

# *Commonwealth of Kentucky Radiation Protection Regulatory Guide*



## **Guidance for Industrial Radiography Use**

**KYREG-IR**

**Kentucky Department for Public Health  
Radiation Health Branch  
275 East Main Street  
Mailstop HS1C-A  
Frankfort, KY 40621  
Phone: (502) 564-3700  
<http://www.chfs.ky.gov/dph/radioactive.htm>**

# EXECUTIVE SUMMARY

Kentucky Regulatory Guides (**KYREGS**) are issued to describe and make available to the applicant or licensee, acceptable methods of implementing specific parts of **Title 902, Kentucky Administrative Regulations, Chapter 100, Radiology (902 KAR 100)**, to delineate techniques used by the staff in evaluating past specific problems or postulated accidents, and to provide guidance to applicants, licensees, or registrants. KYREGS are not substitutes for **902 KAR 100**; therefore, compliance with them is not required. Methods and solutions different from those set forth in this guide will be acceptable if they provide a basis for the Kentucky Department for Public Health (KYDPH), Radiation Health Branch (KYDPH), to determine if a radiation protection program meets the current rule and protects health and safety.

Comments and suggestions for improvements in this KYREG are encouraged at all times and it will be revised, as appropriate, to accommodate comments and to reflect new information or experience. Comments should be sent to: **Kentucky Department for Public Health, Radiation Health Branch, 275 East Main Street, Mailstop HS1C-A Frankfort, KY 40621.**

Requests for single copies of this guide (which may be reproduced) can be made in writing to Kentucky Department for Public Health, Radiation Health Branch, 275 East Main Street Mailstop HS1C-A Frankfort, KY 40621. This guide is also available on our website: <http://chfs.ky.gov/dph/radioactive.htm>

This KYREG, ‘Guidance for Industrial Radiography Use’, has been developed to streamline the application process for an Industrial Radiography license. A copy of the KYDPH Form RPS-7, ‘Application for a Radioactive Material License’ is located in **Appendix A** of this guide.

**Appendix C through P** provide examples, models and additional information that can be used when completing the application.

It typically takes 60-90 days for a license to be processed and issued if the application is complete. When submitting the application be sure to include the appropriate application fee listed in **902 KAR 100:012. Fee schedule** (<http://www.lrc.state.ky.us/kar/902/100/012.htm> ).

In summary, the applicant will need to perform the following to submit an application for an Industrial Radiography license:

- Use this regulatory guide to prepare the KYDPH Form RPS-7, ‘Application for a Radioactive Material License’ (**Appendix A**).
- Complete the KYDPH Form RPS-7, ‘Application for a Radioactive Material License’ (**Appendix A**). See ‘Contents of Application’ of the guide for additional information.
- Include any additional attachments.

All supplemental pages should be on 8 ½” x 11” paper.

Please identify all attachments with the applicant’s name and license number (if a renewal).

- Avoid submitting proprietary information unless it is absolutely necessary.
- Submit an original signed application along with attachments (if any).
- Submit the application fee (for new licenses only).
- Retain one copy of the licensee application and attachments (if any) for your future reference. You will need this information because the license will require that radioactive material be possessed and used in accordance with statements, representation, and procedures provided in the application and supporting documentation.

If you have any questions about the application process, please contact this office at (502) 564-3700 Monday through Friday, 8:00 AM to 4:30 PM.

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# ABBREVIATIONS

ALARA	as low as reasonably is achievable
ANSI	American National Standards Institute
ALI	annual limit on intake
Bq	Becquerel
CFR	Code of Federal Regulations
Ci	Curie
cm	centimeter
cm <sup>2</sup>	centimeter squared
cpm	counts per minute
COC	Certificate of Compliance
DOE	United States Department of Energy
DOT	United States Department of Transportation
dpm	disintegrations per minute
DU	Depleted uranium
hr	Hour
GM	Geiger-Mueller
IN	Information Notice
mCi	millicurie
mR	milliroentgen
mrem	Millirem
mSv	Millisievert
NARM	Naturally-occurring and Accelerator-produced Radioactive Material
NIST	National Institute of Standards and Technology
NMSS	Office of Nuclear Materials Safety and Safeguards
NRC	United States Nuclear Regulatory Commission
NVLAP	National Voluntary Laboratory Accreditation Program
OSLD	optically stimulated luminescence dosimeter
RG	Regulatory Guide
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
SSDR	Sealed Source and Device Registry
Sv	Sievert
TEDE	Total effective dose equivalent
TI	Transportation Index
TLD	Thermoluminescent dosimeters
KYDPH	Kentucky Department of Public Health
μCi	microcurie
%	percent



# PURPOSE OF GUIDE

This document provides guidance to an applicant in preparing a license application for Industrial Radiography. It also provides guidance on KYDPH's criteria for evaluating an Industrial Radiography license application. It is not intended to 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. The term 'radiography' as used in this guide means an examination of the structure of materials by nondestructive methods, using ionizing radiation to make radiographic images generally using gamma-emitting radioactive materials (radioisotopes). The radioisotopes most commonly used for radiography are Iridium-192 and Cobalt-60; however, other radioisotopes (e.g. Selenium-75 & Californium-252) with unique radiological characteristics may also be used.

This guide identifies the information needed to complete KYDPH Form RPS-7, 'Application for a Radioactive Material License' (**Appendix A**).

The format for each item number in this guide is as follows:

- **Rule** - references the requirements from **902 KAR 100. Radiology** 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; and
- **Response from Applicant** - shows the appropriate item on the application and provides: response(s), offers the option of an alternative response, or indicates that no response is needed on that topic.

The information submitted in the application must be sufficient to demonstrate that proposed equipment, facilities, personnel, and procedures are adequate to protect the health and safety of the citizens of the Commonwealth of Kentucky in accordance with agency guidelines. Submission of incomplete or inadequate information will result in delays in the approval process for the license. Additional information will be requested by KYDPH when necessary to ensure that an adequate radiation safety program has been established. Such requests for additional information will delay completion of the application's review and may be avoided by a thorough study of the rule and these instructions prior to submitting the application. As stated in 902 KAR 100:040, Section 3. Filing of Application for a Specific License., if the applicant fails to respond within thirty (30) days of receipt to a written request for additional information, KYDPH can deny the application or in the event the license has been issued, suspend, modify, or revoke the license in accordance with 902 KAR 100:170. Proceedings. (<http://www.lrc.state.ky.us/kar/902/100/170.htm> )

**902 KAR 100. Radiology** requires the applicant and/or licensee to develop, document, and implement procedures that will ensure compliance with the rule. The appendices describe radiation protection procedures. Each applicant should read the rule and procedures carefully and then decide if the procedure addresses specific radiation protection program needs at the applicant's facility. Applicants may adopt a procedure included in this KYREG or they may develop their own procedures to comply with the applicable rule.

In this guide, "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).

These terms are defined in **902 KAR 100:010. Definitions for 902 KAR Chapter 100.**

(<http://www.lrc.state.ky.us/kar/902/100/010.htm>). Rem and Sievert (Sv), its SI equivalent (1 rem = 0.01 Sv), are used to describe units of radiation exposure or dose. These units are used because **902 KAR 100:019.**

**Standards for protection against radiation.** (<http://www.lrc.state.ky.us/kar/902/100/019.htm>), sets dose limits in terms of rem, not rad or roentgen. Furthermore, radioactive materials commonly used in medicine emit beta and photon radiation, for which the quality factor is 1; a useful rule of thumb is an exposure of 1 roentgen is equivalent to an absorbed dose of 1 rad and dose equivalent of 1 rem.

The KYREG provides the latest guidance and is modeled on the Nuclear Regulatory Commission's (NRC) Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Industrial Radiography Licenses (NUREG-1556, Volume 2) (<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v2/>). The KYREG shows the requirements in terms of the **902 KAR 100** and provides a user-friendly format to assist with the preparation of an Industrial Radiography license application.

# LICENSES

Applicants should study this document, related guidance, and all applicable regulations carefully before completing the KYDPH Form RPS-7 'Application for a Radioactive Material License'. KYDPH expects licensees to provide requested information on specific aspects of their proposed radiation protection program in attachments to the application. When necessary, KYDPH may ask the applicant for additional information to gain reasonable assurance that an adequate radiation protection program has been established.

After a license is issued, the licensee must conduct its program in accordance with the following:

- Statements, representations, and procedures contained in the application and in correspondence with KYDPH;
- Terms and conditions of the license; and
- **902 KAR 100. Radiology.**

# THE ‘AS LOW AS IS REASONABLY ACHIEVABLE (ALARA)’ CONCEPT

**902 KAR 100:019. Standards for protection against radiation.** Section 2. Radiation Protection Programs, states that “*each licensee shall develop, document, and implement a radiation protection program commensurate with the scope and extent of licensed activities*” and “*the licensee shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are...ALARA.*” This section also requires that licensees review the content of the radiation protection program and its implementation annually.

(<http://www.lrc.state.ky.us/kar/902/100/019.htm> )

Information directly related to radiation protection standards in **902 KAR 100:019. Standards for protection against radiation.**, is contained in:

- NRC’s Consolidated Guidance: 10 CFR Part 20 — Standards for Protection Against Radiation (NUREG-1736) (<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1736/> )’

Applicants should consider the ALARA philosophy detailed in these reports when developing plans to work with licensed radioactive materials.

# WHO REGULATES FACILITIES IN THE COMMONWEALTH OF KENTUCKY?

In the special situation of work at federally controlled sites in the Commonwealth of Kentucky, it is necessary to know the jurisdictional status of the land to determine whether the Nuclear Regulatory Commission (NRC) or KYDPH has regulatory authority. The NRC has regulatory authority over land determined to be under “exclusive federal jurisdiction”, while KYDPH has jurisdiction over non-exclusive federal jurisdiction land (see **Table 1**). Applicants and licensees are responsible for finding out, in advance, the jurisdictional status of the specific areas where they plan to conduct licensed operations. KYDPH recommends that applicants and licensees ask their local contacts for the federal agency controlling the site (e.g., contract officer, environmental health officer, district office staff) to help determine the jurisdictional status of the land and to provide the information in writing, so that licensees can comply with KYDPH or NRC regulatory requirements, as appropriate. The following table lists examples of regulatory authority.

**Table 1: Who Regulates the Activity?**

Applicant and Proposed Location of Work	Regulatory Agency
Federal agency regardless of location (except that Department of Energy [DOE] and, under most circumstances, its prime contractors are exempt from licensing [ <b>10 CFR 30.12</b> ])	NRC
Non-federal entity in non-Agreement State, U.S. territory, or possession	NRC
Non-federal entity in Kentucky at non-federally controlled site	KYDPH
Non-federal entity in Kentucky at federally-controlled site <i>not</i> subject to exclusive Federal jurisdiction	KYDPH
Non-federal entity in Kentucky at federally-controlled site subject to exclusive federal jurisdiction	NRC

A current list of Agreement States (states that have entered into agreements with the NRC that give them the authority to license and inspect radioactive material used or possessed within their borders), including names, addresses, and telephone numbers of responsible officials are maintained by NRC Office of Federal and State Materials and Environmental Management Programs and is available on their web site <http://nrc-stp.ornl.gov/>.

# MANAGEMENT RESPONSIBILITY

KYDPH endorses the philosophy that effective radiation protection program management is vital to safe operations that comply with KYDPH regulatory requirements.

"Management" refers to the chief executive officer or other individual having the authority to manage, direct, or administer the licensee's activities or that person's delegate or delegates.

To ensure adequate management involvement, a management representative (i.e., chief executive officer or delegate) must sign the submitted application acknowledging management's commitments to and responsibility for the following:

- Radiation protection, security, and control of radioactive materials, and compliance with rule;
- Knowledge about the contents of the license application;
- Compliance with current KYDPH and United States Department of Transportation (US DOT) regulations and the licensee's operating and emergency procedures;
- Provision of 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;
- Appointment of a qualified individual who has agreed in writing to work as the RSO;
- Confirming that the RSO has independent authority to stop unsafe operations and will be given sufficient time to fulfill his/her radiation safety duties and responsibilities;
- Ensuring worker audits are conducted at 6-month intervals (may be performed by the RSO);
- Ensuring workers have had adequate training;
- Reporting equipment failures as required under **902 KAR 100**; and
- Ensuring current, up-to-date KYDPH and US DOT rules and regulations are available to all employees.

Management may delegate individuals (i.e., an RSO or other designated individual) to submit amendment requests to KYDPH or make license commitments on their behalf. A Signature Authorization letter must be completed, signed by management and submitted to KYDPH. A sample Signature Authorization letter has been included in **Appendix D**.

# APPLICABLE RULE

It is the applicant's or licensee's responsibility to obtain read and follow **902 KAR 100. Radiology**.

The following Parts of **902 KAR 100. Radiology** contain requirements applicable to Industrial Radiography licensees:

- **902 KAR 100:015. General requirements.** (<http://www.lrc.state.ky.us/kar/902/100/015.htm>)
- **902 KAR 100:040. General provisions for specific licenses.**  
(<http://www.lrc.state.ky.us/kar/902/100/040.htm>)
- **902 KAR 100:070. Transportation of radioactive material.**  
(<http://www.lrc.state.ky.us/kar/902/100/070.htm>)
- **902 KAR 100:100. Industrial radiography.** (<http://www.lrc.state.ky.us/kar/902/100/100.htm>)
- **902 KAR 100:165. Notices, reports, and instructions to employees.**  
(<http://www.lrc.state.ky.us/kar/902/100/165.htm>)

Requests for single copies of the above documents (which may be reproduced) can be made in writing to: Kentucky Department for Public Health, Radiation Health Branch, 275 East Main Street, Mailstop HS1C-A Frankfort, KY 40621 or for an electronic copy go to our web site at: <http://chfs.ky.gov/dph/radioactive.htm>.

# HOW TO FILE

Applicants for a materials license should do the following:

- Be sure to use the current guidance from KYDPH in preparing an application. (see “Forms and Guides section at <http://www.chfs.ky.gov/dph/radioactive.htm> )
- Complete KYDPH Form RPS-7, ‘Application for a Radioactive Material License’ (**Appendix A**).
- For each separate sheet, other than submitted with the application, identify and key it to the item number on the application, or the topic to which it refers.
- Submit all documents, on 8-1/2 x 11 inch paper.
- Avoid submitting proprietary information unless it is absolutely necessary.
- Submit an original, signed application.
- Retain one copy of the license application for your future reference.

Deviations from the suggested wording of responses as shown in this KYREG or submission of alternative procedures will require a more detailed review.
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**Note:** Personal employee information (i.e.; home address, home telephone number, Social Security Number, date of birth and radiation dose information) should NOT be submitted unless specifically requested by KYDPH.



# WHERE TO FILE

Applicants wishing to possess or use radioactive material in the Commonwealth of Kentucky are subject to the requirements of **902 KAR 100. Radiology** and must file a license application with:

**Kentucky Department for Public Health**

**Radiation Health Branch**

**275 East Main Street**

**Mailstop HS1C-A**

**Frankfort, KY 40621**

# LICENSE FEES

The appropriate fee must accompany each application or license amendment request. Refer to **902 KAR 100:012. Fee schedule.** (<http://www.lrc.state.ky.us/kar/902/100/012.htm>) to determine the amount of the fee. KYDPH will not issue the new license prior to fee receipt. Once the technical review has begun, no fees will be refunded. Application fees will be charged regardless of KYDPH's disposition of an application or the withdrawal of an application.

Licensees are also subject to annual fees; refer to **902 KAR 100:012. Fee schedule.** (<http://www.lrc.state.ky.us/kar/902/100/012.htm>)

Direct all questions about KYDPH's fees to:

**Kentucky Department for Public Health**

**Radiation Health Branch**

**275 East Main Street**

**Mailstop HS1C-A**

**Frankfort, KY 40621**

**Telephone: (502) 564-3700 8:00 AM – 4:30 PM Monday - Friday**

# CONTENTS OF APPLICATION

## Type of Application

On the application check the box for a new license or list the license number for renewal, amendment, or amendment in entirety as appropriate.

### Response from Applicant:

New License <sup>(1)</sup> Check. _____	Amendment in Entirety <sup>(1)</sup> of License No. _____	Amendment to <sup>(2, 3)</sup> License No. _____	Renewal of <sup>(2, 3)</sup> License No. _____
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## Item 1: Name and Mailing Address of Applicant

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 KYDPH of changes in the mailing address.

### Response from Applicant:

<b>1. Applicant's Name and Mailing Address</b>
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**Note:** KYDPH must be notified in advance in the event of change of ownership or control and bankruptcy proceedings, see below for more details.

## Timely Notification of Change of Ownership or Control

### Rule: 902 KAR 100:040 Section 11

**Criteria:** Licensees must provide full information and obtain KYDPH's written consent prior to transferring control of the license, or, as some licensees call it, 'transferring the license'.

**Discussion:** Changes in ownership may be the results of mergers, contractual agreements, buyouts, or majority stock transfers. Although it is not KYDPH's intent to interfere with the business decisions of licensees, it is necessary for licensees to obtain prior KYDPH's written consent. This is to ensure the following:

- Radioactive materials are possessed, used, or controlled only by persons who have valid license issued by KYDPH, the NRC, or another Agreement state;
- 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 final disposal of radiography devices; and
- Public health and safety are not compromised by the use of such materials.

**Note:** Appendix E identifies the information to be provided about transfer of control.

## Notification of Bankruptcy Proceedings

### Rule: 902 KAR 100:040 Section 4

**Criteria:** Immediately following filing of voluntary or involuntary petition for bankruptcy for or against a licensee, the licensee must notify KYDPH in writing, identify 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 compliance with all regulatory requirements. KYDPH needs to 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). KYDPH shares the results of its determinations with other entities involved (e.g., trustees) so that health and safety issues can be resolved before bankruptcy actions are completed.

Licensees must notify KYDPH immediately of the filing of a bankruptcy petition.

## Item 2: Location of Radioactive Material

### Rule: 902 KAR 100:040, 902 KAR 100:100

**Criteria:** Applicants must provide a specific address for each location where radioactive material will be used, stored, or dispatched.

**Discussion:** Specify the street address, or other descriptive address (such as on Highway 17, 5 miles east of the intersection of Highway 17 and State Route 234), city and zip code for each permanent storage or use facility and field station. A field station is a location where licensed material may be stored or used, and from which the applicant will dispatch equipment to jobsites. In Kentucky, all field stations must apply for and be granted a separate specific license. No two field stations can operate under the same specific license unlike in the NRC and many Agreement States. **A Post Office Box address is not acceptable because KYDPH needs a specific address to allow an inspector to find the use and/or storage location.** If devices will NOT be stored at a dispatch site or field station, indicate this. The applicant should indicate whether a location will be used to perform radiographic operations, storage of sources and devices or used and stored. The applicant should indicate if a permanent cell is located at the address. The applicant should also specify that industrial radiography will be performed at temporary jobsites within the Commonwealth of Kentucky if applicable.

Obtaining a KYDPH license does not relieve a licensee from complying with other applicable federal, state or local regulations (e.g., local zoning requirements for storage locations).

**Response from Applicant:**

**2. Street address(es) where radioactive material will be Used or Stored (no P.O. Boxes)**

**Note:** If radiography operations are expected to exceed 180 days at a temporary jobsite, then provide written notification to KYDPH prior to exceeding the 180 days (a license amendment is not required).

**Item 3: Telephone Number**

**Criteria:** List the telephone number at which the applicant can be contacted during normal working hours, Monday through Friday, 8:00 AM to 4:30 PM. This telephone number will be listed on the license document. Only one telephone number can be listed on the license.

**Discussion:** Notify KYDPH if the telephone number changes. This notice is ‘for information only’ and the change will be processed as a Technical Amendment and it does not require a license amendment fee.

**Response from Applicant:**

**3. Telephone Number**

**Item 4: Person To Contact Regarding Application**

**Criteria:** Identify the individual who can answer questions regarding the application. This is typically the proposed RSO or knowledgeable management official. This individual’s name will be listed on the license document. KYDPH will contact this individual if there are any questions about this application.

**Discussion:** Notify KYDPH if the contact person changes. This notice is ‘for information only’ and does not require a license amendment fee. Contact information changes will be processed as Technical Amendments at no cost to the facility.

**Response from Applicant:**

**4. Person to be contacted and listed as contact person**

## Item 5 & 13: Training for Radiographers and Radiographer's Assistants

**Rule: 902 KAR 100:010; 902 KAR 100:040; 902 KAR 100:100**

**Criteria:** Radiographers and radiographer's assistants must have adequate training and experience as outlined in **902 KAR 100:100** (<http://www.lrc.state.ky.us/kar/902/100/100.htm>)

### **Discussion:**

- A radiographer is a person who performs or personally supervises industrial radiography and is responsible for ensuring compliance with KYDPH rules and the safe use of radioactive materials.
- A certified radiographer is an individual who has been certified by a certifying entity such that he/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 in performing industrial radiographic operations.

**902 KAR 100:100** describes specific training requirements for radiographers and radiographer's assistants and requires that all radiographers be certified. It also addresses annual refresher training and semiannual field audits of radiographers and radiographer's assistants.

