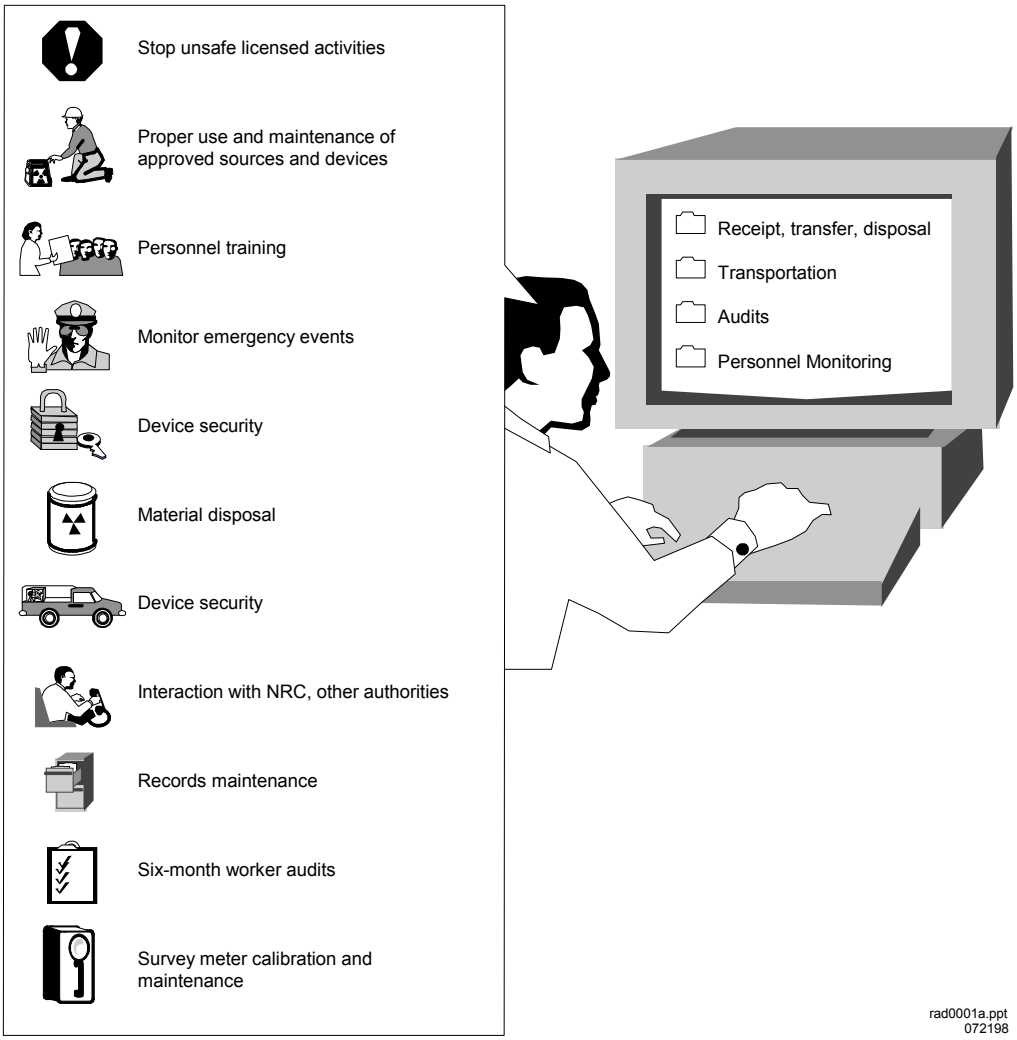


Figure 8.2 Typical duties and responsibilities of RSOs

Note: The NRC will consider individuals with alternative training and experience as RSOs. For example, a person certified in health physics or industrial hygiene with previous experience in managing a radiation safety program of comparable size and scope could be considered as an individual case. The qualifications, training, and experience required of the RSO may vary depending upon the complexity of the applicant's operations and number of radiography personnel.

Response from Applicant: Provide the following:

- The name of the proposed RSO and other potential designees who will be responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures.

AND

- Demonstrate that the RSO has sufficient independence and direct communication with responsible management officials by providing a copy of an organizational chart, by position, demonstrating day-to-day oversight and coordination with management in radiation safety activities.

AND EITHER

- The specific training and experience of the RSO and other potential designees. Include the specific dates of certification or training, or both, in radiation safety.
- Documentation to show that the RSO has a minimum of 2,000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations.
- Documentation to show that the RSO has obtained formal training in the establishment and maintenance of a radiation protection program.

OR

- Alternative information demonstrating that the proposed RSO is qualified by training and experience (e.g., certification by the American Board of Health Physicists, completion of a bachelor's or master's degree in the sciences with at least 1 year of experience in the conduct of a radiation safety program of comparable size and scope).
- Documentation to show that the RSO has obtained formal training in the establishment and maintenance of a radiation protection program.

Note: It is important to notify the NRC and obtain a license amendment before making changes in the designation of the RSO responsible for the radiation safety program.

8.8 Item 8: Training for Radiographers and Radiographer's Assistants

Regulations: 10 CFR 19.12, 10 CFR 30.33, 10 CFR 34.13, 10 CFR 34.43

Criteria: Radiographers and radiographer's assistants must have adequate training and experience as outlined in 10 CFR 34.43, "Training."

Discussion:

- A radiographer is a person who performs or personally supervises industrial radiography and is responsible for ensuring compliance with NRC regulations, license conditions, and the safe use of radioactive materials.
- A certified radiographer is an individual who has been certified by a certifying entity that he or she has met established radiation safety, testing, and experience criteria.
- A radiographer's assistant is an individual, who under the direct supervision (in the physical presence) of the radiographer, uses radiographic equipment (sealed sources containing byproduct material or related handling tools, exposure devices, and radiation survey instruments) in performing industrial radiographic operations.

The regulations in 10 CFR 34.43 describe specific training requirements for radiographers and radiographer's assistants and require that all radiographers be certified. The regulations also address annual refresher training and semiannual audits of radiographers and radiographer's assistants.

The applicant must submit a description of its training program for radiographers and radiographer's assistants. Refer to Appendix E as an aid to determining the specific training requirements for radiographers and radiographer's assistants. No licensing actions are required when radiographers are certified. The NRC will verify radiographer certification during routine NRC inspections.

Because 10 CFR Part 34 contains different requirements for radiographers and radiographer's assistants, include training programs for each. When describing the training programs for these positions, include the sequence of events from the time of hiring through the designation of individuals as radiographers or radiographer's assistants. Experienced radiographers who have worked for another licensee should receive formal instruction in company operations similar to that given to prospective radiographer's assistants. This instruction must include training in the applicant's operating and emergency procedures, in the use of the applicant's exposure devices and associated equipment, and in the use of survey meters and other radiation monitoring devices.

Instructors who provide classroom training to individuals in the principles of radiation and radiation safety should have knowledge and understanding of these principles beyond those obtainable in a course similar to the one given to prospective radiographers. Individuals who provide instruction in the hands-on use of radiography equipment should be qualified radiographers with at least 1 year of experience in performing radiography or should possess a thorough understanding of the operation of radiographic equipment (e.g., a manufacturer's service representative).

An internal inspection program (audit program) of the job performance of each radiographer and radiographer's assistant ensures that the Commission's regulations, license requirements, and the licensee's operating and emergency procedures are followed. The audit must include observation of the performance of each radiographer and radiographer's assistant during an actual industrial radiographic operation at intervals not to exceed 6 months. If a radiographer or radiographer's assistant has not participated in an industrial radiographic operation for more than 6 months, the individual must demonstrate knowledge of the training requirements by practical examination before participating in a radiographic operation. The person conducting internal inspections should have a minimum of 1 year actual experience as a radiographer.

Response from Applicant: Submit an outline of the training to be given to prospective radiographers and radiographer's assistants. Submit your procedures for experienced radiographers who have worked for another licensee.

Provide a copy of a typical examination and the correct answers to the examination questions. Indicate the passing grade.

Specify the qualifications of your instructors in radiation safety principles and describe their experience with radiography. If training will be conducted by someone outside the applicant's organization, identify the course by title and provide the name and address of the company providing the training.

Describe the field (practical) examination that will be given to prospective radiographers and radiographer's assistants. The NRC suggests using the checklist in Appendix F as a source of potential areas to review during the field examination.

Describe the annual refresher training program, including topics to be covered and how the training will be conducted. Topics for discussion might include examples such as those found in Appendix E.

Submit your procedures for verifying and documenting the certification status of radiographers and for verifying that their certification remains valid. As a minimum, your procedures for newly hired, previously certified individuals should require documentation that you contacted the certifying entity and confirmed the certification. Your procedures should also ensure that you are aware of certification expiration dates and that individuals with expired certifications do not act as radiographers.

Submit a description of your program for inspecting the job performance of each radiographer and radiographer's assistant at intervals not to exceed 6 months, as described in 10 CFR 34.43(e). Appendix F provides a sample checklist.

X-ray training by itself will not be considered adequate experience for performing gamma radiography.

8.9 Item 9: Facilities and Equipment

Regulations: 10 CFR 20.1003, 10 CFR 20.1301, 10 CFR 20.1601, 10 CFR 20.1801, 10 CFR 20.1802, 10 CFR 30.33, 10 CFR 34.13(j), 10 CFR 34.33, 10 CFR 34.89

Criteria: Licensees must specifically identify and describe permanent radiographic installations and field stations and any other locations where radiography will be conducted.

Discussion: A permanent radiographic installation is an enclosed shielded room, cell, or vault in which radiography may be performed. A facility is considered "permanent" if it is intended to be used for radiography, even if radiography is rarely performed there. The nature of the facility, rather than the frequency of use, determines a permanent radiographic installation. All radiographic operations conducted at locations of use authorized on the license must be conducted in a permanent radiographic installation, unless specifically authorized by the NRC. If licensees need to perform radiography at their place of business outside of a permanent facility because of unique circumstances (the item to be radiographed is too large for the facility), then the NRC must authorize this method of use. In this case, two individuals must be present whenever radiographic operations occur outside of a permanent installation.

The one primary (and perhaps the most important) reason licensees have for conducting radiography in a permanent radiographic installation is that they can limit access restrictions imposed at a work location. To ensure this control, a permanent radiographic installation, if located on the ground, must be enclosed by a minimum of four shielded walls (otherwise the floor must also be shielded). The use of materials that do not realistically provide shielding do not qualify. Areas outside of the facility generally should qualify as unrestricted areas. While the area outside of an installation should qualify as an unrestricted area (i.e., not exceed 2 millirem in any 1 hour), the regulation did not specify radiation limits to allow for design flexibility for moving equipment into and out of the installation or other considerations.

Radiation levels slightly exceeding these levels outside of the facility should only be considered or allowed when the higher levels result from "sky shine" or the need for equipment movement. If the roof of the facility does not qualify as a restricted area, or if no roof exists, mechanical access restrictions (e.g., fence) must be utilized, and additional administrative controls must be imposed to meet regulatory exposure requirements in 10 CFR 20.1301, "Dose limits for individual members of the public," and 20.1601, "Control of access to high radiation areas," and security requirements in 10 CFR 20.1801, "Security of stored material," and 20.1802, "Control of material not in storage," (see Section 8.10.10). All entrance ways into the facility must be interlocked with control devices required by 10 CFR Part 34. Unless all entrance ways are locked, at least one radiographer must be present at the facility whenever radiography is being conducted.

A field station is a facility where licensed material may be stored or used and from which equipment is dispatched. Radiographic operations may be conducted in a permanent radiographic installation or at the place of business in the same manner as described above.

A restricted area is an area that licensees limit access for the purpose of protecting individuals from undue risks from exposure to radiation and radioactive materials. A restricted area cannot include areas used as residential quarters. Consequently, industrial radiography devices must not be stored in motel rooms or similar locations.

Note: A temporary jobsite is a location where radiographic operations are conducted and where material may be stored other than the locations of use authorized on the license.

The following requirements in 10 CFR 34.33, "Permanent radiographic installations," apply to a permanent installation:

- Visible-audible signals

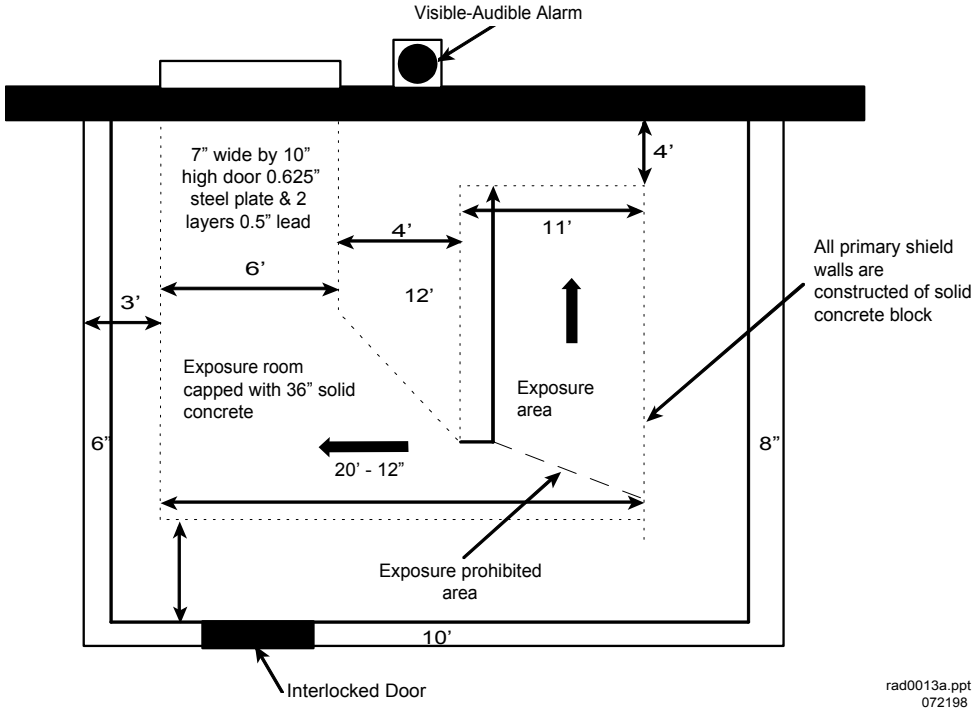
Each access point is equipped with a visible-audible signal system. The visible signal is activated by radiation whenever the source is exposed. The audible signal will sound if anyone tries to enter the installation while the source is exposed. The requirement for the visible-audible signal system is in addition to other measures that may be taken to prevent access to the installation, such as locked doors.

As an alternative to the visible-audible alarm system, it is acceptable to use a control system that will reduce the radiation level if the entrance to a high-radiation area is opened while the source is out. The system must be automatic and independent of radiography personnel action. If this alternative is planned, provide a description of the system.

- Diagram depicting the shielding, layout, and visible-audible alarms

A diagram of the installation is helpful in evaluating the shielding and determining compliance with regulations regarding restricted and unrestricted areas, location of access points, and locations of audible-visible signals. Figure 8.3 shows an example installation diagram. Diagrams of facilities should be marked: "Security-Related Information—Withhold under 10 CFR 2.390."

Security-Related Information—Withhold under 10 CFR 2.390*



*This diagram is an example only and does not contain real security-related information.

Figure 8.3 Example diagram of a permanent radiographic installation

- Calculations or survey results of radiation levels

For a determination of installation adequacy, provide information showing that the radiation level in all directions around the installation, including the roof, will not exceed a dose of 0.02 millisievert (mSv) (2 mrem) in any 1 hour. Take into account the highest quantity of radioactive material that will be used in the installation and any limitations on source positioning in the installation. Radiation levels in all directions around the installation that are below 0.02 mSv (2 mrem) in any 1 hour are considered acceptable. If the radiation levels will exceed 0.02 mSv (2 mrem) in any 1 hour, then steps should be taken (use lower activity source, use collimator, or move setup farther away) to reduce the radiation to the acceptable level.

A radiation level on the roof that exceeds 1.0 mSv (100 mrem) in 1 hour at 30 centimeters from the surface is considered a "high-radiation area" and requires special precautions to control access to the area. Licensees should make efforts to lower a radiation level exceeding 1.0 mSv (100 mrem) in any 1 hour by using additional shielding, collimators, or other engineering controls. The roof of a fixed radiography cell is a potentially occupied area, and applicants must demonstrate that no individual member of the public could receive effective doses in excess of 0.02 mSv (2 mrem) in any 1 hour or 1 mSv (100 mrem) in a year.

Response from Applicant: Provide the following:

If radiography is planned in a permanent radiography installation or installations (including field stations with permanent exposure cells), provide the following information for each installation:

- An annotated sketch or drawing of the facility and its surroundings (properly marked as "Security-Related Information—Withhold under 10 CFR 2.390").
- The scale to which the sketch or drawing is made. The same scale should be used for all sketches and drawings. The recommended scale is 1/4 inch = 1 foot. Drawings to this scale that do not fit on 8-1/2 x 11-inch paper may be provided as sectional drawings.
- The type, thickness, and density of shielding materials on all sides, including the floor and the roof.
- The locations of entrance ways and other points of access to the facility.
- A description of the areas adjacent to the facility and the distance to these areas. Include information on areas adjacent to, above, and below the facility.
- A description of the general location of each proposed permanent installation listed in Item 3 (e.g., located in an industrial park, an office complex) and its current use. If any proposed permanent installation is a private residence, provide diagrams of the installation that include the building, the proposed restricted area or areas, and adjacent areas, including above and below the restricted areas; provide commitments that restricted areas do not include residential quarters, and explain how radiation levels in unrestricted areas will be maintained at less than 1 mSv (100 mrem) per year.
- A description of the visible-audible signal system or entrance control system and its location.
- The results of radiation-level calculations or actual radiation measurements adjacent to, above, and below the installation. The radiation level in all directions around the installation, including the roof, should not exceed 0.02 mSv (2 mrem) in any 1 hour. Clearly identify the type of source (isotope), the amount of radioactive material in the source, and the position of the source within the installation for the calculations or measurements.

Note: Mark drawings and diagrams that provide exact location of materials or depict specific locations of safety or security equipment as "Security-Related Information—Withhold under 10 CFR 2.390."

Variances will be considered if construction requirements preclude shielding the roof[1] to meet the requirement not to exceed 0.02 mSv (2 mrem) in any 1 hour. Provide the following information to obtain approval for a variance:

- Procedures for ensuring that no individual is on the roof or could gain access to the roof during radiography.
- Means of preventing access to the roof.
- A commitment that the roof will be posted with signs stating "Caution (or Danger) Radiation Area".
- Steps taken to minimize radiation on the roof.
- Limitations (if needed) on positioning of sources or type (isotope) and amount of radioactive material that may be used in the installation to ensure that areas adjacent to, above, and below the installation will be unrestricted areas during the performance of radiography.

If radiation levels on the radiography installation roof[1] exceed 1.0 mSv (100 mrem) in any 1 hour, then provide the following information in addition to the items above to apply for this variance:

- A commitment that the roof will be posted with signs stating "Caution (or Danger) High Radiation Area".
- Evidence of constant surveillance of the roof by closed-circuit television.
- A description of a control device that would automatically reduce the radiation level to 1 mSv (100 mrem) in any 1 hour at 30 centimeters from the radiation source if someone enters the roof.
- A description of a control device that activates a visible-audible signal so that both an individual entering the roof and the radiographer on duty are made aware of the entry.

Field Stations

Describe the storage location or locations at the address or addresses listed in Item 3 of the application and submit a diagram showing where the radiography camera will be stored at the field stations. Indicate whether or not radiography will be performed at the place of business outside of a permanent radiography installation. If radiography will be performed at a site outside of a permanent radiography installation, provide a diagram of the location where radiography may be performed and its surroundings, including a description of adjacent property.

Note: Mark drawings and diagrams that provide exact location of materials or depict specific locations of safety or security equipment as "Security-Related Information—Withhold under 10 CFR 2.390."

[1] Facilities for exposures only may or may not have a roof. Applicants are required to explain how these areas around the installation will be controlled to keep exposures to appropriate levels.

Note: Certain records described in the regulations that pertain to radiation safety should be on file at these field stations and each temporary jobsite. Applicant or licensee's records containing security-related information should meet the applicant's or licensee's own security program requirements for marking documents.

Note: An NRC licensee must implement enhanced security measures (Section 8.10.10) before licensed material may be transferred to a new field station. In addition, the new field station must be authorized on the license before licensed material is transferred to it.

8.10 Item 10: Radiation Safety Program

Regulations: 10 CFR 20.1101, 10 CFR 30.33, 10 CFR 34.13

Criteria: A radiation safety program must be established and submitted to the NRC as part of the application. The program must be commensurate with the scope and extent of activities for the use of licensed materials in industrial radiography.

Each applicant for an industrial radiography license must develop, document, and implement a radiation protection program containing the following elements:

- Steps to keep radiation exposures ALARA.
- Description of equipment and facilities adequate to protect personnel, the public, and the environment.
- Conduct of licensed activities by individuals qualified by training and experience.
- Written operating and emergency procedures.
- Program to inspect the job performance of radiographic personnel.
- Description of organization structure and individuals responsible for ensuring implementation of radiation safety program.
- Records management.

Discussion: The specific components of the applicant's radiation safety program are detailed in the following topics found in this NUREG. Some topics will not require the applicant to submit information as part of an application, but simply provide the applicant with guidance to comply with a specific NRC requirement.

8.10.1 Audit Program

Regulations: 10 CFR 20.1101, 10 CFR 20.2102

Criteria: Licensees must review the content and implementation of their radiation protection programs annually to ensure the following:

- Compliance with NRC and DOT regulations (as applicable) and the terms and conditions of the license.
- Occupational doses and doses to members of the public are ALARA.
- Records of audits and other reviews of program content are maintained for 3 years.

Discussion: Appendix G contains a suggested annual audit program that is specific to industrial radiography and is acceptable to the NRC. Since all areas indicated in Appendix G may not be applicable to every licensee and all items may not need to be addressed during each audit, licensees may wish to develop a program-specific audit checklist.

The NRC encourages licensee management to conduct performance-based reviews by observing work in progress, interviewing staff, and spot-checking required records. As a part of the audit program, applicants should consider performing unannounced audits of industrial radiography to observe whether radiation safety procedures are being followed.

It is essential that, once identified, problems are corrected comprehensively and in a timely manner. Information Notice (IN) 96-28, "Suggested Guidance Relating to Development and Implementation of Corrective Action," provides guidance on this subject. The NRC will review the licensee's audit results and determine if corrective actions are thorough, timely, and sufficient to prevent recurrence. Licensees must maintain records of audits and other reviews of program content and implementation for 3 years from the date of the record. The NRC has found audit records that contain the following information acceptable:

- Date of audit.
- Name of person or persons who conducted the audit.
- Names of persons contacted by the auditor or auditors.
- Areas audited.
- Audit findings and corrective actions.
- Follow-up.

Response from Applicant: No response required. The licensee's program for auditing its radiation safety program will be reviewed during inspection.

References: The current version of the NRC's Enforcement Policy is included on the NRC's Web site at http://www.nrc.gov/about-nrc/regulatory/enforcement.html. IN 96-28, "Suggested Guidance Relating to Development and Implementation of Corrective Action," dated May 1, 1996, can be found on the NRC's Generic Communications webpage under Information Notices: http://www.nrc.gov/reading-rm/doc-collections/gen-comm/.

8.10.2 Radiation Monitoring Instruments

Regulations: 10 CFR 30.33(a)(2), 10 CFR 34.25, 10 CFR 34.31, 10 CFR 34.65

Criteria: A radiation survey meter intended for industrial radiography that utilizes sealed radionuclide sources should be capable of accurately measuring the radiation fields produced by the sealed radiography source currently in use and be visually checked for damage and for proper operation with a check source or other appropriate means, such as an exposure device, before use on each day it is to be used. The survey meter shall be calibrated at intervals not to exceed 6 months and after each servicing (except for battery changes). Written procedures are required for inspection and routine maintenance of the survey meters, which is to be performed at intervals not to exceed 3 months or before the first use thereafter to ensure proper functioning of components important to safety.

