SEALED SOURCES

1. INTRODUCTION

Sealed sources are radioactive material usually encased in metal or plastic. Sealed sources may present an external exposure hazard, but are not a significant contamination hazard under normal conditions. The basic principles of time, distance and shielding apply to the safe use of sealed sources. Please refer to the Introductory chapter for more information regarding fundamental principles. Basic radiation safety training for sealed sources should be completed prior to using sealed sources. Dosimetry may be required. When planning to use a sealed source, contact Health Physics at (303) 492-6523 to determine the training and dosimetry requirements.

Sealed sources are found in many different sizes and shapes. Some sources may be alpha, beta, gamma, or a combination of these emitters enclosed in metal or plastic. Sealed sources include those found in Electron Capture Detectors (ECDs) and Liquid Scintillation Counters (LSCs). They may also be inert metal onto which a thin film of radioactivity has been attached, known as plated sources. Metals which have been irradiated with neutrons, protons, or other particles, causing them to become "activated" may also be considered sealed sources. Sealed sources may have as little activity as a few Becquerels (Bq) (fractions of a microcurie (μCi)) or many MBq (mCi) and larger. They may be as small as a button, which can easily be lost, or contained in large devices. See Section 3 of this chapter.

2. STORAGE OF SEALED SOURCES

Possession and use of sealed sources requires a laboratory license. Refer to the Laboratory Licensing chapter for information regarding licensing. Sealed sources are divided into two categories; those that must be leak tested (Tier I), and those that are exempt from leak tests (Tier II).

Tier I Sealed Sources

At the University of Colorado, Tier I sources are defined as α sources with activities greater than 370 kBq (0.010 mCi) and β or γ sources with activities greater than 3.7 MBq (0.10 mCi), as required by regulations. Health Physics performs leak test surveys (also known as "wipe smears") in accordance with regulations on all Tier I sources at the University of Colorado. Leak tests are performed every three months for α Tier I sources and every six months for β or γ Tier I sources. Health Physics will notify the laboratory if a Tier I source is found to be leaking at a level exceeding regulatory limits, currently 185 Bq (0.005 μCi). All leaking sources must be removed from service for repair or disposal.

Tier II Sealed Sources
At the University of Colorado, Tier II sealed sources are sealed sources with activities less than the Tier I amounts indicated above. There are some radioactive materials which do not have a defined Tier II quantity in the regulations. Health Physics inventories all Tier II sources every six months in accordance with regulations. Health Physics will notify the laboratory if a Tier II source cannot be located.

Generally Licensed Devices
Generally Licensed Devices (GLDs) include sealed sources such as ^{63}Ni electron capture detectors (ECDs), ^{85}Kr aerosol neutralizers and ^{210}Po static eliminators. GLDs are leak tested and tracked as Tier I sources for α sources with activities greater than 370 kBq (0.010 mCi) and β or γ sources with activities greater than 3.7 MBq (0.10 mCi). Generally Licensed Devices with activities less than the above will be treated as Tier II sources. As with Tier I and Tier II sources, a license is required before obtaining a GLD. All GLDs must be received and disposed through the Health Physics Office.

The exception is ^{210}Po static eliminators with an activity of 18.5 MBq (500 μCi) or less. These devices are exempt from licensing, leak testing and inventories. However, labs using such devices should notify the Health Physics Office at (303) 492-6523 and have the devices received and disposed through Health Physics whenever possible.

3. USE OF SEALED SOURCES

Health Physics posts a *Sealed Source Inventory* on or near each storage location. The Sealed Source Inventory describes the sources stored in each location. Cabinets used to store sealed sources should be kept locked at all times.

If a sealed source is to be used at another location in the laboratory, it **must be signed out** on the *Sealed Source Sign-out Log*. This log is generally found near the cabinet where the source is stored and must be completed, regardless of location and duration of use. When the source is returned to storage, this also must be noted on the *Sealed Source Sign-out Log*. Refer to Appendix J for sample forms.

Contact Health Physics at (303) 492-6523 if sources are to be moved to a location outside of the laboratory's authorized locations. Proper accountability is essential for sealed sources. If disposal is required, please refer to the Waste chapter or contact Health Physics.

4. GAS CHROMATOGRAPHS AND ELECTRON CAPTURE DETECTORS

Some of the Gas Chromatographs (GCs) at the University of Colorado have Electron Capture Detectors (ECDs) which contain a sealed source, typically ^{63}Ni or ^{3}H (tritium). These machines usually have a radioactive materials sticker or label, identifying the presence of the source. Dosimetry is not required for normal operation of these devices. However, Sealed Source Training is required before using these machines. See Training Chapter.

These sealed sources are inventoried and leak tested periodically by Health Physics staff. If a source is found to be leaking at a level above regulatory limits, it must be taken out of service for repair or disposal.

5. LIQUID SCINTILLATION COUNTERS

Many laboratories use liquid scintillation counters (LSCs) to analyze wipe smears and other samples. Machines which calculate H# (efficiency) may also contain a sealed gamma sources, typically ^{137}Cs or ^{226}Ra. These internal sources are managed in the same way as other sealed sources and must be removed from the machine prior to disposal. Please refer to Section 2 of this chapter. Contact Health Physics at (303) 492-6523 for assistance with disposal. Most LSCs have calibration check sources for routine use. These sources usually are ^{3}H or ^{14}C in sealed liquid form and are inventoried regularly by Health Physics.

6. PORTABLE GAUGES AND XRF DEVICES

Portable gauges and XRF Devices not in storage must be leak tested by Health Physics and require training of personnel working with the source. When planning to obtain or use such a device, contact Health Physics at (303) 492-6523 for more information on licensing, using, and storing these items safely.