Refer to **Appendix G** as an aid to determining the specific training requirements for radiographers and radiographer's assistants. The applicant must submit a description of their training program for radiographers and radiographer's assistants.

Because **902 KAR 100:100** contains different training requirements for radiographers and radiographer's assistants, include specific 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 similar to that given to prospective radiographer's assistants. This instruction must include training in your operating and emergency procedures, in the use of your 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 one (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 KYDPH's rules, 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 six (6) months. If a radiographer or radiographer's assistant has not participated in an industrial radiographic operation for more than six (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 one (1) year actual experience as a radiographer.

The applicant shall:

- Submit an outline of the training to be given to prospective radiographer's assistants. Submit your procedures for experienced radiographers who have worked for another licensee.
- 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 radiographer's assistants. KYDPH suggests using the checklist in **Appendix H** 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.
- Submit your procedures for verifying and documenting the certification status for verifying that their certification remains valid. As a minimum your procedures for newly hired, previously certified individuals should require documentation of your contacting the certifying entity and confirming the certification. Your procedures should also ensure you are aware of certification expiration dates and that individuals with expired certifications do not act a radiographers.
- Submit a description of your program for inspecting the job performance of each radiographer and radiographers' assistant at intervals not to exceed six (6) months as described in **902 KAR 100:100 Section 14**. (<http://www.lrc.state.ky.us/kar/902/100/100.htm>)

**Response from Applicant:**

**5. Individual(s) and Title(s) who will use or directly supervise use of radioactive material**

RADIOACTIVE MATERIALS SHALL ONLY BE USED BY INDIVIDUALS WHO HAVE MET AND MAINTAINED COMPLIANCE WITH THE TRAINING CRITERIA ESTABLISHED IN 902 KAR 100:100 AND HAVE BEEN APPROVED, IN WRITING, BY THE RADIATION SAFETY OFFICER. THE LICENSEE SHALL MAINTAIN RECORDS OF THE TRAINING RECEIVED BY THE RADIOGRAPHERS AND RADIOGRAPHERS' ASSISTANTS FOR INSPECTION BY THE CABINET FIVE (5) YEARS FOLLOWING THE LAST USE OF RADIOACTIVE MATERIAL BY THE INDIVIDUALS

**13. Training and Experience of Users.** Submit the formal training of each individual named in Item 5 and 6 indicating the name of persons or institutions providing the training, duration of training, and when training received in the areas of:

- A) Principles and practices of radiation protection.
- B) Radioactivity measurement standardization and monitoring techniques and instruments.
- C) Mathematics and calculations basic to the use and measurement of radioactivity.
- D) Biological effects of radiation.

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

## Item 6: Radiation Safety Officer (RSO)

**Rule: 902 KAR 100:040; 902 KAR 100:100**

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

**Discussion:** The person responsible for the radiation protection program is called the RSO. KYDPH believes the RSO is the key to overseeing and ensuring safe operation of the licensee's radiography program on a daily basis. 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 radioactive materials are used in a safe manner. Typical RSO duties are illustrated in **Table 2**.

The RSO may delegate certain day-to-day tasks of the radiation protection program to other responsible individuals (potential designees). For example, a large multi-state nondestructive testing company with multiple Agreement State and NRC licenses may appoint an individual designated as 'local KY RSOs' who assists the Corporate RSO located in another state. The local KY RSO can be responsible for overseeing the day-to-day activities at the KY field station or KY office. If that is the case, the local KY RSO overseeing the actual day-to-day operation of the facility will be the person whose name will be listed on the KY specific license as the RSO and not the Corporate RSO. However, the CRSO may be listed as the contact for the license. Licensees may also appoint other individuals who may 'step-in' as an emergency contact when the local KY RSO is unavailable. The potential designees do not need to meet the required RSO qualifications. However, these individuals should be qualified, experienced radiographers who are adequately knowledgeable of the activities to which they are assigned. Applicants do not have to identify other responsible individuals if day-to-day tasks, etc. will not be delegated.

KYDPH requires the name of the RSO on the license to ensure that licensee management has identified a responsible, qualified person and that the named individual knows their designation as RSO. Provide KYDPH with a copy of an organizational chart showing the RSO and other designated responsible individuals starting at the top with senior management, to demonstrate they have sufficient independence and direct communication with responsible management officials. Also show in the organizational chart the position of the senior management official who signs **Item 15** of the 'Application for a Radioactive Material License' (**Appendix A**).

To be considered eligible for the RSO position, an individual must be a qualified radiographer, have a minimum of 2,000 hours (one-year) of full-time, hands-on field 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 running 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. Hands-on experience means experience in all areas considered to be directly involved in the radiography process. This includes taking radiographs, surveying devices, transporting the radiography equipment to temporary jobsites, posting work sites, radiation area surveillance, and completing and maintaining records. Excessive time spent in only one or two of these operations (film development and/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.

KYDPH will consider individuals with alternative training and experience as RSOs. For example, a person certified in health physics by the American Academy of Health Physics (<http://www.hps1.org/aahp/>) with previous experience in managing a radiation safety program of comparable size and scope could be considered on 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.



**Table 2: Radiation Safety Officer Duties and Authorities**

<b>Radiation Safety Officer Duties and Authorities</b>
1. Establish and oversee all operating, emergency, and ALARA procedures and review them regularly.
2. Oversee and approve the training program for radiographic personnel.
3. Ensure required radiation surveys and leak test are performed and documented including any corrective measures taken.
4. Ensure personnel monitoring devices are calibrated and used properly, and that records are kept of results and timely notifications are made.
5. Operations are conducted safely and corrective actions are implemented, when necessary, including terminating operations.
<b>Above all, the RSO is the key to maintaining the radiation safety of the operations to the workers, the public, and the environment.</b>

**Response from Applicant:**

<b>6. Radiation Safety Officer (one person)</b>	Training and experience required for each user named in Item 5 and for the Radiation Safety Officer in Item 6. For the RSO, duties and responsibilities of the RSO and updated organizational chart are required and if necessary, a signature authorization form.
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The applicant shall also provide the following:

- Document that may be incorporated into the radiation safety program which outlines the Duties and Responsibilities of the RSO as they are stated in 902 KAR 100:100 Section 13(3)(a) through (d).
- A Delegation of Authority letter that is compatible with the sample letter provided in **Appendix C**.
- A Signature Authorization letter that is compatible with the sample letter provided in **Appendix D**.

**Note:** A Signature Authorization letter is not required for the RSO. However, if senior management does not grant the RSO Signature Authorization for the license, then a member of senior management must sign all correspondence with KYDPH including all amendment requests and all license commitments.

**Note:** It is important to notify KYDPH and obtain a license amendment prior to making changes in the designation of the RSO responsible for the radiation safety program. If the RSO leaves the organization before an amendment is approved by KYDPH, senior management is responsible for appointing a potential designee who meets the RSO qualification requirements and who is, in turn, responsible for ensuring that the licensee's radiation safety program is implemented in accordance with the license and KYDPH rule. If the designated RSO's employment with the company unexpectedly terminated for any reason, KYDPH must be notified immediately.

## Radioactive Material

### Item 7: Sealed Source Radioactive Material

**Rule: 902 KAR 100:040; 902 KAR 100:058; 902 KAR 100:100**

**Criteria:** Applicants must provide the manufacturer's (or distributor's) name and model number for each requested source assembly (sealed source), exposure device, and source changer. Licensees will only be authorized for radiographic exposure devices, source assemblies or sealed sources containing radioactive material and associated equipment meeting KYDPH performance requirements and specifically approved or registered by the NRC or another Agreement State. Also, 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 another Agreement State performs a safety evaluation of radiography source assemblies (sealed sources) exposure devices and source changers prior to distribution of these sources/devices to specific licensees. The safety evaluation is documented in a Sealed Source and Device Registration (SSDR) Certificate issued to the manufacturer (or distributor). Therefore, if the source assemblies, exposure devices, or source changers are approved for use by the NRC or another Agreement State, the applicant need only note the manufacturer's (or distributor's) name and model number of the sources/devices in its license application to demonstrate that the requirements are met.

SSDR Certificates contain sections on "*Conditions of Normal Use*" and "*Limitation and Other Considerations of Use*". These sections may include limitations derived from conditions imposed by the manufacturer or distributor, by particular conditions of use that would reduce radiation safety of the device, or by circumstances unique to the sealed source or device. For example, working life of the device or appropriate temperature and other environmental conditions are specified. Except as specifically approved by KYDPH, licensees are required to use exposure devices according to their respective SSDR Certificates. Applicants should obtain a copy of the certificate and review it with the manufacturer, distributor or with KYDPH, to ensure that they understand and comply with the requirements of the SSDR.

**Note:** If necessary and manufacturer cannot supply the certificate, SSDR certificates are also available by calling KYDPH at (502) 564-3700. Unfortunately, the NRC restricts access to their Sealed Source and Device Registry website (<http://nrc-stp.ornl.gov/ssdr.html>) strictly to NRC and Agreement State staff.

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 **902 KAR 100:100** that are equivalent to **10 CFR 34.20**. NRC Regulatory Issue Summary (RIS) 2005-10, 'Performance-Based Approach For Associated Equipment in 10 CFR 34.20' (**Appendix F**) alerts licensees to distinguish between 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 another Agreement State before the source assembly may be specifically authorized for use by a licensee. NRC RIS 2005-10 also contains a number of ways that licensees can demonstrate that their associated equipment meets the performance requirements stated in **902 KAR 100:100**.

**Response from Applicant:**

**7. Licensed Material**

Element & Mass Number <b>A</b>	Chemical and/or Physical Form <b>B</b>	Manufacturer Name & Model Number (if sealed source) <b>C</b>	Maximum activity (millicuries) per sealed source <u>OR</u> maximum activity possessed at any one time <b>D</b>	Maximum number of sealed source/device combinations possessed at any one time <b>E</b>

**Describe use of radioactive material (Should be keyed to material in Subitem A above. For specific make & model of sealed source/device combinations in Subitem E above, state maximum number possessed at any one time)**

- The applicant shall identify by manufacturer's name and model number the type of sealed source(s) to be possessed and used as well as the maximum number of those sources possessed at any one time.
- The applicant shall identify by manufacturer's name and model number the type of exposure device(s) to be possessed and used.
- The applicant shall list depleted uranium if it is to be used as shielding in the exposure device and/or collimator. The maximum amount of depleted uranium to be possessed at any one time shall be specified by mass (e.g. 999 kg DU).
- The applicant shall identify by manufacturer's name and model number the type of source changer(s) to be possessed and used.

**Note:** The following tables list several devices with associated radionuclides and amounts:

**Table 3: Industrial Nuclear Model Ir-100 Exposure Device Maximum Authorization -- 120 Ci**

<b>Element</b>	<b>Sealed Source</b>	<b>Curies</b>	<b>Source Changer Meeting 10 CFR 34 Requirements</b>	<b>Maximum Curies Authorized</b>
Ir-192	IN Model 32	120 Ci	Amersham 550-SU IN IR-50	120 Ci 120 Ci
Ir-192	IN Model 33	120 Ci	Amersham 550 -SU IN IR-50	120 Ci 120 Ci
Ir-192	Amersham 87703	120 Ci	Amersham 550 -SU Amersham 650L Amersham 820 Amersham 855 IN IR-50	120 Ci 240 Ci 1,000 Ci 960 Ci 120 Ci
Ir-192	Amersham 87704	120 Ci	Amersham 550 -SU Amersham 650 Amersham 820 Amersham 855	120 Ci 240 Ci 1,000 Ci 960 Ci
Ir-192	SPEC G-40F	120 Ci	Amersham 550 -SU SPEC C-1 IN IR-50	120 Ci 150 Ci 120 Ci
Ir-192	SPEC G-40T	120 Ci	Amersham 550 -SU SPEC C-1 IN IR-50	120 Ci 150 Ci 120 Ci

**Table 4: Spec Model 150 Exposure Device Maximum Authorization -- 150 Ci**

<b>Element</b>	<b>Sealed Source</b>	<b>Curies</b>	<b>Source Changer</b>	<b>Curie Authorization</b>
Ir-192	SPEC G-60	240 Ci	SPEC C-1	150 Ci

**Table 5: Amersham Model 680 System Exposure Device Maximum Authorization -- 110 Ci**

<b>Element</b>	<b>Sealed Source</b>	<b>Curies</b>	<b>Source Changer</b>	<b>Curie Authorization</b>
Co-60	Amersham A424- 14	110 Ci	Amersham 770 Amersham 771	550 Ci 110 Ci
Co-60	Amersham 943	110 Ci	Amersham 770 Amersham 771	550 Ci 110 Ci

## Items 8 & 9: Radiation Detection Instruments

**Rule: 902 KAR 100:019, 902 KAR 100:040 902 KAR 100:100**

**Criteria:** A radiation survey meter intended for industrial radiography that utilizes sealed radioisotope 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 six (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 three (3) months or before the first use thereafter to ensure proper functioning of components.

**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 instrument shall 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 six (6) months and after instrument servicing, except for battery changes. Records of survey instrument calibrations will be retained for a minimum of three (3) years. Records are to be made of equipment problems and maintenance performed and these shall be retained for three (3) years. At least one calibrated, fully functional survey meter shall be available for each and every exposure device in use at a temporary job site. However, a backup second survey meter is recommended should the primary survey meter malfunction.

### Response from Applicant:

8. Radiation Detection Instruments			
<u>Model</u>	<u>Number Available</u>	<u>Radiation Detected (alpha, beta, gamma, neutron)</u>	<u>Sensitivity Range</u>
9. a) <b>Calibrated by Service Company</b> (Name, Address, and Frequency)		b) <b>Calibrated by Applicant</b> (Attach procedures describing method and standards used and training provided to individuals performing calibration)	

**Note:** For detailed information about survey instrument calibration, refer to ANSI N323-1978, 'Radiation Protection Instrumentation Test and Calibration'. Reaffirmed 1993 copies may be obtained from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

## Item 10: Occupational Dosimetry

**Rule: 902 KAR 100:019, 902 KAR 100:040, 902 KAR 100:100**

**Criteria:** Licensees must provide to employees dosimetry processing that has been accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) operated by the National Institute of Standards and Technology (NIST). A complete listing of NVLAP accredited ionizing radiation dosimetry laboratories can be found at <http://ts.nist.gov/standards/scopes/dosim.htm>.

**Table 7: Occupational Dose Limits For Adults**

<b>Occupational Dose Limits for Adults (12VAC5-481-640)</b>	
<u>Body Location</u>	<u>Dose (Annual)</u>
Total Effective Dose Equivalent (TEDE)	0.05 Sv (5 Rem)
Dose to the skin of the whole body or any extremity*	0.5 Sv (50 Rem)
Dose to lens of the eyes	0.15 Sv (15 Rem)
<i>*Extremities includes the arms below the elbows and the legs below the knees</i>	

**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 between the neck and the waist, a combination of a direct-reading dosimeter (ion chamber pocket dosimeter or electronic personal dosimeter), an operating alarming ratemeter, and either a film badge, thermoluminescent dosimeter (TLD) or optical stimulated luminescent dosimeter (OSLD), or similar approved device. At permanent radiography installations where other appropriate alarming or warning devices are in routine use, wearing an alarming ratemeter is not required. The direct-reading pocket dosimeters must have a range from zero to 2 mSv (200 mrem), must be recharged and re-zeroed at the start of each shift, and must be checked for correct response to radiation at intervals not to exceed twelve (12) months. Electronic personal dosimeters may only be used in place of ion-chamber pocket dosimeters and not in place of alarming rate meters. Alarming ratemeters must be preset to give an alarm signal at a dose rate of 5 Sv/hr (500 mrem/hr) and must be calibrated for correct response at intervals not to exceed twelve (12) months.

A film badge shall be replaced each month and other personal dosimeters processed and evaluated by an accredited NVLAP processor shall be replaced at intervals not to exceed three (3) months. However, KYDPH recommends that all personal dosimeters regardless of type, be replaced at one (1) month intervals for all active radiographers and assistants.

## Response from Applicant:

10. Personal Monitoring Devices		
Type	Supplier	Exchange Frequency
<input type="checkbox"/> (1) Film Badge <input type="checkbox"/> (2) TLD <input type="checkbox"/> (3) OSLD <input type="checkbox"/> (4) Other (specify)		<input type="checkbox"/> Monthly <input type="checkbox"/> Bi-monthly <input type="checkbox"/> Quarterly <input type="checkbox"/> Other (specify)

**Note:** To obtain a copy of the NIST Publication 810, ‘National Voluntary Laboratory Accreditation Program, 1997 Directory’, contact the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9225. (For information on the program call NIST at 301-975-3679). Also NVLAP maintains a directory of accredited laboratories on the Internet which is updated quarterly. The URL for NVLAP’s home page on the internet is <http://ts.nist.gov/standards/scopes/dosim.htm>.

## Item 11: Facilities

### Rule: 902 KAR 100:040, 902 KAR 100:100

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

**Discussion:** A permanent radiographic installation is an enclosed shielded room, cell, or vault, not located at a temporary jobsite, 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 installation, 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 KYDPH. If licensees need to perform radiography at their place of business outside of a permanent radiographic installation due to unique circumstances (the item to be radiographed is too large for the facility), then KYDPH must authorize this method of use. In this case, two individuals, at least one of who must be a radiographer, must be present whenever radiographic operations occur outside of a permanent radiographic 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. In order to ensure this control, a permanent radiographic installation 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 a permanent radiographic installation should qualify as an unrestricted area (i.e., not to exceed 2 mR in one-hour), the rule does not specify radiation limits in order to allow for design flexibility for moving equipment into and out of the permanent radiographic installation, or other considerations. If the roof of the installation does not qualify as an unrestricted area, or if no roof exists, mechanical access restrictions (fence, etc.) must be utilized and additional administrative controls must be imposed to ensure that unwanted access can be gained only through extraordinary effort. All entrances into the installation must be interlocked with required control devices as per **902 KAR 100:100**. Unless all entrances are locked, at least one radiographer must be present at the facility whenever radiography is being performed.

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. In KY, all field stations are required to have a separate specific license authorizing the storage and use of radioactive materials.

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

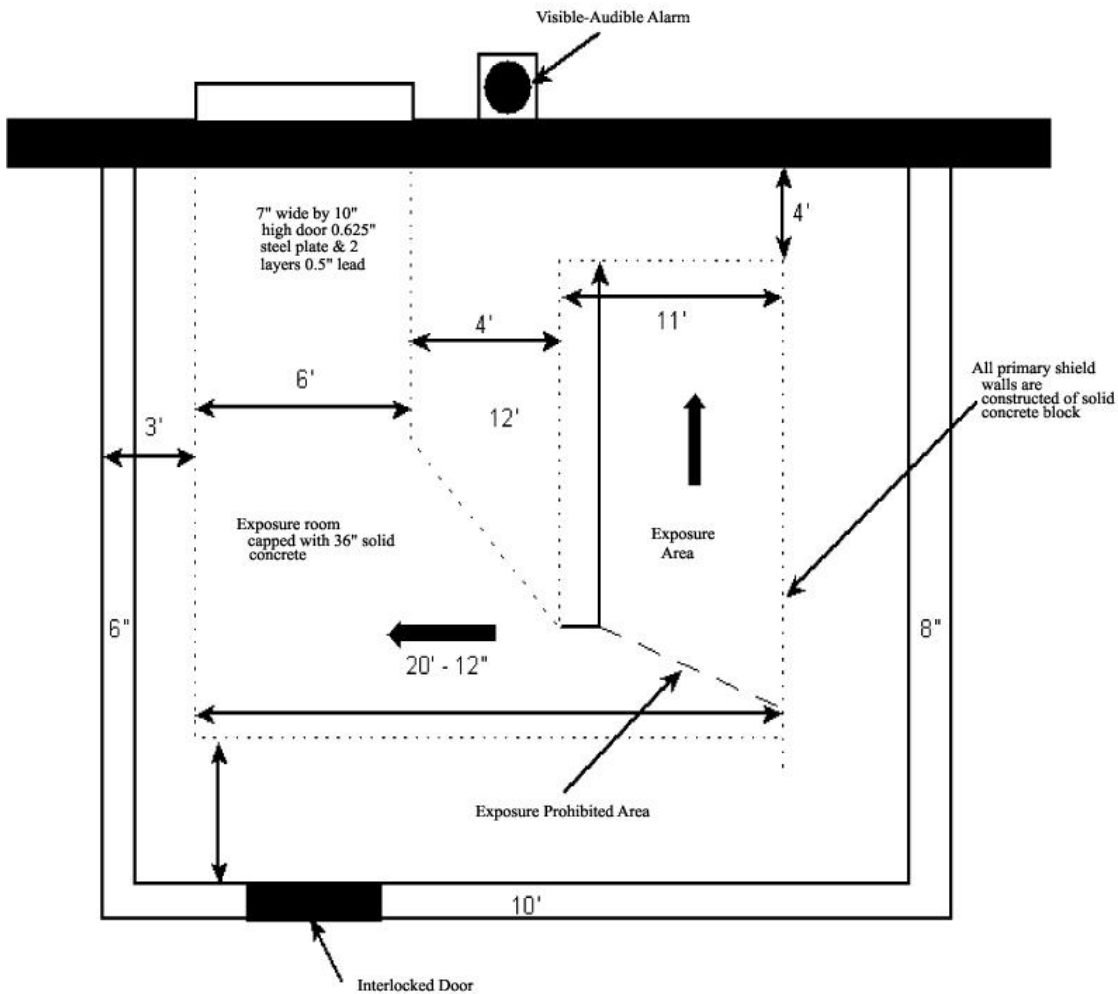
Requirements for a permanent radiographic installation:

- 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 audible-visual alarms. A diagram of the installation is helpful in evaluating the shielding and determining compliance with rules regarding restricted and unrestricted areas, location of access points, and locations of audible-visible signals. **Figure 1** shows an example installation diagram.