Discussion: The licensee shall keep an adequate number of appropriate radiation survey instruments that are both calibrated and operable at each location where radioactive material is present to make the required radiation surveys. The instruments must be capable of measuring

a range from 0.02 mSv (2 mrem) per hour through 10 mSv (1 rem) per hour. Each radiation survey instrument shall be calibrated at intervals not to exceed 6 months and after each instrument servicing, except for battery changes. Records of survey instrument calibrations will be retained for a minimum of 3 years (10 CFR 34.65, "Records of radiation survey instruments"). Records are to be made of equipment problems and maintenance performed, and these shall be retained for 3 years (10 CFR 34.73, "Records of inspection and maintenance of radiographic exposure devices, transport and storage containers, associated equipment, source changes, and survey instruments").

Response from Applicant: Provide the following:

- A statement that: "We will possess and use calibrated and operable radiation survey meters."

AND

- If calibration is performed by a person or firm outside the applicant's organization, specify that the calibration will be performed by an NRC or Agreement State licensee specifically authorized to perform instrument calibration.

OR

- If the calibration is to be performed in-house, either state that the model procedures in Appendix H will be followed or describe alternative procedures. Identify the qualifications of the individuals who will perform the calibrations.

8.10.3 Material Receipt and Accountability

Regulations: 10 CFR 20.2207, 10 CFR 30.34(e), 10 CFR 30.41, 10 CFR 30.51, 10 CFR 34.29, 10 CFR 34.63, 10 CFR 34.69,

Criteria: Licensees must do the following:

- Maintain records of receipt, transfer, and disposal of sources and devices.
- Update transactions in the NSTS, including an annual inventory reconciliation.
- Conduct physical inventories at quarterly intervals (not to exceed 3 months) to account for all sealed sources containing byproduct material and for devices containing depleted uranium.

Discussion: As illustrated in Figure 8.4, licensed materials must be tracked from "cradle to grave" to ensure accountability; identify when sources/devices may be lost, stolen, or misplaced; and ensure that the possession limit stated on the license is not exceeded.

Physical inventories, which should be conducted at intervals not to exceed 3 months, should account for all sealed sources and devices containing depleted uranium (i.e., locate, verify the presence of the material, and account for it in material transfer records).

Inventory records should be maintained for 3 years and contain the following types of information:

- Radionuclide and amount (in units of becquerels or curies) of byproduct material in each sealed source.
- Manufacturer's name, model number, and serial number of each sealed source containing byproduct material.
- Manufacturer's name, model number, and serial number of each device containing depleted uranium or byproduct material.
- Location (e.g., permanent facility, field station, temporary jobsite) of each sealed source and device.
- Date of the inventory.
- Name with signature of individual performing inventory.

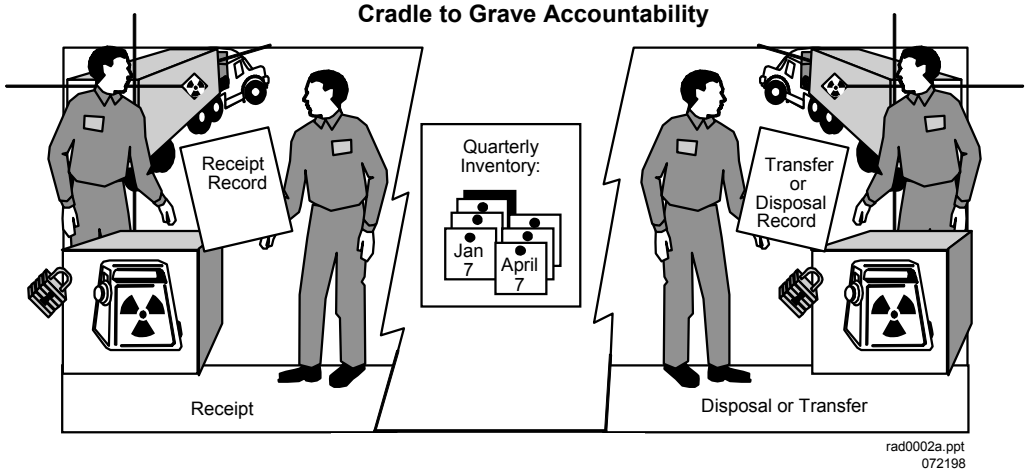


Figure 8.4 Material receipt and accountability. Licensees must maintain records of receipt and disposal and conduct physical inventories quarterly (not to exceed 3 months).

Response from Applicant: Provide the following statements:

- "Physical inventories will be conducted and documented at quarterly intervals (not to exceed 3 months) to account for all sealed sources containing byproduct material and devices containing depleted uranium received and possessed under the license."

AND

- "We will comply with the NSTS reporting requirement as described in 10 CFR 22.2207."

8.10.4 Minimization of Contamination

Regulations: 10 CFR 20.1406

Criteria: Applicants for new licenses must describe how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste.

Discussion: All applicants for new licenses need to consider the importance of designing and operating their facilities so as to minimize the amount of radioactive contamination generated at the site during its operating lifetime and the generation of radioactive waste during decontamination. Sealed sources and devices that are approved by the NRC or an Agreement State and located and used according to their respective SSD registration certificates usually pose minimal risk of contamination. Industrial radiography applicants usually do not need to address these issues as a separate item since they are included in responses to other items of the application.

Leak tests performed as specified in 10 CFR 34.27, "Leak testing and replacement of sealed sources," should identify defective sources. Leaking sources must be withdrawn from use and decontaminated, repaired, or disposed of according to NRC requirements. These steps minimize the spread of contamination and reduce radioactive waste associated with decontamination efforts. Other efforts to minimize radioactive waste do not apply to programs using only sealed sources and devices that have not leaked.

Response from Applicant: The applicant does not need to respond to this item under the following condition. The NRC will consider that the above criteria have been met if the applicant's responses meet the criteria for the following sections: "Radioactive Material—Sealed Sources and Devices"; "Facilities and Equipment"; "Radiation Safety Program—Leak Tests"; "Radiation Safety Program—Operating and Emergency Procedures"; and "Waste Management—Sealed Source/DU Device Transfer and Disposal."

8.10.5 Leak Tests

Regulations: 10 CFR 30.53, 10 CFR 34.13(h), 10 CFR 34.27, 10 CFR 34.67

Criteria: The NRC requires testing to determine whether there is any radioactive leakage from the source or from devices containing depleted uranium shielding. The NRC finds testing to be acceptable if it is conducted by an organization licensed by the NRC or an Agreement State or if it is conducted in accordance with procedures approved by the NRC or an Agreement State.

Discussion: The NRC or an Agreement State may authorize manufacturers, consultants, and other organizations to either perform the entire leak-test sequence for other licensees or provide leak-test kits to licensees. In the latter case, the licensee is expected to take the leak-test sample according to the device manufacturer's and the kit supplier's instructions and return it to the kit supplier for evaluation and reporting results. Licensees may also be authorized to conduct the entire leak-test sequence themselves. Measurement of the leak-test sample is a quantitative analysis requiring that instrumentation used to analyze the sample be capable of detecting 185 Bq (0.005 microcurie (μCi)) of radioactivity.

Sealed sources containing byproduct material must be leak tested at intervals not to exceed 6 months, and depleted uranium devices must be tested at intervals not to exceed 12 months.

Response from Applicant: State either of the following:

- "Leak tests will be performed by an organization authorized by NRC or an Agreement State to provide leak testing services to other licensees; or by using a leak test kit supplied by an organization licensed by NRC or an Agreement State to provide leak test kits and/or services to other licensees and according to the instructions provided in the leak test kit."

OR

- "Leak testing and analysis will be done by the applicant." Provide the information in Appendix I supporting a request to perform leak testing and sample analysis and either state that you will follow the model procedures in Appendix I or submit a description of alternative procedures.

Note: Requests for authorization to perform leak testing and sample analysis will be reviewed on a case-by-case basis and, if approved, the NRC staff will authorize these activities via a license condition.

8.10.6 Occupational Dose

Regulations: 10 CFR 20.1201, 10 CFR 20.1207, 10 CFR 20.1208, 10 CFR 20.1501, 10 CFR 20.1502, 10 CFR 34.47

Criteria: Licensees must evaluate the potential occupational exposure of all workers and monitor occupational exposure. Provide to employees film, thermoluminescent dosimeters (TLDs), or other personal dosimetry processing that has been accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) operated by the National Institute of Standards and Technology (NIST).

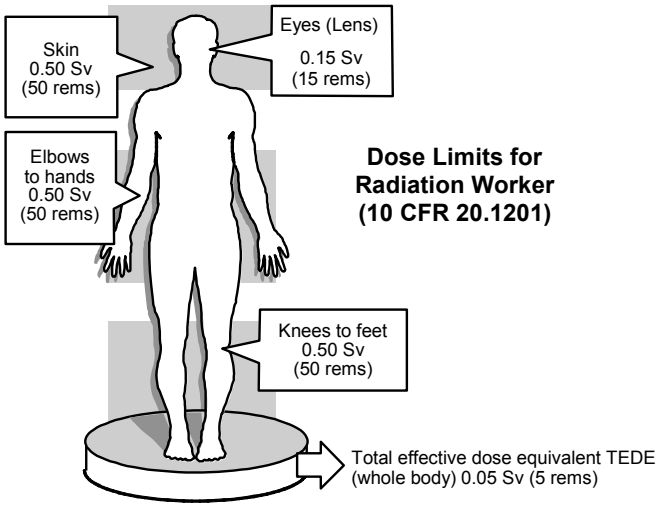


Figure 8.5 Dose limits for radiation workers

Discussion: The licensee may not permit any individual to act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations, each individual wears, on the trunk of the body, a combination of a direct-reading dosimeter (pocket dosimeter or electronic personal dosimeter), an operating alarm ratemeter, and a film badge, TLD, or other personal dosimetry device that is NVLAP processed. At permanent radiography installations where other appropriate alarming or warning devices are in routine use, wearing an alarming ratemeter is not required. The pocket dosimeters must have a range from zero to 2 mSv (200 mrem), must be recharged at the start of each shift, and must be checked for correct response to radiation at intervals not to exceed 12 months. Electronic personal dosimeters may only be used in place of ion-chamber pocket dosimeters. Alarm ratemeters must be preset to give an alarm signal at a dose rate of 5 millisievert per hour (mSv/h) (500 millirem per hour (mrem/h)) and must be calibrated for correct response at intervals not to exceed 12 months.

Film badges must be replaced at intervals not to exceed 1 month, and TLDs or other personal dosimetry device that are NVLAP processed must be replaced at intervals not to exceed 3 months.

Response from Applicant: Provide the following:

- A statement that film, TLD, or other personal dosimetry device is processed and evaluated by an NVLAP-accredited processor.
- A statement that film, TLD, or other personal dosimetry device will be exchanged at the required frequency and will be assigned to and worn by radiographic personnel.
- A statement that the required personnel monitoring equipment, including 0-to-2 mSv (200 mrem) dosimeters or electronic personal dosimeters, will be worn by radiographic personnel.
- A statement that alarming ratemeters will be worn by all radiography personnel except those at permanent radiography installations where other appropriate alarming or warning devices are in use.
- A statement that pocket dosimeters and alarm ratemeters will be checked for correct response at intervals not to exceed 12 months. If adjustment is necessary, state either that the devices will be returned to the manufacturer or describe in-house procedures if adjustments are made in-house.

Note: Information on NVLAP accreditation and directory of accredited laboratories can be obtained from the Internet at http://ts.nist.gov/nvlap.

8.10.7 Public Dose

Regulations: 10 CFR 20.1003, 10 CFR 20.1301, 10 CFR 20.1302

Criteria: Licensees must do the following:

- Ensure that radiography devices will be used, transported, and stored in such a way that members of the public will not receive more than 1 mSv (100 mrem) in a year, and the dose from licensed operations in any unrestricted area will not exceed 0.02 mSv (2 mrem) in any 1 hour.

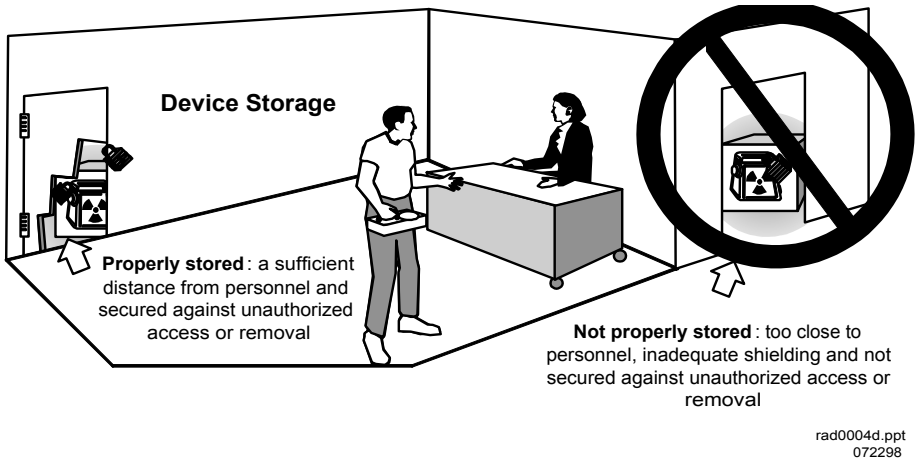


Figure 8.6 Storing devices. Devices must be stored away from occupied areas and secured against unauthorized removal.

Discussion: Operating and emergency procedures that address security and surveillance should be sufficient to limit exposure of the public during use and after accidents. Public dose is controlled, in part, by ensuring that devices not in use are stored securely (e.g., stored in a locked area) to prevent unauthorized access or use. If devices are not in storage, then authorized users must maintain constant surveillance.

Public dose is also affected by the choice of the permanent radiographic installation and storage locations and conditions, as illustrated in Figure 8.6. Since radiation levels around a permanent radiographic installation or storage area will vary based on the type and strength of sources used, the frequency of use, and scatter radiation from radiographic operations, it is not sufficient to perform surveys with portable survey meters to determine the annual public dose. Use of area monitors, such as environmental TLDs, is an acceptable means of demonstrating compliance with the annual limit of 1 mSv (100 mrem) in unrestricted areas.

Use the concepts of time, distance, and shielding when choosing a permanent radiographic installation, field location, or storage area. Decreasing the time spent near radiographic operations, increasing the distance of the device from occupied locations, using shielding material (i.e., high-density concrete, solid block, or lead sheets), and implementing conservative operating procedures (i.e., use of collimators or limiting the direction of exposures towards the floor) will reduce the radiation exposure of personnel and members of the public. Alternatively, the remote location of and access to a permanent radiographic installation could prevent members of the public from receiving 1 mSv (100 mrem) in a year.

If, after an initial evaluation, a licensee makes changes affecting the permanent radiographic installation storage area (e.g., changing the location of devices within the storage area, removing shielding, adding devices, changing the occupancy of adjacent areas, moving the storage area to a new location), then the licensee must perform a new evaluation to ensure that the public dose limits are not exceeded and devices are properly secured.

Response from Applicant: No response is required from the applicant in a license application, but this matter will be examined during an inspection.

Appendix J provides additional information for determining that radiation doses for other licensee personnel and members of the public will not exceed allowable limits.

8.10.8 Quarterly Maintenance

Regulations: 10 CFR 34.31, 10 CFR 34.73, 10 CFR 71.101(g)

Criteria: The licensee shall have written procedures for inspecting and maintaining radiographic exposure devices, source changers, associated equipment, transport and storage containers, and survey instruments. Inspection and maintenance must be conducted at intervals not to exceed every 3 months, or before the first use thereafter, to ensure the proper functioning of components important to safety. The licensee must also have procedures necessary to maintain the Type B packaging used to transport radioactive materials, ensure that Type B packages are shipped properly, and maintain Type B packages in accordance with the certificate of compliance (COC) issued by the NRC or other agencies approving such transport packages.

If equipment problems are found, the equipment must be withdrawn from service until repaired. Records are required.

Discussion: These procedures are intended to allow the licensee's staff to evaluate equipment used in radiography for safe continued use, to provide a record of this evaluation, and to guide the staff in maintenance. Equipment found to be unsuitable for service must be withdrawn until repair and an evaluation for return to service is made. These procedures may be based on the manufacturer's recommendations. The procedures are to be specific to the equipment. For example, radiography drive cable assemblies should be cleaned and lubricated (when operationally appropriate) in accordance with the recommendations of the equipment manufacturer or the cable manufacturer. Procedures are also required for Type B packaging used to transport radioactive materials. These procedures are to be used for shipping and maintenance and may be properly drawn from the manufacturer's procedures and information submitted as a basis for the COC or other transport package approval.

The general license requirements of 10 CFR 71.101, "Quality assurance requirements," apply to all NRC licensees that transport, or deliver to a carrier for transport, licensed material in an NRC-approved transport package. Transport package users must do the following:

- Register with the NRC before their first use of the package.

- Obtain a copy of the COC, or other approval of the package, and comply with the terms and conditions of the certificate or approval.

NRC licensees using NRC-approved transport packages are responsible for ensuring that all of these requirements have been met and that they are using currently authorized packages (see list of approved packages in NUREG-0383, "Directory of Certificates of Compliance for Radioactive Materials Packages").

Response from Applicant:

- Submit the quarterly maintenance procedures to the NRC for review and approval. The applicant should develop procedures specific to its equipment and program. The

guidance provided in Sections 8.10.8 and 8.10.9 of NUREG-1556, Volume 2 should be of assistance inthe development of the applicant's procedures.

AND

- State: "Before using a new sealed source/device combination, we will have written inspection and maintenance procedures that address the use of the new equipment as a Type B transport package. In addition, we will provide training to radiographic personnel before using a new sealed source/device combination."

8.10.9 Operating and Emergency Procedures

Regulations: 10 CFR 34.13(d), 10 CFR 34.45

Criteria: As a part of the radiation safety program, operating and emergency procedures must be established and submitted to the NRC as part of the application package. Sections 8.10.9.1 through 8.10.9.13 discuss the specific operation and emergency procedures. In addition, if radiographers will perform other operations, such as source exchange, leak testing, quarterly (not to exceed 3 months) inspection and maintenance of equipment, and instrument calibration, the operating and emergency procedures should include appropriate procedures and instructions for these operations.

Each licensee should consider the following information when developing, implementing, and maintaining operating and emergency procedures:

- Handling and use of sealed sources and devices to maintain radiographic exposures within dose limits.
- Conducting radiation surveys.
- Access control to radiographic areas.
- Securing of exposure devices during storage and transport.
- Personnel monitoring and use of personnel monitoring equipment.
- Transport of exposure devices to field locations in accordance with DOT requirements.
- Equipment maintenance program.
- Immediate response actions to an off-scale dosimeter or ratemeter alarm.
- Reporting defects as required by 10 CFR Part 21.
- Actions to take and when to notify (licensee personnel and other agencies) when an incident occurs.
- Source recovery procedures, if authorization for source recovery is requested.
- Record maintenance.

Discussion: The purpose of operating and emergency procedures is to provide radiography personnel with specific guidance for all operations they will perform. These topics should be included in the operating and emergency procedures and need not be presented in order of importance. A sequential set of procedures and instructions from the beginning to the end of the workday is an acceptable format. Instructions for nonroutine operations (e.g., quarterly (not to exceed 3 months) inspection and maintenance or instrument calibration) may be included as separate appendices.

It is not necessary for operating and emergency procedures to be specific to a particular make and model of exposure device, source changer, or survey instrument. Procedures submitted to the NRC should provide sufficient guidance and instruction for each specific type of device. For example, you may submit a single operating procedure for crankout devices regardless of the manufacturer or a single operating procedure for other categories of exposure devices regardless of manufacturer.

Note: Providing specific operating and emergency procedures for a particular manufacturer's make and model number will require an amendment to the license to obtain the NRC's authorization for a new sealed source/device combination.

Applicants who plan to conduct lay-barge, offshore platform, or underwater radiography are required to have their procedures approved by the NRC in accordance with 10 CFR 34.45, "Operating and emergency procedures." If you plan to conduct lay-barge, offshore platform, or underwater radiography, your radiation safety program will be reviewed to ensure that it contains procedures that specifically address the following:

- Transport of licensed material.
- Storage facilities for licensed material.
- Methods for restricting access to radiation areas.
- Radiation safety procedures and radiographer responsibilities unique to lay-barge, offshore platform, or underwater radiography.
- Radiographic equipment and radiation safety procedures unique to underwater radiography.
- Methods appropriate for use of equipment in water environments.
- Applicable inspection and maintenance procedures unique to lay-barge, offshore platform, or underwater radiography equipment.
- Emergency procedures unique to lay-barge, offshore platform, or underwater radiography.

Operating and emergency procedures must be submitted to the NRC for review.

8.10.9.1 Operating and Emergency Procedures: Handling and Use of Sealed Sources and Radiography Exposure Devices

Regulations: 10 CFR 34.41, 10 CFR 34.45, 10 CFR 34.46, 10 CFR 34.47, 10 CFR 34.49, 10 CFR 34.51

Criteria: Licensees must establish operating and emergency procedures.

Discussion: The crankout device is normally used for radiography. Separate instructions are not necessary for each different model of a given type of device since the operation of each type is essentially the same regardless of the manufacturer. Some applicants may choose to use one basic instruction for all crankout devices; others may choose to have separate instructions for each model. Either approach is acceptable**.**

Specific procedures should be required for performing source exchanges, including those at temporary jobsites, field stations, and in permanent radiographic installations. The procedures should contain warnings of areas of concern during source exchanges. Incidents of sources becoming dislodged from the shielded position indicate the importance of training personnel in the appropriate techniques. Procedures should require the use of survey instruments, dosimetry, and surveys during and after movement of sources.

Response from Applicant:

- Provide step-by-step instructions for using each type of radiographic device.
- Include instructions for performing source exchanges.
- Instructions for crankout devices should be separate from those for other categories of exposure devices.

Manufacturers' manuals and similar documents should not be incorporated into the procedures; rather, information should be extracted from them and paraphrased.

Appendix K provides information for applicants to consider when developing their procedures for operating radiography equipment.

8.10.9.2 Operating and Emergency Procedures: Methods and Occasions for Conducting Required Radiation Surveys

Regulations: 10 CFR 20.1301(a)(2), 10 CFR 20.1302(a)(1), 10 CFR 20.1906, 10 CFR 34.20(a), 10 CFR 34.21, 10 CFR 34.27(c)(1), 10 CFR 34.27(e), 10 CFR 34.49(b), 10 CFR 34.49(c), 49 CFR 172.403, 49 CFR 173.441

Criteria: Perform radiation surveys during use, movement, and storage of licensed material to ensure its safe use and comply with regulatory requirements.

Discussion: In general, surveys are required whenever a source is manipulated or moved. Surveys should be made with a radiation survey instrument calibrated in accordance with 10 CFR 34.25, "Radiation survey instruments." The following table provides examples of surveys made during radiographic and associated operations that should be included in the operating and emergency procedures.

Table 8.1 Surveys Required for Radiographic Operations

Requirement	Frequency	Radiation Survey Limits
10 CFR 20.1301(a)(2)	During the first exposure for each set up of radiographic device	Boundary of restricted area at temporary jobsite does not exceed 0.02 mSv (2 mrem) in any 1 hour
10 CFR 20.1302(a)(1)	At intervals not to exceed 12 months	Unrestricted area in vicinity of permanent radiographic installation or storage area does not exceed 1 mSv (100 mrem) per year
10 CFR 20.1906	Each receipt of package	External radiation levels when a package is received does not exceed 2 mSv/h (200 mrem/h)
10 CFR 34.20(a)	Each installation of new source in exposure device	Exposure rate does not exceed 2 mSv/h (200 mrem/h) on surface and 0.1 mSv/h (10 mrem/h) at 1 meter
10 CFR 34.21	Each installation of new source in a storage container or source changer	Exposure rate does not exceed 2 mSv/h (200 mrem/h) at any exterior surface and 0.1 mSv/h (10 mrem/h) at 1 meter from any exterior surface with the sealed source in the shielded position
10 CFR 34.27(c)(1)	At intervals not to exceed 6 months	Contamination level for leak tests of sealed sources does not exceed 185 Bq (0.005 µCi)
10 CFR 34.27(e)	At intervals not to exceed 12 months	Contamination level for leak tests of S-tube of exposure device does not exceed 185 Bq (0.005 µCi)
10 CFR 34.49(b)	After every radiographic exposure	Confirm source has returned to a shielded position
10 CFR 34.49(c)	After every source exchange or exposure device is placed in storage	Confirm source is in shielded position
49 CFR 172.403	Every movement of licensed material on public roads	Confirm exposure rates meet labeling of package (i.e., Yellow II) and determine Transport Index
49 CFR 173.441	Every movement of a package labeled Yellow III	Exposure rates in and around vehicle do not exceed 0.002 mSv/h (2 mrem/h) in driver's seat, 2 mSv/h (200 mrem/h) on surface and 0.1 mSv/h (10 mrem/h) at 2 meters from vehicle

Response from Applicant: Where applicable, the operating and emergency procedures must include each of the surveys included in Table 8.1 above.

