

Radioactive Chemicals Fact Sheet

Purpose and Applicability

On Sept. 27, 2007, new rules were enacted in the Ohio Administrative Code (OAC) in Chapter 3701-54, which is also known as, Jarod's Law. Chapter 3701-54-08, paragraph (A)(12)(i) states, "No chemicals from Appendix A to this rule shall be used or stored in the classroom." Within "Appendix A: Substances with Greater Hazardous Nature than Educational Utility," one category of prohibited chemicals is "radioactive chemicals." Within the ensuing chemical name list are two radioactive chemicals, which are uranium and uranyl acetate.

The purpose of this fact sheet, within the scope of Jarod's Law, is to provide information to assist educators in the identification, characterization and safety considerations with respect to radiation and radioactive materials.

What is radiation and radioactive materials?

Radiation is defined in Ohio Administrative Code (OAC) rule 3701:1-38-01 as

"Radiation" or "ionizing radiation" means alpha particles, beta particles, gamma rays, x-rays, neutrons, high speed electrons, high speed protons and other particles capable of producing ions. Radiation does not include non-ionizing radiation, such as radio or microwaves, or visible, infrared or ultraviolet light.

Radioactive material is defined in Ohio Administrative Code (OAC) rule 3701:1-38-01 as

"Radioactive material" means any solid, liquid or gaseous material that emits ionizing radiation spontaneously. "Radioactive material" includes accelerator-produced and naturally occurring radioactive materials and byproduct, source and special nuclear material.

With ionizing radiation, particles or electromagnetic waves are emitted from an atom or device having the right amount of energy to interact with electrons of other atoms. The interaction with the electrons of other atoms can result in changing chemical bonds, changing valence or the creation of free radicals. When the originating atom emits radiation, the original atom usually changes to another kind of atom.

It's important to note that in addition to manmade sources of radiation, there are many naturally occurring sources of radiation. We receive radiation doses from outer space (cosmic radiation), from the land we live on, the foods we eat, as well as from the materials our homes are made from. The natural material in our bodies allows radio carbon dating to determine the age of items in geology and archeology.

Who regulates radiation and radioactive materials?

The Ohio Department of Health, Bureau of Radiation Protection is the lead agency in regulating radioactive materials and radiation-generating equipment within the State of Ohio. Ohio Department of Health rules and regulations are enforced to protect public health and safety and the environment, from harmful levels of ionizing radiation.

How is ionizing radiation harmful? What are the hazards of the radioactive materials?

Ionizing radiation can be harmful when the interaction of the radiation with other atoms occurring in living organisms, especially humans, disrupts the integrity and functioning of the biological systems. Very high levels of ionizing radiation can cause cell death and destroy the capillaries in tissues and organs, either in the exposed areas or death of the entire person. On the other end of the spectrum, low levels of radiation, above the natural background radiation levels, may have no discernable effect for many years, if ever.

There are several factors used by radiation professionals to determine the degree of hazard from a radioactive material. One is the quantity of material present. In most cases within educational classroom settings, there are only small quantities of radioactive chemicals present. Another consideration is the type of radiation emitted from the material, which determines how easy it is to shield or reduce the radiation. Some types of radioactive emissions may go only a couple of inches in air, others may go much farther. The simplest way to shield radioactive materials is to put sufficient distance between the radioactive material and people.

The primary hazard from radioactive chemicals in the classroom setting is spilling it or otherwise getting the material onto people or other surfaces. This is referred to as contamination. Skin contamination can be readily washed off. Spills and external contamination should also be surveyed or measured with specialized counting equipment by specifically trained personnel to verify removal efforts were successful. The primary concern with external contamination is that if not effectively removed or cleaned up, it could become internal contamination and a potential medical event. If the radioactive material gets inside a person by direct ingestion (accidental or deliberate), by inhalation of dust or absorbed in open wounds, this is a cause for concern. Suspected internal contamination should always be treated as a significant event requiring prompt professional medical assessment.

What are radioactive chemicals?

Radioactive chemicals are chemicals that contain one or more atoms that are radioactive. Some contain commonly recognizable, naturally occurring radioactive elements such as uranium or thorium. Others are specifically made for research purposes. In many cases, the element or chemical form is more hazardous than the radioactive component. The chemical form can be acutely toxic or lethal and the radioactive component poses an increased risk of cancer concern.