**Figure 1: 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 mSv (2 mrem) in any one 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 doses in all directions around the installation that are below 0.02 mSv (2 mrem) in any one-hour are considered acceptable. If the radiation doses will exceed 0.02 mSv (2 mrem) in any one-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 one hour at 30 cm 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 one 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 one hour or 1 mSv (100 mrem) in a year.

Provide the following as applicable:

- 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. 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" 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 entranceways 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 2** (e.g., located in an industrial park, an office complex, etc.) and its current use. If any proposed permanent installation is adjacent to a private residence, provide diagrams of the installation that include the building, the proposed restricted area(s), 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 dose in all directions around the installation, including the roof, should not exceed 0.02 mSv (2 mrem) in any one hour. Clearly identify the type of source (isotope), the amount (activity) of radioactive material in the source, and the position of the source within the installation for the calculations or measurements.
  
- Variances will be considered if construction requirements preclude shielding the roof in order to meet the requirement not to exceed 0.02 mSv (2 mrem) in any one 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 "*Caution (or Danger) Radiation Area*" signs;
  - Steps taken to minimize radiation on the roof; and
  - 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 doses on the radiography installation roof exceed 1.0 mSv (100 mrem) in any one 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 "*Caution (or Danger) High Radiation Area*" signs;
  - Evidence of constant surveillance of the roof by closed circuit TV;
  - Fluctuation of the dose rate;
  - A description of a control device that would automatically reduce the radiation level to 1 mSv (100 mrem) in any one hour at 30 cm from the radiation source if someone accesses the roof; and
  - A description of a control device that activates a visible-audible signal so that both an individual accessing the roof and the radiographer on duty are made aware of the entry.

- Field Stations:
  - Describe the storage location(s) at the address listed in **Item 4** and submit a diagram showing where the radiography cameras will be stored at both permanent radiographic installations and 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. Again, in KY all field stations must apply for and be granted a distinct specific license authorizing the storage and use and dispatching of radioactive materials.

**Response from Applicant:**

**11. Facilities and Equipment.** Describe the facilities, remote handling equipment, shielding, fume hoods, etc. Attach a sketch of the facility indicating the location of any radioactive materials (i.e. fixed gauges, storage areas, etc.).

- The applicant shall submit the required information as listed in the section titled ‘Facilities and Equipment’ of KYREG ‘Guidance for Industrial Radiography Use’.

**Note:** Certain records described in the rule pertaining to radiation safety may need to be on file at these field stations and each temporary jobsite.

## Radiation Safety Program

### Item 12: Radiation Safety Program

**Rule:** 902 KAR 100:019, 902 KAR 100:040, 902 KAR 100:100

**Criteria:** A radiation protection program must be established and submitted to KYDPH 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 as low as reasonably achievable (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; and
- Records management.

**Discussion:** The specific components of the applicant's radiation safety program are detailed in this guide. 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 KYDPH requirement.

## Item 12.1: Radiation Safety Program Audit

**Rule:** 902 KAR 100:019, 902 KAR 100:040

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

- Compliance with KYDPH and DOT requirements, and the terms and conditions of the license;
- Occupational doses and doses to members of the public that are ALARA; and
- Records of audits and other reviews of program content are maintained for three (3) years.

**Discussion:** **Appendix I** contains a suggested annual audit program that is specific to industrial radiography and is acceptable to KYDPH. All areas indicated in **Appendix I** may not be applicable to every licensee and may not need to be addressed during each audit.

Audit records acceptable to KYDPH should contain the following information:

- Date of audit;
- Name of person(s) who conducted the audit;
- Names of persons contacted by the auditor(s);
- Areas audited;
- Audit findings, and corrective actions; and
- Follow-up.

It is essential that once identified, problems be corrected in a timely manner. NRC Information Notice (IN) 96-28, 'Suggested Guidance Relating to Development and Implementation of Corrective Action' (<http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/1996/in96028.html>) provides guidance on this subject. KYDPH will review the licensee's audit results and determine if corrective actions are thorough, timely, and sufficient to prevent recurrence. If violations are identified by the licensee and these steps are taken, KYDPH can exercise discretion and may elect not to cite a violation. KYDPH's goal is to encourage prompt identification and prompt comprehensive correction of violations and deficiencies.

### Response from Applicant:

The applicant shall submit an annual review policy that is compatible with **Appendix I**.

## Item 12.2: Termination of Activities

**Rule:** 902 KAR 100:040

**Criteria:** The licensee must do the following:

- Promptly notify KYDPH, in writing of:
  - A decision to permanently cease licensed activity at the entire site or in any separate building or outdoor area if it contains residual radioactivity making it unsuitable for release according to KYDPH requirements;
  - No principal activities have been conducted at the entire site under the license for a period of twenty-four (24) months;

- No principal activities have been conducted for a period of twenty-four (24) months in any separate building or outdoor area if it contains residual radioactivity making it unsuitable for release according to KYDPH requirements.
- Submit a decommissioning plan, if required by **902 KAR 100:042**;
- Decommissioning, as required by **902 KAR 100:040 and 902 KAR 100:042**;
- Submit to KYDPH, a completed KYDPH Form ‘RPS-10 Disposition of Radioactive Materials’ (**Appendix B**) and demonstrate that the premises are suitable for release for unrestricted use (e.g. results of final survey); and
- Before a license is terminated, send the records important to decommissioning to KYDPH as required by **902 KAR 100:042**. If licensed activities are transferred or assigned in accordance with **902 KAR 100:040**, transfer records important to decommissioning to the new licensee.

**Discussion:** For guidance on the disposition of radioactive material, and for guidance on decommissioning records, see **Item 14** ‘Waste Management’.

### **Response from Applicant:**

No response is required from the applicant during the licensing phase.

## **Item 12.3: Material Receipt and Accountability**

**Rule:** **902 KAR 100:040, 902 KAR 100:100**

**Criteria:** Licensees must do the following:

- Maintain records of receipt, transfer, and disposal of sources/devices; and
- Conduct physical inventories at quarterly intervals [not to exceed three (3) months] to account for all sources of radiation and for devices, including devices containing depleted uranium;

**Discussion:** Licensed materials must be tracked from ‘cradle to grave’ in order 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.

Conduct physical inventories (i.e., locate, verify the presence of the material, and account for it in material transfer record) at quarterly intervals [not to exceed three (3) months] to account for all sealed sources and devices containing depleted uranium. Records of such inventories must be retained for three (3) years.

Maintain inventory records that contain the following types of information:

- Radionuclide and amount (in units of Bq or curies) of radioactive material in each sealed source;
- Manufacturer's name, model number, and serial number of each sealed source;
- Manufacturer's name, model number, and serial number of each device containing depleted uranium or radioactive material;
- Location of each sealed source and device;
- Date of the inventory; and
- Name of individual performing inventory.

‘Cradle to Grave’ accountability refers to maintaining the radioactive material from the moment it becomes a part of your organization through performing the physical inventories (ensuring the material’s location, etc.) until it leaves your organization (through transfer, return to manufacturer/distributor, or disposal to properly licensed facility). It is not enough to simply say you got rid of a sealed source or device, you must have written proof that another licensed entity took physical possession of that same material.

### **Response from Applicant:**

The applicant shall submit a policy for conducting quarterly inventories including a sample inventory record sheet which is compatible with the requirements of KYREG Guidance for Industrial Radiography Use **Item 12.3 Material Receipt and Accountability.**

### **Item 12.4: Leak Tests**

**Rule: 902 KAR 100:040, 902 KAR 100:100**

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

**Discussion:** Manufacturers, consultants, and other organizations may be authorized by KYDPH, the NRC or another Agreement State 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 by KYDPH 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 reliably detecting 185 Bq (0.005 microcurie) of radioactivity. In practice, the minimum detectable activity (MDA) of the instrumentation should be at least one-half of the removable contamination limit.

Sealed sources containing radioactive material must be leak tested at intervals not to exceed six (6) months and devices containing depleted uranium tested at intervals not to exceed twelve (12) months.

### **Response from Applicant:**

The Applicant shall submit a policy for conducting leak testing that satisfies the following:

Leak tests will be performed by an organization authorized by KYDPH, the NRC or another Agreement State to provide leak testing services to other licensees; or by using a leak test kit supplied by an organization licensed by KYDPH, the NRC or another Agreement State to provide leak test kits to other licensees according to kit suppliers' instructions.

List the name and license number of organization authorized to perform or analyze leak test (Specify whether KYDPH, NRC, or another Agreement State):

**Note:** An alternate organization may be used to perform or analyze leak test, without amending the license, provided the organization is specifically authorized by KYDPH, the NRC or another Agreement State.

**OR**

We will perform our own leak testing and sample analysis. We will follow the procedures in Appendix K of KYREG 'Guidance for Industrial Radiography Use'.

**OR**

We will submit alternative procedures. (Procedures are attached)

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

## Item 12.5: Public Dose

**Rule:** 902 KAR 100:019, 902 KAR 100:040, 902 KAR 100:100

**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 one hour; and
- Control and maintain constant surveillance over devices that are not in storage and secure stored devices from unauthorized removal or use.

**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 control and direct visual surveillance.

Public dose is also affected by the choice of the permanent radiographic installation and storage locations and conditions. An example of a properly stored device would be a locked room a sufficient distance from any individual, especially personnel. Use of area monitors such as a TLD or OSLD 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 or storage location. 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. A detailed sketch or drawing of the storage area describing the specific changes made should also be submitted to KYDPH for review.

### **Response from Applicant:**

No response is required, in this license application, however the licensee's evaluation of public dose will be examined during an inspection.

**Note:** Appendix L provides additional information for determining that radiation doses for other licensee personnel and members of the public will not be exceed allowable limits.

## **Item 12.6: Quarterly Maintenance**

**Rule: 902 KAR 100:040, 902 KAR 100:100**

**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 three (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 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 repaired 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 or alternatively, with any lubrication and cleaning recommendations established by the industrial radiography community.

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. COC's for many Type B packages can be found on the U.S. Department of Energy RAMPAC website at <http://rampac.energy.gov/>.

### **Response from Applicant:**

The Applicant shall include procedures for accomplishing quarterly maintenance. These procedures may be submitted as part of the operating and emergency procedures.

**AND**

The applicant shall provide a written commitment to the following: before using a new sealed source/device combination, we will have written inspection and maintenance procedures that address the use of 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

## **Operating and Emergency Procedures**

### **Item 12.7: Operating and Emergency Procedures**

**Rule: 902 KAR 100:019, 902 KAR 100:040, 902 KAR 100:100**

**Criteria:** Operating and emergency procedures must be established and submitted to KYDPH as part of the application package. In addition, if radiographers will perform other operations such as source exchange, leak-testing, and quarterly [not to exceed three (3) months] inspection and maintenance of equipment, appropriate procedures and instructions for these operations should be included in the operating and emergency procedures.



Each licensee must develop, implement, and maintain operating and emergency procedures containing the following elements:

- Instructions for maintaining security during storage and transportation;
- Instructions to keep radiography devices under control and immediate surveillance during use;
- Steps to take to keep radiation exposures ALARA;
- Steps to maintain accountability during use;
- Steps to control access to work sites;
- Use of personnel monitoring and radiation survey equipment;
- Instruction for packaging and transporting licensed material; and
- Steps to take and whom to contact when an emergency occurs.

**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 non-routine operations, for example, quarterly [not to exceed three (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 exchanger, or survey instrument. Procedures submitted to KYDPH should provide sufficient guidance and instruction for each specific type of device. For example, you may submit a single operating procedure for crank-out regardless of the manufacturer and/or a single operating procedure for pipeliner exposure devices regardless of manufacturer.

Applicants who plan to conduct lay-barge, offshore platform, or underwater radiography are required to have their procedures approved by KYDPH. If you plan to conduct lay-barge, offshore platform or underwater radiography, your radiation safety program will be reviewed to assure that it contains procedures that specifically address:

- 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; and
- Emergency procedures unique to lay-barge, offshore platform, or underwater radiography.

Operating and emergency procedures must be submitted to KYDPH for review.

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

### **Response from Applicant:**

The Applicant shall submit operating and emergency procedures to KYDPH for review.

## **Item 12.7.1: Handling and Use of Sealed Sources and Radiography Exposure Devices**

**Rule:** 902 KAR 100:040, 902 KAR 100:100

**Criteria:** Licensees need to establish operating and emergency procedures.

**Discussion:** There are two types of devices normally used for radiography, crankout, and pipeliner. There should be separate instructions for each type of device. 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 a permanent radiographic installation. The procedures should contain warnings of areas of concern during source exchanges. Recent 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 for conducting surveys during and after movement of sources.

### **Response from Applicant:**

The applicant shall submit the following:

- Step-by-step instructions for using each type of radiographic devices;
- Instructions for performing source exchanges; and
- Instructions for crankout devices should be separate from those for pipeliner devices.

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

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

## **Item 12.7.2: Methods and Occasions for Conducting Radiation Surveys**

**Rule:** 902 KAR 100:019, 902 KAR 100:040, 902 KAR 100:100

**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 need to be made whenever a source is manipulated or moved. Surveys should be made with a radiation survey instrument calibrated in accordance with **902 KAR 100**. 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: Surveys Required for Radiographic Operations**

<b>Type of Radiation Survey</b>	<b>Frequency</b>	<b>Requirement</b>
Boundary of restricted area at temporary jobsite does not exceed 0.02 mSv (2 mrem) in any one hour	During the first exposure for each set up of radiographic device	<b>902 KAR 100:019</b>
Unrestricted area in vicinity of permanent radiographic installation or storage area does not exceed 1 mSv (100 mrem) per year	At intervals not to exceed twelve (12) months	<b>902 KAR 100:019</b>
External radiation levels when a package is received and opened	Each receipt of package	<b>902 KAR 100:070</b>
Exposure rate does not exceed 2 mSv/hr (200 mrem/hr) on surface and 0.1 mSv/hr (10 mrem/hr) at one meter	Each installation of new source in exposure device	<b>902 KAR 100:070</b>
Exposure rate does not exceed 2 millisieverts (200 millirem) per hour at any exterior surface, and 0.1 millisieverts (10 millirem) per hour at 1 meter from any exterior surface with the sealed source in the shielded position.	Each installation of new source in a storage container or source changer	<b>902 KAR 100:070</b>
Removable contamination level for leak tests of sealed sources does not exceed 185 Bq (0.005 microcuries)	At intervals not to exceed six (6) months	<b>902 KAR 100:100</b>
Removable contamination level for leak test of S-tube of exposures device does not exceed 185 Bq (0.005 microcuries) of DU	At intervals not to exceed twelve (12) months	<b>902 KAR 100:100</b>
Confirm source has returned to a shielded position	After every radiographic exposure	<b>902 KAR 100:100</b>
Confirm source is in shielded position	After every source exchange or exposure device is placed in storage	<b>902 KAR 100:100</b>
Exposure rates meet labeling of package (i.e., Yellow II) and determine Transportation Index	Every movement of licensed material on public roads	<b>902 KAR 100:070</b>
Exposure rates in and around vehicle do not exceed 0.002 mSv/hr (2 mrem/hr) in driver's seat, 2 mSv/hr (200 mrem/hr) on surface and 0.1 mSv/hr (10 mrem/hr) at 2 meters from vehicle	Every movement of a package labeled Yellow III	<b>902 KAR 100:070</b>

**Response from Applicant:**

The Applicant shall include in the operating and emergency procedures all surveys as described in the section titled ‘**Methods And Occasions For Conducting Radiation Surveys**’ in KYREG ‘**Guidance for Industrial Radiography Use**’.

## Item 12.7.3: Methods for Controlling Access to Radiographic Areas

**Rule: 902 KAR 100:019, 902 KAR 100:040, 902 KAR 100:100**

**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:**

#### **1. Field/Temporary Jobsites**

When radiographic operations are performed outside a permanent radiographic installation, at least two qualified radiographic personnel must be present. At least one of the individuals must be a radiographer; the other may be another radiographer or a radiographer's assistant. Both individuals must maintain constant visual surveillance of the operations to prevent unauthorized entry to the restricted area. 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.

All areas where radiographic operations are conducted require posting of the radiation areas and the high radiation areas. 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 "*Caution Radiation Area*" signs at the point where radiation levels have been calculated to reach 0.02 mSv (2 mrem) in any one hour. A confirming survey during to the first exposure of the source should be conducted to confirm the location of the boundary and any necessary adjustments should be made.

The perimeter of the high radiation area must be posted with a "*Caution (or Danger) High Radiation Area*" sign(s) at the point where radiation levels have been calculated to reach 1 mSv (100 mrem) in any one 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. Operating procedures and instruction to personnel should include specific steps for these circumstances to ensure that access into the restricted area is properly controlled. Adequate control of the restricted area at with multiple levels would require several personnel and many postings. 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.

## 2. Permanent Radiographic Installations

For permanent radiographic installations, instruct personnel about posting each entrance to the facility with a "*Caution (or Danger) High Radiation Area*" sign(s), and provide procedures to ensure that the visible-audible signal system is operable. The operability of the visible-audible system must be checked daily before beginning radiographic operations. 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; and
- 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 seven (7) days while the defective equipment is fixed, provided that:

- The entrance control device is labeled as defective;
- Radiography personnel maintain continuous, direct, visual surveillance of access installation points; and
- Radiography personnel use an alarming rate meter.

## 3. Storage Areas

Radiographic equipment containing licensed material stored in controlled or unrestricted areas must be secured from unauthorized removal or access. Operating procedures should specify how stored licensed material should be secured and who is authorized access to licensed material.

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. 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/hr (2 mrem/hr) at 45 cm (18 inches) 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 heavy duty storage container or 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:**

The Applicant shall include procedures to control access to radiographic operations and storage areas in the operating and emergency procedures.

**Note:** All regulatory criteria applying to your normal place of business for conducting industrial radiography operations also apply to the location in which you store at your radiographic equipment at a temporary jobsite or an approved private residence. You must specify this storage location in your license application.

## **Item 12.7.4: Methods And Occasions For Locking And Securing Radiographic Exposure Devices, Storage Containers, and Sealed Sources**

**Rule:** 902 KAR 100:040, 902 KAR 100:100

**Criteria:** 902 KAR 100:100 requires locking and securing radiographic equipment 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. If a radiographer had to leave an exposure device at a temporary jobsite, it would have to be secured against unauthorized removal or tampering by using the lock on the device and then locking it in an available space such as a shed, room, etc. Likewise, while in storage being transported to and from the temporary jobsite, the radiographer would ensure the lock is on the device and then lock the device in the trailer, etc. All radiographic devices must have two independent physical controls that form tangible barriers to secure the material from unauthorized removal when the device is not under direct control and constant surveillance by the licensee both in storage and during transportation not including the lock on the device. Radiographers and/or radiographer's assistants must ensure that the exposure device and/or 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:**

The Applicant shall include procedures for locking and securing radiographic equipment in the operating and emergency procedures

## **12.7.5: Personnel Monitoring and the Use of Personnel Monitoring Equipment**

**Rule:** 902 KAR 100:019, 902 KAR 100:040, 902 KAR 100:100

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

**Discussion:** All radiographers or radiographer's assistants are required to wear on the trunk of their body:

- Direct-reading dosimeters;
- Film badges, TLDs, OSLDs or similar devices; and
- Alarming ratemeters when they are engaged in radiographic field operations.

Film badges, TLDs, OSLDs or similar 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 alarming ratemeters must be checked each day before use to ensure that the alarm functions properly. The manufacturer's recommended procedures should be followed.

All radiographers or radiographer's assistants are required to wear alarming 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. Include instructions about how and where dosimetry devices are to be stored when not in use. The storage place should be dry, radiation free, and cool so that the devices will not be affected by adverse environmental conditions.