8.10.9.3 Operating and Emergency Procedures: Methods for Controlling Access to Radiographic Areas

Regulations: 10 CFR 20.1801, 10 CFR 20.1802, 10 CFR 20.1902(a), 10 CFR 20.1902(b), 10 CFR 34.33, 10 CFR 34.41(a), 10 CFR 34.51, 10 CFR 34.53

Criteria: Each licensee must control access to areas where licensed material is either used or stored to prevent the unnecessary exposure of members of the public. This can be achieved through the use of posting, by locking devices and areas where licensed materials are stored, and by maintaining constant control and continuous surveillance of areas where radiographic operations are conducted. Operating and emergency procedures should include steps for radiographic personnel to ensure that access to licensed materials is controlled for the types of operations that will be performed.

Discussion:

Field/Temporary Jobsites

When radiographic operations are performed outside a permanent radiographic installation, at least two qualified radiographic personnel must be present to provide constant surveillance of the operations and be capable of providing immediate assistance to prevent unauthorized entry to the restricted area. At least one of the individuals must be a radiographer; the other may be another radiographer or a trained radiographer's assistant. Operating procedures must comply with the two-man rule for radiographic operations at any locations other than permanent radiographic facilities.

Radiographic personnel are required to maintain continuous direct visual surveillance of operations to protect against unauthorized entry to the high-radiation area during radiographic operations. Radiographic personnel should be instructed to keep the perimeter of the restricted area under continuous surveillance to prevent unnecessary exposure of individuals. Operating procedures should specify steps for responding to unauthorized entry to the restricted area. For example, personnel should be instructed to terminate the radiographic exposure immediately before confronting the person who entered the restricted area.

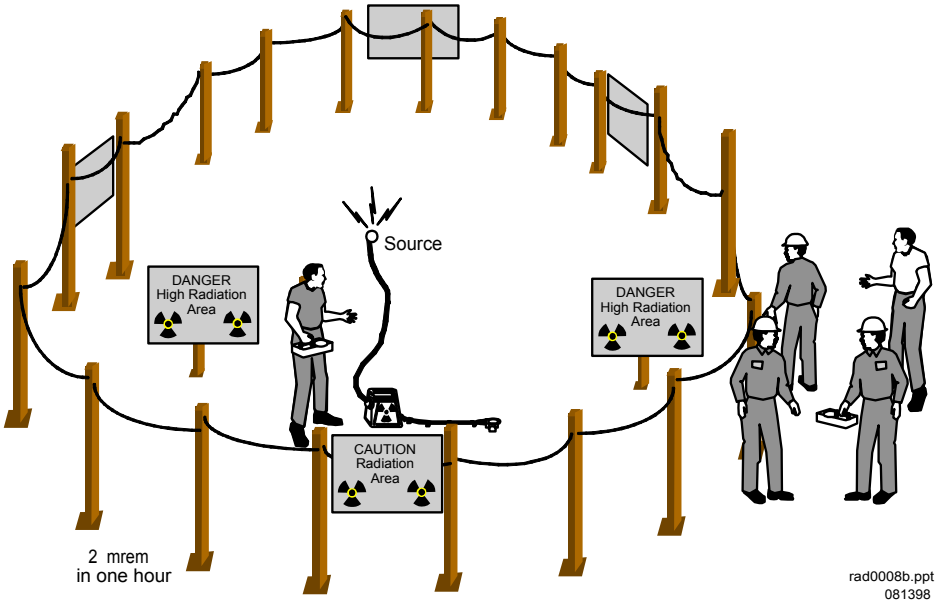


Figure 8.7 Posting. A radiographer is likely to use only a single rope barrier. The radiation area and restricted area would be combined into one and located at the boundary of 2 mrem in any 1 hour.

All areas where radiographic operations are conducted require posting of the radiation areas and the high-radiation areas, as shown in Figure 8.7. Specific exceptions to posting listed in 10 CFR 20.1903, "Exceptions to posting requirements," do not apply to industrial radiography (10 CFR 34.53, "Posting"). However, it is acceptable to post the perimeter of the restricted area rather than the perimeter of the radiation area. Personnel should be instructed to post signs stating "Caution Radiation Area" at the point where radiation levels have been calculated to reach 0.02 mSv (2 mrem) in any 1 hour. A confirming survey during the first exposure of the source should be conducted to confirm the location of the boundary, and any necessary adjustments should be made. As a "rule of thumb," radiographers should establish the boundary where measured exposure levels do not exceed 0.02 mSv/h (2 mrem/h).

The perimeter of the high-radiation area must be posted with a sign or signs stating "Caution (or Danger) High-Radiation Area" at the point where radiation levels have been calculated to reach 1 mSv (100 mrem) in any 1 hour. A confirming survey of the high-radiation area perimeter should not be conducted, since such a survey could lead to unnecessary exposure of personnel.

Surveillance of the restricted area at facilities with multiple levels and multiple access points, or where members of the public are close to the radiographic operations (e.g., boilers, commercial manufacturing plants, or power plants during outages), can usually be performed only when more than two radiographic personnel are assigned to the job. Figure 8.8 provides one example of such a temporary jobsite. Operating procedures and instruction to personnel should include specific steps for these circumstances to ensure that access into the restricted area is properly controlled. These special instructions may include the use of additional personnel to assist radiographic personnel in controlling access into the restricted area, providing instruction to other workers in the area, or making announcements over the public address system before and during radiographic operations.

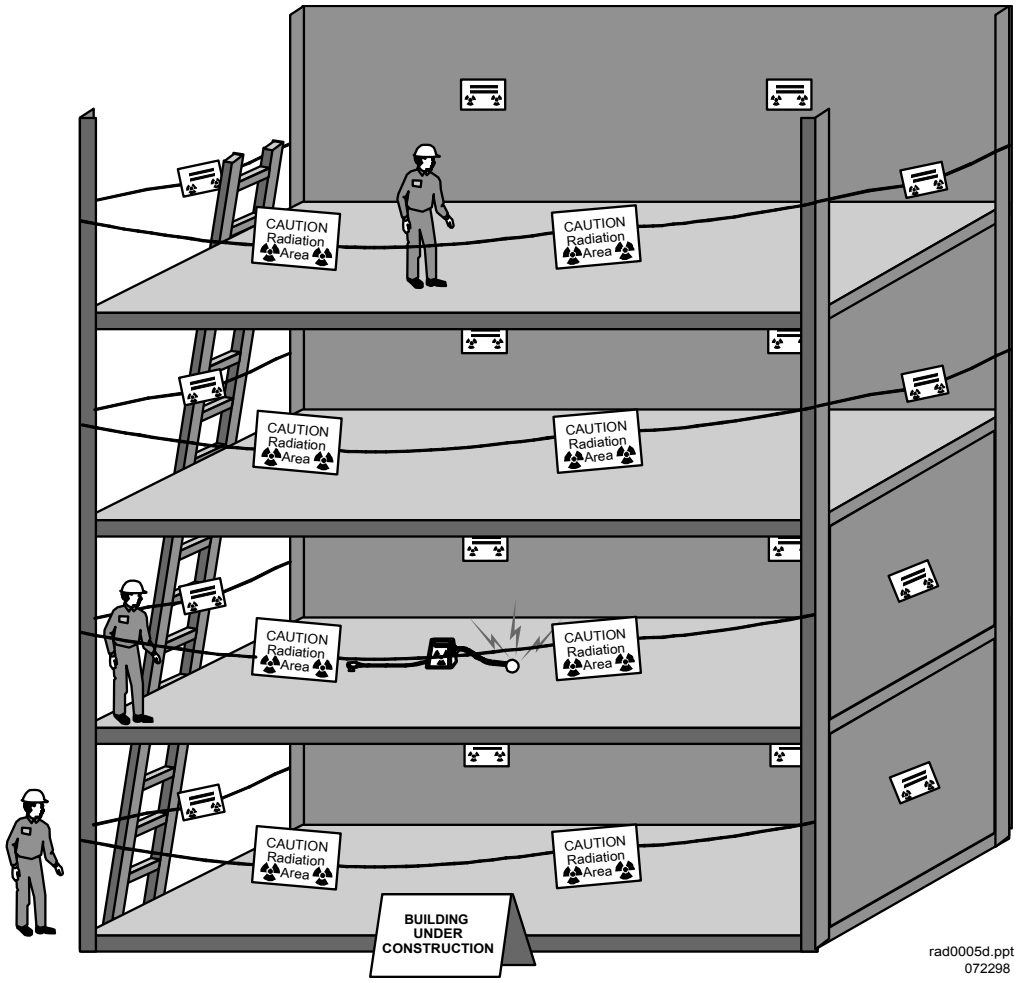


Figure 8.8 Surveillance and posting at a temporary jobsite with multiple floors and access points. Adequate control of the restricted area at this type of job site requires several personnel and many postings.

Permanent Radiographic Installations

For permanent radiographic installations, instruct personnel about posting each entrance to the facility with a sign or signs stating “Caution (or Danger) High-Radiation Area,” and provide procedures to ensure that the visible-audible signal system is operable. The operability of the visible-audible system must be checked daily. The following procedures may be used:

- Expose a radiation source in the permanent installation with all entrances closed.
- Determine that each visible signal in and outside the installation is functional.
- Open the door to each entrance into the installation to activate the audible alarm.
- Close the entrance and confirm that the alarm stops. If the installation has more than one entrance, only one entrance should be tested at a time.
- Record results of test.

In the event that an entrance control device or an alarm fails to operate properly at the permanent radiographic installation, the installation may continue to operate for up to 7 days while the defective equipment is fixed, provided that the following is true:

- The entrance control device is labeled as defective.
- Radiography personnel maintain continuous, direct, and visual surveillance of access installation points.
- Radiography personnel use an alarming rate meter.
- The radiographer must be accompanied by at least one other qualified radiographer or individual who has at a minimum met the requirements of 10 CFR 34.43(c).

Storage Areas

Radiographic equipment containing licensed materials stored in controlled or unrestricted areas must be secured from unauthorized removal or access. Operating procedures should specify how stored licensed materials should be secured.

A vehicle used to transport licensed material can also be used for storage at locations such as temporary jobsites or overnight lodging. If the applicant plans to use vehicles for storage, there should be procedures and instructions to personnel about proper posting of the vehicle. Vehicles should be posted with a sign stating "Caution—Radioactive Material" on the entrance to the area of the vehicle were licensed material is stored. A physical survey should be performed to confirm that the area around the storage facility is an unrestricted area. Radiation levels may not exceed 0.02 mSv/h (2 mrem/h) at 18 inches (45 centimeters) from any external surface of the vehicle, and the vehicle shall be locked when it is used for storage. Radiographic equipment stored at temporary jobsites must be secured at a location that prevents access by unauthorized personnel. This usually requires that the equipment be locked in a cabinet or other secure area where key access is controlled by site management and radiographic personnel. It is not acceptable for a device to be chained to a post and left unattended at the place of use during lunch, breaks, or after hours. Storage of exposure devices at a private residence is unacceptable unless it has been identified and approved in a license.

Response from Applicant: Submit the procedures to control access to radiographic operations and storage areas.

8.10.9.4 Operating and Emergency Procedures: Methods and Occasions for Locking and Securing Radiographic Exposure Devices, Storage Containers, and Sealed Sources

Regulations: 10 CFR 34.20, 10 CFR 34.23

Criteria: NRC regulations require radiographic equipment to be locked and secured to protect the public and radiographers from an inadvertent exposure to radiation.

Discussion: All radiographic devices (i.e., gamma cameras, sealed source storage containers, and source changers) are required to have a lock or outer locked container to maintain the sealed source in its shielded position. During radiographic operations, the source must automatically be secured in the shielded position each time the source is returned. Radiographers must not attempt to circumvent the automatic securing features or tamper with the safety features of radiographic devices. As shown in Figure 8.9, radiographers must never

leave the exposure device at the temporary jobsite (including in a storage area or vehicle) without securing it properly from unauthorized removal or tampering. Radiographers and radiographer's assistants must ensure that the exposure device and storage or source containers are maintained locked (and if key locked, with the key removed at all times) when they are not under the direct supervision of the radiographer or the radiographer's assistant, except at permanent radiographic installations.

Response from Applicant: Submit operating and emergency procedures that include procedures for locking and securing radiographic equipment.

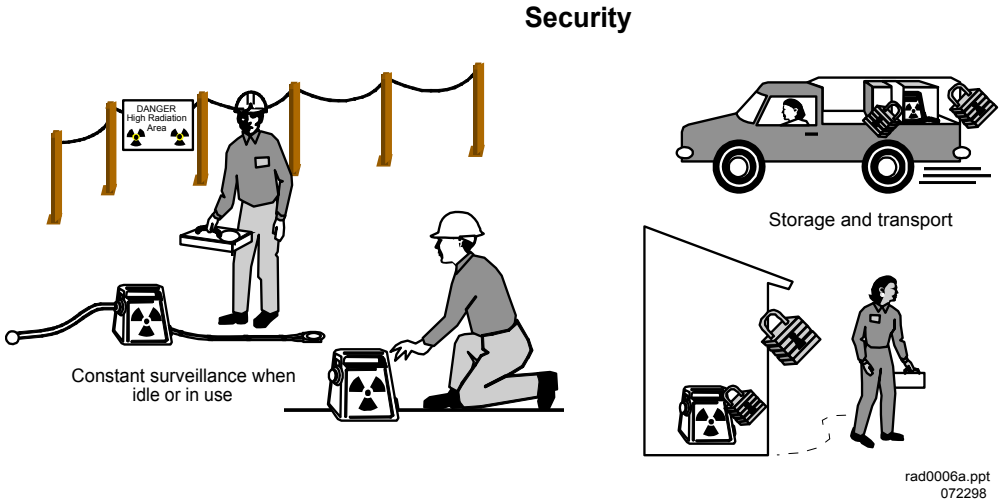


Figure 8.9 Security. To avoid lost or stolen devices, licensees must keep the devices under constant surveillance or secured against unauthorized use or removal.

8.10.9.5 Operating and Emergency Procedures: Personnel Monitoring and the Use of Personnel Monitoring Equipment

Regulations: 10 CFR 34.45(a)(5), 10 CFR 34.47

Criteria: Provide procedures for appropriate use of personnel monitoring equipment.

Discussion: As shown in Figure 8.10, all radiographers or radiographer's assistants are required to wear:

- Direct-reading dosimeters and either film badges, TLDs, or other personal dosimetry devices.
- Alarm ratemeters when they are engaged in radiographic operations.

Film badges, TLDs, or other personal dosimetry devices must be assigned to and worn by only one individual. To ensure full-scale reading capability, direct-reading dosimeters, such as pencil (pocket) dosimeters or electronic personal dosimeters, must be recharged or reset at the start of each shift so that the dosimeters will be capable of reading the full scale. Personnel should be instructed that direct-reading dosimeters must be read and recorded at the beginning and end of each shift. Proper operation of alarm ratemeters must be checked each day before

use to ensure that the alarm functions properly. The manufacturer's recommended procedures should be followed.

Include instructions about how and where dosimetry devices are to be stored when not in use. The storage place should be dry, with a low-radiation background area, and cool so that the devices will not be affected by adverse environmental conditions.

It is good practice to check the dosimeter reading after each exposure and during the work shift; however, there is no regulatory requirement for the dosimeter to be read during the work shift.

All radiographers or radiographer's assistants are required to wear alarm ratemeters except at permanent radiographic facilities where other appropriate alarm or warning devices (e.g., visible and audible alarms) are in routine use and are operable.

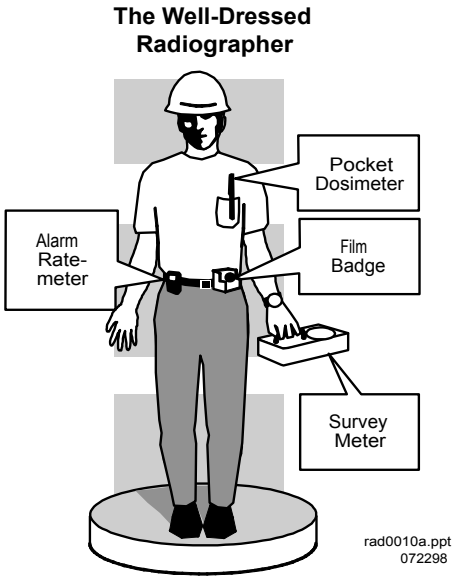


Figure 8.10 The well-dressed radiographer. The radiographer is equipped with the required personnel monitoring devices and survey instrument.

Response from Applicant: The operating procedures must include instructions for proper use of personnel monitoring equipment.

8.10.9.6 Operating and Emergency Procedures: Transporting Sealed Sources to Field Locations, Securing Exposure Devices and Storage Containers in Vehicles, Posting Vehicles, and Controlling Sealed Sources During Transportation

Regulations: 10 CFR 71.5, 49 CFR Parts 171–178

Criteria: Licensees must develop, implement, and maintain procedures for transporting radioactive material to ensure compliance with DOT regulations.

Discussion: Figure 8.11 illustrates some often overlooked DOT requirements. During an inspection, the NRC uses the provisions of 10 CFR 71.5, "Transportation of licensed material," and a memorandum of understanding with DOT to examine and enforce transportation requirements applicable to radiography licensees. Appendix L contains a list of major DOT regulations applicable to transporting radiographic devices.

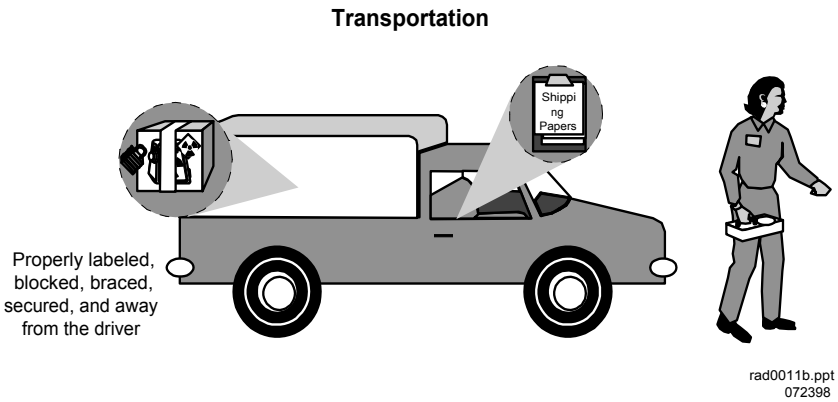


Figure 8.11 Transportation. Licensees often transport their radiographic devices to and from sites and must ensure compliance with DOT regulations.

Instructions to personnel should not reference DOT requirements. Information should be extracted, paraphrased, and placed into the instructions so that personnel know exactly what they are expected to do. The following items should be covered in instructions to personnel:

- Labeling containers appropriately (i.e., when to use labels Radioactive White I, Radioactive Yellow II, or Radioactive Yellow III).
- Securing the exposure device or storage container within the transporting vehicle. The instructions should specify how to prevent the package from moving during transport.
- Preparing shipping papers. The instructions should specify that the papers must be completed before transporting the licensed material and must be accessible in the driver's compartment at all times.
- Placarding both sides, the front, and the back of the vehicle with "RADIOACTIVE" placards if the package being transported requires a Radioactive Yellow III label. If the vehicle requires placarding and the package radiation levels exceed 2 mSv/h (200 mrem/h) or the transport index exceeds 10, the exterior surfaces and passenger compartment of the vehicle must be surveyed to ensure that the radiation levels do not exceed 0.02 mSv/h (2 mrem/h) from any exterior surface and 0.02 mSv/h (2 mrem/h) in the passenger compartment. Include instructions to personnel on the measures to take if the radiation level exceeds 0.02 mSv/h (2 mrem/h) in the passenger compartment (e.g., adding more shielding or repositioning the device within the vehicle). If an exposure device is transported in an overpack, the procedures should include instructions that the overpack must be properly marked with the shipping name and identification number, labeled (Radioactive White I or Radioactive Yellow II), and marked when required with a statement that indicates the inner package complies with prescribed specifications.

Because the licensee may have authorization to possess and use several sealed source/device combinations that are registered by the NRC or an Agreement State and meet the safety performance requirements of 10 CFR 34.20, the applicant must, before using a new sealed source/device combination, develop written inspection and maintenance procedures for it and for the corresponding Type B transport package. In addition, the applicant must provide adequate training for radiographic personnel before using a new sealed source/device combination.

The applicant's inspection and maintenance procedures for radiographic equipment, which are also used for Type B packages, should ensure that these packages are shipped and maintained in accordance with their COC.

Response from Applicant: Submit operating and emergency procedures for transporting sealed sources containing byproduct material, exposure devices, and source changers.

8.10.9.7 Operating and Emergency Procedures: Daily Inspection and Maintenance of Radiographic Equipment

Regulations: 10 CFR 34.31, 10 CFR 34.33, 10 CFR 34.45(a)(7), 10 CFR 34.47, 10 CFR 34.73, 10 CFR 34.83

Criteria: The licensee shall perform visual and operability checks before using radiography equipment on each day it is used.

Discussion: Visual and operability checks must be performed on radiographic exposure devices, survey meters, associated equipment, and transport and storage containers before use each day that the equipment is used. These checks are intended to ensure that the equipment is in good working condition, the sources are adequately shielded, and the required labeling is present. Licensees must check survey instrument operability using check sources or other appropriate means. The exposure device may be used as a check source.

Inspection records shall contain information about equipment problems found in daily checks and quarterly (not to exceed 3 months) maintenance inspections. Records shall include the date of check or inspection, name of inspector, equipment involved, any problems found, and what repair or maintenance, if any, was done.

Instructions to personnel using radiographic equipment must clearly state that inspections are to be made before the equipment is used each day. While not a requirement, good practice would be to inspect the equipment before the start of each shift, if the equipment is used on more than one shift in the day.

The procedures should specify the items that are to be checked and the steps that are to be taken if any defects are found. If problems are found, the equipment must be removed from service until it is repaired.

Equipment manufacturers can provide a list of items that should be checked in the daily inspection of radiography equipment.

Permanent radiographic installation visible and audible alarms must be checked for operability daily before use, and faulty radiographic equipment must be labeled and repaired within 7 days,

with compensatory measures taken in the interim. Compensatory measures taken include the following:

- The faulty equipment is immediately labeled as defective.
- The radiographer must be accompanied by at least one other qualified radiographer or individual who has at a minimum met the requirements of 10 CFR 34.43(c).
- Continuous surveillance requirements are implemented until repairs are completed.
- Alarm ratemeters shall be worn and checked for alarm function at the beginning of each shift.
- Records must be maintained of faulty equipment.

Direct-reading dosimetry devices must be read and the exposures recorded at the beginning and end of each shift. Alarm ratemeters shall be checked for alarm function at the beginning of each shift. Records are to be maintained.

Appendix M provides example instructions for daily inspection of radiographic devices and equipment.

Response from Applicant: Submit operating and emergency procedures for daily inspection and maintenance of radiographic equipment.

8.10.9.8 Operating and Emergency Procedures: Ratemeter Alarms or Off-Scale Dosimeter Readings

Regulations: 10 CFR 34.43(b)(2), 10 CFR 34.45(a)(8), 10 CFR 34.47(d)

Criteria: Licensees must instruct personnel in the following:

- appropriate handling and use of sealed radionuclide sources and radiography devices
- methods and occasions for conducting radiation surveys; controlling access to radiation areas; and locking, securing, and transporting storage containers, radiographic exposure devices, and sealed radionuclide sources
- the licensee's license and operating and emergency procedures
- actions to be taken if a dosimeter shows an off-scale reading or an alarm ratemeter alarms (e.g., sounds) unexpectedly
- procedures to be followed if a personal dosimeter (processed by NVLAP processor) is lost or damaged
- procedures for notifying the proper persons in the event of an accident

Discussion: If an individual's self-reading pocket dosimeter is found to be off scale, an individual's electronic personal dosimeter reads above 2 mSv (200 mrem), or an alarm ratemeter alarms (e.g., sounds) unexpectedly, the RSO or designee must be notified immediately. If the RSO or designee cannot rule out radiation exposure as the root cause, the individual's personal dosimetry device must be sent for processing within 24 hours. The affected individual may not resume work with licensed radioactive material until the RSO or

designee has determined the individual's radiation exposure. There are no exceptions to this requirement.