Radiation professionals classify radioactive chemicals as unsealed radioactive material. Discussion on sealed source radioactive material, devices/products and natural occurring radioactive ores are discussed further under other sources of radiation.

How could radioactive chemicals get into the schools?

Radioactive chemicals could get into the schools through old science kits and other chemicals that were not directly identified as being radioactive. Some sources of radioactive chemicals and sources were used as state-of-the-art science projects and civil defense demonstrations in the 1960s and 1970s.

There is also a category of radioactive materials called exempt quantities. In some cases, companies are permitted by license to distribute "exempt quantities" of radioactive materials to persons without a radioactive materials license and are released from regulatory control. These may be either in the form

of sealed or unsealed materials. Exempt quantities of radioactive materials were approved based on the concept that the amount of radioactive material present does not represent a radiological hazard.

How can I identify radioactive chemicals in my possession?

There are three means to identify radioactive chemicals without the use of any specialized measuring equipment. The three ways are by labeling, name and MSDS as described below.

First, some radioactive chemicals may be explicitly labeled and identified with the words “Caution - Radioactive Material” or “Danger – Radioactive Material” and have the radioactive trefoil symbol.



Second, sometimes, the chemicals may not be labeled as radioactive, but are made of atomic constituents that are always assumed to be radioactive and are identified by their chemical name (or derivative). Examples include Uranium (or Uranyl), Thorium (thoriated), Radium, Tritium (tritiated) and Americium.

Third, read through the MSDS for the compound. In the information provide in the MSDS sheets, it will mention that the product is also radioactive.

How can I safely handle the radioactive chemicals?

The safe handling of laboratory scale radioactive chemicals is to use the appropriate personal protective equipment indicated for the chemical form. In general, this includes the use of gloves and eye protection. The complete safety precautions for how to handle the radioactive chemicals are required to be in the MSDS sheet for every chemical. The MSDS sheets will also outline first aid and other measures to take in case of spills or contamination.

How do I dispose of the radioactive chemicals?

Radioactive chemicals must be disposed of at a facility specifically licensed to accept radioactive materials. In addition, there are specific U.S. Department of Transportation requirements for packaging and manifesting of radioactive materials. Accordingly, any person/entity that is used to package and dispose of the radioactive chemicals must also be licensed to perform these activities.

Are there other sources of radiation that might be present?

Radioactive chemicals are only one of the many radioactive materials present in the public environment. The predominant use of radioactive material in consumer products is in the form of sealed sources within devices. Sealed sources are special forms of radioactive materials that are packaged (encapsulated) to prevent contamination of people or the environment. A typical household smoke detector is an example of a device containing radioactive material (these are specifically exempt from regulation). The manufacture and distribution of most other devices are regulated either by the state or the Nuclear Regulatory Commission. These devices include self-luminous tritium exit signs, which bear small radiation trefoil labels and must be properly disposed of by returning them to the manufacturer or to a licensed disposal facility. Radioactive sources are sometimes used as static eliminators in devices such as spray paint guns or precision lab balances. Some types of stone and ores contain naturally occurring radioactive material. Typically these may be found in the classroom as geology specimens. These types of natural specimens are exempt from regulation in Ohio.

Where can I get additional information?

There are several ways that additional information can be obtained on radioactive materials and their regulation. The sources can be very technical to general discussion. Some information sources applicable to the academic classroom can be located from the following areas.

Radiation regulatory agencies – the Ohio Department of Health regulates and licensees use in Ohio

Ohio Department of Health
Bureau of Radiation Protection
246 N. High Street
Columbus, OH 43216-0118
Phone 614-644-2727
Web <http://www.odh.ohio.gov/odhPrograms/rp/radprot/radprot1.aspx>

Nuclear Regulatory Commission
Washington DC
Web <http://www.nrc.gov>
(general fact sheets can be located in the “electronic reading room”)

Professional Societies – professional radiation societies have resources available for the general public and teachers

Health Physics Society <http://www.hps.org>
American Nuclear Society <http://www.ans.org>

The Internet via search engines. Universities that use radioactive and other hazardous materials have safety departments that have usually generated Web-based guidance to their university laboratory students and researchers.