## Response from Applicant:

The applicant shall include instructions for proper use of personnel monitoring equipment in the operating and emergency procedures

**Note:** It is good practice to check the dosimeter periodically during the work shift.

## Item 12.7.6: Transporting Sealed Sources To Field Locations, Securing Exposure Devices And Storage Containers In Vehicles, Posting Vehicles, And Controlling Sealed Sources During Transportation

**Rule:** 902 KAR 100:040, 902 KAR 100:070 902 KAR 100, 49 CFR Parts 171-178

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

**Discussion:** During an inspection, KYDPH uses the provisions of **902 KAR 100:070** which incorporates the requirements of **49 CFR**, to examine and enforce transportation requirements applicable to radiography licensees. **Appendix N** contains: 1) a list of major DOT regulations applicable to transporting radiographic devices; 2) a condensed summary of KYDPH/DOT requirements; and 3) two sample shipping papers, the second of which may be more useful for multiple-use, temporary jobsite activities.

Instructions to personnel should not reference KYDPH/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. Two independent physical controls that form tangible barriers to secure the material from unauthorized removal shall be used when the device is not under direct control and constant surveillance by the licensee. The instructions should specify how to prevent the package from moving during transport;
- Preparation of shipping papers. The instructions should specify that the shipping papers must be completed before transporting the licensed material and must be accessible in the driver's compartment at all times. **Appendix N** contains examples of shipping papers for transporting radiographic exposure devices;
- 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/hr (200 mrem/hr) or the transport index exceeds 10, exterior surfaces and passenger compartment of the vehicle must be surveyed to ensure that the radiation levels do not exceed 0.02 mSv/hr (2 mrem/hr) from any exterior surface and 0.02 mSv/hr (2 mrem/hr) in the passenger compartment. Include instructions to personnel on the measures to take if the radiation level exceeds 0.02 mSv/hr (2 mrem/hr) in the passenger compartment (e.g., adding more shielding or repositioning the device within the vehicle);
- Ensure that the licensees name and city/town is prominently displayed as a label on both sides of the vehicle; and
- If an exposure device is transported in an overpack, the procedures should include instructions that the overpack must be properly marked with an overpack label, the shipping name and UN 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 another Agreement State and meet the safety performance requirements of **902 KAR 100:100**, 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.

### **Response from Applicant**

The applicant shall include procedures for transporting sealed sources containing radioactive material, exposure devices, and source changers in the operating and emergency procedures.

### **OR**

The applicant shall provide a statement to the effect that Devices are not transported beyond the confines of the applicant's facilities.

**Note:** 'A Review of Department of Transportation Regulations for Transportation of Radioactive Materials (2008 revision)' can be obtained at the DOT's Office of Hazardous Material Initiatives and Training at [http://phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/RAM\\_Regulations\\_Review\\_12-2008.pdf](http://phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/RAM_Regulations_Review_12-2008.pdf).

Before the 1997 revision of **10 CFR Part 34**, a licensee who intended to transport a radiographic Type B package was required to submit a quality assurance program to NRC for approval, separate from the license approval. The 1997 revision to **10 CFR Part 34** requires written procedures for inspection and maintenance of radiographic Type B packages (**10 CFR 34.31(b)**). In conjunction with the revision to **10 CFR Part 34**, the NRC also amended **10 CFR 71.101(g)** to specifically state that if the applicant's written procedures for inspection and maintenance of radiographic Type B packages are approved, then the applicant also meets NRC quality assurance requirements in **10 CFR Part 71** and does not have to submit or maintain a separate quality assurance program to transport a Type B package. The application'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.

## **Item 12.7.7: Daily Inspection and Maintenance of Radiography Equipment**

**Rule:** **902 KAR 100:040, 902 KAR 100:100**

**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 the equipment is used. These checks are intended to ensure that the equipment is in good working condition, that the sources are adequately shielded, and that required labeling is present. Licensees must check survey instrument operability using check sources or other appropriate means.

Inspection records shall contain information about equipment problems found in daily checks and quarterly [not to exceed three (3) months] maintenance inspections. Records shall include the date of check or inspection, name of inspector, equipment involved, any problems found, and what repair and/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 that if the equipment is used on more than one shift in the day, the equipment should be inspected before the start of each shift.

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. A list of items that should be checked in the daily inspection of radiography equipment can be obtained by contacting the equipment manufacturers.

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 seven (7) days, with compensatory measures taken in the interim. Compensatory measures taken include:

- Immediately label faulty equipment as defective;
- The radiographer must be accompanied by at least one other radiographer or radiographer's assistant;
- Continuous surveillance requirements are implemented until repairs are completed;
- Alarming ratemeters shall be worn and checked for alarm function at the beginning of each shift; and
- Records must be maintained of faulty equipment.

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

### **Response from Applicant:**

The applicant shall include procedures for daily inspection and maintenance of radiography equipment in the operating and emergency procedures

**Note:** Direct reading dosimetry devices must be read and the exposures recorded at the beginning and end of each shift. Alarming ratemeters shall be checked for alarm function at the beginning of each shift. Records are to be maintained per **902 KAR 100:100**.

## **Item 12.7.8: Ratemeter Alarms or Off-Scale Dosimeter Readings**

**Rule: 902 KAR 100:040, 902 KAR 100:100**

**Criteria:** Licensees must instruct personnel in:

- Appropriate handling and use of sealed radioisotope 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 radioisotope sources;
- The operating and emergency procedures;
- Actions to be taken if a dosimeter shows an off-scale reading or an alarm ratemeter alarms (sounds, etc.) unexpectedly;
- Procedures to be followed if a film badge, TLD, OSLD, or similar device is lost or damaged; and
- 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 a ratemeter alarms (sounds, etc.) unexpectedly, the RSO or designee must be notified immediately. If radiation exposure cannot be ruled out by the RSO or designee as the root cause, the individual's film badge, TLD, OSLD or similar approved device must be sent for processing within 24 hours. The affected individual may not resume work with radioactive material until the RSO or designee has determined the individual's radiation exposure. **There are no exemptions 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, ensure that the source is in the safe storage position in the exposure device, and vacate the radiation area;
- If the ratemeter alarms (sounds, etc.), 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; and
- If the exposure cannot be ruled out by the RSO or designee, then the film badge or OSL must be processed within twenty (24) hours.

**Response from Applicant:**

The applicant shall include procedures for ratemeter alarms and off scale dosimeters in the operating and emergency procedures.

**Item 12.7.9: Procedure For Identifying And Reporting Defects And Non-Compliance**

**Rule: 902 KAR 100:019, 902 KAR 100:040, 902 KAR 100:100**

**Criteria:** Licensees must notify management if defects are found in radiography equipment.

**Discussion:** Equipment defects that cause a substantial safety hazard, or equipment failures involving KYDPH-regulated activities, must be reported to KYDPH. For example, a failure of the coupling between the source assembly and the control cable must be reported to KYDPH. Radiography personnel should be instructed to report any malfunction or defect in radiography equipment to management, so that management can take appropriate action.

**Response from the Applicant:**

The applicant shall include procedures for notifying management of equipment malfunction or defect in the operating and emergency procedures.

**Note:** See NRC IN 91-39 'Compliance with 10 CFR part 21, Reporting of Defects and Non-compliance'. This is available from the NRC website at <http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/1991/in91039.html> .

## **Item 12.7.10: Required Notifications**

**Rule:** 902 KAR 100:019, 902 KAR 100:040, 902 KAR 100:100

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

**Discussion:** The emergency procedures should clearly identify the names and telephone numbers of the RSO or other persons who can provide assistance in an emergency or accident. Such persons may also include the exposure device manufacturer's and KYDPH's 24-hour toll free telephone number **1-800-255-2587**. The emergency procedures shall always be available to radiography personnel during radiography and up-to-date.

KYDPH rules also require immediate notification upon the discovery of certain events. Notify KYDPH when radiographic devices are lost or stolen or if there is indication of overexposure. Refer to the rule stated above or to **Appendix P** for additional guidance in the preparation of emergency procedures. **Table 9** below provides a description of events that require notification and/or reports. KYDPH can be notified by calling **(502) 564-3700** during normal working hours, Monday through Friday, 8:00 AM to 4:30 PM. After-hours and in the event of an emergency, KYDPH can be contacted 24/7/365 by calling **1-800-255-2587** which reaches the Duty Officer at the Commonwealth Emergency Operations Center in Frankfort, KY. Please notify the Duty Officer that this is a radiological event.

**Table 9: Required Notifications**

<b>EVENT</b>	<b>TELEPHONE NOTIFICATION</b>	<b>WRITTEN REPORT</b>	<b>RULE</b>
Fire, explosion or toxic gas release	Immediate	30 days	<b>902 KAR 100:040</b>
Unplanned contamination event	24 hours	30 days	<b>902 KAR 100:040</b>
Equipment is disabled or fails to function as designed	24 hours	30 days	<b>902 KAR 100:040</b>
Theft or loss of material	Immediate	30 days	<b>902 KAR 100:019</b>
Whole body dose greater than 0.25 Sv (25 rems)	Immediate	30 days	<b>902 KAR 100:019</b>
Extremity dose greater than 2.5 Sv (250 rems)	Immediate	30 days	<b>902 KAR 100:019</b>
Whole body dose greater than 0.05 Sv (5 rems) in 24 hours	24 hours	30 days	<b>902 KAR 100:019</b>
Extremity dose greater than 0.5 Sv (50 rems) in 24 hours	24 hours	30 days	<b>902 KAR 100:019</b>
Whole body dose greater than 0.05 Sv (5 rems)	None	30 days	<b>902 KAR 100:019</b>
Dose to minor greater than 5mSv (500 mrem)	None	30 days	<b>902 KAR 100:019</b>
Dose to embryo or fetus of a declared pregnant woman greater than 5 mSv (500 mrem)	None	30 days	<b>902 KAR 100:019</b>
Dose to individual member of public greater than 1 mSv (100 mrems)	None	30 days	<b>902 KAR 100:019</b>
Any applicable limit in the license or registration	None	30 days	<b>902 KAR 100:019</b>
Leak test of sealed source or guide tube greater than 185 Bq (0.005 $\mu$ Ci)	None	5 days	<b>902 KAR 100:100</b>
Unintentional disconnection of the source assembly from the control cable	None	30 days	<b>902 KAR 100:100</b>
Inability to retract the source assembly to its fully shielded position and secure it in its retracted position	None	30 days	<b>902 KAR 100:100</b>
Failure of any component which is critical to safe operation of the device to properly perform its intended function	None	30 days	<b>902 KAR 100:100</b>
An indicator on radiation machine fails to show that radiation is being produced, and exposure switch fails to terminate production of radiation when turned to the off position or a safety interlock fails to terminate x-ray production	None	30 days	<b>902 KAR 100:100</b>
Use of licensed material at any location not on license for more than 180 days in a calendar year	Notify KYDPH prior to exceeding 180 days	None	<b>902 KAR 100:100</b>

**Note:** Telephone notifications shall be made to KYDPH at **(502) 564-3700** during normal business hours (8 AM – 4:30 PM) for immediate notifications after normal business hours, the 24 hour emergency telephone number is **(800) 255-2587**. Identify the emergency as radiological.

## Item 12.7.11: Minimizing Exposure Of Persons In The Event Of An Accident

**Rule:** 902 KAR 100:019, 902 KAR 100:040, 902 KAR 100:100

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

**Discussion:** Since it is not possible to specify all possible situations that would constitute an emergency, a general instruction is acceptable. 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 posting the restricted area, maintaining surveillance of the restricted area, and notifying the RSO.

General instructions that give a basic idea of how to react when something unexpected happens should include such direction as immediately move away from the source, while at a safe distance from the source and maintaining a low exposure, calm down and begin to survey to verify the boundary of the restricted area (2 mR/hr boundary). Remain at this boundary, but maintain visual surveillance of source. Contact RSO or designee; however, do not leave where you cannot maintain surveillance of source, send someone to the phone if necessary.

### **Response from Applicant:**

The applicant shall include instructions for minimizing exposure of persons in the event of an accident in the operating and emergency procedures.

## Item 12.7.12: Source Retrieval

**Rule:** 902 KAR 100:040, 902 KAR 100:100

**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, KYDPH 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 a licensee whose is specifically authorized for these activities by KYDPH, NRC or another Agreement State. Proof of successful completion of a device manufacturer's source retrieval course is acceptable training for persons authorized by a specific license to perform source retrieval.

Licensees specifically approved to perform source retrievals will have a specific license condition authorizing these activities and listing the names of those individuals who are allowed to perform source retrievals. In addition, these individuals are authorized to perform source retrievals for other licensees.
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KYDPH 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 that only specifically authorized individuals, or personnel supervised by such authorized individuals and working in their physical 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 should be used during source retrievals, for example, 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. The procedure should prohibit using alarming dosimeters or electronic dosimeters as survey instrument substitutes;
- 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; and
- Notification to KYDPH.

**Response from Applicant:**

The applicant shall provide a statement to the effect that the applicant will not perform source retrieval and will use the services of a person specifically licensed by KYDPH, NRC or another Agreement State to perform the retrievals of our sources.

**OR**

If the applicant will perform source retrieval; the applicant shall include source retrieval procedures in the operating and emergency procedures and submit specific training for agency review

**Note:** Radiography personnel should not attempt to perform operations involving source retrieval or recovery unless they have actual training in retrieval operations using a dummy source with the appropriate handling tools, survey instruments, and dosimetry. Source retrieval must be specifically authorized on the license and the persons conducting those activities specifically named.

## Item 12.7.13: Maintenance Of Records

**Rule:** 902 KAR 100:019, 902 KAR 100:040, 902 KAR 100:100

**Criteria:** The licensee shall meet KYDPH record requirements.

**Discussion:** Personnel must generate and maintain certain records when performing radiography, including:

- 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; dates device is removed and returned to storage.
- Records of daily inspection of equipment;
- Pocket dosimeter readings. These readings must be made at the beginning and end of a work shift. Instructions to personnel must specify that the readings be recorded; and
- Results of the physical survey to ensure that the sealed source is in the shielded position, when a radiographic exposure device is placed in a storage area (as defined in **902 KAR 100:010**) and if that survey is the last one performed in the workday.

Operations requiring records include inspections and maintenance at intervals not to exceed three (3) months. Other examples include instrument calibration and shipment of packages. Radiography personnel should also be aware of the records that must be maintained at temporary jobsites listed in **902 KAR 100:100 Section 17**. 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:

The applicant shall include procedures which ensure proper maintenance of records in the operating and emergency procedures.

**AND**

The applicant shall include the physical address where records can be reviewed by KYDPH Monday through Friday during normal working hours. The address provided by the applicant shall **NOT** be a Post Office Box.

## Item 12.8: Minimization of Contamination

**Rule:** 902 KAR 100:040, 902 KAR 100:042

**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 to minimize the amount of radioactive contamination generated at the site during its operating lifetime and to minimize the generation of radioactive waste during decontamination. 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.

Sealed source and devices that are approved by the NRC or another Agreement State and located and used according to their respective SSDR Certificates usually pose little risk of contamination. Leak tests performed as specified in **902 KAR 100:100** should identify defective sources. Leaking sources must be withdrawn from use and decontaminated, repaired, or disposed of according to **902 KAR 100**, ‘**Kentucky Radiation Protection Regulations**’. 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.

**Note:** The applicant does not need to provide a response to this item. KYDPH will consider that the above Criteria have been met if the applicant's responses meet the criteria for the following items: ‘Sealed Sources and Devices’, ‘Facilities and Equipment’, ‘Leak Tests’, ‘Operating and Emergency Procedures’, and ‘Waste Management’.

## **Item 14: Waste Management**

**Rule:** **902 KAR 100:021, 902 KAR 100:040, 902 KAR 100:100**

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

**Discussion:** Licensees who dispose of radiography sealed sources, or dispose of radiography devices containing depleted uranium, must transfer them to an authorized recipient. Recipients authorized to accept radioactive material are the original manufacturer of the device, or a commercial firm licensed by KYDPH, the NRC or another Agreement State.

Before transferring radioactive material, a licensee must use one of the methods described in **902 KAR 100:040** 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 KYDPH/DOT requirements. Records of the transfer must be maintained as required by **902 KAR 100:040**.

### **Response from Applicant:**

The applicant shall provide a statement to the effect that the applicant will return the radiography sealed source(s) to the manufacturer for disposal or transfer the radiography sealed source(s) to a specific licensee authorized by KYDPH, the NRC or another Agreement State to receive radioactive material.

**Note:** Because of the difficulties and costs associated with disposal of sealed sources containing radioactive 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.



## License Fees

**Rule: 902 KAR 100:012, 902 KAR 100:040**

**Criteria:** The applicant must submit the appropriate application fee in the form of a check or money order made payable to the Kentucky State Treasurer.

### Response from Applicant:

The applicant shall submit the applicable application fee as stated in **902 KAR 100:012. Fee Schedule** (<http://www.lrc.state.ky.us/kar/902/100/012.htm>). See also the “Kentucky Radioactive Materials License Fee Schedule” at the following website <http://www.chfs.ky.gov/dph/radioactive.htm>.

**Note:** An application submitted without the applicable fee will not be processed until such time as the fee is paid in full

## Item 15: Certification

### Criteria:

- Individuals acting in a private capacity are required to sign and date KYDPH Form RPS-7, ‘Application for a Radioactive Material License’ (**Appendix A**).
- Senior management representatives of a corporation or legal entity must sign and date KYDPH Form RPS-7, ‘Application for a Radioactive Material License’ (**Appendix A**). Senior management personnel include the President, Chief Executive Officer, Chief Operating Officer, etc. KYDPH also uses the required corporate filings made with the Kentucky Secretary of State’s office to determine who is a member of senior management (<http://sos.ky.gov/bus/business-filings/Pages/default.aspx>). All entities doing business in Kentucky, including corporations, limited liability companies, limited partnerships and business trusts, must file an annual report with the KY SOS by June 30 of each year. Failure to file the annual report by June 30 will result in the entity being listed in bad standing with this office and could lead to administrative dissolution or revocation of authority to do business in Kentucky.

**Representatives signing an application must be authorized to make binding commitments and sign official documents on behalf of the applicant.** As discussed in the section titled ‘Management Responsibility’, signing the application acknowledges management’s commitment and responsibilities for the radiation protection program. KYDPH will return all unsigned applications for proper signature.

### Response from Applicant:

**15. Certification.** The applicant understands that all statements and representations made in the application are binding upon the applicant.

The applicant and any official executing this certification on behalf of the applicant, named in Item 1, certify that this application is prepared in conformity with Kentucky Cabinet for Health and Family Services Administrative Regulations 902 KAR 100, and that all information contained herein, is true and correct to the best of their knowledge and belief.

Signature of Certifying Management Official	Type/Printed Name	Title	Date

### Note:

- It is a violation of **902 KAR 100:170** to make a willful false statement or representation on applications or correspondence.
- When the application references commitments, those items become part of the licensing conditions and regulatory requirements.