If any of the events described above should occur, personnel should be instructed to do the following at a minimum:

- Stop work immediately and ensure that the source is in the safe storage position in the exposure device, and vacate the radiation area.
- If the alarm ratemeter alarms (e.g., sounds), evaluate pocket dosimeter reading.
- Notify the individual specified in the emergency procedures.
- Notify the RSO or designee of the problem.
- If pocket dosimeter is off scale, do not resume operations until authorized by the RSO or designee.
- If the RSO or designee cannot rule out the exposure, then process the personal dosimetry device within 24 hours.

Response from Applicant: Submit operating and emergency procedures to address ratemeter alarms or off-scale dosimeters.

8.10.9.9 Procedure for Identifying and Reporting Defects and Noncompliance As Required By 10 CFR Part 21

Regulations: 10 CFR Part 21, 10 CFR 30.50, 10 CFR 34.101(a)(3)

Criteria: Licensees must notify the NRC if defects are found in radiography equipment.

Discussion: Equipment defects that could create a substantial safety hazard or equipment failures involving NRC-regulated activities must be reported to the NRC. For example, a failure of a lock box or a failure of the coupling between the source assembly and the control cable are defects that must be reported to the NRC. Radiography personnel should be instructed to report any malfunction or defect in radiography equipment to management, so that management can take appropriate action. IN 91-39, "Compliance with 10 CFR Part 21, Reporting of Defects and Noncompliance," dated June 17, 1991, provides additional guidance on determining whether a safety hazard exists and sample procedures for identifying and reporting defects.

Response from the Applicant: Submit operating and emergency procedures for notifying management of equipment malfunction or defect.

IN 91-39, "Compliance with 10 CFR Part 21, Reporting of Defects and Noncompliance," dated June 17, 1991, can be found on the NRC's Generic Communications webpage under Information Notices : http://www.nrc.gov/reading-rm/doc-collections/gen-comm/.

8.10.9.10 Notification of Proper Persons in the Event of an Accident

Regulations: 10 CFR 30.50, 10 CFR 34. 45(a)(10), 10 CFR 34.101(a), 10 CFR 20.2201, 10 CFR 20.2202, 10 CFR 20.2203

Criteria: Operating and emergency procedures must ensure that appropriate notifications are made during and after an incident.

Discussion: The emergency procedures should clearly identify the names and telephone numbers of the RSO and other persons who can provide assistance in an emergency or accident. Such persons may also include the exposure device manufacturer and State and local agencies. The emergency procedures should always be available to radiography personnel during radiography and must be as up to date as possible.

NRC regulations also require telephone notification and/or a written report based on the discovery of certain events. Licensees must notify the NRC when radiographic devices are lost or stolen or if there is indication of overexposure. Licensees must notify the NRC when radiographic device components fail, such as unintended source disconnects or locking mechanism failures. Refer to the regulations listed above or to Appendix N for additional guidance in the preparation of emergency procedures. Table 8.2 describes events that require notification or reports.

Table 8.2 Regulatory-Required Notifications

Typical NRC Notifications Required for Radiography Licensees			
Event	**Telephone Notification**	**Written Report**	**Regulatory Requirement**
Theft or loss of material	immediate	30 days	10 CFR 20.2201(a)(1)(i)
Whole body dose greater than 0.25 Sv (25 rem)	immediate	30 days	10 CFR 20.2202(a)(1)(i)
Extremity dose greater than 2.5 Sv (250 rem)	immediate	30 days	10 CFR 20.2202(a)(1)(iii)
Whole body dose greater than 0.05 Sv (5 rem) in 24 hours	24 hours	30 days	10 CFR 20.2202(b)(1)(i)
Extremity dose greater than 0.5 Sv (50 rem) in 24 hours	24 hours	30 days	10 CFR 20.2202(b)(1)(iii)
Whole body dose greater than 0.05 Sv (5 rem)	none	30 days	10 CFR 20.2203(a)(2)(i)
Dose to individual member of public greater than 1 mSv (100 mrem)	none	30 days	10 CFR 20.2203(a)(2)(iv)
Defect in equipment that could create a substantial safety hazard	2 days	30 days	10 CFR 21.21(d)(3)(i)

Typical NRC Notifications Required for Radiography Licensees			
Event	**Telephone Notification**	**Written Report**	**Regulatory Requirement**
Event that prevents immediate protective actions necessary to avoid exposure to radioactive materials that could exceed regulatory limits	immediate	30 days	10 CFR 30.50(a)
Equipment is disabled or fails to function as designed when required to prevent radiation exposure in excess of regulatory limits	24 hours	30 days	10 CFR 30.50(b)(2)
Unplanned fire or explosion that affects the integrity of any licensed material or device, container, or equipment with licensed material	24 hours	30 days	10 CFR 30.50(b)(4)
Leak test of sealed source or guide tube greater than 185 Bq (0.005 µCi)	none	5 days	10 CFR 34.27(d)
Unintentional disconnect of source assembly from control cable	none	30 days	10 CFR 34.101(a)(1)
Inability to retract source to a safe shielded position	none	30 days	10 CFR 34.101(a)(2)
Failure of any component to perform its intended function which is critical for safe operation of device	none	30 days	10 CFR 34.101(a)(3)
Use of licensed material at any location not on license for more than 180 days in a calendar year	notify NRC regional office	none	10 CFR 34.101(c)

Note: Telephone notifications shall be made to the NRC Operations Center at (301) 816-5100, except as noted. The Center is staffed 24 hours a day and accepts collect calls. NRC notification is required when licensed materials are lost or stolen or involved in an incident that may have resulted in doses in excess of NRC limits.

Response from Applicant: Submit operating and emergency procedures that include appropriate instructions for notifying the RSO and other personnel in the event of an emergency.

8.10.9.11 Minimizing Exposure of Persons in the Event of an Accident

Emergency Procedures

Regulations: 10 CFR 34.45(a)(11)

Criteria: To maintain exposures as low as possible in the event of an emergency.

Discussion: An emergency situation may be considered to exist whenever an abnormal event occurs or the source has failed to return to the safe position. Since it is not possible to specify all possible situations that would constitute an emergency, a general instruction is acceptable as shown in Figure 8.12. This general instruction should describe licensee actions to maintain the dose at a minimal level after an abnormal event is identified. The instruction should include routine emergency actions, such as evacuating personnel from the area, posting the restricted area, maintaining surveillance of the restricted area, and notifying the RSO. Appendix N provides an example of a routine emergency procedure.

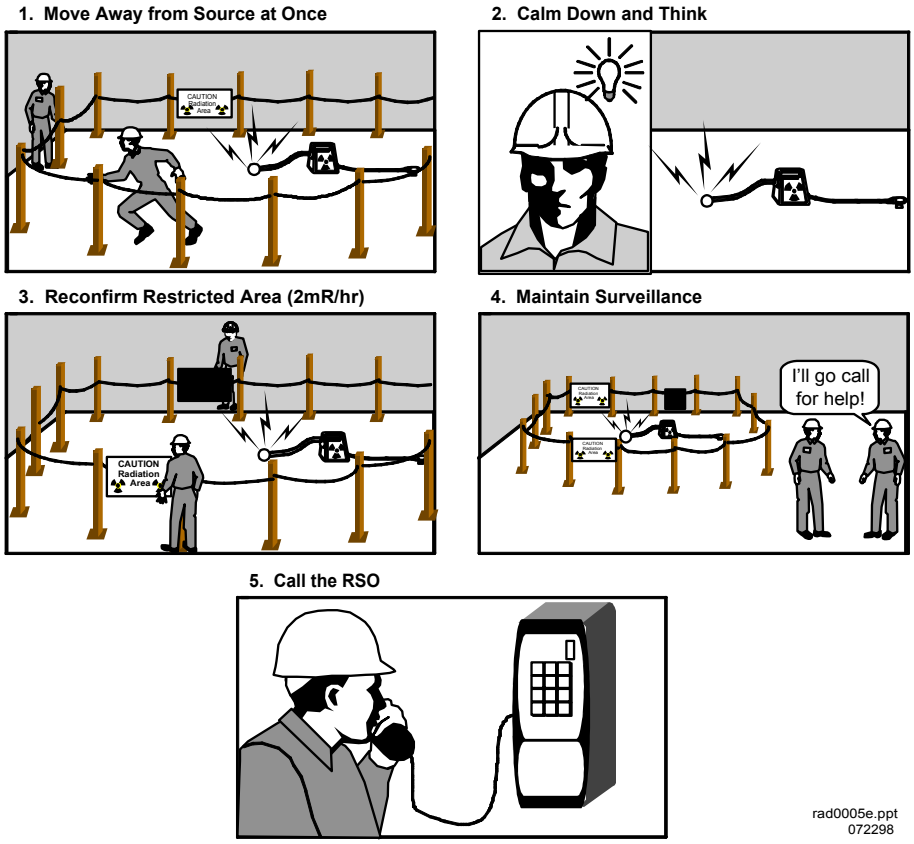


Figure 8.12 Emergency procedures. These steps provide guidance in an emergency.

Response from Applicant: Submit operating and emergency procedures that include instructions for minimizing exposure of persons in the event of an accident.

8.10.9.12 Source Retrieval

Regulations: 10 CFR 34.45(a)(12), 10 CFR 34.101(a), 10 CFR 34.101(b)

Criteria: Each licensee who intends to perform source retrieval operations must have appropriate equipment, training, and procedures.

Discussion: Applicants must develop source retrieval procedures if their own radiographic personnel with appropriate training and experience will conduct source retrievals. If procedures

are submitted, the NRC will review and approve applicants to perform source retrieval. If source retrieval procedures are not submitted for review, then source retrieval activities must be conducted by an NRC or Agreement State licensee whose license specifically authorizes these activities.

Licensees specifically approved to perform source retrievals will have a specific license condition authorizing these activities. In addition, these individuals would be authorized to perform source retrievals for other licensees.

The NRC will review the applicant's procedures for source retrieval with respect to keeping exposures ALARA and controlling exposures to radiation. Since it is not possible to specify all potential exposure situations, a general procedure is acceptable. A retrieval procedure should contain the following elements:

- Warnings stating that only specifically authorized individuals, or personnel supervised by such authorized individuals and working in their presence, are allowed to perform retrievals.
- A clear statement that no source or suspected source containing items such as a stuck source in a guide tube will be handled directly.
- Expedient methods of reducing unintended exposure to staff and the public, such as using lead shot bags, sandbags, steel plates, remote handling devices, and culverts cut lengthwise.
- Additional dosimetry to be used during source retrievals (e.g., pocket dosimeters with a range greater than 2 mSv (200 mrem) or finger badges).
- Methods of restricting access to the area, including establishing a restricted area and obtaining outside help in controlling access.
- Appropriate use of survey instruments, including a procedure prohibiting the use of alarming dosimeters or electronic dosimeters as substitutes for survey instruments.
- Criteria for requesting outside assistance.
- Instructions for reducing the exposure to other personnel and members of the public during recovery operations.
- Notification of the RSO, RSO designee, and management.
- Specific training, including practice with special tools, shielding, and additional dosimetry with a dummy source.
- Notification of the NRC or Agreement State.

Radiography personnel should not attempt to perform operations involving retrieval or recovery unless they have actual practice in retrieval operations using a dummy source with the appropriate handling tools, survey instruments, and dosimetry.

Response from Applicant:

- Submit the following statement: "We will not perform source retrievals and will use the services of a person specifically licensed by the NRC or an Agreement State to perform the retrievals of our sources."

OR

- Submit source retrieval procedures and specific training for NRC review in accordance with the criteria listed above.

8.10.9.13 Maintenance of Records

Regulations: 10 CFR 34.45(a)(13), 10 CFR 34.47, 10 CFR 34.71, 10 CFR 34.73, 10 CFR 34.83, 10 CFR 34.85, 10 CFR 34.87, 10 CFR 34.89

Criteria: The licensee shall meet NRC record requirements to support operating and emergency procedures.

Discussion: Personnel must generate and maintain certain records when performing radiography operations, including the following:

- Utilization logs showing the following:
  - Description, including the make, model, and serial number of the device used.
  - Identification and signature of the radiographer.
  - Where the device is used and dates of use and the dates the device is removed and returned to storage.
- Records of daily inspection of equipment.
- Pocket dosimeter readings made at the beginning and end of a work shift and recorded.
- Results of the physical survey to ensure that the sealed source is in its shielded position when a radiographic exposure device is placed in a storage area (as defined in 10 CFR 34.3, "Definitions") and an indication as to whether that survey was the last one performed in the workday.

Examples of other operations that may require records include quarterly (not to exceed 3 months) inspection and maintenance, instrument calibration, and shipment of packages. Radiography personnel should also be aware of the records that must be maintained at temporary jobsites. Radiographers performing radiographic duties should be given specific instructions for recordkeeping. These should not include instructions about records that are the responsibility of management and supervision.

Response from the Applicant: Submit operating and emergency procedures which ensure proper maintenance of records.

8.10.10 Security Program

Regulations: 10 CFR 20.1801, 10 CFR 20.1802, and 10 CFR 20.2207

Criteria: Licensees must ensure the security and control of licensed material.

Discussion: The regulations in 10 CFR 20.1801, and 10 CFR 20.1802 require licensees to secure radioactive materials from unauthorized removal or access while in storage and to control and maintain constant surveillance over licensed material that is not in storage.

The regulations in 10 CFR 20.2207, "Reports of transactions involving nationally tracked sources," require that each licensee who manufactures, transfers, receives, disassembles, or disposes of a nationally tracked source shall complete and submit a National Source Tracking Transaction Report (NSTS). The NSTS is a major security initiative of the NRC. The NSTS is a secure, accessible and easy-to-use computer system that tracks high-risk radioactive sources from the time they are manufactured or imported through the time of their disposal or export, or until they decay enough to no longer be of concern.

In addition to the regulations, the NRC in 2005 began issuing Orders imposing security requirements on licensees who possessed radioactive materials quantities of concern (RAMQC). The Orders required licensees to implement enhanced security to control access to RAMQC and to protect sensitive security-related information. In 2007, the NRC issued additional Orders to the same licensees requiring fingerprinting and criminal history records checks for unescorted access to RAMQC. The specific radionuclides and associated thresholds were based on the Category 1 and Category 2 quantities described in the International Atomic Energy Agency's "Code of Conduct on the Safety and Security of Radioactive Sources."

Applicants and licensees should visit the NRC's public Web site (www.nrc.gov) and select the Nuclear Security tab at the top of the NRC home page for additional information regarding the security of licensed material or any enhanced security requirements imposed by Orders.

Please contact the appropriate regional office for questions regarding the security of licensed material or any enhanced security requirements imposed by the Orders.

8.11 Item 11: Waste Management

8.11.1 Disposal or Transfer of Radiography Sealed Sources Containing Byproduct Material or Devices Containing Depleted Uranium

Regulations: 10 CFR 20.2001, 10 CFR 30.41, 10 CFR 30.51, 10 CFR 20.2207

Criteria: Licensed materials must be disposed of in accordance with NRC requirements by transfer to an authorized recipient. Appropriate records must be maintained.

Discussion: Licensees who dispose of radiography sealed sources containing byproduct material, or dispose of radiography devices containing depleted uranium, must transfer them to an authorized recipient licensed by either the NRC or an Agreement State. Before transferring radioactive material, a licensee must use one of the methods described in 10 CFR 30.41, "Transfer of byproduct material," to verify that the recipient is properly authorized to receive it. In addition, all packages containing radioactive sources must be prepared and shipped in accordance with NRC and DOT regulations. Records of the transfer must be maintained as required by 10 CFR 30.51.

If source activity exceeds activities listed in Appendix E, "Nationally Tracked Source Thresholds," to 10 CFR Part 20, the transfer transaction must be reported in accordance with 10 CFR 20.2207.

Response from Applicant: The applicant does not need to provide a response to this item during the licensing process. However, the applicant should establish and include waste disposal procedures in its radiation safety program.

Because of the difficulties and costs associated with disposal of sealed sources containing byproduct material and devices containing depleted uranium, applicants should preplan the disposal. Applicants may want to consider contractual arrangements with the sealed source and device supplier as part of a purchase agreement.

The next two items on NRC Form 313 are to be completed on the form itself.

8.12 Item 12: License Fees

On NRC Form 313, enter the appropriate fee category from 10 CFR 170.31 and the amount of the fee enclosed with the application.

Direct all questions about NRC's fees or completion of Item 12 of NRC Form 313 to the Office of the Chief Financial Officer at NRC Headquarters in Rockville, MD, (301) 415-7554. Information about fees may also be obtained by calling NRC's toll free number, (800) 368-5642, extension 415-7554. The e-mail address is Fees.Resource@nrc.gov.

8.13 Item 13: Certification

Regulations: 10 CFR 34.11 and 10 CFR 30.32(c)

Criteria: To ensure adequate management involvement, a duly authorized management representative pursuant to 10 CFR 34.11, "Application for a specific license," *must* sign the submitted application acknowledging management's commitments and responsibilities.

Discussion: Individuals acting in a private capacity are required to date and sign NRC Form 313. Otherwise, representatives of the corporation or legal entity filing the application should date and sign NRC Form 313. Representatives signing an application must be authorized to make binding commitments and to sign official documents on behalf of the applicant. As discussed previously in Chapter 3, "Management Responsibility," signing the application acknowledges management's commitment and responsibilities for the radiation protection program. The NRC will return all unsigned applications for proper signature.

Response from Applicant: Certifying Officer signs and dates the application.

Notes:

- It is a criminal offense to make a willful false statement or representation on an application or correspondence (18 U.S.C. 1001).
- When the application references commitments, those commitments can become part of the license conditions and regulatory requirements. Therefore, the applicant is responsible for proper implementation of commitments.

9. AMENDMENTS AND RENEWALS TO A LICENSE

It is the licensee's obligation to keep the license current. If any of the information provided in the original application is to be modified or will change, the licensee must submit an application for a license amendment before the change takes place. The change is not in effect until the amendment has been issued. Also, to continue the license after its expiration date, the licensee must submit an application for a license renewal at least 30 days before the expiration date (10 CFR 2.109(a), 10 CFR 30.36(a)).

Applicants for license amendment or renewal should do the following:

- Use the most recent guidance in preparing an amendment or renewal request.
- Submit, in duplicate, either an NRC Form 313 or a letter requesting amendment or renewal.
- Provide the license number and docket number.
- For renewals, provide a complete and up-to-date application if many outdated documents are referenced or there have been significant changes in regulatory requirements, NRC guidance, the licensee's organization, or the licensee's radiation protection program. Alternatively, describe clearly the exact nature of the changes, additions, and deletions.

9.1 Timely Notification of Transfer of Control

Regulation: 10 CFR 30.34(b)

Criteria: Licensees must provide full information and obtain the NRC's *prior written consent* before transferring control of the license.

Discussion: Transferring control may be the result of mergers, buyouts, or majority stock transfers. Although it is not the NRC's intent to interfere with the business decisions of licensees, it is necessary for licensees to obtain prior NRC written consent to ensure the following:

- Radioactive materials are possessed, used, or controlled only by persons who have valid NRC or Agreement State licenses.
- Materials are properly handled and secured.
- Persons using these materials are competent and committed to implementing appropriate radiological controls.
- A clear chain of custody is established to identify who is responsible for disposition of records and licensed material.
- Public health and safety are not compromised by the use of such materials.

Response from Applicant: No response is required from an applicant for a new license. However, current licensees should refer to Appendix O to this report or to NUREG-1556, Volume 15 for more information on transfer of ownership.

10. APPLICATIONS FOR EXEMPTIONS

Regulations: 10 CFR 19.31, 10 CFR 20.2301, 10 CFR 30.11

Criteria: Licensees may request exemptions to regulations. The licensee must demonstrate that the exemption is authorized by law; will not endanger life, property, or the common defense and security; and is otherwise in the public interest.

Discussion: Various sections of NRC's regulations address requests for exemptions (e.g., 10 CFR 19.31, "Application for exemptions"; 10 CFR 20.2301, "Applications for exemptions"; 10 CFR 30.11(a)). These regulations state that the NRC may grant an exemption, acting on its own initiative or on an application from an interested person.

Exemptions are not intended to revise regulations or to apply to large classes of licensees and are generally limited to unique situations. Exemption requests must be accompanied by descriptions of the following:

- Exemption requested, basis, and justification for the requested exemption.
- Proposed compensatory safety measures intended to provide a level of health and safety equivalent to the regulation for which the exemption is being requested.
- Alternative methods for complying with the regulation and an explanation as to why compliance with the existing regulation is not feasible.

Until the NRC has granted an exemption in writing, the NRC expects strict compliance with all applicable regulations.

11. TERMINATION OF ACTIVITIES

Regulations: 10 CFR 30.34(b), 10 CFR 30.35(g), 10 CFR 30.36(d), 10 CFR 30.36(g), 10 CFR 30.36(h), 10 CFR 30.36(j), 10 CFR 30.51(f)

Criteria: The licensee must do the following:

- Notify the NRC, in writing, within 60 days of any of the following:
  - Expiration of its license.
  - A decision to cease licensed activities permanently at the entire site.
  - A decision to cease licensed activities permanently in any separate building or outdoor area that contains residual radioactivity such that the building or area is unsuitable for release in accordance with NRC requirements.
  - No principal activities having been conducted at the entire site under the license for a period of 24 months.
  - No principal activities have been conducted for a period of 24 months in any separate building or outdoor area, if it contains residual radioactivity making it unsuitable for release in accordance with NRC requirements.

Submit a decommissioning plan, if required by 10 CFR 30.36(g).
Conduct decommissioning, as required by 10 CFR 30.36(h) and 10 CFR 30.36(j).
Submit, to the appropriate NRC regional office, completed NRC Form 314, "Certificate of Disposition of Materials" (or equivalent information), and information demonstrating that the premises are suitable for release for unrestricted use (e.g., results of final survey).
Before a license is terminated, send the records required by 10 CFR 30.51(f) to the appropriate NRC regional office. If licensed activities are transferred or assigned in accordance with 10 CFR 30.34(b), transfer records important to decommissioning to the new licensee in accordance with 10 CFR 30.35(g).

Discussion: To comply with the above criteria, before a licensee can decide whether it must notify the NRC, the licensee must determine whether residual radioactivity is present and, if so, whether the levels make the building or outdoor area unsuitable for release, according to NRC requirements. A licensee's determination that a facility is not contaminated is subject to verification by NRC inspection.

For guidance on the disposition of licensed material, see Section 8.11 "Waste Management." For guidance on decommissioning records, see Section 8.5.2, "Financial Assurance and Recordkeeping for Decommissioning."

Response from Applicant: The applicant is not required to submit a response to the NRC during the initial application. The licensee's obligations in this matter begin when the license expires or at the time the licensee ceases operations, whichever is earlier. These obligations

are to undertake the necessary decommissioning activities, to submit NRC Form 314 or equivalent information, and to perform any other actions summarized in “Criteria” above.

Reference: NRC Form 314 is available at http://www.nrc.gov/reading-rm/doc-collections/forms.

APPENDIX A

LIST OF DOCUMENTS CONSIDERED IN DEVELOPMENT OF THIS NUREG

Office of Federal and State Materials and Environmental Management Programs Letter

FSME-10-019, "Reporting Requirements for Industrial Radiography," March 12, 2010, (Agencywide Documents Access and Management System (ADAMS) Accession No. ML100610424).

Orders

EA-05-090 "Order Imposing Increased Controls," November 14, 2005 (ADAMS Accession No. ML053130218).

EA-07-305 "Order Imposing Fingerprinting and Criminal History Records Check Requirements for Unescorted Access to Certain Radioactive Material (Effective Immediately) and Opportunity to Request a Hearing," December 5, 2007 (ADAMS Accession No. ML073250084).

Regulatory Issue Summaries (RISs)

RIS 2005-10 "Performance-Based Approach for Associated Equipment in 10 CFR 34.20," June 10, 2005 (ADAMS Accession No. ML051590049).

RIS 2005-15 "Reporting Requirements for Damaged Industrial Radiographic Equipment," August 3, 2005 (ADAMS Accession No. ML052100127).

RIS-2005-31 "Control of Security-Related Sensitive Unclassified Non-Safeguards Information Handled by Individuals, Firms, and Entities Subject to NRC Regulation of the Use of Source, Byproduct, and Special Nuclear Material," December 2005 (ADAMS Accession No. ML053480073).

RIS-2007-07 "Clarification of Increased Controls for Licensees That Possess Collocated Radioactive Material During Transportation Activities," April 5, 2007 (ADAMS Accession No. ML070250497).

RIS-2007-14 "Fingerprinting Requirements for Licensees Implementing the Increased Control Order," June 5, 2007 (ADAMS Accession No. ML071500056).

RIS-2007-23, "Date for Operation of National Source Tracking System," October 4, 2007 (ADAMS Accession No. ML072680241).

RIS-2008-02, "Actions To Increase the Security of High Activity Radioactive Sources," February 1, 2008 (ADAMS Accession No. ML080150638).

RIS 2008-24 "Security Responsibilities of Service Providers and Client Licensees," October 3, 2008 (ADAMS Accession No. ML082200597).

RIS 2009-15 "National Source Tracking System Annual Inventory Reconciliation," December 3, 2009 (ADAMS Accession No. ML093170822).

Information Notices (INs)

IN 83-81 "Entry into High Radiation Areas from Areas Which Are Not Under Direct Surveillance," December 7, 1983 (ADAMS Accession No. ML0829703291).

IN 84-25 "Recent Serious Violations of NRC Requirements by Radiography Licensees," April 16, 1984 (ADAMS Accession No. ML0829703570).

IN 85-57 "Lost Iridium-192 Source Resulting in the Death of Eight Persons in Morocco," July 16, 1985 (ADAMS Accession No. ML0311801880).

IN 87-45 "Recent Safety-Related Violations of NRC Requirements by Industrial Radiography Licensees," September 25, 1987 (ADAMS Accession No. ML031130602).

IN 87-47 "Transportation of Radiography Devices," October 5, 1987 (ADAMS Accession No. ML082910458).

IN 88-66 "Industrial Radiography Inspection and Enforcement," August 22, 1988 (ADAMS Accession No. ML031150170).

IN 89-25 "Unauthorized Transfer of Ownership or Control of Licensed Activities," Rev. 1, December 7, 1994 (ADAMS Accession No. ML082320739).

IN 90-15 "Reciprocity: Notification of Agreement State Radiation Control Directors Before Beginning Work in Agreement States," March 7, 1990 (ADAMS Accession No. ML031130264).

IN 91-23 "Accidental Radiation Overexposures to Personnel Due to Industrial Radiography Accessory Equipment Malfunctions," March 26, 1991 (ADAMS Accession No. ML031190662).

IN 91-60 "False Alarms of Alarm Ratemeters Because of Radiofrequency Interference," September 24, 1991 (ADAMS Accession No. ML031190235).

IN 93-05 "Locking of Radiography Exposure Devices," January 14, 1993 (ADAMS Accession No. ML031080041).

IN 93-69 "Radiography Events at Operating Power Reactors," September 2, 1993 (ADAMS Accession No. ML031070112).

IN 95-44 "Ensuring Compatible Use of Drive Cables Incorporating Industrial Nuclear Company Ball-Type Male Connectors," September 26, 1995 (ADAMS Accession No. ML031060191).

IN 96-20 "Demonstration of Associated Equipment Compliance with 10 CFR 34.20," April 4, 1996 (ADAMS Accession No. ML031060147).

IN-96-28 "Suggested Guidance Relating to Development and Implementation of Corrective Action," May 1, 1996 (ADAMS Accession No. ML092450179).

IN 96-53 "Retrofit to Amersham 660 Posilock Radiography Camera to Correct Inconsistency in 10 CFR Part 34 Compatibility," October 15, 1996 (ADAMS Accession No. ML031060041).

IN 97-35 "Retrofit to Industrial Nuclear Company (INC) IR100 Radiography Camera to Correct Inconsistency in 10 CFR Part 34 Compatibility," June 18, 1997 (ADAMS Accession No. ML031050568).

IN 97-86 "Additional Controls for Transport of the Amersham Model No. 660 Series Radiographic Exposure Devices," December 12, 1997 (ADAMS Accession No. ML031050028).

IN 97-87 "Second Retrofit to Industrial Nuclear Company IR100 Radiography Camera to Correct Inconsistency in 10 CFR Part 34 Compatibility," December 12, 1997 (ADAMS Accession No. ML031050023).

IN 97-91 "Recent Failures of Control Cables Used on Amersham Model 660 Posilock Radiography Systems," December 31, 1997 (ADAMS Accession No. ML031050007).

IN 98-16 "Inadequate Operational Checks of Alarm Ratemeters," April 30, 1998 (ADAMS Accession No. ML031050179).

IN 01-03 "Incident Report Requirements for Radiography Licenses," April 6, 2001 (ADAMS Accession No. ML010800026).

IN 04-13 "Registration, Use, and Quality Assurance Requirements for NRC-Certified Transportation Packages," June 30, 2004 (ADAMS Accession No. ML041810535).

APPENDIX B

U.S. NUCLEAR REGULATORY COMMISSION FORM 313

United States Nuclear Regulatory Commission Form 313

NRC FORM 313 (3-2009) 10 CFR 30, 32, 33, 34, 35, 36, 39, and 40	U.S. NUCLEAR REGULATORY COMMISSION	APPROVED BY OMB: NO. 3150-0120	EXPIRES: 3/31/2012

APPLICATION FOR MATERIALS LICENSE

Estimated burden per response to comply with this mandatory collection request: 4.3 hours. Submittal of the application is necessary to determine that the applicant is qualified and that adequate procedures exist to protect the public health and safety. Send comments regarding burden estimate to the Records and FOIA/Privacy Services Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects.resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0120), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

OFFICE OF FEDERAL & STATE MATERIALS AND
ENVIRONMENTAL MANAGEMENT PROGRAMS
DIVISION OF MATERIALS SAFETY AND STATE AGREEMENTS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

ALABAMA, CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, FLORIDA, GEORGIA, KENTUCKY, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, NORTH CAROLINA, PENNSYLVANIA, PUERTO RICO, RHODE ISLAND, SOUTH CAROLINA, TENNESSEE, VERMONT, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

LICENSING ASSISTANCE TEAM
DIVISION OF NUCLEAR MATERIALS SAFETY
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
2443 WARRENVILLE ROAD, SUITE 210
LISLE, IL 60532-4352

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MISSISSIPPI, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
612 E. LAMAR BOULEVARD, SUITE 400
ARLINGTON, TX 76011-4125

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S.NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*
   - ☐ A. NEW LICENSE
   - ☐ B. AMENDMENT TO LICENSE NUMBER _____
   - ☐ C. RENEWAL OF LICENSE NUMBER _____

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include ZIP code)*

3. ADDRESS WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

   TELEPHONE NUMBER

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
   a. Element and mass number; b. chemical and/or physical form; and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSE FEES *(See 10 CFR 170 and Section 170.31)*

FEE CATEGORY	AMOUNT ENCLOSED $

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35 , 36, 39, AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

CERTIFYING OFFICER -- TYPED/PRINTED NAME AND TITLE	SIGNATURE	DATE

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED $	CHECK NUMBER	COMMENTS
APPROVED BY				DATE	

NRC FORM 313 (3-2009) PRINTED ON RECYCLED PAPER

APPENDIX C

SUGGESTED FORMAT FOR PROVIDING INFORMATION REQUESTED IN ITEMS 5 THROUGH 11 OF U.S. NUCLEAR REGULATORY COMMISSION FORM 313

Suggested Format for Providing Information Requested in Items 5 through 11 of NRC Form 313

Item No.	Title and Criteria	Yes	Description Attached
5	**RADIOACTIVE MATERIAL** **Sealed Sources and Devices**		
	• Identify each radionuclide that will be used for performing radiography.		[ ]
	• Identify the manufacturer (or distributor) and model number of each sealed source.		[ ]
	• Identify the manufacturer (or distributor) and model number of each exposure device. Indicate if a device is only to be used in a permanent radiographic installation.		[ ]
	• Identify the manufacturer (or distributor) and model number of each source changer.		[ ]
	• If depleted uranium is used as shielding material, specify the total amount (in kilograms).		[ ]
	• Confirm that each sealed source, device, and source/device combination possessed is registered as an approved sealed source or device by the U.S. Nuclear Regulatory Commission (NRC) or an Agreement State and will be possessed and used in accordance with the conditions specified in the registration certificate.	[ ]	
	• Confirm that associated equipment is compatible with the exposure devices, source changers, and sealed sources containing byproduct material.	[ ]	
	• Confirm that only radiographic exposure devices, source assemblies or sealed sources, and associated equipment which meet the requirements specified in Title 10 of the *Code of Federal Regulations* (10 CFR) 34.20, “Performance requirements for industrial radiography equipment,” will be used in radiographic operations.		[ ]
	• Identify each radionuclide and the manufacturer (or distributor) and model number of each sealed source and/or device containing byproduct material that will not be used for performing radiography.		

Item No.	Title and Criteria	Yes	Description Attached
5	**RADIOACTIVE MATERIAL** **Financial Assurance and Recordkeeping for Decommissioning** • Pursuant to 10 CFR 30.35(g), we shall maintain drawings and records important to decommissioning and to transfer these records to a new licensee before licensed activities are transferred, or to assign the records to the appropriate NRC regional office before the license is terminated. **OR** • If financial assurance is required, submit evidence following NUREG-1757, Volume 3.	[ ]	[ ]
6	**PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED** Equipment will only be used for the following: • industrial radiography • underwater radiography • lay-barge radiography (see Appendix D) • off-shore platform radiography (see Appendix D) • other than radiography	[ ] [ ] [ ] [ ]	[ ]

Item No.	Title and Criteria	Yes	Description Attached
7	**INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE** **Radiation Safety Officer (RSO)** • The name of the proposed RSO and other potential designees who will be responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures. **AND** • Demonstrate that the RSO has sufficient independence and direct communication with responsible management officials by providing a copy of an organizational chart, by position, demonstrating day-to-day oversight and coordination with management in radiation safety activities. **AND EITHER** • The specific training and experience of the RSO and other potential designees. Include the specific dates of certification and/or training in radiation safety. • Documentation to show that the RSO has a minimum of 2,000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations. • Documentation to show that the RSO has obtained formal training in the establishment and maintenance of a radiation protection program. **OR** • Alternative information demonstrating that the proposed RSO is qualified by training and experience. • Documentation to show that the RSO has obtained formal training in the establishment and maintenance of a radiation protection program.		[ ] [ ] [ ] [ ] [ ] [ ] [ ]

Item No.	Title and Criteria	Yes	Description Attached
8	**TRAINING FOR RADIOGRAPHERS AND RADIOGRAPHER'S ASSISTANTS**		
	• Submit an outline of the training to be given to prospective radiographers and radiographer's assistants. Submit your procedures for experienced radiographers who have worked for another licensee.		[ ]
	• Provide a copy of a typical examination and the correct answers to the examination questions. Indicate the passing grade.		[ ]
	• While you do not need to provide a description of the training and examination program in the topics listed in 10 CFR 34.43(g), all other training program descriptions must still be submitted.	[ ]	
	• Specify the qualifications of your instructors in radiation safety principles and describe their experience with radiography. If training will be conducted by someone outside the applicant's organization, identify the course by title and provide the name and address of the company providing the training.		[ ]
	• Describe the field (practical) examination that will be given to prospective radiographers and radiographer's assistants.		
	• Describe the annual refresher training program, including topics to be covered and how the training will be conducted.		[ ]
	• Submit your procedures for verifying and documenting the certification status of radiographers and for verifying that their certification remains valid.		[ ] [ ]
	• Submit a description of your program for inspecting the job performance of each radiographer and radiographer's assistant at intervals not to exceed 6 months, as described in 10 CFR 34.43(e).		[ ]

Item No.	Title and Criteria	Yes	Description Attached
9	**FACILITIES AND EQUIPMENT** **Permanent Radiography Installations** Provide the following information for each permanent radiography installation: • Provide an annotated sketch or drawing of the facility and its surroundings. Diagrams of facilities should be marked: "Security-related information—Withhold under 10 CFR 2.390." • Identify the scale to which the sketch or drawing is made. • Identify the type, thickness, and density of shielding materials on all sides, including the floor and the roof. • Identify the locations of entranceways and other points of access to the facility. • Describe the areas adjacent to the facility and the distance to these areas. Include information on areas adjacent to, above, and below the facility. • Describe the general location of each proposed permanent facility listed in Item 3 (e.g., located in an industrial park, an office complex) and its current use. • If a proposed permanent facility is a private residence, provide diagrams of the facility that include the building, the proposed restricted area(s), and adjacent areas, including above and below the restricted areas. (Note: Local municipalities may limit the use of radioactive material to certain zone areas.) • Restricted areas do not include residential quarters. • Explain how radiation levels in unrestricted areas will be maintained at less than 1 millisievert (mSv) (100 millirem (mrem)) per year. • Describe the visible-audible signal system or entrance control system and its locations. • Provide the results of radiation-level calculations or actual radiation measurements adjacent to, above, and below the facility.	[ ]	[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

Item No.	Title and Criteria	Yes	Description Attached
9	**FACILITIES AND EQUIPMENT** **Permanent Radiography Installations**		
	Provide the following information to obtain approval for a variance if construction requirements preclude shielding the roof to meet the requirement not to exceed 0.02 mSv (2 mrem) in any 1 hour:		[ ]
	• means of access to the roof		[ ]
	• procedures for ensuring that no individual is on the roof or could gain access to the roof during radiography		[ ]
	• a commitment that the roof will be posted with “Caution (or Danger) Radiation Area” sign(s)	[ ]	
	• steps taken to minimize radiation on the roof		[ ]
	• limitations (if needed) on positioning of sources or type (isotope) and amount of radioactive material that may be used in the installation to ensure that areas adjacent to, above, and below the installation will be unrestricted areas during the performance of radiography		[ ]
	Provide the following information to obtain approval for a variance if radiation levels on the radiography installation roof exceed 1.0 mSv (100 mrem) in any 1 hour:		
	• a commitment that the roof will be posted with a “Caution (or Danger) High-Radiation Area” sign(s)	[ ]	
	• evidence of constant surveillance of the roof by closed-circuit television		[ ]
	• a description of a control device that would automatically reduce the radiation level to 1 mSv (100 mrem) in any 1 hour at 30 centimeters from the radiation source if someone enters the roof		[ ]
	• a description of a control device that activates a visible-audible signal so that both an individual entering the roof and the radiographer on duty are made aware of the entry		[ ]

Item No.	Title and Criteria	Yes	Description Attached
9	**FACILITIES AND EQUIPMENT** **Field Stations** Provide the following information for each field station: • Describe the storage location(s) at the address(es) listed in Item 3 of the application, and submit a diagram showing where the radiography camera will be stored at the field stations. • Indicate whether radiography and source exchanges will be performed at the place of business outside of a permanent facility as if the work were "in the field." • For radiography or source exchanges performed at the place of business as if the work were "in the field," provide a diagram of the location where radiography may be performed and its surroundings, including a description of adjacent property.	[ ]	[ ] [ ]
10	**RADIATION SAFETY PROGRAM** **Audit Program** The applicant is <u>not</u> required to, and should not, submit its audit program to the NRC for review during the licensing phase. (See Appendix G for a sample radiation safety program audit). Audits will be reviewed during inspections to determine compliance with NRC regulations.	Need Not Be Submitted With Application	
	Instruments We will possess and use calibrated and operable radiation survey meters. Calibration will be performed by an NRC or Agreement State licensee specifically authorized to perform instrument calibration. Calibration is to be performed in-house, and the model procedures in Appendix H will be followed. Calibration is to be performed in-house, and alternate procedures will be followed. The qualifications of the individuals who will perform the calibrations must be identified.	[ ] [ ] [ ]	[ ] [ ]

Item No.	Title and Criteria	Yes	Description Attached
10	**RADIATION SAFETY PROGRAM** **Material Receipt and Accountability** Physical inventories will be conducted and documented at quarterly intervals (not to exceed 3 months) to account for all sealed sources containing byproduct material and devices containing depleted uranium received and possessed under the license.	[ ]	
	Minimization of Contamination The applicant is not required to provide a response to the minimization of contamination, if the applicant's responses meet the criteria for the following sections: "Radioactive Material—Sealed Sources and Devices"; "Facilities and Equipment"; "Radiation Safety Program—Leak Tests"; "Radiation Safety Program—Operating and Emergency Procedures"; and "Waste Management—Sealed Source/DU Device Transfer and Disposal."	Need Not Be Submitted With Application	
	Leak Tests Leak tests will be performed by an organization authorized by the NRC or an Agreement State to provide leak-testing services to other licensees, or by using a leak-test kit supplied by an organization licensed by the NRC or an Agreement State to provide leak-test kits and services to other licensees, and according to the instructions provided in the leak-test kit.	[ ]	
	OR		
	Leak testing will be done by the applicant.	[ ]	
	• The information in Appendix I supporting a request to perform leak testing and sample analysis is attached.		[ ]
	• We will follow the model procedures in Appendix I.	[ ]	
	• We will follow alternate procedures.		[ ]

Item No.	Title and Criteria	Yes	Description Attached
10	**RADIATION SAFETY PROGRAM** **Occupational Dosimetry** Radiography personnel will wear film, thermoluminescent dosimeter, or other personal dosimetry processed and evaluated by a processor accredited by the National Voluntary Laboratory Accreditation Program and exchanged at the required frequency. Radiographic personnel will wear the required personnel monitoring equipment, including 0-to-2-mSv (200-mrem) dosimeters or electronic personal dosimeters. All radiography personnel will wear alarming ratemeters set to alarm at ±20 percent of 500 millirem per hour (mrem/h), except those personnel at permanent radiography installations where other appropriate alarming or warning devices are in use. Pocket dosimeters and alarm ratemeters will be checked for correct response at intervals not to exceed 12 months. • If adjustment is necessary, the devices will be returned to the manufacturer. • If adjustment is necessary, in-house procedures for adjustments are described.	[ ] [ ] [ ] [ ] [ ]	[ ]
	Public Dose The applicant is <u>not</u> required to, and should not, submit a response to the public dose section during the licensing phase. Public dose will be reviewed during inspections to determine compliance with NRC regulations.	Need Not Be Submitted With Application	
10	**RADIATION SAFETY PROGRAM** **Quarterly Maintenance** Submit the procedures to the NRC for review and approval as operating and emergency procedures or as shipping package procedures as needed. Before using a new sealed source/device combination, we will have written inspection and maintenance procedures that address the use of the new equipment as a Type B transport package. In addition, we will provide training to radiographic personnel before using a new sealed source/device combination.	[ ]	[ ]

Item No.	Title and Criteria	Yes	Description Attached
	Operating and Emergency Procedures **Handling and Use of Sealed Sources and Radiography Exposure Devices** Submit operating and emergency procedures which provide step-by-step instructions for using each type of radiographic device. Submit operating and emergency procedures which provide instructions for performing source exchanges. **Methods and Occasions for Conducting Radiation Surveys** Submit operating and emergency procedures which, where applicable, include each of the surveys included in Table 8-1. **Methods for Controlling Access to Radiographic Areas** Submit the procedures to control access to radiographic operations and storage areas.		[ ] [ ] [ ] [ ]
10	**RADIATION SAFETY PROGRAM** **Methods and Occasions for Locking and Securing Radiographic Exposure Devices, Storage Containers, and Sealed Sources** Submit operating and emergency procedures that include procedures for locking and securing radiographic equipment. **Personnel Monitoring and the Use of Personnel Monitoring Equipment** Submit operating procedures that include instructions for proper use of personnel monitoring equipment. **Transporting Sealed Sources to Field Locations, Securing Exposure Devices and Storage Containers in Vehicles, Posting Vehicles, and Controlling Sealed Sources during Transportation** Submit operating and emergency procedures for transporting sealed sources containing byproduct material, exposure devices, and source changers.		[ ] [ ] [ ]

Item No.	Title and Criteria	Yes	Description Attached
	Daily Inspection and Maintenance of Radiographic Equipment		
	Submit operating and emergency procedures for daily inspection and maintenance of radiographic equipment.		[ ]
	Ratemeter Alarms or Off-Scale Dosimeter Readings		
	Submit operating and emergency procedures to address ratemeter alarms or off-scale dosimeters.		[ ]
	Procedure for Identifying and Reporting Defects and Noncompliance as Required by 10 CFR Part 21		[ ]
	Submit operating and emergency procedures for notifying management of equipment malfunction or defect.		
10	**RADIATION SAFETY PROGRAM**		
	Notification of Proper Persons in the Event of an Accident		
	Submit operating and emergency procedures that include appropriate instructions for notifying the RSO and other personnel in the event of an emergency.		[ ]
	Minimizing Exposure of Persons in the Event of an Accident—Emergency Procedures		
	Submit operating and emergency procedures that include instructions for minimizing exposure of persons in the event of an accident.		[ ]
	Source Retrieval		
	We will not perform source retrievals and will use the services of a person specifically licensed by the NRC or an Agreement State to perform the retrievals of our sources.	[ ]	
	Submit operating and emergency procedures that include instructions for source retrieval procedures and specific training.		[ ]
	Security Program		
	Licensees must ensure the security and control of licensed material. The regulations in 10 CFR 20.1801 and 20.1802 require licensees to secure radioactive materials from unauthorized removal or access while in storage and to control and maintain constant surveillance over licensed material that is not in storage.		Need Not Be Submitted With Application

Item No.	Title and Criteria	Yes	Description Attached
11	**WASTE MANAGEMENT** **Disposal or Transfer of Radiography Sealed Sources Containing Byproduct Material or Devices Containing Depleted Uranium** The applicant does not need to provide a response to this item during the licensing process. However, the applicant should establish and include waste disposal procedures in its radiation safety program.	Need Not Be Submitted With Application	

APPENDIX D

LICENSING GUIDANCE FOR LAY-BARGE AND OFFSHORE RADIOGRAPHY

Basic Description of an Offshore Platform

An offshore platform, often referred to as an oil platform or oil rig, is a large structure used to house workers and machinery needed to drill wells in the ocean bed, extract oil or natural gas, process the produced fluids, and ship them to shore. Depending on the circumstances, the platform may be attached to the ocean floor, consist of an artificial island, or be floating.

Offshore Platform Radiography Safety Issues

- The use of crankout devices for offshore platform radiography has some inherent risk. If a source disconnect were to occur, source recovery resources and expertise may not be available. Licensee staff may not have received the appropriate training to perform source retrieval operations and may not be authorized to perform such operations under their current license. (Shielding may not be available and also it is difficult to keep people away from source).

- There may be specific physical or space configurations that the licensee needs to consider to ensure compliance with the limit of 2 millirem in any 1 hour in unrestricted areas required by 10 CFR 20.1301.

- Members of the public on an offshore platform (e.g., welders, divers) could receive doses well above regulatory limits in the event of a source disconnect event.

- Offshore platform operators (who are production oriented) cannot override radiography companies on radiation safety issues. Written arrangements should be in place to allow radiography company representatives to stop work if there is a radiation safety issue.

As required by Title 10 of the *Code of Federal Regulations* (10 CFR) 34.41(c), a licensee may only conduct lay-barge, offshore platform, or underwater radiography if procedures have been approved by the NRC or by an Agreement State. Based on the above potential hazardous conditions, licensees must provide operating and emergency procedures for lay-barge, offshore platform, or underwater radiography that address the following safety aspects:

(1) Procedures, as required to comply with 10 CFR 34.45(a), unique to offshore platform radiography, should minimize the potential for a source disconnect.

(2) Emergency procedures, as required by 10 CFR 34.45(a), unique to offshore platform radiography, should address unintentional source disconnects and recovery. These procedures should address minimizing radiation exposure for all personnel on the offshore platform during a disconnect event, including considerations such as staff training, availability of portable shielding, survey instruments, dosimetry, and other equipment.

(3) Operating procedures and practices unique to offshore platform radiography should ensure compliance with the requirements of 10 CFR 34.41, “Conducting Industrial Radiographic Operations,” for personnel to be present during radiography and 10 CFR 34.46, “Supervision of radiographers’ assistants,” for supervision of radiography assistants.

(4) Operating procedures and practices, as required to comply with 10 CFR 34.45(a), should ensure that radiography personnel have the authority necessary to protect personnel on an offshore platform from radiation doses in excess of regulatory limits. These procedures and practices should include provisions to ensure that radiographic operations are conducted only in those locations shielded for such operations (if those enclosures are relied upon to control dose) and that radiographic personnel can direct personnel as necessary for radiation safety both during normal operations and in the event of a disconnect or other emergency.