## **Appendix A**

### **KYDPH Form RPS-7**

### **‘Application for a Radioactive Material License’**

**Application for a Kentucky Radioactive Materials License  
Radiation Health Branch, Department for Public Health  
Cabinet for Health and Family Services**

Completed applications must be filed with Radiation Health Branch, Cabinet for Health and Family Services, 275 East Main Street, Mailstop HS1C-A, Frankfort, KY 40621, Tel: 502-564-3700, Fax: 502-564-1492  
Application is for one of the following:

New License <sup>(1)</sup> Check.	Amendment in Entirety <sup>(1)</sup> of License No.	Amendment to <sup>(2, 3)</sup> License No.	Renewal of <sup>(2, 3)</sup> License No.
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**(1)** All sections must be completed **(2)** Complete all applicable sections & section 15 **(3)** Amendments & renewals cannot be combined

<b>1. Applicant's Name and Mailing Address</b>	<b>2. Street address(es) where radioactive material will be Used (no P.O. Boxes)</b>
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<b>3. Telephone Number</b>	<b>4. Person to be contacted and listed as contact person</b>
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**5. Individual(s) and Title(s) who will use or directly supervise use of radioactive material**

<b>6. Radiation Safety Officer (one person)</b>	Training and experience required for each user named in Item 5 and for the Radiation Safety Officer in Item 6. For the RSO, duties and responsibilities of the RSO and updated organizational chart are required and if necessary, a signature authorization form.
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**7. Licensed Material**

Element & Mass Number  A	Chemical and/or Physical Form  B	Manufacturer Name & Model Number (if sealed source)  C	Maximum activity (millicuries) per sealed source <u>OR</u> maximum activity possessed at any one time  D	Maximum number of sealed source/device combinations possessed at any one time  E

**Describe use of radioactive material (Should be keyed to material in Subitem A above. For specific make & model of sealed source/device combinations in Subitem E above, state maximum number possessed at any one time)**

<b>8. Radiation Detection Instruments</b>				
<u>Manufacturer</u>	<u>Model</u>	<u>Number Available</u>	<u>Radiation Detected</u> (alpha, beta, gamma, neutron)	<u>Sensitivity Range</u>
<b>9. a) Calibrated by Service Company</b> (Name, Address, and Frequency)		<b>b) Calibrated by Applicant</b> (Attach procedures describing method and standards used)		
<b>10. Personal Monitoring Devices</b>				
Type	Supplier		Exchange Frequency	
<input type="checkbox"/> (1) Film Badge <input type="checkbox"/> (2) TLD <input type="checkbox"/> (3) OSLD <input type="checkbox"/> (4) Other (specify)			<input type="checkbox"/> Monthly <input type="checkbox"/> Bi-monthly <input type="checkbox"/> Quarterly <input type="checkbox"/> Other (specify)	
<b>11. Facilities and Equipment.</b> Describe the facilities, remote handling equipment, shielding, fume hoods, etc. Attach a sketch of the facility indicating the location of any radioactive materials (i.e. fixed gauges, storage areas, etc.).				
<b>12. Radiation Protection Program.</b> Describe the radiation protection program as appropriate for the material to be used including the duties and responsibilities of the Radiation Safety Officer, control measures, bioassay procedures, day-to-day general safety instruction to be followed, etc. If sealed sources are to be possessed, describe leak test procedures or if kit is used specify the manufacturer, model number of kit and person performing test. If radiation detection instruments are to be calibrated in-house or leak test swipes analyzed, submit detailed procedures and methods.				
<b>13. Training and Experience of Users.</b> Submit the formal training of each individual named in Item 5 and 6 indicating the name of persons or institutions providing the training, duration of training, and when training received in the areas of: A) Principles and practices of radiation protection. B) Radioactivity measurement standardization and monitoring techniques and instruments. C) Mathematics and calculations basic to the use and measurement of radioactivity. D) Biological effects of radiation.				
<b>14. Waste Disposal.</b> Describe the methods which will be used for disposing of radioactive waste.				
<b>15. Certification.</b> The applicant understands that all statements and representations made in the application are binding upon the applicant.  The applicant and any official executing this certification on behalf of the applicant, named in Item 1, certify that this application is prepared in conformity with Kentucky Cabinet for Health and Family Services Administrative Regulations 902 KAR 100, and that all information contained herein, is true and correct to the best of their knowledge and belief.				
Signature of Certifying Management Official	Type/Printed Name	Title	Date	

**Appendix B**

**KYDPH Form RPS-10**

**‘Disposition of Radioactive Material’**

**RPS-10 - DISPOSITION OF RADIOACTIVE MATERIAL**

Radiation Health Branch  
Department for Public Health  
Cabinet for Health and Family Services  
275 East Main Street  
Mailstop HS1C-A  
Frankfort, KY 40621

1. Licensee Name \_\_\_\_\_

2. Address \_\_\_\_\_

3. Radioactive Material License Number \_\_\_\_\_

4. Expiration Date \_\_\_\_\_

5. Radioactive Material Disposition for (check one only)  Transfer  Termination (see 8 below).

6. Check one of the following and provide any requested information

A. No radioactive material has been procured and/or possessed by the licensee under this license.

B. All licensed activities have ceased and all radioactive material procured and/or possessed by the licensee has been transferred to the following licensee/supplier:

Name \_\_\_\_\_

Address \_\_\_\_\_

License Number \_\_\_\_\_

Date Transferred \_\_\_\_\_

C. All licensed activities have ceased and all radioactive material has been disposed of in the following manner. (Describe specific disposal procedures. Use reverse side of form if necessary) \_\_\_\_\_

7. If unsealed sources or a leaking sealed source of radioactive material had been used, submit a copy of a radiation survey conducted to determine whether any contamination remains at location(s) authorized by license.

Survey not required. (Explain) \_\_\_\_\_

Survey report attached.

8. If the license is to be terminated a Low Level Radioactive Waste Form **Must** Be Submitted.

This form is on the Radiation Health Branch Website at <http://chfs.ky.gov/dph/radiation.htm>

9. Form must be signed and dated by person authorized to act on behalf of licensee.

I hereby certify that the information provided is true and correct to the best of my knowledge and belief.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Typed/Printed Name

\_\_\_\_\_  
Title

**Appendix C**  
**Sample ‘Delegation of Authority to Radiation**  
**Safety Officer’ Letter**

**MODEL DELEGATION OF AUTHORITY TO THE RSO**

(to be printed on company letter head)

Date: \_\_\_\_\_(required)

Memo To: \_\_\_\_\_  
*(write in name & title of person being granted RSO authority)*

From: \_\_\_\_\_  
*(write in name & title of Senior Management official granting RSO authority)*

(e.g. President, Chief Executive Officer)

Subject: Delegation of Authority to the Radiation Safety Officer

You have been appointed Radiation Safety Officer for license number \_\_\_\_\_. You are responsible for ensuring the safe use of radiation. You are responsible for managing the radiation safety program; identifying radiation safety problems; initiating, recommending, or providing corrective actions; verifying implementation of corrective actions; stopping unsafe activities; and ensuring compliance with the regulations 902 KAR 100 and compliance with the terms and conditions of the license and commitments contained therein. You are hereby delegated the authority necessary to meet those responsibilities, including prohibiting the use of radioactive material by employees who do not meet the necessary requirements and shutting down operations where justified by radiation safety. You are required to notify management of situations where staff are not cooperating and not addressing radiation safety issues. In addition, you are free to raise issues with the Radiation Health Branch, Frankfort, KY at any time.

\_\_\_\_\_  
Signature and Title of Management

I, \_\_\_\_\_ hereby I accept the above delegated authority.  
*(print name)*

\_\_\_\_\_  
Signature of the Radiation Safety Officer



## **Appendix D**

### **Sample ‘Signature Authorization’ Letter**

## **MODEL SIGNATURE AUTHORIZATION FORM**

(To be submitted on company letter head)

Date: \_\_\_\_\_ (required)

Memo To: \_\_\_\_\_, Title of person being granted signature authority  
(e.g., RSO, EH&S Supervisor, etc.)

From: \_\_\_\_\_, Title of Senior Management granting that authority  
(e.g. Chief Executive Officer, President, etc.)

Subject: Delegation of Signature Authority for License Number \_\_\_\_\_

I hereby delegate authority to you for making commitments and signing amendment requests to the Kentucky radioactive materials license for (write in name and address of license) on behalf of senior management. As a member of management, I recognize the radioactive materials license is a legal document that includes the application and all approved amendments. Furthermore, only management can obligate the institution and management is held accountable for the commitments in the license. In addition, I acknowledge that only a member of management has authority to provide necessary resources to achieve regulatory compliance. Necessary resources include finance, personnel, and physical plant.

---

Signature and Title of Management

I, \_\_\_\_\_ hereby I accept the above delegated authority.  
(print name)

---

Signature of the authorized individual

# **Appendix E**

## **Information Needed for Transfer of Control of a License**

# Information Needed for Transfer of Control of a License

Licensees must provide full information and obtain KYDPH's **prior written consent** before transferring control of the license; some licensees refer to this as 'transferring the license'. Provide the following information concerning changes of control by the applicant (transferor and/or transferee, as appropriate). If any items are not applicable, so state.

**Control:** Control of a license is in the hands of the person or persons who are empowered to decide when and how that license will be used. That control is to be found in the person or persons who, because of ownership or authority explicitly delegated by the owners, possess the power to determine corporate policy and thus the direction of the activities under the license.

**Transferee:** A transferee is an entity that proposes to purchase or otherwise gain control of a KYDPH-licensed operation.

**Transferor:** A transferor is a KYDPH licensee selling or otherwise giving up control of a licensed operation.

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 non-licensed business without the license.
5. A complete, clear description of the transaction, including any transfer of stocks or assets, mergers, etc., so that legal counsel is able, when necessary, to differentiate between name changes and transferring 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 transferring 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, pursuant to 902 KAR 100:042. Decommissioning and financial surety. (<http://www.lrc.ky.gov/kar/902/100/042.htm>); public dose; and waste disposal by release to sewers, incineration, radioactive material spills, and on-site burials, have been transferred to the new licensee, if licensed activities will continue at the same location, or to the KYDPH for license terminations.

11. A description of the status of the facility. Specifically, the presence or absence of contamination should be documented. 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 902 KAR 100:042. Decommissioning and financial surety. (<http://www.lrc.ky.gov/kar/902/100/042.htm> ). 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.

**References:** The information above is derived from Information Notice 89-25, Revision 1, “*Unauthorized Transfer of Ownership or Control of Licensed Activities*,” which is available at the NRC’s webpage at <http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/1989/in89025.html> .

## RPS-12 – TRANSFER OF CONTROL OF RADIOACTIVE MATERIAL LICENSE

Radiation Health Branch  
 Department for Public Health  
 Cabinet for Health and Family Services  
 275 East Main Street  
 Mailstop HS1CA  
 Frankfort, KY 40621

1. Licensee Requesting Permission from KYDPH to Transfer Control of Its RAM License:

Current Facility Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

License Number \_\_\_\_\_ Expiration Date: \_\_\_\_\_

(The Radiation Health Branch reviews requests for **transfer of license control** on a case-by-case basis and may require application for a new license and termination of the existing license. Transfer of license control before notification, licenses more than five years old and not Amended in Entirety within five years are subject to increased scrutiny in accordance with 902 KAR 100:040. <http://www.lrc.ky.gov/kar/902/100/040.htm>)

2. Entity Requesting Permission from KYDPH to Take Control of Above RAM License

Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Registered with the Kentucky Secretary of State's Office:  Yes  No

If yes, under what name: \_\_\_\_\_

If no, please explain why not: \_\_\_\_\_

(All corporations (profit, non-profit & professional service), limited liability companies (profit, non-profit & professional service), limited partnerships (filed under 2006 Act), limited liability limited partnerships and business trusts are required by law to register with the Kentucky Secretary of State and to file an annual report by June 30 of each year <http://www.sos.ky.gov/business/filings/> )

3. All "Information Needed for Transfer of Control Application" as described on the following page has been submitted for review by KYDPH and is complete and accurate.

Yes  No If not, state why: \_\_\_\_\_

4. Form must be signed and dated by person authorized to act on behalf of the licensee requesting permission from KYDPH to transfer control of its existing RAM license.

Signature

Typed/Printed Name

Date

**FOR RADIATION HEALTH BRANCH USE ONLY**

Reviewer	Review Date	Date License Issued or AE	Meets Requirements for Transfer of Control
			<input type="checkbox"/> Yes <input type="checkbox"/> No

## **Appendix F**

### **NRC Regulatory Issue Summary 2005-10 'Performance-Based Approach for Associated Equipment in 10 CFR 34.20'**

## ADDRESSEES

All industrial radiography licensees and manufacturers and distributors of industrial radiography equipment.

## INTENT

The U.S. Nuclear Regulatory Commission (NRC) is issuing this regulatory issue summary (RIS) to explain the performance-based approach NRC has decided to take regarding the requirements in **10 CFR 34.20**, "*Performance requirements for industrial radiography equipment*", which addresses the regulation of associated equipment used in an industrial radiography system. This RIS supersedes and replaces Information Notice 96-20, "*Demonstration of Associated Equipment Compliance with 10 CFR 34.20*". No specific action or written response is required.

## BACKGROUND

In the *Federal Register* notice (68 FR 41757, July 15, 2003), NRC announced its denial of the petitioner's request for rulemaking to remove from **10 CFR 34.20** the term "*associated equipment*". The notice also explained that NRC's practice of registering associated equipment under **10 CFR 32.210**, "*Registration of product information*", which was previously described in Information Notice 96-20, had been discontinued. This RIS supersedes and replaces Information Notice 96-20.

## SUMMARY OF ISSUE

To maintain safety, each licensee must take special care to ensure that all associated equipment (including modified or customized associated equipment) meets the minimum performance criteria required in **10 CFR 34.20**. A licensee that modifies associated equipment is required to demonstrate by actual testing or an alternative analysis that the performance of the radiographic system and individual items of associated equipment meet the criteria in **10 CFR 34.20**. The results of actual testing or analysis must demonstrate that the replacement component will not compromise the design safety features of the industrial radiography system. Compliance with the performance criteria prevents a licensee from using substandard associated equipment.

## PERFORMANCE REQUIREMENTS FOR ASSOCIATED EQUIPMENT

The performance requirements for associated equipment are set forth in the paragraphs of **10 CFR 34.20**, described below:

- paragraph (a)(1), incorporates by reference the American National Standards Institute (ANSI) N432–1980, "*Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography*", (ANSI N432) which specifies the design and method of qualifying (testing) industrial radiography equipment, including equipment that NRC has defined as "*associated equipment*";
- paragraph (a)(2), provides for an engineering analysis as an alternative to actual testing, to demonstrate the performance of individual radiography equipment components;
- paragraph (b)(3), allows associated equipment to be modified unless the replacement component would compromise the design safety features of the industrial radiography system;
- paragraph (c)(5) and (8), respectively address crushing and kinking tests for a guide tube and the standard test for tensile strength of an exposure head;
- paragraph (e), allows a licensee or vendor to apply a realistic torque to the drive mechanism during the life cycle test.

The regulations require a licensee to use industrial radiography equipment that has been manufactured and tested to meet radiation safety performance criteria under **10 CFR 34.20**.

The life cycle test in ANSI N432 is an evaluation of the endurance of a source or device. To test the life cycle of an industrial radiography source or exposure device, all components of the industrial radiography system (including the associated equipment) must be assembled and operated for the duration of the test. This



requirement, NRC determined, is sufficient to maintain safety and a separate regulatory approval for associated equipment is not needed as long as the associated equipment meets the minimum criteria in **10 CFR 34.20**. Attachment 1 to this RIS contains additional information about definitions and applicable requirements, certificates of registration for a sealed source or device, custom-built items of associated equipment, acceptable methods to demonstrate compliance, inspection and licensing guidance, and inspection and maintenance procedures. Attachment 2 indicates the availability of reference documents that are cited in this RIS and Attachment 1.

### **ENFORCEMENT POLICY**

The NRC Enforcement Policy, Supplement VI, provides examples of violations in each of the four severity levels as guidance in determining the appropriate severity level for violations in the area of fuel cycle and materials operations, including industrial radiographic operations. An example of an activity that would normally result in the NRC issuing a Severity Level III Notice of Violation is possession or use of unauthorized equipment or materials in the conduct of licensee activities that degrades safety. Based on this example, enforcement action would be considered for a licensee that used associated equipment that had not been tested or analyzed to meet the performance requirements or that used modified associated equipment that compromised the design safety features of an industrial radiography system and threatened or did not protect the health and safety of workers or members of the public.

### **AGREEMENT STATE COMPATIBILITY**

NRC has determined that the information provided in this RIS does not change the level of compatibility of the Agreement State regulations to the existing NRC requirements. Use of the information in this RIS continues to provide Agreement States with the flexibility to revise their policy and guidance to meet unique situations and local conditions and to ensure an orderly, uniform implementation of the performance-based approach for associated equipment.

### **FEDERAL REGISTER NOTIFICATION**

A notice of opportunity for public comment on this RIS was not published in the *Federal Register* because it is informational, and does not represent a departure from current regulatory requirements.

### **SMALL BUSINESS REGULATORY ENFORCEMENT FAIRNESS ACT**

NRC has determined that this action is not subject to the Small Business Regulatory Enforcement Fairness Act of 1996.

### **PAPERWORK REDUCTION ACT STATEMENT**

This RIS requires no specific action or written response. If you have any questions about this summary, please contact one of the individuals listed below or the appropriate regional office.

**/RA/ Thomas Essig for**  
Patricia K. Holahan, Acting Director  
Division of Industrial and  
Medical Nuclear Safety  
Office of Nuclear Material Safety  
and Safeguards

Technical Contacts: J. Bruce Carrico, NMSS  
301-415-7826  
E-mail: [jbc@nrc.gov](mailto:jbc@nrc.gov)

Thomas Young, NMSS  
301-415-5795  
E-mail: [ty@nrc.gov](mailto:ty@nrc.gov)

**Note:** NRC generic communications may be found on the NRC public Web site, <http://www.nrc.gov>, under Electronic Reading Room/Document Collections.

Attachments: 1. Additional Information and Applicable Requirements Regarding Associated Equipment  
2. Availability of Reference Documents

## ADDITIONAL INFORMATION AND APPLICABLE REQUIREMENTS REGARDING ASSOCIATED EQUIPMENT

### Definitions

**10 CFR 34.3**, “*Definitions*”, defines associated equipment as equipment that is used in conjunction with a radiographic exposure device to make radiographic exposures that drives, guides, or comes in contact with the source [e.g., guide tube, control tube, control (drive) cable, removable source stop, ‘J’ tube, and collimator when it is used as an exposure head]. **10 CFR 34.3** defines the following items of associated equipment: collimator, control (drive) cable, control (drive) mechanism, control tube, exposure head (source stop), and guide tube. **10 CFR 34.3** defines the following radiographic equipment and related terms: radiographic exposure device, s-tube, sealed source, source assembly, source changer, and storage container.

Licenses should be aware of the specific meaning of the terms indicated above. The requirements applicable to items of equipment depend on how the equipment is defined in **10 CFR 34.3**. It is important to distinguish between items of equipment that are considered to be associated equipment and items of equipment that are not. In some cases, there may be no regulatory requirements that apply to an item of equipment; in other cases, an item of equipment may be a component of a source or device that is required to be specifically authorized for use. Following are two examples that illustrate important distinctions which determine regulatory requirements for an item of equipment.

The first example distinguishes certain types of collimators that are not associated equipment and are not required to meet the performance criteria in ANSI N432. Various types of collimators are used as radiation safety devices for industrial radiographic operations. In many cases, the exposure head at the end of the guide tube is inserted into a collimator. This type of collimator is not an item of associated equipment because the source does not come in contact with the collimator. This type of collimator is not subject to the performance requirements in **10 CFR 34.20** or the evaluation process in **10 CFR 32.210**. However, if a collimator does come in contact with the source because it also acts as a source stop (exposure head), then it falls within the scope of the definition of associated equipment that is subject to the performance requirements in **10 CFR 34.20**.

The second example distinguishes the connector that is located between the sealed source and the control (drive) cable. **10 CFR 34.3** defines the source assembly to include the connector, stating, “*Source assembly means an assembly that consists of the sealed source and a connector that attaches the source to the control cable*”. The connector is a component of the source assembly and is, therefore, not an item of associated equipment. The source assembly is subject to the requirements in **10 CFR 30.32**, “*Application for a specific license*”. **10 CFR 30.32(g)** indicates that an application for a specific license to use byproduct material in the form of a sealed source or in a device that contains a sealed source must either identify the sealed source or the device as registered under **10 CFR 32.210** or with an Agreement State or must include the information identified in **10 CFR 32.210(c)**. The manufacturing processes used to attach the connector to the source cable and to the control (drive) cable are also subject to evaluation by NRC or an Agreement State under these requirements.

Portable industrial radiographic systems typically include a two-piece connector (swivel coupling design) to attach the source assembly to the control (drive) cable in order to operate the system. The performance-based requirement in **10 CFR 34.20(c)(1)** indicates that the coupling must be designed such that it cannot be unintentionally disconnected under normal and reasonably foreseeable abnormal conditions. The Statements of Consideration at 55 FR 843 (January 10, 1990) include a response to comments received for **10 CFR 34.20(c)(1)**. The response indicates, “*NRC’s source and device registration process will ensure compliance with this performance requirement by requiring NRC approval before the newly designed connectors could be used*”.

The sealed source or device evaluation process ensures compliance with the performance criteria in the rule. Both pieces of the two-piece connector are subject to evaluation under **10 CFR 30.32(g)** or **32.210(c)**.

### **Sealed Source and Device (SS&D) Certificate of Registration**

NRC determined that the previous practice of registering associated equipment under **10 CFR 32.210** was not only not required, but was a regulatory practice that imposed an unnecessary burden on licensees and for NRC and the Agreement States which are authorized to evaluate SS&Ds. Therefore, this practice has been discontinued. NRC does not intend to independently revise current SS&D certificates of registration only to remove references to associated equipment. If it becomes necessary to amend a current SS&D certificate of registration, the applicant may remove or update the information about associated equipment in the application.

As a matter of convenience, an SS&D applicant under **10 CFR 32.210** may describe the associated equipment that was used in the life cycle test for the radiographic source or device that is being registered; however, there is no requirement to do so. If an applicant wants the associated equipment to be included on the certificate of registration, the application which describes associated equipment must include sufficient information to demonstrate that the performance criteria were met for associated equipment under **10 CFR 34.20**. If a certificate of registration does not identify the associated equipment that was used in the system along with the source or device, then each end-user (licensee) must demonstrate that the items of associated equipment which the licensee uses in the system meet the performance criteria under **10 CFR 34.20** and do not compromise the design safety features of the system.

NUREG-1556, Volume 3, Revision 1, "*Consolidated Guidance About Materials Licenses—Applications for Sealed Source and Device Evaluation and Registration*", (Final Report, April 2004), Section 4.6, "*Radiography Equipment*", indicates that there is no requirement to identify associated equipment for an SS&D certificate of registration. **Note**—In Section 15, "*Glossary*", the definition of "*associated equipment*" was intended to be removed and should be disregarded because it has been superseded by Section 4.6.

### **Custom-Built or Unique Items of Associated Equipment**

Associated equipment specifically designed and constructed to the order of a single licensee must comply with the performance criteria in **10 CFR 34.20**. There is no requirement to register custom-built or unique items of associated equipment. However, when modified or custom-built associated equipment introduces components or fabrication methods that differ from those that were used in the endurance test for a source assembly or exposure device that was previously registered, the licensee must demonstrate compliance with the requirements in **10 CFR 34.20** before the equipment can be used for industrial radiographic operations. For example, licensees must obtain information demonstrating that modified guide tubes and exposure heads will withstand tests that demonstrate the equipment will maintain its integrity in normal use and likely accident conditions.

### **Acceptable Methods to Demonstrate that Associated Equipment Complies with 10 CFR 34.20**

The performance-based approach that NRC has decided to take for associated equipment recognizes that a licensee has latitude to use modified components, unless the design of any replacement component would compromise the design safety features of the system. Further guidance about testing or an alternative analysis to testing is described in NUREG-1556, Volume 3, Revision 1, Section 10.5, "*Prototype Testing*". The NUREG addresses appropriate methods a licensee may use to demonstrate the ability of a modified industrial radiography system to maintain its integrity when subjected to conditions of normal use and likely accident conditions.

For example, information about an equivalent system that was previously registered may be used to demonstrate safety and integrity of the modified system, if the design of the modified system and its intended normal and likely accident conditions of use are identical or similar to the previously registered system. In some cases, an engineering analysis or operational history with supporting documentation may be sufficient for a licensee to

justify the use of a modified system without repeating, e.g., an endurance test. However, when an appropriate comparison to the previously registered system is not possible because a licensee is unable to obtain appropriate information about previous prototype testing, engineering analysis, or operational history for the previously registered system or item of associated equipment, then the licensee must complete actual testing of the modified system and the individual items of associated equipment to demonstrate compliance with **10 CFR 34.20**.

NRC contracted a testing laboratory to complete actual testing of three industrial radiography systems from three manufacturers. The contractor developed procedures to test the systems and individual items of associated equipment to meet the performance criteria in **10 CFR 34.20**. In a similar manner, a licensee could contract a testing laboratory or manufacturer of industrial radiography equipment to test or analyze a modified system or component that will be used in a system that was previously licensed or registered.

If a licensee needs to modify associated equipment, the licensee should adopt and implement a suitable engineering procedure or plan to ensure that a modified component will not compromise the design safety features of the industrial radiographic system. Implementation of such a procedure or plan should demonstrate that modifications to the equipment: (1) will not create material incompatibility that may degrade a sealed source or device over the expected useful life time; (2) will not diminish the performance of the system in expected use environments and in likely accident conditions over the expected life time of the various system components; (3) will not allow a source to inadvertently exit the system; and (4) will not initiate or propagate equipment failures resulting in a “source disconnect.” An endurance test for a modified system should indicate that the modified component does not interfere with the performance of the components of the system that were previously registered.

Examples of the performance-based approach that NRC has decided to use for **10 CFR 34.20** are included in the following paragraphs to illustrate situations when a licensee must complete testing or analysis of associated equipment to demonstrate that the associated equipment meets the performance criteria in **10 CFR 34.20** and does not compromise the design safety features of the system.

It is acceptable for a licensee to assume that no further testing is needed for associated equipment which is listed along with the source or device as an entire system on the certificate of registration because the associated equipment has already been verified to meet the performance criteria in **10 CFR 34.20** when the associated equipment is used with the source or device. However, a licensee that substitutes associated equipment into an industrial radiography system that was registered as an entire system which specified the associated equipment must demonstrate that the reconfigured system meets the performance criteria under **10 CFR 34.20**.

It is acceptable for a licensee to assume that associated equipment that is used as the manufacturer intended as described in the SS&D certificate of registration meets the performance criteria under **10 CFR 34.20**. The SS&D certificate of registration indicates the principal use, normal conditions of use, and the limitations on use for the source or device. However, a licensee that uses associated equipment in a manner that was not intended by the manufacturer as described in the SS&D certificate of registration for the source or device must describe the conditions of use for the equipment and obtain information about performance of the equipment under these conditions of use to demonstrate compliance with **10 CFR 34.20**. Conditions of use include, for example, extremely hot or cold operating temperature, excessive vibration or shock, high concentrations of corrosive materials, and underwater usage.

### **Inspection and Licensing Guidance**

NRC is revising inspection and licensing guidance to incorporate the explanation provided by this RIS. Inspection Procedure 87121, “*Industrial Radiography Programs*”, directs an inspector to follow a performance-based approach to examine available associated equipment, observe work in progress that involves use of associated equipment, and interview workers about the inspection and maintenance procedures and the worker’s awareness that associated equipment must comply with the performance criteria in **10 CFR 34.20**.

If the associated equipment appears to be modified or defective, the inspector should verify whether or not the licensee had developed and implemented a testing program to demonstrate that modified components meet the performance criteria in **10 CFR 34.20**. The inspector should alert the inspection supervisor who may extend the inspection and request an SS&D reviewer to evaluate the licensee's modification of the equipment. The expectation is that the design safety features of the industrial radiography system were not compromised by a replacement component of associated equipment that was modified by the licensee. Before using the modified system, the licensee is required to demonstrate that the replacement component meets the performance criteria in **10 CFR 34.20**.

NUREG-1556, Volume 2, "*Consolidated Guidance about Materials Licensees—Program-Specific Guidance about Industrial Radiography Licenses*" (Final Report, August 1998) is being amended to remove statements that indicate associated equipment must be specifically approved or registered by NRC or an Agreement State. Instead, the guidance will state that vendors or distributors of industrial radiography equipment may voluntarily include the items of associated equipment that were used in the system with their SS&Ds that are registered under **10 CFR 32.210**. To include associated equipment in the certificate of registration, the vendor's application must include information that demonstrates the associated equipment meets the minimum criteria in **10 CFR 34.20**. Also, copies of this RIS will be inserted into Appendix F to replace Information Notice 96-20.

### **Inspection and Maintenance Procedures**

NRC completed a generic assessment and special team inspection which was published in NUREG-1631, "*Source Disconnects Resulting from Radiography Drive Cable Failures*" (June 1998). The inspection team observed that, in general, radiography exposure devices appeared to be in good working order, showing no evidence of damage, abuse, or lack of maintenance. By contrast, the associated equipment (i.e., control mechanisms, including drive cables) often appeared to be damaged, in disrepair, and lacking maintenance.

NUREG-1631 emphasized the importance of a licensee's understanding and commitment to the operating and use conditions specified by a vendor (manufacturer or distributor) of an industrial radiography system which, if exceeded, could compromise the safety and reliability of the system. This is particularly true of items of associated equipment, including drive cables. A licensee should be vigilant to inspect and maintain associated equipment in order to avoid component failures that could result in unnecessary radiation exposures to workers and members of the public.

A licensee's equipment inspection and maintenance program should prevent particular equipment problems that may develop from excessive uses where harsh or abusive conditions exist that may cause a component to fail. **10 CFR 34.31**, "*Inspection and maintenance of radiographic exposure devices, transport and storage containers, associated equipment, source changers, and survey instruments*", requires a licensee to perform visual and operability checks on associated equipment before use on each day the equipment is to be used to ensure that the equipment is in good working condition. If equipment problems are found, the equipment must be removed from service until repaired. In addition, the licensee is required to have written procedures for inspection and routine maintenance of associated equipment at intervals not to exceed three months or before the first use thereafter to ensure the proper functioning of components important to safety. Replacement components shall meet design specifications. If problems are found, the equipment must be removed from service until repaired. Records are required for equipment problems and any maintenance performed.

## AVAILABILITY OF REFERENCE DOCUMENTS

Below are the titles of the reference documents along with the URLs and the ADAMS accession numbers (e.g., MLxxxxxxx), if available. The URLs link directly to the documents that are posted on the NRC's public web site. For documents without an URL, NRC maintains an Agencywide Document Access and Management System (ADAMS), which provides text and image files of NRC's public documents. These documents may be accessed through the NRC's Public Electronic Reading Room on the Internet at <http://www.nrc.gov/reading-rm/adams.html>. If you do not have access to ADAMS or if there are problems in accessing the documents located in ADAMS, contact the NRC Public Document Room (PDR) Reference staff at 1-800- 397-4209, 301-415- 4737, or by e-mail to [pdr@nrc.gov](mailto:pdr@nrc.gov). If no URL or ADAMS accession number is indicated for the document then send a written request for a single, paper copy of the document to the Office of Administration, Distribution and Mail Services Section, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; or contact the PDR noted above.

1. Federal Register notice (68 FR 41757, July 15, 2003), Denial of a petition for rulemaking [Docket No. PRM-34-5, Amersham Corporation] ML050620568
2. 10 CFR Part 32, Specific domestic licenses to manufacture or transfer certain items containing byproduct material <http://www.nrc.gov/reading-rm/doc-collections/cfr/part032/>
3. 10 CFR Part 34, Licenses for Industrial Radiography and Radiation Safety Requirements for Industrial Radiographic Operations <http://www.nrc.gov/reading-rm/doc-collections/cfr/part034/>
4. American National Standards Institute (ANSI) N432–1980, Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography, (ANSI N432) ML050840139
5. NRC Enforcement Policy <http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>
6. NUREG-1556, Volume 3, Revision 1, Consolidated Guidance About Materials Licenses–Applications for Sealed Source and Device Evaluation and Registration, (Final Report, April 2004) ML041340618 <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v3/r1/>
7. Inspection Procedure 87121, Industrial Radiography Programs, <http://www.nrc.gov/reading-rm/doc-collections/insp-manual/inspection-procedure/ip87121.pdf>
8. NUREG-1556, Volume 2, Consolidated Guidance about Materials Licensees–Program-Specific Guidance about Industrial Radiography Licenses (Final Report, August 1998) <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v2/>
9. NUREG-1631, Source Disconnects Resulting from Radiography Drive Cable Failures (June 1998) <http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/1997/in97091s1.html>

**Appendix G**

**Radiographer and Radiographer's Assistant  
Training**

# Radiographer's Training

REFERENCE	REQUIREMENT	TRAINING CRITERIA
<b>902 KAR 100:100</b>	Training  Classroom Training – 40 hours in Length	Topics in <b>902 KAR 100:100 SECTION 14</b>  Fundamentals of Radiation Safety <ul style="list-style-type: none"> <li>• Characteristics of gamma radiation</li> <li>• Units of radiation dose and quantity of radioactivity</li> <li>• Hazards of exposure to radiation</li> <li>• Levels of radiation from licensed material</li> <li>• Methods of controlling radiation dose (time, distance, and shielding)</li> </ul> Radiation Detection Instruments <ul style="list-style-type: none"> <li>• Use, operation, calibration and limitations</li> <li>• Survey techniques</li> <li>• Personnel monitoring equipment</li> </ul> Equipment to be Used <ul style="list-style-type: none"> <li>• Operation and control of radiographic exposure equipment, remote handling equipment, storage containers and pictures or models of source assemblies (pigtailed)</li> <li>• Storage, control and disposal of licensed material</li> <li>• Inspection and maintenance of equipment</li> </ul> Requirements of <b>902 KAR 100, 'Kentucky Radiation Protection Regulations'</b>  Case Histories of Accidents in Radiography
	On-the-Job Training- 2 months or 320 hours	Under the supervision of a qualified radiographer
	Certification by a Certifying Entity	Certified through a radiographer certification program meeting the requirements of <b>10 CFR 34 Appendix A</b> . See the following CRCPD website for a listing of Industrial Radiography Certification entities <a href="http://www.crcpd.org/IR.aspx#List of States">http://www.crcpd.org/IR.aspx#List of States</a>



<b>902 KAR 100:100</b>	Must Receive Copies of and Instruction in:	<b>902 KAR 100 Parts</b> <ul style="list-style-type: none"> <li>• 019(<a href="http://www.lrc.state.ky.us/kar/902/100/019.htm">www.lrc.state.ky.us/kar/902/100/019.htm</a>)</li> <li>• 040(<a href="http://www.lrc.state.ky.us/kar/902/100/040.htm">www.lrc.state.ky.us/kar/902/100/040.htm</a>)</li> <li>• 070(<a href="http://www.lrc.state.ky.us/kar/902/100/070.htm">www.lrc.state.ky.us/kar/902/100/070.htm</a>)</li> <li>• 100(<a href="http://www.lrc.state.ky.us/kar/902/100/100.htm">www.lrc.state.ky.us/kar/902/100/100.htm</a>)</li> <li>• 165(<a href="http://www.lrc.state.ky.us/kar/902/100/165.htm">www.lrc.state.ky.us/kar/902/100/165.htm</a>)</li> </ul> The License The Licensee's Operating & Emergency Procedures
	Written Examination of items listed above	Successful completion
<b>902 KAR 100:100</b>	Receive Equipment Training	Training includes: <ul style="list-style-type: none"> <li>• Exposure devices</li> <li>• Sealed sources</li> <li>• Associated equipment</li> <li>• Survey meters</li> <li>• Daily inspection</li> </ul>
	Demonstrate Understanding in Use of Equipment by Practical Exam	Successful completion
<b>902 KAR 100:100</b>	Annual Refresher Training	Review the following: <ul style="list-style-type: none"> <li>• Radiation Safety review</li> <li>• New procedures or equipment</li> <li>• New rule requirements</li> <li>• Observations and deficiencies during audits and discussion of any significant incidents or accidents involving radiography</li> <li>• Employee questions</li> </ul>
<b>902 KAR 100:100</b>	Records of Training and Certification	Maintained in accordance with rule

## Radiographer's Assistant Training

REFERENCE	REQUIREMENT	TRAINING CRITERIA
<b>902 KAR 100:100</b>	Must Receive Copies of and Instruction in:	<b>902 KAR 100 Parts</b> <ul style="list-style-type: none"> <li>• 019</li> <li>• 040</li> <li>• 070</li> <li>• 100</li> <li>• 165</li> </ul> The License The Licensee's Operating & Emergency Procedures
	Written Examination of items listed above	Successful completion
<b>902 KAR 100:100</b>	Receive Equipment Training	Training under the supervision of a qualified radiographer that includes: <ul style="list-style-type: none"> <li>• Exposure devices</li> <li>• Sealed sources</li> <li>• Associated equipment</li> <li>• Survey meters</li> <li>• Daily inspection</li> </ul>
	Demonstrate Understanding in Use of Equipment by Practical Exam	Successful completion
<b>902 KAR 100:100</b>	Annual Refresher Training	Review the following: <ul style="list-style-type: none"> <li>• Radiation Safety review</li> <li>• New procedures or equipment</li> <li>• New rule requirements</li> <li>• Observations and deficiencies during audits and discussion of any significant incidents or accidents involving radiography</li> <li>• Employee questions</li> </ul>
<b>902 KAR 100:100</b>	Records of Training and Certification	Maintained in accordance with rule

## **Appendix H**

# **Six-Month Radiographer/Radiographer's Assistant Inspection Checklist**

# Six-Month Radiographer/Radiographer's Assistant

## Inspection Checklist

Date: _____ Time: _____	
Radiographic Location: _____	
Radiographer/Radiographer's Assistant: _____	
Device Model No.: _____	Serial No.: _____
Survey Meter Functionality: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Calibrated: <input type="checkbox"/> Yes <input type="checkbox"/> No	Daily Source Check: <input type="checkbox"/> Yes <input type="checkbox"/> No
Dosimetry: OSLD, Film Badge, Or Similar Device and Pocket Dosimeter: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Pocket Dosimeter Calibrated: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Alarming Dosimeter: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Calibrated: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Daily Operational Check Performed: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Were other individuals working within the restricted area wearing film badges, OSLDs or similar devices, dosimeters and alarming ratemeters?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the restricted area posted with a " <i>CAUTION (or DANGER) RADIATION AREA</i> " sign(s)?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the restricted area properly controlled to prevent unauthorized entry?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the high-radiation area posted with a " <i>CAUTION (OR DANGER) HIGH RADIATION AREA</i> " sign(s)?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the Utilization Log properly filled out?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Did the radiographer/radiographer's assistant have sufficient knowledge of safety rules?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the radiographer working with properly inspected and operable equipment?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Did the radiographer/radiographer's assistant properly survey the camera?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Did the radiographer properly supervise the radiographer's assistant?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the camera properly locked and secured to prevent unauthorized removal?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the restricted area properly controlled?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the high radiation area under continuous direct observation except where entry had been prevented?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Were radioactive isotopes stored properly and kept locked to prevent removal?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was the storage area posted with a " <i>CAUTION (or DANGER) RADIOACTIVE MATERIAL</i> " sign(s)?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Did the radiographer/radiographer's assistant possess and use a copy of the operating and emergency procedures and KYDPH rules for protection against radiation?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Were there any other safety items found to be lacking? If yes, explain in Remarks.	<input type="checkbox"/> Yes <input type="checkbox"/> No
Remarks/Comments: _____ _____ _____ _____	

# **Appendix I**

## **Radiation Protection Program Audit**

# Radiation Protection Program Audit

Date of this Audit: \_\_\_\_\_  
Next Audit Date: \_\_\_\_\_

Date of Last Audit: \_\_\_\_\_

Auditor \_\_\_\_\_  
(Signature)

Date \_\_\_\_\_

Management Review \_\_\_\_\_  
(Signature)

Date \_\_\_\_\_

## Organization and Scope of Program

A. Organizational structure. (specify any changes)

1. Matches license requirements. [L/C]
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 radioactive material, frequency of use, staff size, etc.

B. Radiation Safety Officer.

1. Named on license. [L/C]
2. Fulfills duties as RSO. **902 KAR 100:100**
3. Meets requirements. **902 KAR 100:100**

C. Radiographers and radiographer's assistants named in documents. [L/C]

## Training, Retraining, and Instructions to Workers

A. Instructions to workers. [902 KAR 100:165]

B. **902 KAR 100** Parts: 019, 040, 070, 100 and 165; the license; and operating and emergency procedures are furnished to all radiographers and radiographer's assistants. [902 KAR 100:100]

C. Training program description the same as that submitted with license application or as amended?  
[902 KAR 100:100]

1. Written tests completed by all radiographers and radiographer's assistants.
2. Oral tests.
3. All radiographers completed on-the-job training.
4. Periodic training program implemented.
5. Records maintained [902 KAR 100:100].

D. Workers cognizant of requirements for:

1. Radiation safety program. [902 KAR 100]
  - a. Occupational exposure annual limits. [902 KAR 100:019]
  - b. Public annual dose limits. [902 KAR 100:019]
2. 10% monitoring threshold. [902 KAR 100:019]
3. Dose limits to embryo/fetus and declared pregnant worker. [902 KAR 100:019]
4. Procedures for opening packages. [902 KAR 100:070]

## Operating and Emergency Procedures

- A. Procedures current? **[902 KAR 100:100]**
- B. Procedures contain information specified. **[902 KAR 100:100]**
- C. Procedures submitted to KYDPH. **[L/C]**

## Internal Audits or Inspections

- A. Audits/inspections of each radiographer and radiographer's assistants conducted at 6-month intervals or after as appropriate. **[902 KAR 100:100]**
- B. Equipment check before use each day. **[902 KAR 100:100]**
- C. Equipment inspection and maintenance performed at 3-month intervals. **[902 KAR 100:100]**
- D. Records maintained. **[902 KAR 100:019, 902 KAR 100:040, 902 KAR 100:100]**

## Facilities

- A. Permanent radiographic installation. **[902 KAR 100:100]**
  - 1. High Radiation Area posted. **[902 KAR 100:019]**
  - 2. Entrance controls are as described. **[902 KAR 100:100]**
    - 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 before use with radiation source.
    - e. Records maintained for 3 years. **[902 KAR 100:100]**
- B. Temporary High Radiation Area Entry Controlled. **[902 KAR 100:100]**
- C. Storage Area
  - 1. Storage Facilities as Described in license. **[L/C]**
  - 2. Sources Locked in Devices. **[902 KAR 100:100]**
  - 3. Devices secured to prevent tampering or unauthorized removal. **[902 KAR 100:100]**

## Equipment

- A. Radiography devices, source assemblies and source changers in use meet requirements. **[902 KAR 100:100]**
- B. Associated equipment in use complies with requirements. **[902 KAR 100:100]**
- C. Source changers and storage containers meet radiation level limits. **[902 KAR 100:100]**
- D. 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 on the license. [L/C]
- B. All sealed sources not fastened to or contained in an exposure device are tagged. [902 KAR 100:100]
- C. Leakage and contamination tests.
  - 1. Sealed sources.
    - a. Leak test method approved. [902 KAR 100:100]
    - b. Leak tests performed at 6 month intervals. [902 KAR 100:100]
    - c. Leakage is less than 185 Becquerel (Bq) (0.005 microcuries).
  - 2. Depleted uranium (DU) shielding with S-tubes.
    - a. Test every 12 months. [902 KAR 100:100]
    - b. DU is less than 185 Bq (0.005 microcuries).
  - 3. Records maintained for 3 years. [902 KAR 100:100]
- D. Inventories
  - 1. Conducted quarterly (not to exceed 3 months). [902 KAR 100:100]
  - 2. Contain all required information. [902 KAR 100:100]
  - 3. Records maintained for 3 years. [902 KAR 100:100]
  - 3. Most recent inventory conducted on \_\_\_\_\_
- E. Utilization Logs
  - 1. Utilization logs maintained. [902 KAR 100:100]
  - 2. Contain all required information. [902 KAR 100:100]

## Instrumentation

- A. Describe the survey instruments possessed:  
Model No. \_\_\_\_\_ Quantity \_\_\_\_\_
- B. Capable of measuring 0.02 mSv (2 mrem)/hr through 0.01 Sv (1 rem)/hr. [902 KAR 100:100]
- C. Operable and calibrated survey instruments available and used on each job (at least one survey instrument per every exposure device). [902 KAR 100:100]
- D. Calibration performed at intervals not to exceed six months or after servicing. [902 KAR 100:100]
- E. Records maintained for 3 years. [902 KAR 100:100]

## Radiation Surveys

- A. Area or facility surveys conducted to show compliance with 902 KAR 100:100. [902 KAR 100:100]
- B. Records maintained. [902 KAR 100:100]
- C. Survey after each exposure, including device, guide tube, ensuring source has returned to the shielded position. [902 KAR 100:100]
- D. Survey of device when place in storage to ensure source is in shielded position. [902 KAR 100:100]



E. Protection of members of the public **[902 KAR 100:019]**

1. Adequate surveys made to demonstrate.
  - a. The TEDE to the individual likely to receive the highest dose does not exceed 0.1 mSv (100 mrem) in a year;
- Or**
- b. That if an individual were continuously present in an unrestricted area, the external dose would not exceed 1 mSv (100 mrem) in a year. **[902 KAR 100:019]**
2. Unrestricted area radiation levels do not exceed 0.02 mSv (2 mrem) in any 1 hour. **[902 KAR 100:019]**
3. Records maintained. **[902 KAR 100:019]**

## Personnel Radiation Protection

A. Dosimetry

1. Workers monitored as required. **[902 KAR 100:100]**
2. Exchange Frequency \_\_\_\_\_ Supplier \_\_\_\_\_
3. Verify supplier is NVLAP-approved. **[902 KAR 100:100]**
4. Dosimetry exchanged at required frequency. **[902 KAR 100:100]**
5. Dosimetry records maintained. **[902 KAR 100:100]**

B. Pocket Dosimeters and Electronic Personal Dosimeters **[902 KAR 100:100]**

1. Model No. \_\_\_\_\_ Range \_\_\_\_\_  
Model No. \_\_\_\_\_ Range \_\_\_\_\_
2. Read and recorded at start of each shift.
3. Daily readings recorded.
4. Dosimeters checked for response ( $\pm 20\%$ ) at intervals not to exceed 12 months.
5. Off-scale dosimeter procedure and records.