Basic Description of Lay-Barges

An aspect of the petroleum industry is the ability to transport the petroleum from the ocean floor to the coastal refineries for processing. This transport is facilitated by use of underwater pipelines that are laid on the ocean floor by pipe lay-barges. These lay-barges allow sections of piping to be welded together on deck, radiographed to ensure weld quality, coated to prevent corrosion, and subsequently lowered to the ocean floor. These activities are performed sequentially as an assembly-line process onboard the barges. These pipe lay-barges are configured in either a side-lay or center-lay arrangement, which dictates how the pipe is assembled on the lay-barge. Work onboard these lay-barges can be hazardous because of the close proximity of the pipe to the workers, as well as the relative motion that is created between components and personnel as a result of ocean waves and currents.

Lay-Barge Radiography Safety Issues

- The use of crankout devices for lay-barge radiography has some inherent risk. Disconnects are more likely than with the previously used pipeliner devices because of motion between source (attached to pipe) and crankout device (attached to barge).

- If a source disconnect occurs and the source recovery resources and expertise are not on the barge, licensee staff may not have received the appropriate training to perform source retrieval operations and may not be authorized to perform such operations under their current license. (Shielding is not available and it is difficult to keep people away from the source.)

- There may be specific physical or space configurations that the licensee needs to consider to ensure compliance with the limit of 2 mrem in any 1 hour in an unrestricted area required by 10 CFR 20.1301. For lay-barges, radiography should be restricted to the shielded enclosures on the barges where it is intended to be done.

- Members of the public on the offshore platform (e.g., welders, divers) could receive doses well above regulatory limits in the event of a source disconnect event.

- Lay-barge operators (who are production oriented) cannot override radiography companies on radiation safety issues. Written arrangement should be in place to allow radiography company representatives to stop work if there is a radiation safety issue.

As required by 10 CFR 34.41(c), a licensee may only conduct lay-barge, offshore platform, or underwater radiography if procedures have been approved by the NRC or by an Agreement State. Based on the above potential hazardous conditions, licensees must provide operating and emergency procedures for lay-barge, offshore platform, or underwater radiography that address the following safety aspects.

(1) Procedures, as required by 10 CFR 34.45(a) and unique to lay-barge radiography, are designed to minimize the potential for a source disconnect.

(2) Emergency procedures, as required by 10 CFR 34.45(a) and unique to lay-barge radiography, address unintentional source disconnects and recovery. These procedures should address minimizing radiation exposure for all personnel onboard the lay-barge during a disconnect event, considering issues such as staff training, availability of portable shielding, survey instruments, dosimetry, and other equipment.

(3) Operating procedures and practices unique to lay-barge radiography should ensure compliance with the requirements of 10 CFR 34.41 for personnel to be present during radiography and the requirements of 10 CFR 34.46 for supervision of radiography assistants.

(4) Operating procedures and practices, as required by 10 CFR 34.45(a), should ensure that radiography personnel have the authority necessary to protect personnel onboard the lay-barges from radiation doses in excess of regulatory limits. These procedures and practices should include provisions to ensure that radiographic operations are conducted only in those locations shielded for such operations (if those enclosures are relied upon to control dose) and that radiographic personnel can direct personnel as necessary for radiation safety both during normal operations and in the event of a disconnect or other emergency.

APPENDIX E

RADIOGRAPHER AND ASSISTANT RADIOGRAPHER TRAINING

Radiographer and Assistant Radiographer Training
Table E.1 10 CFR Part 34, "Radiographer and Assistant Radiographer Training Requirements"

Requirement		Training Criteria
34.43(a)(1)		**Radiographer**
A.	Receive Training in 10 CFR 34.43(g) Topics (Classroom Training—Approximately 40 hours in Length)	Topics in 10 CFR 34.43(g) Fundamentals of Radiation Safety · characteristics of gamma radiation · units of radiation dose and quantity of radioactivity · hazards of exposure to radiation · levels of radiation from licensed material · methods of controlling radiation dose (time, distance, and shielding) Radiation Detection Instruments · use, operation, calibration, and limitations · survey techniques · personnel monitoring equipment Equipment to be Used · operation and control of radiographic exposure equipment, remote handling equipment, storage containers, and pictures or models of source assemblies (pigtails) · storage, control, and disposal of licensed material · inspection and maintenance of equipment Requirements of Pertinent Federal Regulations Case Histories of Accidents in Radiography
B.	On-the-Job Training—2 months or 320 hours	Under the supervision of a qualified radiographer
C.	Certification by a Certifying Entity	<u>Radiographer Certification</u> Radiographers must be certified by a certifying entity and the licensee must ensure that training on the subjects listed in 10 CFR 34.43(g) has been conducted.
34.43(b)		**Radiographer**

Requirement		Training Criteria
D.	Must Receive Copies of and Instruction in: (Training—Approximately 8 hours in Length)	NRC Regulations 10 CFR Part 34 · 10 CFR 30.7, 10 CFR 30.9, and 10 CFR 30.10 · Applicable parts of 10 CFR Part 19 and 10 CFR Part 20 · Applicable DOT regulations and 10 CFR Part 71 The NRC License The Licensee's Operating and Emergency Procedures
E.	Pass Written or Oral Examination on Licensee's Operating and Emergency Procedures	· 50 questions · Passing Grade 80%
F.	Receive Equipment Training (Approximately 4 hours in Length)	Training includes: · exposure devices · sealed sources · associated equipment · survey meters · daily inspection
G.	Demonstrate Understanding in Use of Equipment by Passing Practical Exam	Questions on topics determined by the licensee. Use the Six-Month Radiographer/Radiographer's Assistant Inspection Checklist (Appendix F) as a potential source of questions.
H.	Annual Refresher Training	Review the following: · radiation safety review · new procedures or equipment · new regulations · observations and deficiencies during audits and discussion of any significant incidents or accidents involving radiography · employee questions
I.	Records	To be maintained in accordance with 10 CFR 34.79
34.43(c)		**Assistant Radiographer**

Requirement		Training Criteria
A.	Must Receive Copies of and Instruction in: (Training—Approximately 8 hours in Length)	NRC Regulations: · 10 CFR Part 34 · 10 CFR 30.7, 10 CFR 30.9, and 10 CFR 30.10 · applicable parts of 10 CFR Part 19 and 10 CFR Part 20 · applicable DOT regulations and 10 CFR Part 71 The NRC License The Licensee's Operating and Emergency Procedures
B.	Pass Written Exam	· 25–50 questions · closed book · passing grade 80%
C.	Receive Equipment Training (Approximately 4 hours in Length)	Training under the supervision of a qualified radiographer that includes: · exposure devices · sealed sources · associated equipment · survey meters · daily inspection
D.	Demonstrate Understanding in Use of Equipment by Passing Practical Exam	25–50 questions on topics determined by the licensee. The NRC suggests using the Six-Month Radiographer/Radiographer's Assistant Inspection Checklist (Appendix F) for a potential source of questions.
E.	Annual Refresher Training	Review the following: · any significant item identified in the annual review of the radiation safety program · new procedures or equipment · new regulations · observations and deficiencies during audits and discussion of any significant incidents or accidents involving radiography · employee questions
F.	Records	To be maintained in accordance with 10 CFR 34.79.

APPENDIX F

SIX-MONTH RADIOGRAPHER/RADIOGRAPHER'S ASSISTANT INSPECTION CHECKLIST

Six-Month Radiographer/Radiographer's Assistant Inspection Checklist

Date: _____ Time: _____

Radiographic Location: _____

Radiographer/Radiographer Assistant: _____

Last Six-Month Performance Observation: Date: _____ By: _____

Device Model No.: _____ Serial No.: _____

Survey Meter Functionality: Yes _____ No _____

Calibrated: Yes ____ No _____ Daily/Source Check for Operation: Yes _____ No_____

Dosimetry: TLD/Film Badge and Pocket Dosimeter: Yes _____ No _____

Calibrated: Yes _____ No _____

Alarming Dosimeter: Yes _____ No _____ Calibrated: Yes _____ No _____

- □ Were other individuals working within the restricted area wearing film badges/TLDs, dosimeters, and alarm dosimeters?
- □ Was the restricted area posted with a "CAUTION (or DANGER) RADIATION AREA" sign(s)?
- □ Was the restricted area properly controlled to prevent unauthorized entry?
- □ Was the high-radiation area posted with a "CAUTION (OR DANGER) HIGH-RADIATION AREA" sign(s)?
- □ Was the utilization log properly filled out?
- □ Did the radiographer/radiographer assistant have sufficient knowledge of safety rules? (Ascertained by oral questions)
- □ Was the radiographer working with properly inspected and operable equipment?
- □ Did the radiographer/radiographer assistant properly survey the source projector?
- □ Did the radiographer properly supervise the radiographer assistant?
- □ Was the source projector properly locked and secured to prevent unauthorized removal?
- □ Was the restricted area properly controlled for radiological exposure?
- □ Were calculations or surveys performed to determine the restricted area boundary?

□ Was the high-radiation area under continuous direct observation except where entry had been prevented?

□ Were radioactive isotopes stored properly and kept locked to prevent removal?

□ Was the storage area posted with a “CAUTION (or DANGER) RADIOACTIVE MATERIAL” sign(s)?

□ Did the radiographer/radiographer assistant possess and use a copy of the operating and emergency procedures and (State or NRC) rules and regulations for protection against radiation?

□ Were there any other safety items found to be lacking? If yes, explain in Remarks.

Remarks:

APPENDIX G

RADIATION SAFETY PROGRAM AUDIT

Radiation Safety Program Audit

Annual Radiation Protection Industrial Radiography Audit

Date of this Audit _____ Date of Last Audit _____

Next Audit Date _____

Auditor _____ Date _____
(Signature)

Management Review _____ Date _____
(Signature)

Note: Except where noted, references are to Title 10 of the *Code of Federal Regulations* (10 CFR).

Organization and Scope of Program

A. Organizational structure (specify any changes)
   1. Matches license requirements [L/C[3]]
   2. Multiple authorized locations of use and/or field sites authorized
   3. List of location(s) inspected—attached or reference
   4. Brief description of scope of activities, including types of equipment, types and quantities of use involving byproduct material, frequency of use, staff size, etc.

B. Radiation Safety Officer (RSO)
   1. Named on license [L/C]
   2. Fulfills duties as RSO [34.42(c)]
   3. Meets requirements [34.42]

C. Radiographers and radiographer's assistants named in documents [34.43, 34.79; L/C].

D. Commensurate security program implemented.

Training, Retraining, and Instructions to Workers

A. Instructions to workers [19.12]

B. Parts 19, 20, 21, 34; the license; and operating and emergency procedures are furnished to all radiographers and radiographer's assistants [34.43(b)(1), (c)(1)]

C. Training program description the same as that submitted with license application or as amended? [34.13(b); L/C]
   1. Written tests completed by all radiographers and radiographer's assistants.
   2. Oral tests
   3. All radiographers completed on-the-job training

[3] L/C refers to license condition.

4. Periodic training program implemented
5. Records maintained [34.79]

D. Part 20. Workers cognizant of requirements for:
   1. Radiation safety program [20.1101]
      a. Occupational exposure annual limits [20.1201; 20.1202]
      b. Public annual dose limits [20.1301; 20.1302]
   2. U.S. Nuclear Regulatory Commission (NRC) Forms 4 and 5
   3. 10% monitoring threshold [20.1502]
   4. Dose limits to embryo/fetus and declared pregnant worker [20.1208]
   5. Procedures for opening packages [20.1906]

Operating and Emergency Procedures

A. Procedures current? [34.45; 34.81; 34.89]
B. Procedures contain information specified
C. Procedures submitted to the NRC [34.13(d)]

Internal Audits or Inspections

A. Audits/inspections of each radiographer and radiographer's assistants conducted at 6-month intervals or after as appropriate [34.111(e); 34.42(e); L/C]
B. Equipment check before use each day [34.31(a)]
C. Equipment inspection and maintenance performed at 3-month intervals [34.31(b)]
D. Records maintained [34.73]

Facilities

A. Permanent radiographic installation [34.3; 34.33]
   1. High-radiation area posted [20.1601(a); 20.2902(b)]
   2. Entrance controls are as described [20.1601(a); L/C]
      a. Visible and audible radiation signals
      b. Visible signal actuates if entry is attempted when source is exposed
      c. Audible signal actuates if entry is attempted when source is exposed
      d. System tested daily with radiation source
      e. Records maintained for 3 years [34.75]
B. Temporary high-radiation area entry controlled [20.1601(b); 34.31]
C. Storage area
   1. Storage facilities as described in license [L/C]
   2. Sources locked in devices [34.23]

3. Devices secured to prevent tampering or unauthorized removal [34.23; 20.1801; 20.2803]
4. Storage locations comply with the appropriate security program measures

D. Field radiography conducted at location identified on license [L/C]

Equipment

A. Radiography devices, source assemblies, and source changers in use meet requirements [34.20]

B. Associated equipment in use complies with requirements [34.20]

C. Awareness that associated equipment must comply with 34.20

D. Source changers and storage containers meet radiation level limits [34.21]

E. Equipment exempted by specific license condition is used in accordance with license commitments and authorization

Materials

A. Isotope, chemical/physical form, quantity, and use as authorized [L/C]

B. All sealed sources not fastened to or contained in an exposure device are tagged [34.20(b)(4)(I)]

C. During radiographic operations, sources are secured in shielded position each time source is returned to that position [34.49(b)]

D. Leakage and contamination tests
   1. Sealed sources
      a. Leak-test method approved [34.27(c)]
      b. Leak tests performed at 6-month intervals [34.27]
      c. Leakage is less than 185 becquerels (Bq) (0.005 microcuries (µCi)
   2. Depleted uranium (DU) shielding with S-tubes
      a. Test every 12 months [34.27]
      b. DU is less than 185 Bq (0.005 µCi)
   3. Records maintained for 3 years [34.67]

E. Inventories
   1. Conducted quarterly (not to exceed 3 months) [34.29]
   2. Contain all required information [34.69]
   3. Most recent inventory conducted on: < date > _____

F. Utilization Logs
   1. Utilization logs maintained [34.71]
   2. Contain all required information [34.71]

Instrumentation

A. Describe the survey instruments possessed:

Model No. Quantity

B. Capable of measuring 0.02 millisievert (mSv) (2 millirem (mrem)) per hour (h) through 0.01 Sv (1 rem)/h [34.25]

C. Operable and calibrated survey instruments available and used on each job [34.25(a)]

D Calibration performed at intervals not to exceed 6 months or after servicing [34.25(a)]

E. Records maintained for 3 years [34.65]

Radiation Surveys

A. Area or facility surveys conducted to show compliance with 20.1301 and 20.1302(a) [20.1501(a)]

B. Records maintained [20.2103]

C. Survey after each exposure, including the exposure device and the guide tube, ensuring that the source has returned to the shielded position [34.49(b)]

D. Survey of device when placed in storage (including vehicles) to ensure source is in shielded position [34.49(c)]

E. Protection of members of the public [20.1301]

1. Adequate surveys made to demonstrate:
    a. the total effective dose equivalent to the individual likely to receive the highest dose does not exceed 0.1 mSv (100 mrem) in a year, or
    b. for an individual continuously present in an unrestricted area, the external dose would not exceed 0.02 mSv (2 mrem) in any 1 hour and 1 mSv (100 mrem) in a year [20.1301(a)(1); 20.1302(b)]
2. Unrestricted area radiation levels do not exceed 0.02 mSv (2 mrem) in any 1 hour [20.1301(a)(2)]
3. Records maintained [20.2103, 20.2107]

Personnel Radiation Protection

A. Dosimetry

1. Workers monitored as required [20.1502; 34.47(a); L/C]
2. Exchange Frequency Supplier
3. Verify supplier is approved by the National Voluntary Laboratory Accreditation Program [20.1501(c)]
4. Dosimeters exchanged at required frequency [L/C]
5. Dosimetry records maintained [20.2106; 34.83(c)]

B. Pocket Dosimeters and Electronic Personal Dosimeters

1. Model No. _____ Range _____

Model No. _____ Range _____

2. Read and recorded at start of each shift [34.47(b)]
3. Daily readings recorded [34.47(b)]
4. Dosimeters checked for response (±20%) at intervals not to exceed 12 months
5. Off-scale dosimeter procedure and records [34.47; 34.87(d)]

C. Alarm Ratemeters

1. Model No. Range
2. Checked that alarm functions properly at start of each shift [34.47(g)(1)]
3. Preset at 5 mSv (500 mrem)/h [34.47(g))(2)]
4. Calibrated to ±20% at intervals not to exceed 12 months [34.47(g)(4)]
5. Records maintained [34.83(b)]

D. Dosimetry Reports

1. Reviewed by Frequency .
2. Reviewed personnel monitoring records for interval (from to)
3. Maximum exposures: TEDE extremity
   other
4. NRC Forms (or equivalent) [20.2104(d); 20.2106(c)]
   a. NRC Form 4—occupational exposure history
   b. NRC Form 5—current occupational exposure
5. Maximum exposures in compliance with annual limits [20.1201]
6. Fetal and pregnant worker exposure [20.1206; 20.2106(e)]
   a. Worker declared pregnancy in writing during the audit interval
   b. If yes, licensee in compliance? Records maintained?
7. Dosimetry records maintained [34.83]

E. Radiation Protection Program

1. Program includes provisions for keeping dose as low as reasonably achievable (ALARA) [20.1101]
2. Procedures and engineering controls used to achieve ALARA [20.1101(b)]
3. Content and implementation reviewed annually by licensee [20.101(c)]
4. Records of program reviews maintained [20.2102(a)(2)]

F. Planned Special Exposures (PSEs) [20.1206]

1. PSEs performed?
2. If so, when, where, and why?
3. Records maintained [20.2105; 20.2106; 20.2204]

Receipt and Transfer of Radioactive Material

A. Procedures established and followed for picking up, receiving, and opening packages [20.1906(e)]

B. Incoming packages surveyed [20.1906(b)(2); L/C]

C. Shipment of sources since last inspection

   1. Used container authorized by license or certificate of compliance (COC) [L/C; COC]

   2. Transfers [30.41]

   3. All sources surveyed before shipment and transfer [20.1501(a); 49 CFR 173.475(I); L/C]

D. Records of surveys and receipt/transfer maintained [20/2103(a); 30.51; 34.63]

E. Transactions entered into the National Source Tracking System, including annual reconciliation [20.2207]

Transportation (10 CFR 71.5(a) and 49 CFR 170–189)

A. Shipments are:

   □ Delivered to common carriers

   □ Transported in company's private vehicle

   □ Both

   □ No shipments since last audit

B. HAZMAT training [49 CFR 172.700–172.704]

C. Packages:

   1. Authorized packages used [49 CFR 173.415; 173.416]

   2. Performance test records on file

      a. Special form sources [49 CFR 173.476(a)]

      b. DOT-7A packages [49 CFR 173.415(a)]

   3. COCs on file with the NRC for Type B [71.12(c)(1)]

   4. Two labels with Transport Index, Nuclide, Hazard Class [49 CFR 172.403; 172.441]

   5. Properly marked (Shipping name, UN number[4], Package type, Reportable quantity (RQ), Name and address of consignee [49 CFR 172.301; 172.310; 172.324; 172.101]

   6. Closed and sealed during transport [49 CFR 173.475(f)]

D. Shipping papers

   1. Prepared and used [49 CFR 172.200(a)]

   2. Proper (Shipping name, Hazard class, UN number, Quantity, Package type, Nuclide, RQ, Radioactive material, Physical and chemical form, Category of label, Transport Index, Shipper's name, Certification and signature, Emergency response phone

[4] The UN number identifies the hazardous substance. The UN number is universally recognized and assigned by the United Nations.

number, “Limited Quantity,”“Cargo Aircraft Only” if applicable) [49 CFR 172.200–172.204; 175.700]

3. Readily accessible during transport

E. Vehicles

1. Placarded [49 CFR 172.504]
2. Cargo blocked and braced [49 CFR 177.842(d)]
3. Proper overpacks (shipping name, UN number label, statement of inner packaging complies with specification packaging) [49 CFR 171.15; 171.16]

F. Any transportation incidents reported to DOT National Response Center [49 CFR 171.15; 171.16]

Auditor’s Independent Measurements

A. Survey Instrument _____
Serial No. _____
Last Calibration _____

B. Auditor’s measurements were compared with audited person’s measurement

C. Describe the type, location, and results of measurements; attach a diagram/survey sheet and refer to this section

Notifications and Reports

A. Reports to individuals, public and occupational, monitored to show compliance with Part 20 [19.13; 30.50]

B. Theft or loss [20.2201; 30.50]

C. Incidents [20.2202; 30.50; 34.101]

D. Overexposures and high radiation levels [20.2203; 30.50]

E. Annual reports furnished to the NRC [20.2206(b), (c)]

F. Reporting of defects and noncompliance [21.21]

Posting and Labeling

A. Radiation areas [20.1902(a)]

B. High-radiation areas [20.1902(b)]

C. Use or storage areas [20.1902(e)]

D. Containers or devices labeled [20.1904(a)]

E. NRC Form 3 [19.11]

F. Parts 19, 20, 21 (Section 206 of Energy Reorganization Act) OR notification of location of required documents [19.11; 21.6]

G. Other posting and labeling [20.1902; 20.1904]

Recordkeeping for Decommissioning

A. Records in independent and identifiable location [30.35(g)]
B. Records include all required data [30.35(g)]

Generic Communications and Newsletters

A. Communications received and reviewed
B. Appropriate response to bulletin, generic letters, etc.

Special License Conditions or Issues

Evaluate special license conditions for data, actions

Performance Evaluation Factors

These indicators may provide an indication of the status of the radiation safety program as perceived by management.

A. Lack of senior management involvement with the radiation safety program and/or RSO oversight
B. RSO too busy with assignments other than radiation safety
C. Insufficient staffing
D. Radiation Safety Committee fails to meet or functions inadequately
E. Inadequate consulting service or inadequate audits

APPENDIX H

MODEL PROCEDURE FOR CALIBRATING SURVEY INSTRUMENTS

Model Instrument Calibration Program

Note: *This model provides acceptable procedures for calibrating survey instruments. Applicants may either adopt this model procedure or develop an alternate procedure to meet the requirements of Title 10 of the Code of Federal Regulations Section 34.25, "Radiation Survey Instruments."*

Training

Before allowing an individual to perform survey instrument calibrations, the Radiation Safety Officer (RSO) will ensure that he or she has sufficient training and experience to perform independent survey instrument calibrations.

Classroom training may be in the form of lecture, videotape, or self-study and will cover the following subject areas:

- principles and practices of radiation protection
- radioactivity measurements, monitoring techniques, and instrument use
- mathematics and calculations basic to using and measuring radioactivity
- biological effects of radiation

Appropriate on-the-job-training consists of the following:

- observing authorized personnel performing survey instrument calibration
- conducting survey meter calibrations under the supervision and in the physical presence of an individual authorized to perform calibrations

Facilities and Equipment for Calibration of Dose Rate or Exposure Rate Instruments

- To reduce doses received by individuals not calibrating instruments, calibrations will be conducted in an isolated area of the facility or at times when no one else is present.
- Individuals conducting calibrations will wear assigned dosimetry.
- Individuals conducting calibrations will use a calibrated and operable survey instrument to ensure that unexpected changes in exposure rates are identified and corrected.

Model Procedure for Calibrating Survey Instruments

A radioactive sealed source or sealed sources used for calibrating survey instruments will do the following:

- approximate a point source
- have its apparent source activity or the exposure rate at a given distance traceable by documented measurements to a standard certified to be accurate within ±5 percent by the National Institutes of Standards and Technology (NIST)

- approximate the same energy and type of radiation as the environment in which the calibrated device will be employed

- For dose rate and exposure rate instruments, the source should be strong enough to give an exposure rate of at least about 7.7×10^{-6} coulombs/kilogram/hour (30 milliroentgen/hour) at 100 centimeters (cm) (e.g., 3.1 gigabecquerels (85 mCi) of cesium-137 or 7.8×10^{2} megabecquerels (21 mCi) of cobalt-60).