C. Alarming Ratemeters **[902 KAR 100:100]**

1. Model No. \_\_\_\_\_ Range \_\_\_\_\_
2. Checked that alarm functions properly at start of each shift.
3. Preset at 5 mSv (500 mrem)/hr.
4. Calibrated to  $\pm 20\%$  at intervals not to exceed 12 months.
5. Records maintained.

D. Dosimetry Reports

1. Reviewed by \_\_\_\_\_ Frequency \_\_\_\_\_.
2. Reviewed personnel monitoring records for interval (from \_\_\_\_\_ to \_\_\_\_\_).
3. Maximum exposures: TEDE \_\_\_\_\_ extremity, other \_\_\_\_\_.
4. NRC Form 5 (or equivalent). **[902 KAR 100:019, 902 KAR 100:100]**
5. Maximum exposures in compliance with annual limits. **[902 KAR 100:019]**
6. Fetal and Pregnant worker exposure. **[902 KAR 100:019]**
  - a. Worker declared pregnancy in writing during the audit interval.
  - b. If yes, licensee in compliance? Records maintained?
7. Dosimetry records maintained. **[902 KAR 100:019]**
8. Annual exposure reports given to workers? **[902 KAR 100:165]**

E. Radiation Protection Program **[902 KAR 019]**

1. Program includes provisions for keeping dose ALARA.
2. Procedures and engineering controls used to achieve ALARA.
3. Content and implementation reviewed annually by licensee.
4. Records of program reviews maintained.

F. Planned Special Exposures (PSEs) [902 KAR 100:019]

1. PSEs performed? \_\_\_\_\_
2. If so, when, where and why? \_\_\_\_\_
3. Records maintained.

**Receipt and Transfer of Radioactive Material [902 KAR 100:040]**

A. Procedures established and followed for picking up, receiving, and opening packages.

B. Incoming packages surveyed.

C. Shipment of sources since last inspection.

1. Used container authorized by license or Certificate of Compliance (COC).
2. Transfers.
3. All sources surveyed before shipment and transfer.

D. Records of surveys and receipt/transfer maintained. [902 KAR 100:040]

**Transportation [902 KAR 100:070 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. DOT 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. COC's on file with NRC for Type B. [10 CFR 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, Package type, 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, TI, Shipper's name, Certification and signature, Emergency response phone number, "Limited Quantity", "Cargo Aircraft Only" if applicable). [49 CFR 172.200 - 172.204; 175.700]
3. Emergency Response Information required by 49 CFR 172 subpart G, 172.600 and 172.602 presented along with the Shipping Paper, either on the document itself or as an attached document with specific instructions for (1) Immediate hazards to health; (2) Risks of fire or explosion; (3) Immediate precautions to be taken in the event of an accident or incident; (4) Immediate methods for handling fires; (5) Initial methods for handling spills or leaks in the absence of fire; and (6) Preliminary first aid measures.
4. Readily accessible during transport (on seat next to driver or driver's side door pouch).

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 [902 KAR 100:019]

B. Theft or loss [902 KAR 100:019]

C. Incidents [902 KAR 100:040]

D. Overexposures and high radiation levels [902 KAR 100:019]

E. Annual reports furnished to KYDPH

F. Reporting of defects and non-compliance [902 KAR 100:100]

### **Posting and Labeling**

A. Radiation areas [12VAC5-481-860]

B. High radiation areas [12VAC5-481-860]

C. Use or storage areas [12VAC5-481-860]

D. Containers or devices labeled [12VAC5-481-880, 12VAC5-481-1290]

E. Notice to Employees, Form KR-441 [12VAC5-481-2260 C]

## **Recordkeeping for Decommissioning [902 KAR 100:042]**

- A. Records in independent and identifiable location
- B. Records include all required data

## **Bulletins and Information Notices**

- A. Communications received and reviewed
- B. Appropriate response to Information Notices

## **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 J**

# **Procedure for Calibrating Survey Instruments**

# Procedure for Calibrating Survey Instruments

A. Sealed source(s) used for calibrating survey instruments should:

1. Approximate a point source
2. Have its exposure rate at a given distance traceable by documented measurements to a standard certified to be within +/- 5% accuracy by NIST
3. Approximate the same photon energy (Ir-192, Co-60) as the source to be used in the radiography device.
4. Be of sufficient strength to give an exposure rate of about 0.3 mSv/hr (30 mrem/hr) at 100 cm. (85 mCi of Cs-137 or 21 mCi of Co-60).

B. Use the inverse square and radioactive decay law to correct changes in exposure rate due to source decay or different distances from the source.

C. Record survey meter calibration data and maintain written records for each instrument being used to satisfy regulatory requirements. Survey meter calibration reports should indicate the procedure used and the data obtained. Calibration records should contain the following information and must be maintained three (3) years from date of calibration of each instrument:

1. Owner or user identification, including name, address, and person to be contacted;
2. Instrument description that includes manufacturer, model number, serial number, and type of detector;
3. Calibration source description that includes exposure rate, indicated exposure rate at a specified distance on a specified date, and the calibration procedure;
4. Each calibration point identifying the calculated exposure rate, the indicated exposure rate, the deduced correction factor, and the scale selected on the instrument;
5. Exposure reading indicated with the instrument in the 'battery check' mode, if available;
6. Angle between the radiation flux field and the detector (parallel, perpendicular);  
**Note:** Internal detectors should specify angle between radiation flux field and a specified surface of the instrument
7. For detectors with removable shielding, note whether the shielding was in place or removed during the calibration procedure;
8. Include person's name who performed the calibration and the date on which the calibration was performed;

D. A single point on a survey meter scale can be considered satisfactorily calibrated if the indicated exposure rate differs from the calculated exposure rate by less than 10%.

**Note:** Three kinds of scales are frequently used on radiation survey meters:

1. Linear Scale: Meters on which the user selects a linear scale must be calibrated at no less than two points on each scale. The points should be at approximately 1/3 and 2/3 of the decade.
2. Multidecade Logarithmic Scale: Meters that have a multidecade logarithmic scale must be calibrated at no less than one point on each decade and no less than two points on one of the decades. Those points should be approximately 1/3 and 2/3 of the decade.
3. Automatically Ranging Digital Display: Meters that have a device for indicating rates must be calibrated at no less than one point on each decade and at no less than two points on one of the decades. Those points should be at approximately 1/3 and 2/3 of the decade.

E. Scales in excess of 10 mSv/hr (1,000 mrem/hr) need not be calibrated. However, such scales should be checked for operation and approximately correct response.

- F. The following information should be attached to the instrument as a calibration sticker or tag:
1. Source that was used to calibrate the instrument
  2. A calibration chart or graph for each scale or decade of a survey meter that is greater than +/- 20% of the actual values identifying the average correction factor, or a note indicating that scale was checked only for function or is inoperative.
  3. Date of calibration
  4. Date survey instrument is due calibration
  5. Name or initials of individual calibrating instrument.

**Note:** Detailed information about survey instrument calibration may be obtained by referring to ANSI N323-1978, "*Radiation Protection Instrumentation Test and Calibration*". Copies may be obtained from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

NUREG 1556, Volume 18 'Program-Specific Guidance About Service Provider Licenses' is available from the NRC website at <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v18/>.

## **Appendix K**

# **Requests to Perform Leak Testing and Sample Analysis**



# Requests to Perform Leak Testing and Sample Analysis

## A. Requests to Perform Leak Testing and Sample Analysis

1. Identify the individual who will make the analysis and provide his or her qualifications to make quantitative measurements of radioactivity.
2. Specify how and where test samples will be taken on the radiography device. Describe materials used and methods of handling samples to prevent or minimize exposure to personnel.
3. Specify the type of instrument(s) that will be used for measurement, the counting efficiency, and minimum levels of detection for each radionuclide to be measured.

**Note:** An instrument capable of making quantitative measurements should be used; hand-held survey meters will not normally be considered adequate for measurements.

4. Specify the standard sources used to calibrate the instrument; for each, specify the radionuclide, quantity, accuracy, and tractability to primary radiation standards.

**Note:** Accuracy of standards should be within  $\pm 5\%$  of the stated value and traceable to a primary radiation standard such as those maintained by the National Institutes of Standards and Technology (NIST).

NUREG 1556, Volume 18 'Program-Specific Guidance About Service Provider Licenses' is available at the NRC website: <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v18/>, or from DHFS upon request.

5. Include a sample calculation for conversion of the measurement data to Bq (or microcuries).
6. Provide instructions on actions to take and persons to be notified if sources are found to be leaking.

## B. Procedure for Performing Leak Testing and Analysis

1. For each source to be tested, list identifying information such as radiography device serial number, radionuclide, activity.
2. If available, use a survey meter to monitor exposure.
3. Prepare a separate wipe sample (e.g., cotton swab or filter paper) for each source.
4. Number each wipe to correlate with identifying information for each source.
5. Wipe the most accessible area where contamination would accumulate if the sealed source were leaking.
6. Using the instrument identified to and approved by KYDPH, count and record background count rate.
7. Check the instrument's counting efficiency using standard source of the same radionuclide as the source being tested or one with similar energy characteristics.
8. Calculate efficiency.

9. Count each wipe sample; determine net count rate.
10. For each sample, calculate and record estimated activity in Bq (or microcuries).
11. Sign and date the list of sources, data and calculations.
12. If the wipe test activity is 185 Bq (0.005 microcurie) or greater, notify the RSO, so that the source can be withdrawn from use and disposed of properly. Also notify KYDPH.

### **C. Sampling and Analysis for Depleted Uranium as a Result of S-tube Breakthrough**

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

1. 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.
2. Alpha counting sensitivity should be able to detect 185 Bq (0.005 microcuries) of contamination.
3. 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 L**

# **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

## A. Licensees must ensure that:

1. The radiation dose received by individual members of the public resulting from the licensee's possession and/or use of licensed materials does not exceed 1 mSv (100 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.

2. The radiation dose in unrestricted areas does not exceed 0.02 mSv (2 mrem) in any one 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.

3. Licensees must show compliance with both portions of the rule. 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 one hour. For storage areas and permanent radiographic facilities, calculations or a combination of calculations and measurements (e.g., using an environmental TLD) are often used to prove compliance with levels of 0.02 mSv (2 mrem) in any one hour and 1mSv (100 mrem) in a calendar year.

## B. Calculation Method

1. For ease of use by most industrial radiography licensees, the examples in this Appendix use conventional units. The conversions to SI units are as follows: 1 foot (ft) = 0.305 meter (m); 1 mrem = 0.01 mSv.
2. The calculation 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 & 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.
3. Part 1 of the calculation 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 calculation 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.

### C. Example 1

1. To better understand the calculation 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 KYDPH regulations.
2. 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 KYDPH rule or DOT regulations: 2 mSv/hr (200 mrem/hr) on the surface and 0.1 mSv/hr (10 mrem/hr) at one meter.

### D. Findings

1. Upon his inspection, Joe found that there were two sources in the room. One Ir-192 device (Type B container) had a reading of 10 mrem/hr at 1 meter (3.3 ft) and was 12 ft from the secretary's chair. The other was a Co-60 device (Type B container) had a reading of 10 mrem/hr at 1 meter (3.3 ft) and was 18 ft from the secretary's chair.

### E. Example 1: Part 1

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 10 CFR 20.1301. So, taking a worst case approach, he assumes: 1) the devices are constantly present (i.e., 24 hr/d), 2) both devices remain in storage with no other use, and 3) the secretary is constantly sitting in the desk chair (i.e., 24 hr/d). Joe proceeds to calculate the dose she might receive hourly and yearly from each device, as shown in **Tables 10** and **11** below.

**F. Table 10: Calculation Method, Part 1: Hourly and Annual Dose Received from Device 1**

Step No.	Description	Device 1 Input Data	Results
1	Dose received in an hour at known distance from device (e.g., from manufacturers data), in mrem/hr	10	10
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft <sup>2</sup>	(3.3) <sup>2</sup>	10.9
3	Square of the distance (ft) from the device the secretary's desk in an unrestricted area, in ft <sup>2</sup>	(12) <sup>2</sup>	144
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	10 x 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 an hour.	109/144	0.76
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICE 1, in mrem in a year.	0.76 x 24 x 365	6,630

**G. Table 11: Calculation Method, Part 1: Hourly and Annual Dose Received from Device 2**

Step No.	Description	Device 1 Input Data	Results
1	Dose received in an hour at known distance from device (e.g., from manufacturers data), in mrem/hr	10	10
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft <sup>2</sup>	(3.3) <sup>2</sup>	10.9
3	Square of the distance (ft) from the device the secretary's desk in an unrestricted area, in ft <sup>2</sup>	(18) <sup>2</sup>	324
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	10 x 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 2, in mrem in an hour.	109/324	0.34
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICE 2, in mrem in a year.	0.34 x 24 x 365	2,950

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

**Table 12: Calculation 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 <b>Tables 9</b> and <b>10</b> , in mrem in an hour	0.76	0.34	0.76 + 0.34 = 1.1
8	TOTAL ANNUAL DOSE RECEIVED from Step 6 of <b>Tables 10</b> and <b>11</b> , in mrem in a year	6,630	2,950	9,580

**Note:** The Sum in Step 7 demonstrates compliance with the limit of 2 mrem in any one 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 one hour is only 1.1 mrem in an hour, but notes that an individual could receive a dose of 9,580 mrem in a year, much higher than the 100 mrem limit.

**I. Example 1: Part 2**

1. Joe reviews his assumptions and recognizes that the secretary is not at the desk 24 hr/d. 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 (i.e., 24 hr/d), both devices remain in storage with no other use). He then recalculates the annual dose received.

**2. Table 13: Calculation 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 hr/day; 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 x 3x 52 = <b>780</b>
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 a year	1.1 x 780 = <b>860</b>

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

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

**J. Example 1, Part 3**

1. 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.
2. Summary of Information: Device #1 (Ir-192 Exposure Device) is located in the storage area overnight and used every day at temporary jobsites all year long; it is returned to the storage location at the end of each day meaning it is only present for the secretary’s first and last hours of work each day. Device #2 (Co-60 Exposure Device) is in the storage area continuously (24 hr/d) for 8 months of the year and at a temporary jobsite for the remaining 4 months. The secretary is sitting at the desk 5 hours/day, 3 days/week and 52 weeks/year.

### 3. Table 14: Calculation 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	$2 \times 3 \times 52 = 312$	$5 \times 3 \times 32 = 480$
16	Multiply the results of Step 15 by the results of Step 7 = ANNUAL DOSE RECEIVED FROM EACH DEVICE, in mrem in a year	$312 \times 0.76 = 237$	$480 \times 0.34 = 163$
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 a year	$237 + 163 = 400$	

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

4. Joe notes that the result in Step 17 does not show compliance with the 100 mrem/yr limit. Since the result in Step 17 is higher than 100 mrem/yr, then Joe has to consider 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 (HVL) for Ir-192 and Co-60.

### 5. Table 15: Half Value Layers (HVL) 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.

### K. Example 1, Part 4

1. 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.



**2. Table 16: Calculation 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, need to evaluate each shielding material separately by type of radionuclide	$4.0/1.7 = 2.35$	$4.0/2.1 = 1.9$
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 a year	$0.2 \times 237 = 47$	$0.27 \times 163 = 44$
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 a Year	$47 + 44 = \mathbf{91}$	

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

3. Joe is glad to see that the results in Step 22 show compliance with the 100 mrem in a calendar year limit.
4. 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 ALARA principal, 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.

**RECORD KEEPING: 12VAC5-481-1050** requires licensees to maintain records demonstrating compliance with the dose limits for individual members of the public.

**L. Combination Measurement - Calculation Method**

1. 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 2080 hours (i.e., a work year of 40 hr/wk for 52 wk/yr) 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 G-M survey instruments.

2. 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., LiF) 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 1 mSv/yr (100 mrem/yr) limit. 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 CaF<sub>2</sub> 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 1 mSv/yr (100 mrem/yr) limit.

## M. 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 **D** 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 workspace 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 the TLD received 100 mrem.

### 3. Table 17: Combination Measurement - Calculation Method

Step No.	Description	Input Data and Results
<b>Part 1</b>		
1	Dose received by OSL, in mrem	100
2	Total hours OSL exposed	224 hr/d x 30 d/month = 720
3	Divide the results of Step 1 by the results of Step 2 to determine HOURLY DOSE RECEIVED, in mrem in an hour	0.14
4	Multiply the results of Step 3 by 365 d/yr x 24 hr/d = 8760 hours in one year = MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICES, in mrem in a year	365 x 24 x 0.14 = 8760 x 0.14 = 1226
<b>Part 2</b>		
Adjust for realistic estimates of the time the secretary spends in the area as in Part 2 of Example 1.		
<b>Part 3</b>		
Adjust for realistic estimates of time devices spend in area of concern as in Part 3 of Example 1.		

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

- 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.

5. 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 -- i.e., 24 hr/d for the 30 days that the TLD was in place.)

## **Appendix M**

# **Information for Applicants to Consider When Developing Procedures for Operating Radiography Equipment**

# Information for Applicants to Consider When Developing Procedures for Operating Radiography Equipment

## A. Crank-out Device

1. Locate the source shield at the desired distance from the object to be radiographed.
2. Mount the source tip firmly, using jigs or other attachments, with the tip in the exact exposure position.
3. Locate the control unit at the maximum distance (25 feet or 7.6 meters) from the source shield with the control tubes laid out as straight as possible.
4. Join the control cable to the unit following the manufacturer's instructions.
5. Establish and post the restricted area and high radiation area.
6. Unlock the device.
7. Turn the hand crank steadily to move the source out of the source shield to the exposure position.
8. Survey the perimeter of the restricted area to be sure that radiation levels do not exceed 0.02 mSv (2 mrem) in any one hour.
9. Maintain continuous visual surveillance over the restricted area during an exposure, keeping all persons from entering.
10. After completing the exposure, retract the source by turning the crank until the "safe" position is indicated.
11. Approach the device with the survey meter and survey the entire circumference of the device and the guide tube to determine that the source is in a shielded position.
12. Lock the device and remove the key.

## B. Pipeliner Device

1. Establish and post the restricted area and high radiation area.
2. Unlock the device.
3. Stand as far away as possible and out of the direction of the beam and expose the source
4. Survey the perimeter of the restricted area to be sure that the radiation levels do not exceed 0.02 mSv (2 mrem) in any one hour.
5. Maintain continuous visual surveillance over the restricted area during an exposure, keeping all persons from entering.
6. After completing the exposure, return the source to the shielded position.
7. Survey the device to determine that the source is in a shielded position.
8. Lock the device.