The three kinds of scales frequently used on dose or dose rate survey meters are calibrated as follows[1]:

- Linear readout instruments with a single calibration control for all scales shall be adjusted at the point recommended by the manufacturer or at a point within the normal range of use. Instruments with calibration controls for each scale shall be adjusted on each scale. After adjustment, the response of the instrument shall be checked at approximately 20 percent and 80 percent of full scale. The instrument's readings shall be within ±15 percent of the conventionally true values for the lower point and ±10 percent for the upper point.
- Logarithmic readout instruments, which commonly have a single readout scale spanning several decades, normally have two or more adjustments. The instrument shall be adjusted for each scale according to site specifications or the manufacturer's specifications. After adjustment, calibration shall be checked at a minimum of one point on each decade. Instrument readings shall have a maximum deviation from the conventionally true value of no more than 10 percent of the full decade value.
- Meters with a digital display device shall be calibrated the same as meters with a linear scale.

Notes:

- Readings above 2.58×10^{-4} coulomb/kilogram/hour (1 roentgen/hour) need not be calibrated, but such scales should be checked for operation and response to radiation.

- The inverse square and radioactive decay law should be used to correct changes in exposure rate resulting from changes in distance or source decay.

Surface Contamination Measurement Instruments

- The efficiency of survey meters must be determined by using radiation sources with energies and types of radiation similar to those that the survey instrument will be used to measure.
- If each scale has a calibration potentiometer, the reading shall be adjusted to read the conventionally true value at approximately 80 percent of full scale, and the reading at approximately 20 percent of full scale shall be observed. If only one calibration potentiometer is available, the reading shall be adjusted at midscale on one of the scales, and readings on the other scales shall be observed. Readings shall be within 20 percent of the conventionally true value.

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[1] American National Standards Institute, "Radiation Protection Instrumentation Test and Calibration," ANSI N323A-1997.

Calibration Records

Calibration reports, for all survey instruments, will indicate the procedure used and the data obtained. The description of the calibration will include the following:

- the owner or user of the instrument
- a description of the instrument, including the manufacturer's name, model number, serial number, and type of detector
- a description of the calibration source, including the exposure rate at a specified distance or activity on a specified date
- for each calibration point, the calculated exposure rate or count rate, the indicated exposure rate or count rate, the deduced correction factor (the calculated exposure rate or count rate divided by the indicated exposure rate or count rate), and the scale selected on the instrument
- for instruments with external detectors, the angle between the radiation flux field and the detector (i.e., parallel or perpendicular)
- for instruments with internal detectors, the angle between radiation flux field and a specified surface of the instrument
- for detectors with removable shielding, an indication of whether the shielding was in place or removed during the calibration procedure
- the exposure rate or count rate from a check source, if used
- the name of the person who performed the calibration and the date it was performed

The following information will be attached to the instrument as a calibration sticker or tag:

- for exposure rate meters, the source isotope used to calibrate the instrument (with correction factors) for each scale
- the efficiency of the instrument for each isotope the instrument will be used to measure (if efficiency is not calculated before each use)
- for each scale or decade not calibrated, an indication that the scale or decade was checked only for function but not calibrated
- the date of calibration and the next calibration due date
- the apparent exposure rate or count rate from the check source, if used

APPENDIX I

REQUESTS TO PERFORM LEAK TESTING AND SAMPLE ANALYSIS

Requests to Perform Leak Testing and Sample Analysis

Note: *This model provides acceptable procedures for performing leak testing and sample analysis. Applicants may either adopt this model procedure or develop an alternate procedure to meet the requirements of Title 10 of the Code of Federal Regulations (10 CFR) Section 34.27, "Leak Testing and Replacement of Sealed Sources."*

Training

Before allowing an individual to perform leak testing, the licensee must ensure that he or she has sufficient classroom and on-the-job training to show competency in performing leak tests independently.

Classroom training may be in the form of lecture, videotape, or self-study and will cover the following subject areas:

- principles and practices of radiation protection
- radioactivity measurements, monitoring techniques, and instrument use
- mathematics and calculations used for measuring radioactivity
- biological effects of radiation

Appropriate on-the-job-training consists of the following:

- observing authorized personnel collecting and analyzing leak-test samples
- collecting and analyzing leak-test samples under the supervision and in the physical presence of an individual authorized to perform leak tests

Facilities and Equipment

- To ensure achieving the required sensitivity of measurements, analyze leak tests in a low-background area.
- Use a calibrated and operable survey instrument to check leak-test samples for gross contamination before they are analyzed.
- Analyze the leak-test sample using an instrument that is appropriate for the type of radiation to be measured (e.g., NaI (Tl) well-counter system for gamma emitters, liquid scintillation for beta emitters, gas-flow proportional counters for alpha emitters).
- If the sensitivity of the counting system is unknown, determine the minimum detectable activity (MDA). The MDA may be determined using the following formula:

$$MDA = \frac{2.71 + 4.65\sqrt{(B_R \times t)}}{t \times E} = \text{Minimum Detectable Activity}$$

where: MDA = minimum detectable activity in disintegrations per minute (dpm)
bkg = background count rate in counts per minute (cpm)
t = background counting time in minutes
E = detector efficiency in counts per disintegration

For example:

where: bkg = 200 counts per minute (cpm)
E = 0.1 counts per disintegration (10% efficient)
t = 2 minutes

$$MDA = \frac{2.71 + 4.65\sqrt{(200 \text{ cpm} \times 2 \text{ minutes})}}{2 \times 0.1} = \frac{2.71 + 4.65\sqrt{(400)}}{0.2}$$

$$= \frac{2.71 + 4.65\,(20)}{0.2} = \frac{2.71 + 93}{0.2} = \frac{95.71}{0.2}$$

$$= \frac{478.55 \text{ disintegrations}}{\text{minute}}$$

$$\text{becquerels (Bq)} = \frac{1 \text{ disintegration}}{\text{second}}$$

$$Bq = \frac{478.55 \text{ disintegration}}{\text{minutes}} \times \frac{\text{minute}}{60 \text{ seconds}} = 7.976 \text{ Bq}$$

Frequency for Conducting Leak Tests of Sealed Sources

Leak tests will be conducted at the frequency specified in the respective sealed source and device registration certificate.

Procedure for Performing Leak Testing and Analysis

- For each source to be tested, list identifying information such as sealed source serial number, radionuclide, and activity.
- If available, use a survey meter to monitor exposure.
- Prepare a separate wipe sample (e.g., cotton swab or filter paper) for each source.
- Number each wipe to correlate with identifying information for each source.
- Wipe the most accessible area where contamination would accumulate if the sealed source were leaking.
- Select an instrument that is sensitive enough to detect 185 Bq (0.005 microcuries (µCi)) of the radionuclide.
- Using the selected instrument, count and record background count rate.

- Check the instrument's counting efficiency using a standard source of the same radionuclide as the source being tested or one with similar energy characteristics. Accuracy of standards should be within ±5 percent of the stated value and traceable to primary radiation standards such as those maintained by the National Institute of Standards and Technology.
- Calculate efficiency.

For example: $\frac{\text{[(cpm from std) - (cpm from bkg)]}}{\text{activity of std in Bq}}$ = efficiency in cpm/Bq

where: cpm = counts per minute
std = standard
bkg = background
Bq = becquerel

- Count each wipe sample; determine net count rate.
- For each sample, calculate and record estimated activity in Bq (or millicuries).

For example: $\frac{\text{[(cpm from wipe sample) - (cpm from bkg)]}}{\text{efficiency in cpm/Bq}}$ = Bq on wipe sample

- Sign and date the list of sources, data, and calculations. Retain records for 3 years (10 CFR 20.2103(a)). If the wipe test activity is 185 Bq (0.005 µCi) or greater, notify the radiation safety officer (RSO), so that the source can be withdrawn from use and disposed of properly. Also notify the U.S. Nuclear Regulatory Commission (NRC).

Reference: See NUREG-1556, Volume 18, "Program-Specific Guidance About Service Provider Licenses," issued November 2000.

Sampling and Analysis for Depleted Uranium as a Result of S-Tube Breakthrough

Note: As an ALARA safety measure for devices with an S-tube configuration, the source should be transferred to a source changer before the S-tube is tested for breakthrough.

The wipe test sample should be obtained from the areas of the tube where wear is likely to be most severe, at the first curve nearest the ends of the radiography device. The sample should be analyzed for alpha contamination. Alpha contamination present indicates that wear has broken through the S-tube to expose the depleted uranium.

Alpha counting sensitivity should be able to detect 185 Bq (0.005 µCi) of contamination.

A worn S-tube could create equipment operating difficulties. Upon verification of the presence of alpha-particle emitting uranium, the radiographic exposure device should be removed from use until an evaluation of the wear of the S-tube has been made. Should the evaluation reveal that the S-tube is worn through, the device may not be used again. No user repairs are permitted.

APPENDIX J

GUIDANCE FOR DEMONSTRATING THAT INDIVIDUAL MEMBERS OF THE PUBLIC WILL NOT RECEIVE DOSES EXCEEDING THE ALLOWABLE LIMITS

Guidance for Demonstrating That Individual Members of the Public Will Not Receive Doses Exceeding the Allowable Limits

Licensees must ensure the following:

- The radiation dose received by individual members of the public resulting from the licensee's possession or use of licensed materials does not exceed 1 millisievert (mSv) (100 millirem (mrem)) in one calendar year.

Members of the public include persons who live, work, or may be near locations where industrial radiography devices are used or stored and employees whose assigned duties do not include the use of licensed materials and who work in the vicinity where devices are used or stored.

- The radiation dose in unrestricted areas does not exceed 0.02 mSv (2 mrem) in any 1 hour.
- Typical unrestricted areas may include offices, shops, laboratories, areas outside buildings, property, and nonradioactive equipment storage areas. The licensee does not control access to these areas for purposes of controlling exposure to radiation or radioactive materials. However, the licensee may control access to these areas for other reasons, such as security.
- Licensees must show compliance with both portions of the regulation. Radiographic operations at temporary jobsites must be demonstrated to have doses to the public in unrestricted areas that do not exceed 0.02 mSv (2 mrem) in any 1 hour. For storage areas and permanent radiographic facilities, calculations or a combination of calculations and measurements (e.g., an environmental thermoluminescent device (TLD)) is often used to prove compliance with levels of 0.02 mSv (2 mrem) in any 1 hour and 1 mSv (100 mrem) in a calendar year.

Calculational Method

For ease of use by most industrial radiography licensees, the examples in this appendix use conventional units. The conversions to International System of Units (SI) units are as follows: 1 foot (ft) = 0.305 meter (m); 1 mrem = 0.01 mSv.

The calculational method takes a tiered approach, going through a three-part process starting with a worst-case situation and moving toward more realistic situations. It makes the following simplifications: (1) each device is a point source, (2) typical radiation levels encountered when the source is in the shielded position are taken from either the sealed source and device (SSD) registration sheet, the maximum dose levels allowed for a transport package (exposure device) labeled YELLOW III, or the manufacturer's literature, and (3) no credit is taken for any shielding found between the devices and the unrestricted areas.

Part 1 of the calculational method is simple but conservative. It assumes that a member of the public is present 24 hours a day, and it uses only the inverse square law to determine if the distance between the device and the affected member of the public is sufficient to show compliance with the public dose limits. Part 2 considers not only distance, but also the time that a member of the public is actually in the area under consideration. Part 3 considers distance

and the portion of time that both the device and the affected member of the public are present. Part 4 considers the distance, the portion of time that both the device and the affected member of the public are present, and the shielding provided by the structural materials or shielding materials specifically added by the licensee. Using this approach, licensees make only those calculations that are needed to demonstrate compliance. In many cases, licensees will need to use the calculational method through Part 1 or Part 2. These calculations typically result in higher radiation levels than would exist at typical facilities, but provide a method for estimating conservative doses which could be received.

Example 1

To better understand the calculational method, Mo-Rad, Inc., a hypothetical radiography licensee, is demonstrated. Yesterday, the company's president noted that the new device storage area is close to his secretary's desk and he asked Joe, the Radiation Safety Officer (RSO), to determine if the company is complying with the U.S. Nuclear Regulatory Commission's (NRC's) regulations.

The secretary's desk is near the wall separating the reception area from the designated, locked device storage area, where the company is storing its two devices. Joe measures the distances from each device to the wall and assumes that each device would have the maximum dose rate allowed under NRC or U.S. Department of Transportation (DOT) regulations: 2 millisievert per hour (mSv/h) (200 millirem per hour (mrem/h)) on the surface and 0.1 mSv/h (10 mrem/h) at 1 meter. Figure J.1 is Joe's sketch of the areas in question, and Table J.1 summarizes the information Joe has on each device.

A Bird's Eye View of Office and Device Storage Area

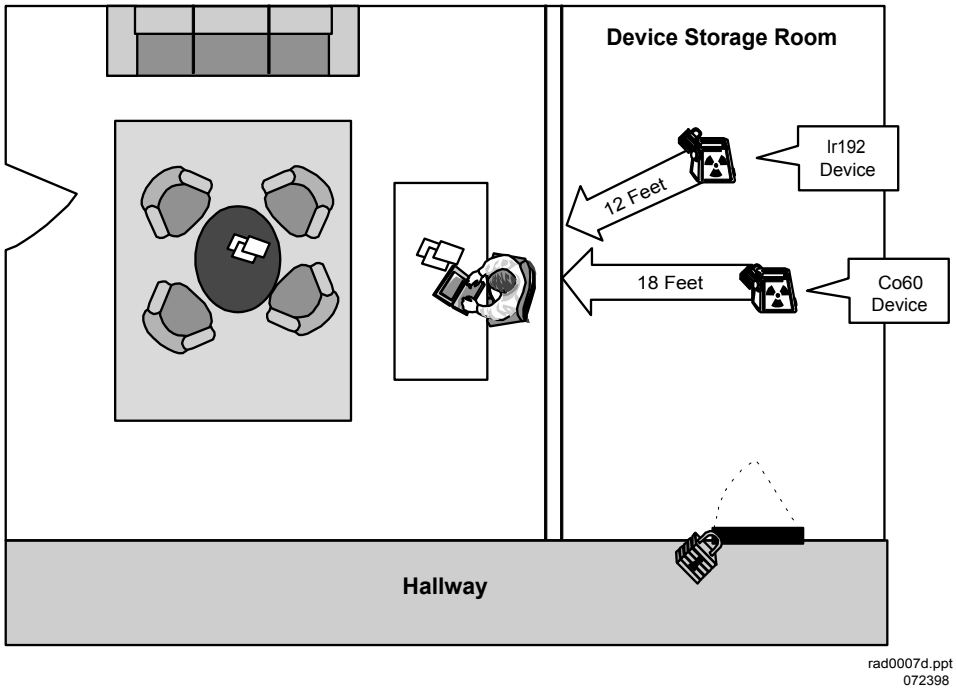

Figure J.1 Diagram of office and device storage area. This sketch shows the areas described in Examples 1 and 2.

Table J.1 Information Known about Each Device

Description of Known Information	Device 1	Device 2
How device is stored	Ir-192 exposure device (Type B container)	Co-60 exposure device (Type B container)
Dose rate in mrem/h encountered at specified distance from the device	10 mrem/h at 1 m (3.3 ft)	10 mrem/h at 1 m (3.3 ft)
Distance in ft to secretary's chair	12 ft	18 ft

Example 1: Part 1

Joe's first thought is that the distance between the devices and the secretary's chair may be sufficient to show compliance with the regulation in Title 10 of the *Code of Federal Regulations* (10 CFR) 20.1301. Taking a worst case approach, he assumes that (1) the devices are constantly present (i.e., 24 hours per day), (2) both devices remain in storage with no other use, and (3) the secretary is constantly sitting in the desk chair (i.e., 24 hours per day). Joe proceeds to calculate the dose she might receive hourly and yearly from each device, as shown in Tables J.2 and J.3 below.

Table J.2 Calculational Method, Part 1: Hourly and Annual Dose Received from Device 1

Step No.	Description	Device 1 Input Data	Results
1	Dose received in 1 hour at known distance from device (e.g., from manufacturer's data), in mrem/h	10	10
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft^2	(3.3) 2	10.9
3	Square of the distance (ft) from the device the secretary's desk in an unrestricted area, in ft^2	(12) 2	144
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	10 × 10.9 = 109	
5	Divide the result of Step 4 by the result of Step 3 to calculate the dose received by an individual at the secretary's desk**, HOURLY DOSE RECEIVED FROM DEVICE 1**, in mrem in 1 hour.	109/144 = **0.76**	
6	Multiply the result of Step 5 by 24 hours per day (h/d) × 365 days per year (d/yr) = **MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICE 1**, in mrem in 1 year.	0.76 × 24 × 365 = 0.76 × 8,760 = **6,630**	

Table J.3 Calculational Method, Part 1: Hourly and Annual Dose Received from Device 2

Step No.	Description	Device 2 Input Data	Results
1	Dose received in 1 hour at known distance from device (e.g., from manufacturer's data), in mrem/h	10	10
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft^2	(3.3) 2	10.9
3	Square of the distance (ft) from the device to the secretary's desk in an unrestricted area, in ft^2	(18) 2	324
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	10 × 10.9 = 109	
5	Divide the result of Step 4 by the result of Step 3 to calculate dose received in 1 hour by an individual at the secretary's desk**, HOURLY DOSE RECEIVED FROM DEVICE 2**, in mrem in 1 hour	109/324 = **0.34**	
6	Multiply the result of Step 5 by 24 h/d × 365 d/yr = **MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICE 2**, in mrem in 1 year	0.34 × 24 × 365 = 0.34 × 8,760 = **2,950**	

To determine the total hourly and total annual dose received, Joe adds the pertinent data from the preceding tables.

Table J.4 Calculational Method, Part 1: Total Hourly and Annual Dose Received from Devices 1 and 2

Step No.	Description	Device 1	Device 2	Sum
7	**TOTAL HOURLY DOSE RECEIVED** from Step 5 of Tables K.3 and K.4, in mrem in 1 hour	0.76	0.34	0.76 + 0.34 = **1.1**
8	**TOTAL ANNUAL DOSE RECEIVED** from Step 6 of Tables K.3 and K.4, in mrem in 1 year	6,630	2,950	6,630 + 2,950 = **9,580**

Note: The sum in Step 7 demonstrates compliance with the limit of 2 mrem in any 1 hour. Reevaluate if assumptions change. If the sum in Step 8 exceeds 100 mrem/yr, proceed to Part 2 of the calculational method.

At this point, Joe is pleased to see that the total dose that an individual could receive in any 1 hour is only 1.1 mrem, but notes that an individual could receive a dose of 9,580 mrem in a year, much higher than the 100-mrem limit.

Example 1: Part 2

Joe reviews his assumptions and recognizes that the secretary is not at the desk 24 hours per day. He decides to make a realistic estimate of the number of hours the secretary sits in the chair at the desk, keeping his other assumptions constant (i.e., the devices are constantly present (24 hours per day), both devices remain in storage with no other use). He then recalculates the annual dose received.

Table J.5 Calculational Method, Part 2: Annual Dose Received from Devices 1 and 2

Step No.	Description	Results
9	A. Average number of hours per day that individual spends in area of concern (e.g., secretary sits at desk 5 h/d; the remainder of the day the secretary is away from the desk area copying, filing, etc.) B. Average number of days per week in area (e.g., secretary is part time and works 3 days/week) C. Average number of weeks per year in area (e.g., secretary works all year)	5 3 52
10	Multiply the results of Step 9.A by the results of Step 9.B by the results of Step 9.C = **AVERAGE NUMBER OF HOURS IN AREA OF CONCERN PER YEAR**	5 × 3 × 52 = **780**
11	Multiply the sum in Step 7 by the results of Step 10 = **ANNUAL DOSE RECEIVED FROM DEVICES CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN**, in mrem in 1 year	1.1 × 780 = **860**

Note: If Step 11 exceeds 100 mrem in a year, proceed to Part 3 of the calculational method.

Although Joe is pleased to note that the calculated annual dose received is significantly lower, he realizes it still exceeds the annual limit of 100 mrem.

Example 1, Part 3

Again Joe reviews his assumptions and recognizes that the devices are not always in storage when the secretary is seated at the desk. As he examines the situation, he realizes he must consider each device individually.

Table J.6 Calculational Method, Part 3: Summary of Information

Summary
Information on When Devices Are Present in the Storage Area: · **Device 1:** An iridium-192 exposure device located in the storage area overnight and used every day at temporary jobsites all year and returned to the storage location at the end of each day. The device is usually present during the secretary's first and last hours of work each day. · **Device 2:** A cobalt-60 exposure device located in the storage area continuously (24 h/d) for 8 months of the year; for the remaining 4 months of the year, it is at temporary jobsites.
Information from Example 1, Part 2, on When the Secretary Is Sitting at the Desk: · 5 days per week · 3 days per week · 52 weeks per year

Table J.7 Calculational Method, Part 3: Annual Dose Received from Devices 1 and 2

Step No.	Description	Device 1	Device 2
12	Average number of **hours per day** device is in storage while secretary is present	**2**	**5**
13	Average number of **days per week** device is in storage while secretary is present	**3**	**3**
14	Average number of **weeks per year** device is in storage while secretary is present	**52**	**32**
15	Multiply the results of Step 12 by the results of Step 13 by the results of Step 14 = **TOTAL HOURS EACH DEVICE IS STORED PER YEAR WHILE SECRETARY IS PRESENT**	2 × 3 × 52 = **312**	5 × 3 × 32 = **480**
16	Multiply the results of Step 15 by the results of Step 7 = **ANNUAL DOSE RECEIVED FROM EACH DEVICE**, in mrem in 1 year	312 × 0.76 = **237**	480 × 0.34 = **163**
17	Sum the results of Step 16 for each device = **TOTAL ANNUAL DOSE RECEIVED CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN AND TIME DEVICE IS IN STORAGE**, in mrem in 1 year	237 + 163 = **400**	

Note: If the result in Step 17 is greater than 100 mrem/yr, the licensee must take corrective actions.

Joe notes that the result in Step 17 does not show compliance with the limit of 100 mrem/yr. Since the result in Step 17 is higher than 100 mrem/yr, Joe has to do one or more of the following:

- Consider whether the assumptions used to determine occupancy and the time each device is in storage are accurate, revise the assumptions as needed, and recalculate using the new assumptions.
- Calculate the effect of any shielding located between the device storage area and the secretarial workstation. Listed below are typical half-value layers (HVLs) for iridium-192 and cobalt-60.

Table J.8 Half-Value Layers for Typical Shielding Materials

	Steel	HVL (inches) Lead	Concrete
Ir-192	0.5	0.25	1.7
Co-60	0.8	0.5	2.1

- Take corrective action (e.g., move devices within storage area, move the storage area, move the secretarial workstation) and perform new calculations to demonstrate compliance
- Designate the area outside the storage area as a restricted area and the secretary as an occupationally exposed individual. This would require controlling access to the area for purposes of radiation protection and training the secretary, as required by 10 CFR 19.12, "Instruction to workers."

Example 1, Part 4

Joe decides to take into account the amount of shielding provided by the wall between the secretary's desk and the storage area where the two devices are located. The wall between the secretary's office and the storage area is a 4-inch-thick concrete fire wall.

Table J.9 Calculational Method, Part 4: Annual Dose Received from Devices 1 and 2

Step No.	Description	Device 1	Device 2
18	Annual dose received from each device from Step 15	**237**	**163**
19	Number of HVLs (thickness of shielding material/thickness for one HVL); if more than one shielding material, evaluate each shielding material separately by type of radionuclide.	**4.0/1.7 = 2.35**	**4.0/2.1 = 1.9**

Step No.	Description	Device 1	Device 2
20	Fraction of radiation dose transmitted through shield: 0.5 (total number of HVLs); if more than one shielding material, then sum the number results from Step 19 by radionuclide.	**0.5(2.35) = 0.2**	**0.5(1.9) = 0.27**
21	Multiply the results of Step 20 by the results of Step 18 = **ANNUAL DOSE RECEIVED FROM EACH DEVICE**, in mrem in 1 year	0.2 × 237 = **47**	0.27 × 163 = **44**
22	Sum the results of Step 21 for each device = **TOTAL ANNUAL DOSE RECEIVED CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN, TIME DEVICE IS IN STORAGE AND SHIELDING OF STRUCTURAL MATERIALS**, in mrem in 1 year	47 + 44 = **91**	

Note: If the result in Step 22 is greater than 100 mrem/yr, the licensee must take corrective actions.

Joe is glad to see that the results in Step 22 show compliance with the annual limit of 100 mrem.