**Note:** KYDPH 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.

## C. Source Exchange

1. Removing the Old Source

Caution: Always use a calibrated, operable survey meter while performing a source exchange!

- a. Survey the shipping container upon receipt with a survey meter. Note that the surface reading should not exceed 2 mSv/hr (200 mem/hr).
- b. Attach the end of the source guide tube to the exposure device.
- c. Connect the other end of the source guide tube to the empty side of the source changer.
- d. Unlock the empty side of the source changer.
- e. Unlock the camera and crank out the source from the camera into the source changer.
- f. Survey the source changer and guide tube to verify that the source is in the safe position.
- g. Lock the source changer.

- h. Disconnect the source guide tube and drive cable to the source pigtail. Replace the dust cap on the source changer.
- i. 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.

## 2. Installing the New Source

- a. Remove the dust cap on the source changer lock body identified with the new source tag.
- b. Align the camera and source guide tube with the source changer.
- c. Connect the new source to the drive cable.
- d. Connect the source guide tube to the source changer.
- e. Unlock the source changer and retract the new source into the exposure device.
- f. Survey the exposure device and guide tube to assure that the source is in the safe position.
- g. Lock the exposure device.
- h. Disconnect the source guide tube and drive accessories.
- i. Affix the new source identification plate on the exposure device.

# **Appendix N**

## **Transportation**

# Transportation

The following are the major areas in DOT regulations most relevant for transporting radiographic exposure devices and source exchangers that are shipped as Type B quantities are:

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, 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 non-bulk 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. Security Plans – **49 CFR 172**

1. **49 CFR 172.800, 49 CFR 172.802**: Purpose and applicability, components of a security plan;



I. Shippers - General Requirements for Shipments and Packaging - **49 CFR 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]

J. Carriage by Public Highway - **49 CFR 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]

### Labeling Packages (49 CFR 172.400-450)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments. This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.

- Labeling is required to be: (1) placed near the required marking of the proper shipping name, (2) printed or affixed to the package surface, (3) in contrast with its background, (4) unobscured by markings or attachments, (5) within color, design, and size tolerance, and (6) representative of the HAZMAT contents of the package.
- Two labels are required on opposite sides of the package, excluding the bottom.

#### Determination of Required Label

Size: Sides: $\geq 100$ mm  Border: 5-6.3 mm			
	49 CFR 172.436	49 CFR 172.438	49 CFR 172.440
	WHITE-I	YELLOW-II	YELLOW-III
Required when:	Surface radiation level $\leq 0.005$ mSv/hour (0.5 mrem/hour)	0.005 mSv/hour (0.5 mrem/hour) < surface radiation level $\leq 0.5$ mSv/hour (50 mrem/hour)	0.5 mSv/hour (50 mrem/hour) < surface radiation level $\leq 2$ mSv/hour (200 mrem/hour)
Or:	TI = 0 [1 meter dose rate < 0.5 mrem/hour]	TI $\leq 1$ [1 meter dose rate $\leq 1$ mrem/hour]	1 < TI $\leq 10$ [1 meter dose rate $\leq 10$ mrem/hour]

#### Content on Radioactive Labels

RADIOACTIVE label must contain (entered using a durable, weather-resistant means):

- (1) The radionuclides in the package. Symbols (e.g., Ir-192) are acceptable.
- (2) The activity in SI units (e.g., Bq, TBq) or both SI units with customary units (e.g., Ci, mCi) in parenthesis.
- (3) The Transport Index (TI) in the supplied box. The TI is entered only on YELLOW-II and YELLOW-III labels.

#### Some Special Considerations for Labeling Requirements

- Radioactive material, excepted packages (e.g., Limited Quantity, Radioactive Instrument and Article) are excepted from labeling.
- The “Cargo Aircraft Only” label is typically required for radioactive materials packages shipped by air [§172.402(c)]

### Marking Packages (49 CFR 172.300-308)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments. This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.

Always Required, Unless Excepted	Sometimes Required	Optional
<ul style="list-style-type: none"> <li>• Proper shipping name</li> <li>• U.N. Identification Number</li> <li>• Name and address of consignor or consignee, unless:                             <ul style="list-style-type: none"> <li>-Highway only and no motor carrier transfers, or</li> <li>-Part of truckload lot and entire contents of freight container are shipped from one consignor to one consignee (§172.301(d))</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• If in excess of 50 kg, Gross Weight</li> <li>• If hazardous substance, “RQ” in association with the proper shipping name</li> <li>• The package type if Type A or Type B (1/2” or greater letters)</li> <li>• The specification-required markings (see §178.350-353)</li> <li>• For approved packages, the certificate ID number</li> </ul>	<ul style="list-style-type: none"> <li>• Both the name and address of consignor and consignee are recommended.</li> <li>• Other markings (e.g., advertising) are permitted, but must be sufficiently away from markings and labeling</li> </ul>

#### Some Special Considerations for Marking Requirements

- Marking is required to be (1) durable, (2) printed on a package, label, tag, or sign, (3) unobscured by labels or attachments, (4) isolated from other marks, and (5) be representative of the hazmat contents of the package.
- Limited quantity packages (§173.421) must bear the marking “radioactive” on the outside of the inner package, or the outer package itself, and are excepted from other marking.
- Empty (§173.428) and Radioactive Instrument and Article (§173.424) packages are excepted from marking.

### DOT Shipping Papers (49 CFR 172.200-205)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments. This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.

Always Required, Unless Excepted	Sometimes Required
<ul style="list-style-type: none"> <li>• The basic description, in sequence                             <ul style="list-style-type: none"> <li>Proper shipping name</li> <li>Hazard Class (7)</li> <li>U.N. Identification Number</li> </ul> </li> <li>• 24 hour emergency response telephone number</li> <li>• Name of shipper</li> <li>• Proper page numbering (Page 1 of 4)</li> <li>• The total quantity (mass), in appropriate units</li> <li>• The name of each radionuclide and total package activity. The activity must be in SI units (e.g., Bq, TBq) or both SI units and customary units (e.g., Ci, mCi).</li> <li>• For each labeled package:                             <ul style="list-style-type: none"> <li>- The category of label used</li> <li>- The transport index of each package with a Yellow-II or Yellow-III label</li> <li>- Shipper’s certification (not required of private carriers)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• If hazardous substance, “RQ” as part of the basic description</li> </ul>
	Optional
	<ul style="list-style-type: none"> <li>• The type of packaging (e.g., Type B)</li> <li>• Other information is permitted (e.g., functional description of product), provided it does not confuse or detract from the proper shipping name or other required information</li> <li>• Emergency response hazards and guidance information (§§172.600-604) may be entered on the shipping papers, or may be carried with the shipping papers</li> </ul>

#### Some Special Considerations/Exceptions for Shipping Paper Requirements

- Shipments of Radioactive Material, excepted packages, under UN2908-UN2911 (e.g., Limited Quantity, Empty, or Instrument and Article), are excepted from shipping papers. For limited quantities (§173.421), this is only true if the limited quantity is not a hazardous substance (RQ) or hazardous waste.
- Shipping papers must be in the pocket on the left door, or readily visible to a person entering the driver’s compartment and within arm’s reach of the driver.
- For shipments of multiple cargo types, any HAZMAT entries must appear as the first entries on the shipping papers, be designated by an “X” (or “RQ”) in the hazardous material column, or be highlighted in a contrasting color.

**SHIPPER'S DECLARATION FOR DANGEROUS GOODS**

(Provide at least two copies to the airline.)

Shipper <b>YOUR COMPANY NAME</b> YOUR STREET ADDRESS CITY & STATE & ZIP CODE	Air Waybill No. Page 01 of 01 Pages Shipper's Reference Number <b>RETURN</b> (optional)
--	--

Consignee **AEA TECHNOLOGY QSA**  
**40 North Avenue**  
**Burlington MA 01803**  
**U.S.A.**

Two completed and signed copies of this Declaration must be handed to the operator

**WARNING**  
 Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

**TRANSPORT DETAILS**

This shipment is within the limitations prescribed for: (delete non-applicable)

<del>PASSENGER AND CARGO</del>	CARGO AIRCRAFT ONLY
--------------------------------	---------------------

Airport of Departure: \_\_\_\_\_

Airport of Destination: \_\_\_\_\_

Shipment type: (delete non-applicable)

~~NON-HAZARDOUS~~ **RADIOACTIVE**

**NATURE AND QUANTITY OF DANGEROUS GOODS**

Dangerous Goods Identification					Quantity and Type of packing	Packing Inst.	Authorization
Proper Shipping Name	Class or Division	UN or ID No.	Packing Group	Subsidiary Risk			
RQ, RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE,	7	UN2916			IR-192, Special Form 1 Type B(U) Package 1 X 925.0 GBq	II  YELLOW T.I. 0.5  DIMS 26x22x34 CMS	Special Form Cert USA/0335/8 ATTACHED  PACKAGE Cert. USA/9269/ B(U)-96 ATTACHED

Additional Handling Information **This shipment may be carried on passenger aircraft outside US jurisdiction.**

**" ICAO/IATA REGS USED"**

24 hr. Emergency Contact Tel. No. **YOUR 24 HR. NUMBER**

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Name/Title of Signatory  
**YOUR NAME & TITLE**

Place and Date  
**CITY & DATE**

Signature  
(see warning above)

ATTENTION SHIPPERS!

FREIGHT CHARGES ARE PREPAID ON THIS BILL OF LADING UNLESS MARKED COLLECT.

**STRAIGHT BILL OF LADING**  
ORIGINAL - NOT NEGOTIABLE

Shipper No. \_\_\_\_\_

Carrier No. \_\_\_\_\_

Date **6/23/03**

Page **01** of **01**

(Name of carrier) (SCAC)

TO: **AEA TECHNOLOGY QSA**  
Consignee  
Street **40 NORTH AVENUE**  
City **BURLINGTON** State **MA** Zip Code **01803**

FROM: **YOUR COMPANY NAME**  
Shipper  
Street **YOUR STREET ADDRESS**  
City **CITY** State **STATE** Zip Code **ZIP CODE**  
**YOUR 24 HOUR EMERGENCY NUMBER**  
24 hr. Emergency Contact Tel. No. \_\_\_\_\_

Route	No. of Units & Container Type	HM	BASIC DESCRIPTION Proper Shipping Name, Hazard Class, Identification Number (UN or NA), Packing Group, per 172.101, 172.202, 172.203	TOTAL QUANTITY (Weight, Volume, Gallons, etc.)	WEIGHT (Subject to Correction)	RATE	CHARGES (For Carrier Use Only)
	<b>01</b>		<b>MODEL 650L CONTAINING:</b>	<b>01</b>	<b>80 LBS</b>	<b>CL100</b>	
		<b>XXX</b>	<b>RQ RADIOACTIVE MATERIAL</b>				
			<b>TYPE B(U) PACKAGE,</b>				
			<b>CLASS 7, UN2916</b>				
			<b>Special Form,</b>				
			<b>IR-192</b>				
			<b>925.0 GBq T.I. 0.5</b>				
			<b>USA/9269/B(U)-96 TYPE B</b>				
			<b>Yellow II Labels Attached</b>				

**PLACARDS TENDERED: YES  NO**

Note - (1) Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property, as follows: "The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding \_\_\_\_\_ per \_\_\_\_\_"  
 (2) Where the applicable tariff provisions specify a limitation of the carrier's liability absent a release or a value declaration by the shipper and the shipper does not release the carrier's liability or declare a value, the carrier's liability shall be limited to the extent provided by such provisions. See NMFC Item 172.  
 (3) Commodities requiring special or additional care or attention in handling or stowing must be so marked and packaged as to ensure safe transportation. See section 2(e) of item 360, Bills of Lading, Freight Bills and Statements of Charges and Section 1(a) of the Contract Terms and Conditions for a list of such articles.

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name and are classified, packed, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

REMIT C.O.D. TO: ADDRESS **COD** Amt: \$ \_\_\_\_\_

Signature \_\_\_\_\_ (Signature of Consignor)

C.O.D. FEE: PREPAID  COLLECT  \$ \_\_\_\_\_

TOTAL CHARGES: \$ \_\_\_\_\_

FREIGHT CHARGES: FREIGHT PREPAID  except when box is checked  Check box if charges are to be collect

RECEIVED, subject to classifications and tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order, except as noted (contents and condition of contents of packages unknown), marked consigned, and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.

Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

SHIPPER **YOUR COMPANY NAME** CARRIER \_\_\_\_\_

PER **YOUR NAME & TITLE** PER \_\_\_\_\_

DATE \_\_\_\_\_



## **Appendix O**

# **Daily Maintenance Check of Radiographic Equipment**

# Daily Maintenance Check of Radiographic Equipment

A. 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 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 at a specific location on the 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:** 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 one 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; and
    - Check for any impairment of the locking mechanism.

4. Record the results of the daily inspection.



# **Appendix P**

## **Model Emergency Procedure**

# Model 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, etc.)

- Immediately secure the area and post the restricted area at the 0.02 mSv/hr (2 mrem/hr) radiation level; maintain continuous surveillance and restrict access to the restricted area.
- Notify the RSO and/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.
- Don't panic. Source retrieval can be performed with very little exposure when properly planned by trained personnel authorized to do so by a specific license.
- 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 Radiation Safety Officer (RSO), or other knowledgeable licensee staff, licensee's consultant, device manufacturer) to be contacted in case of emergency. Update information as necessary.

Follow the directions provided by the person contacted above.

## **RSO 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 manufacture. Management should have access to emergency equipment to keep doses to radiographers ALARA. Emergency equipment may include high range dosimeters, extra lead shielding, remote tongs, etc.

Notify local authorities as well as KYDPH as required. KYDPH 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 threatens to cause an exposure in excess of **902 KAR 100:019** limits. Reports to KYDPH must be made within the reporting time frames specified by **902 KAR 100:019, 902 KAR 100:040, 902 KAR 100:100**.

**Telephone notifications shall be made to KYDPH at (502) 564-3700 during normal business hours (8 a.m. – 4:30 p.m.). For immediate notifications after normal business hours, KYDPH’s 24 hour emergency telephone number is (800) 255-2587. Identify the emergency as radiological.**

# **Appendix Q**

## **Annual Low-Level Waste Reporting Requirements**

Kentucky Administrative Regulation 902 KAR 100:21, Section 12 requires each holder of a specific radioactive material license to annually file a report with KYDPH regarding radioactive waste associated with activities authorized by the license.

The report shall be filed no later than January 15 of the year following the reporting period, whether that licensee was or was not a low level radioactive waste (LLRW) or radioactive mixed hazardous waste generator during the calendar year reporting period. Further information can be found at the Kentucky legislative Research Website at <http://www.lrc.ky.gov/kar/TITLE902.HTM>.

LLRW is only waste material which contains any regulated level of radioactivity, whether man made or naturally occurring. Radioactive material (RAM) becomes a waste when the generator has removed the RAM, and items contaminated with RAM, from the process or procedure in which it was used or produced, and segregated for disposal. **Even though many licensees do not produce such LLRW materials, the LLRW form must be completed and returned every year by the licensee. Furthermore, any facility that was just granted a license in the current calendar year must also complete a LLRW Report.**

Information regarding any radioactive mixed waste in your possession must also be reported. Radioactive mixed waste contains both radioactive waste and a hazardous waste. Examples of hazardous waste include organic solvents, metallic lead, mercury, chromate, cadmium, aqueous corrosive liquids, waste oils, and halogenated cleaning/degreasing wastes (i.e., wastes that are subject to the Resource Conservation and Recovery Act (RCRA)).

Disposal data submitted by Kentucky licensees must agree with records compiled by the disposal sites. This information is required by the Central Midwest Compact, which Kentucky and Illinois entered for the disposal of low-level waste, pursuant to the Federal Low-Level Waste Policy Act of 1985 (<http://www.cmcompact.org/>)

**ANNUAL LOW LEVEL RADIOACTIVE WASTE (LLRW) REPORT**

REPORTING PERIOD – CALENDAR YEAR 20\_\_ \_\_

Kentucky Radiation Health Branch  
275 East Main Street  
Mail stop HS 1C-A  
Frankfort, KY 40621  
FAX: 502 564-1492  
TEL: 502 564-3700

1. Licensee Information

Facility Name: \_\_\_\_\_

License Number: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Address where LLRW stored and/or held for decay in storage (if different from above)

\_\_\_\_\_  
\_\_\_\_\_

In calendar year 20\_\_ \_\_ stated above, this license was (check one):

\_\_\_\_\_ newly granted    \_\_\_\_\_ active all year    \_\_\_\_\_ terminated

Person's responsible for low level radioactive waste management

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Phone Number: (    ) \_\_\_\_\_

Person responsible for completing LLRW annual report

Name (printed): \_\_\_\_\_ Title: \_\_\_\_\_

Phone Number: (    ) \_\_\_\_\_

2. Did this licensee possess or dispose of any low level radioactive waste (LLW) during this reporting period?    \_\_\_\_\_ Yes    \_\_\_\_\_ No

NOTE: Return of nuclear medicine radioactive materials back to the originating pharmacy is considered a transfer of radioactive material and not waste generation or waste shipment for the purposes of this report. The same is true of sealed sources and devices returned to the manufacturer.

3. Did this licensee possess or dispose of any mixed radioactive waste during this reporting period?    \_\_\_\_\_  
Yes    \_\_\_\_\_ No

4. Does this licensee currently possess any LLW in storage?    \_\_\_\_\_ Yes    \_\_\_\_\_ No

NOTE: This does not apply to medical wastes held in accordance with 902 KAR 100:072, Section 29.

**IF YOUR RESPONSE WAS "NO" TO QUESTIONS #2, #3 AND #4 ABOVE,**

**COMPLETE ITEM #14 AND RETURN THIS FORM**

**ANNUAL LOW LEVEL RADIOACTIVE WASTE (LLRW) REPORT**

REPORTING PERIOD – CALENDAR YEAR 20\_\_ \_\_

5. If yes to question 4, provide the following information, as defined in 902 KAR 100:021, Section 6 (2), Classes of Waste.

**STORED RADIOACTIVE WASTE**

As defined in 902 KAR 100:021, Section 6 (2)

CLASS A	CLASS B	CLASS C
Volume (Cubic Feet)	Volume (Cubic Feet)	Volume (Cubic Feet)
Volume (Cubic Feet)	Volume (Cubic Feet)	Volume (Cubic Feet)

6. Which method(s) of disposal of LLW are used by your facility?

(IF MORE THAN ONE METHOD OF DISPOSAL IS USED, RANK THE METHODS NUMERICALLY, ACCORDING TO VOLUME OF WASTE)

- Decay in storage     Ship directly to LLW disposal site  
 Sanitary sewer     Use of LLW broker for final disposal  
 Return to supplier     Other (specify)  
 Dilution via air effluent

7. If radioactive waste was shipped directly to a disposal site or via a broker during this reporting period complete the following. (One 55 gallon drum is equivalent to 7.5 cubic feet)

**SHIPPED DIRECTLY TO:**    CUBIC FEET    ACTIVITY (Millicuries)

- Richland, WA    \_\_\_\_\_    \_\_\_\_\_  
 Barnwell, SC    \_\_\_\_\_    \_\_\_\_\_  
 Envirocare, UT    \_\_\_\_\_    \_\_\_\_\_  
 Other \_\_\_\_\_    \_\_\_\_\_    \_\_\_\_\_  
 Via Broker    \_\_\_\_\_    \_\_\_\_\_

8. If a broker was utilized during this reporting period, indicate name, address and telephone number

Broker name \_\_\_\_\_ Tel. (\_\_\_\_) \_\_\_\_\_  
 Address \_\_\_\_\_  
 \_\_\_\_\_  
 City/State/Zip \_\_\_\_\_

**ANNUAL LOW LEVEL RADIOACTIVE WASTE (LLRW) REPORT**

REPORTING PERIOD – CALENDAR YEAR 20\_\_ \_\_

9. What were the five (5) isotopes with the highest activity disposed directly or via a broker at a disposal site?

10. Indicate by percentage the classification of the LLW, as defined in 902 KAR 100:021, Section 6 (2), shipped or stored for shipment:

Class A \_\_\_\_\_ Class B \_\_\_\_\_ Class A \_\_\_\_\_  
Greater than Class C \_\_\_\_\_

11. Do you have any LLW in storage for future shipment, directly or via a broker, to a waste disposal site?  
Yes \_\_\_\_\_ No \_\_\_\_\_

12. If you have mixed waste in storage, or shipped mixed waste during the reporting period, please provide the following information.

Volume (cu.ft.)	Physical form (i.e. solid, liquid)	Radionuclides present	Activity (mCi)

13. Describe your plans for treatment, disposal or storage of mixed waste.

14. I hereby certify that the information provided is true and correct to the best of my knowledge and belief.  
(\*Must be signed by someone with Signature Authority for license)

\_\_\_\_\_  
\*Signature

\_\_\_\_\_  
Title

\_\_\_\_\_  
Type/Printed Name

\_\_\_\_\_  
Date