Note that in the example, Joe evaluated the unrestricted area outside only one wall of the device storage area. Licensees also need to make similar evaluations for other unrestricted areas and to keep in mind the principle of maintaining doses as low as reasonably achievable (ALARA), taking reasonable steps to keep radiation dose received below regulatory requirements. In addition, licensees need to be alert to changes in situations (e.g., moving any of the devices closer to the secretarial workstation, adding a device to the storage area, changing the secretary to a full-time worker, or changing the estimate of the portion of time spent at the desk) and to perform additional evaluations, as needed.

RECORDKEEPING: As required by 10 CFR 20.2107, "Records of dose to individual members of the public," licensees must maintain records demonstrating compliance with the dose limits for individual members of the public.

Combination Measurement—Calculational Method

This method, which allows the licensee to take credit for shielding between the device and the area in question, begins by measuring radiation levels in the areas, as opposed to using manufacturer-supplied rates at a specified distance from each device. These measurements must be made with calibrated survey meters sufficiently sensitive to measure background levels of radiation. However, licensees must exercise caution when making measurements with currently calibrated radiation survey instruments. A maximum dose of 1 mSv (100 mrem) received by an individual over an interval of 2,080 hours (i.e., a work year of 40 hours per week for 52 weeks per year) is equal to less than 0.5 microsievert (0.05 mrem) per hour.

This rate is well below the minimum sensitivity of most commonly available Geiger-Mueller survey instruments.

Instruments used to make measurements for calculations must be sufficiently sensitive. An instrument equipped with a scintillation-type detector (e.g., NaI (Tl)) or a micro-R meter used in making very low gamma radiation measurements should be adequate.

Licensees may also choose to use environmental TLDs. TLDs used for personnel monitoring (e.g., lithium fluoride)) may not have sufficient sensitivity for this purpose. Generally, the minimum reportable dose received is 0.1 mSv (10 mrem). Suppose a TLD monitors dose received and is changed once a month. If the measurements are at the minimum reportable level, the annual dose received could have been about 1.2 mSv (120 mrem), a value in excess of the limit of 1 mSv/yr (100 mrem/yr). If licensees use TLDs to evaluate compliance with the public dose limits, they should consult with their TLD supplier and choose more sensitive TLDs, such as those containing calcium fluoride, that are used for environmental monitoring in unrestricted areas next to the device storage area for monitoring. This direct measurement method would provide a definitive measurement of actual radiation levels in unrestricted areas without any restrictive assumptions. Records of these measurements can then be evaluated to ensure that rates in unrestricted areas do not exceed the limit of 1 mSv/yr (100 mrem/yr).

Example 2

As in Example 1, Joe is the RSO for Mo-Rad, Inc., a radiography licensee. The company has two devices stored in a designated, locked storage area that adjoins an unrestricted area where a secretarial workstation is located. See Figure J.1 and Table J.1 for information. Joe wants to see if the company complies with the public dose limits at the secretarial station.

During the winter while all the devices were in storage, Joe placed an environmental TLD badge in the secretarial work space for 30 days. Joe chose a winter month so he did not have to keep track of the number of hours that each device was in the storage area. The TLD processor sent Joe a report indicating that the TLD received 100 mrem.

Parts 2 and 3 are calculated in the manner shown in Example 1.

Table J.10 Combination Measurement—Calculational Method

Step No.	Description	Input Data and Results
	Part 1	
1	**Dose** received by TLD, in mrem	**100**
2	**Total hours** TLD exposed	24 h/d × 30 d/mo = **720**
3	Divide the results of Step 1 by the results of Step 2 to determine **HOURLY DOSE RECEIVED**, in mrem in 1 hour	**0.14**
4	Multiply the results of Step 3 by 365 d/yr × 24 h/d = 8,760 hours in 1 year = **MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICES**, in mrem in 1 year	365 × 24 × 0.14 = 8,760 × 0.14 = **1,226**

Step No.	Description	Input Data and Results
	Part 2	
	Part 3	

Note: For the conditions described above, Step 3 indicates that the dose received in any 1 hour is less than the limit of 2 mrem in any 1 hour. However, if there are any changes, then the licensee would need to reevaluate the potential doses which could be received in any 1 hour. Step 4 indicates that the annual dose received would be much greater than the annual limit of 100 mrem allowed by the regulations.

In Step 2, Joe can adjust for a realistic estimate of the time the secretary spends in the area as he did in Part 2 of Example 1.

If the results of Joe's evaluation in Part 2 show that the annual dose received in a year exceeds 100 mrem, then he can make adjustments for realistic estimates of the time spent in the area of concern while the devices are actually in storage, as in Part 3 of Example 1. (Recall that the TLD measurement was made while all the devices were in storage—that is, 24 hours per day for the 30 days that the TLD was in place.)

APPENDIX K

INFORMATION FOR APPLICANTS TO CONSIDER WHEN DEVELOPING PROCEDURES FOR OPERATING RADIOGRAPHY EQUIPMENT

Information for Applicants To Consider When Developing Procedures for Operating Radiography Equipment

Caution: Always use a calibrated, operable survey meter and wear proper dosimetry while performing the following operations:

Crankout Device

- Establish and post the restricted area and high-radiation area.
- Locate the source shield at the desired distance from the object to be radiographed.
- Mount the source tip firmly, using jigs or other attachments, with the tip in the exact exposure position.
- Locate the control unit at a maximum distance from the source shield with the control tubes laid out as straight as possible.
- Join the control cable to the unit following the manufacturer's instructions.
- Unlock the device.
- Turn the handcrank steadily to move the source out of the source shield to the exposure position.
- Survey the perimeter of the restricted area to be sure that radiation levels do not exceed 0.02 millisievert (mSv) (2 millirem (mrem)) in any 1 hour.
- Maintain continuous surveillance over the restricted area during an exposure, keeping all persons from entering.
- After completing the exposure, retract the source by turning the crank until the "safe" position is indicated.
- Survey the entire circumference of the device and the guide tube to determine that the source is in a shielded position.
- Lock the device and remove the key.

Pipeliner Device

- Establish and post the restricted area and high-radiation area.
- Unlock the device.
- Stand as far away as possible and out of the direction of the beam and expose the source (e.g., use the "stretch technique").
- Survey the perimeter of the restricted area to be sure that the radiation levels do not exceed 0.02 mSv (2 mrem) in any 1 hour.
- Maintain continuous surveillance over the restricted area during an exposure, keeping all persons from entering.
- After completing the exposure, return the source to the shielded position.

- Survey the device to determine that the source is in a shielded position.
- Lock the device.

Note: The U.S. Nuclear Regulatory Commission considers the following very important: surveys of the restricted area, continuous surveillance of the restricted area during an exposure, the survey of the device and guide tube, and locking the device.

Source Exchange

Removing the Old Source

(1) Survey the shipping container upon receipt with a survey meter. Note that the surface reading should not exceed 2 millisievert per hour (mSv/h) (200 millirem per hour (mrem/h)).

(2) Attach the end of the source guide tube to the exposure device.

(3) Connect the other end of the source guide tube to the empty side of the source changer.

(4) Unlock the empty side of the source changer.

(5) Unlock the camera and crank out the source from the camera into the source changer.

(6) Survey the source changer and guide tube to verify that the source is in the safe position.

(7) Lock the source changer.

(8) Disconnect the source guide tube and drive cable to the source pigtail. Replace the dust cap on the source changer.

(9) Remove the source identification plate from the exposure device and affix the plate to the side of the source changer loaded with the old source.

Installing the New Source

(1) Remove the dust cap on the source changer lock body identified with the new source tag.

(2) Align the camera and source guide tube with the source changer.

(3) Connect the new source to the drive cable.

(4) Connect the source guide tube to the source changer.

(5) Unlock the source changer and retract the new source into the exposure device.

(6) Survey the exposure device and guide tube to ensure that the source is in the safe position.

(7) Lock the exposure device.

(8) Disconnect the source guide tube and drive accessories.

(9) Affix the new source identification plate on the exposure device.

APPENDIX L

TRANSPORTATION

Transportation

The following are the major areas in U.S. Department of Transportation (DOT) regulations most relevant for transporting radiographic exposure devices and source changers that are shipped as Type B quantities:

A. Table of Hazardous Materials and Special Provisions—49 CFR 172.101

1. 49 CFR 172.101—Hazardous Materials Table [proper shipping name, hazard class, identification number]
2. Table 2, Appendix A to 49 CFR 172.101—List of Hazardous Substances and Reportable Quantities [for radionuclides]

B. Shipping Papers—49 CFR 172.200

1. 49 CFR 172.201—General entries [on shipping papers]
2. 49 CFR 172.202—Description of hazardous material on shipping papers
3. 49 CFR 172.203—Additional description requirements
4. 49 CFR 172.204—Shipper's certification [if applicable]

C. Package Markings—49 CFR 172.300

1. 49 CFR 172.301—General marking requirements for non-bulk packaging
2. 49 CFR 172.304—Marking requirements
3. 49 CFR 172.310—Radioactive material [Type B]
4. 49 CFR 172.324—Hazardous substances in nonbulk packaging [designation of "reportable quantities" with the letters "RQ"]

D. Package Labeling—49 CFR 172.400

1. 49 CFR 172.400(a)—General labeling requirements
2. 49 CFR 172.403—Radioactive materials [types and contents of labels]
3. 49 CFR 172.406—Placement of labels

E. Placarding of Vehicles—49 CFR 172.500

1. 49 CFR 172.504—General placarding requirements
2. 49 CFR 172.516—Visibility and display of placards
3. 49 CFR 172.556—RADIOACTIVE placard

F. Emergency Response Information—Subpart G

1. 49 CFR 172.600—Applicability and general requirements
2. 49 CFR 172.602—Emergency response information

3. 49 CFR 172.604—Emergency response telephone number

G. Training—Subpart H

1. 49 CFR 172.702—Applicability and responsibility for training and testing [for HAZMAT employees]
2. 49 CFR 172.702—Training requirements (includes types of training, when it must be conducted, need for refresher training every 3 years, recordkeeping)

H. Shippers—General Requirements for Shipments and Packaging—49 CFR Part 173

1. 49 CFR 173.25—Requirements for use and labeling of overpacks
2. 49 CFR 173.403—Definitions
3. 49 CFR 173.411—General design requirements
4. 49 CFR 173.413—Additional design requirements for Type B packages
5. 49 CFR 173.416—Authorized Type B packages [includes packaging certification requirements]
6. 49 CFR 173.441—Radiation levels
7. 49 CFR 173.471—Additional requirements for Type B packages approved by NRC
8. 49 CFR 173.476—Approval of special form radioactive materials [includes requirement for documentation of special form status]

I. Carriage by Public Highway—49 CFR Part 177

1. 49 CFR 177.817—Shipping paper [location of shipping papers during transport]
2. 49 CFR 177.842—Class 7 (radioactive) material [includes requirement for blocking and bracing during transport]

Applicants should visit the U.S. DOT Web site for additional information on transportation requirements: http://www.dot.gov/.

APPENDIX M

DAILY MAINTENANCE CHECK OF RADIOGRAPHIC EQUIPMENT

Daily Maintenance Check of Radiographic Equipment

The radiographer or radiographer's assistant shall perform a daily maintenance check of the exposure device and related radiographic equipment. This inspection will be performed before using the equipment on each day the equipment is to be used. Report defective equipment to the Radiation Safety Officer (RSO) immediately. Do **not** attempt to use defective equipment. After the inspection, document the results of the inspection.

(1) Inspect the survey meter for battery check, zero, and operation. If batteries are low, replace, then check for operability. If not able to correct a problem with the survey meter, obtain another meter and start over.

(2) Check survey meter with a check source (which should give a reading of ____ millirem) (or check with camera ____ which should give a reading of ____ millirem) as indicated on the survey meter. If reading is not acceptable, obtain another meter and start again.

Note: The RSO or calibration vendor should determine the acceptable meter reading for each survey meter and post the expected reading on each instrument. This reading shall be obtained and noted at the time of calibration.

(3) Inspect the remote-control radiographic equipment as follows:

- Inspect the cables for cuts, breaks, and broken fittings.
- Carefully inspect approximately 1 foot of the drive cable immediately next to the male connector. Take care not to introduce any dirt or dust on the drive cable during this inspection. In addition to the previously mentioned items, the examination of the cable should look for any of the following:
  - excessive or uneven wearing
  - fraying
  - unraveling
  - nicks
  - kinks or bends
  - loss of flexibility (abnormal stiffness)
  - excessive grit or dirt
  - stretching
- Inspect the crank unit for damage and loose hardware.
- Check operation of the control for freedom of drive cable movement.
- Inspect the guide tube for cuts, crimps, and broken fittings.
- Survey for radiation levels and record readings. The radiation levels should be about the same as those in the previous day's inspection, unless there has been a source change.
- Check that all safety plugs are in place.
- Inspect the exposure device for damage to fittings, lock, fasteners, and labels.
- Check for any impairment of the locking mechanism.

- If provided by the manufacturer or distributor, use the go/no-go tool to determine if the locking ball will function as intended.

(4) Record the results of the daily inspection.

APPENDIX N

SUGGESTED EXAMPLE OF A ROUTINE EMERGENCY PROCEDURE

Suggested Example of a Routine Emergency Procedure

Emergency Procedure

If the source fails to return to the shielded position or if any other emergency or unusual situation arises (e.g., vehicle accident, off-scale dosimeter), take the following actions:

- Immediately secure the area and post the restricted area at the 0.02 millisievert per hour (mSv/h) (2 millirem per hour (mrem/h)) radiation level; maintain continuous surveillance and restrict access to the restricted area.
- Notify the radiation safety officer (RSO) or management personnel.
- Take no further actions until instructions are received from the RSO.
- Do **not** attempt source retrieval until the situation has been discussed with the RSO or other knowledgeable personnel.
- Do not panic. Source retrieval can be performed with very little exposure when properly planned by trained personnel who are specifically authorized by the U.S. Nuclear Regulatory Commission (NRC) or an Agreement State to conduct source retrieval operations.
- Notify the persons listed below of the situation, in the order shown.

Name*	Work Phone Number*	Home Phone Number*

* Fill in with (and update, as needed) the names and telephone numbers of appropriate personnel (e.g., the RSO or other knowledgeable licensee staff, licensee's consultant, device manufacturer) to be contacted in case of emergency.

- Follow the directions provided by the person contacted above.

Radiation Safety Officer and Licensee Management

Discuss emergency operating procedures, and ensure no operations are conducted until the situation has been discussed with and approved by the RSO or other knowledgeable staff, consultants, or device manufacturer. Management should have access to emergency equipment to keep doses to radiographers as low as reasonably achievable. Emergency equipment may include high-range dosimeters, extra lead shielding, or remote tongs.

Notify local authorities as well as the NRC as required. (Even if notification is not required, ANY incident may be reported to the NRC by calling the agency's Emergency Operations Center at (301) 816-5100, which is staffed 24 hours a day and accepts collect calls.) NRC notification is required when sources or devices containing licensed material are lost or stolen and when

radiographic sources or equipment are involved in incidents that may have cause or threaten to cause an exposure in excess of the limits found in Title 10 of the *Code of Federal Regulations* (10 CFR) 20.2202, “Notification of incidents.” Reports to the NRC must be made within the reporting timeframes specified by the regulations. Notification and reporting requirements are found in 10 CFR 20.2201–2203, 10 CFR 21.21, 10 CFR 34.101, and 10 CFR 30.50.

APPENDIX O

INFORMATION NEEDED FOR TRANSFER OF CONTROL APPLICATION

Information Needed for Transfer of Control Application

Licensees must provide full information and obtain **prior written consent** from the U.S. Nuclear Regulatory Commission (NRC) before transferring control of the license; some licensees refer to this as "transferring the license." Provide the information listed below concerning changes of control by the applicant (transferor and/or transferee, as appropriate). If any items are not applicable, so state.

(1) The new name of the licensed organization. If there is no change, the licensee should so state.

(2) The new licensee contact and telephone number(s) to facilitate communications.

(3) Any changes in personnel having control over licensed activities (e.g., officers of a corporation) and any changes in personnel named in the license, such as radiation safety officer, authorized users, or any other persons identified in previous license applications as responsible for radiation safety or use of licensed material. The licensee should include information concerning the qualifications, training, and responsibilities of new individuals.

(4) An indication of whether the transferor will remain in nonlicensed business without the license.

(5) A complete, clear description of the transaction, including any transfer of stocks or assets, mergers, or other actions, so that legal counsel is able, when necessary, to differentiate between name changes and transfer of control.

(6) A complete description of any planned changes in organization, location, facility, equipment, or procedures (i.e., changes in operating or emergency procedures).

(7) A detailed description of any changes in the use, possession, location, or storage of the licensed materials.

(8) Any changes in organization, location, facilities, equipment, procedures, or personnel that would require a license amendment even without the transfer of control.

(9) An indication of whether all surveillance items and records (e.g., calibrations, leak tests, surveys, inventories, and accountability requirements) will be current at the time of transfer. Provide a description of the status of all surveillance requirements and records.

(10) Confirmation that all records concerning the safe and effective decommissioning of the facility, in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) 30.35(g), 10 CFR 40.36(f), 10 CFR 70.25(g), and 10 CFR 72.30(d); public dose; and waste disposal by release to sewers, incineration, radioactive material spills, and onsite burials have been transferred to the new licensee, if licensed activities will continue at the same location, or to the NRC for license terminations.

(11) A description of the status of the facility. Specifically, document the presence or absence of contamination. If contamination is present, will decontamination occur

before transfer? If not, does the successor company agree to assume full liability for the decontamination of the facility or site?

(12) A description of any decontamination plans, including financial assurance arrangements of the transferee, as specified in 10 CFR 30.35, 10 CFR 40.36, and 10 CFR 70.25 (all of these sections are entitled, "Financial Assurance and Recordkeeping for Decommissioning"). Include information about how the transferee and transferor propose to divide the transferor's assets and responsibility for any cleanup needed at the time of transfer.

(13) Confirmation that the transferee agrees to abide by all commitments and representations previously made to the NRC by the transferor. These include, but are not limited to maintaining decommissioning records required by 10 CFR 30.35(g), implementing decontamination activities and decommissioning of the site, and completing corrective actions for open inspection items and enforcement actions.

With regard to contamination of facilities and equipment, the transferee should confirm, in writing, that it accepts full liability for the site and should provide evidence of adequate resources to fund decommissioning, or the transferor should provide a commitment to decontaminate the facility before transferring control.

With regard to open inspection items, the transferee should confirm, in writing, that it accepts full responsibility for open inspection items and any resulting enforcement actions, or the transferee should propose alternative measures for meeting the requirements, or the transferor should provide a commitment to close out all such actions with the NRC before license transfer.

(14) Documentation that the transferor and transferee agree to transferring control of the licensed material and activity, documentation of the conditions of transfer, and documentation that the transferee is made aware of all open inspection items and its responsibility for possible resulting enforcement actions.

(15) A commitment by the transferee to abide by all constraints, conditions, requirements, representations, and commitments identified in the existing license. Lacking this, the transferee must provide a description of its program to ensure compliance with the license and regulations.

APPENDIX P

SAFETY CULTURE STATEMENT OF POLICY

Safety Culture

The safety culture policy statement was published in the *Federal Register* (76 FR 34773) on June 14, 2011 and can be found at: http://www.gpo.gov/fdsys/pkg/FR-2011-06-14/pdf/2011-14656.pdf. It is also posted in NRC's Agencywide Documents Access and Management System (ADAMS) Accession Number ML11146A047.

Safety Culture Policy Statement

The purpose of this Statement of Policy is to set forth the Commission's expectation that individuals and organizations establish and maintain a positive safety culture commensurate with the safety and security significance of their activities and the nature and complexity of their organizations and functions. This includes all licensees, certificate holders, permit holders, authorization holders, holders of quality assurance program approvals, vendors and suppliers of safety-related components, and applicants for a license, certificate, permit, authorization, or quality assurance program approval, subject to NRC authority. The Commission encourages the Agreement States, Agreement State licensees and other organizations interested in nuclear safety to support the development and maintenance of a positive safety culture, as articulated in this Statement of Policy.

Nuclear Safety Culture is defined as *the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment.* Individuals and organizations performing regulated activities bear the primary responsibility for safety and security. The performance of individuals and organizations can be monitored and trended and, therefore, may be used to determine compliance with requirements and commitments and may serve as an indicator of possible problem areas in an organization's safety culture. The NRC will not monitor or trend values. These will be the organization's responsibility as part of its safety culture program.

Organizations should ensure that personnel in the safety and security sectors have an appreciation for the importance of each, emphasizing the need for integration and balance to achieve both safety and security in their activities. Safety and security activities are closely intertwined. While many safety and security activities complement each other, there may be instances in which safety and security interests create competing goals. It is important that consideration of these activities be integrated so as not to diminish or adversely affect either; thus, mechanisms should be established to identify and resolve these differences. A safety culture that accomplishes this would include all nuclear safety and security issues associated with NRC regulated activities.

Experience has shown that certain personal and organizational traits are present in a positive safety culture. A trait, in this case, is a pattern of thinking, feeling, and behaving that emphasizes safety, particularly in goal conflict situations, e.g., production, schedule, and the cost of the effort versus safety. It should be noted that although the term ‘‘security’’ is not expressly included in the following traits, safety and security are the primary pillars of the NRC's regulatory mission. Consequently, consideration of both safety and security issues, commensurate with their significance, is an underlying principle of this Statement of Policy.

The following are traits of a positive safety culture:

(1) *Leadership Safety Values and Actions*—Leaders demonstrate a commitment to safety in their decisions and behaviors;

(2) *Problem Identification and Resolution*—Issues potentially impacting safety are promptly identified, fully evaluated, and promptly addressed and corrected commensurate with their significance;

(3) *Personal Accountability*—All individuals take personal responsibility for safety;

(4) *Work Processes*—The process of planning and controlling work activities is implemented so that safety is maintained;

(5) *Continuous Learning*—Opportunities to learn about ways to ensure safety are sought out and implemented;

(6) *Environment for Raising Concerns*—A safety conscious work environment is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment, or discrimination;

(7) *Effective Safety Communication*—Communications maintain a focus on safety;

(8) *Respectful Work Environment*—Trust and respect permeate the organization; and

(9) *Questioning Attitude*—Individuals avoid complacency and continuously challenge existing conditions and activities in order to identify discrepancies that might result in error or inappropriate action.

There may be traits not included in this Statement of Policy that are also important in a positive safety culture. It should be noted that these traits were not developed to be used for inspection purposes.

It is the Commission's expectation that all individuals and organizations, performing or overseeing regulated activities involving nuclear materials, should take the necessary steps to promote a positive safety culture by fostering these traits as they apply to their organizational environments. The Commission recognizes the diversity of these organizations and acknowledges that some organizations have already spent significant time and resources in the development of a positive safety culture. The Commission will take this into consideration as the regulated community addresses the Statement of Policy.

NRC FORM 335 (12-2010) NRCMD 3.7

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER
(Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)

NUREG-1556, Volume 2, Revision 1

2. TITLE AND SUBTITLE

Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Industrial Radiography Licenses (NUREG-1556, Volume 2, Revision 1) - Draft Report for Comment

3. DATE REPORT PUBLISHED

MONTH	YEAR
November	2011

4. FIN OR GRANT NUMBER

5. AUTHOR(S)

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6. TYPE OF REPORT

Technical

7. PERIOD COVERED *(Inclusive Dates)*

August 1998 to November 2011

8. PERFORMING ORGANIZATION - NAME AND ADDRESS *(If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)*

Division of Materials Safety and State Agreements
Office of Federal and State Material and Environmental Management Programs
11545 Rockville Pike
Rockville, MD 20852

9. SPONSORING ORGANIZATION - NAME AND ADDRESS *(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)*

Same as above

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

This technical report contains informaiton intended to provide program-specific guidance and assist applicants and licensees in preparing applications for materials licenses for industrial radiography. In particular, it describes the types of informaiton needed to complete U.S. Nuclear Regulatory Commission (NRC) Form 313, "Application for Materials Licenses." This document describes both the methods acceptable to the NRC license reviewers in implementing the regulations and the techniques used by the reviewers in evaluating the application to determine if the proposed activities are acceptable for licensing purposes.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

NUREG-1556
Volume 2
Radiography
Industrial Radiography
License

13. AVAILABILITY STATEMENT

unlimited

14. SECURITY CLASSIFICATION

(This Page)

unclassified

(This Report)

unclassified

15. NUMBER OF PAGES

16. PRICE

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