



ALARA Program

Radiation Safety Training

Module 4

- ALARA stands for *As Low As Reasonably Achievable*.
- The maximum permissible occupational dose limits established by regulations are based on limiting individual radiation dose to what is considered to be an acceptable level of occupational risk.
- Although there is no documented evidence linking any health effect with exposures less than 10,000 mrem (100 mSv) delivered at a high dose rate, it is assumed that any radiation exposure may carry some risk.

Program Overview

- Kentucky regulations require that the WKU provide a program designed to keep exposures As Low As Reasonably Achievable (ALARA).
- ALARA takes into account the state of technology, the economics of improvements in relation to benefits to the public health and safety, other societal and socioeconomic considerations, and the utilization of sources of radiation in the public interest.

Program Overview

- ALARA is the responsibility of all employees.
 - Personal radiation exposure shall be maintained As Low As Reasonably Achievable
 - Radiation doses shall be kept well below the regulatory limits

Program Overview

- The University's ALARA Program provides a process for the Radiation Safety Committee and the Radiation Safety Officer to
 - Review the radiation safety program annually
 - Review all proposals for radiation usage
 - Review all occupational radiation exposure reports
 - Investigate any occurrences where occupational exposures exceed established program action levels

Program Overview

- Action Levels

The University has established investigational levels for occupational exposure to radiation.

- Operational Action Level

- The RSO contacts individuals and their supervisor/department head if their monthly/quarterly exposure exceeds any of the action levels listed in the following table.

- Action Level I

- In addition to “Operational Action Level” notifications, the RSO requires the completion of a questionnaire for “Action Level I” exposures.

- Action Level II

- In addition to operational and Level I actions the RSO requires a meeting with the staff member and supervisor regarding exposures in this category.

Action Levels

Action Levels (per calendar quarter)

	Operational	Level I	Level II
Whole Body Deep Dose Equivalent	<i>125 mrem (1.25 mSv)</i>	<i>375 mrem (3.75 mSv)</i>	<i>625 mrem (6.25 mSv)</i>
Whole Body Shallow Dose Equivalent	<i>1,250 mrem (12.5 mSv)</i>	<i>3,750 mrem (37.5 mSv)</i>	<i>6,250 mrem (62.5 mSv)</i>
Lens of Eye Dose Equivalent	<i>375 mrem (3.75 mSv)</i>	<i>1,125 mrem (11.25 mSv)</i>	<i>1,875 mrem (18.75 mSv)</i>
Extremities	<i>1,250 mrem (12.5 mSv)</i>	<i>3,750 mrem (37.5 mSv)</i>	<i>6,250 mrem (62.5 mSv)</i>

ALARA Action Levels

- Engineering controls should be the primary method to control exposure (e.g., enclosed hoods).
- Administrative controls is the next method to control exposures (e.g., postings).
- Personal protective equipment is the last method (e.g., respirators).

External and Internal Dose Reduction

- Time
 - Minimize time in radiation areas.
- Distance
 - Maximize the distance from a source of radiation.
- Shielding
 - Use shielding whenever possible. Shielding appropriate for the various types of radiation was discussed in Module 1.

External Radiation Basic Protective Measures

- Methods for minimizing time in radiation areas
 - Plan and discuss the task thoroughly prior to entering the area. Use only the number of workers actually required to do the job.
 - Have all necessary tools present before entering the area.
 - Use mock-ups and practice runs that duplicate work conditions.
 - Take the most direct route to the job site if possible and practical.
 - Never loiter in an area controlled for radiological purposes.
 - Work efficiently and swiftly.
 - Do the job right the first time.
 - Perform as much work outside the area as possible. When practical, remove parts or components to areas with lower dose rates to perform work.

Time

- Methods for maximizing distance from sources of radiation.
 - Stay as far away from radiation sources as practical given the task assignment.
 - For point sources, the dose rate follows a principle called the inverse square law. This law states that if you double the distance, the dose rate falls to 1/4 of the original dose rate. If you triple the distance, the dose rate falls to 1/9 of the original dose rate, etc.
 - Be familiar with radiological conditions in the area.
 - During work delays, move to lower dose rate areas.
 - Use remote handling devices when possible.

Distance

- Proper uses of shielding

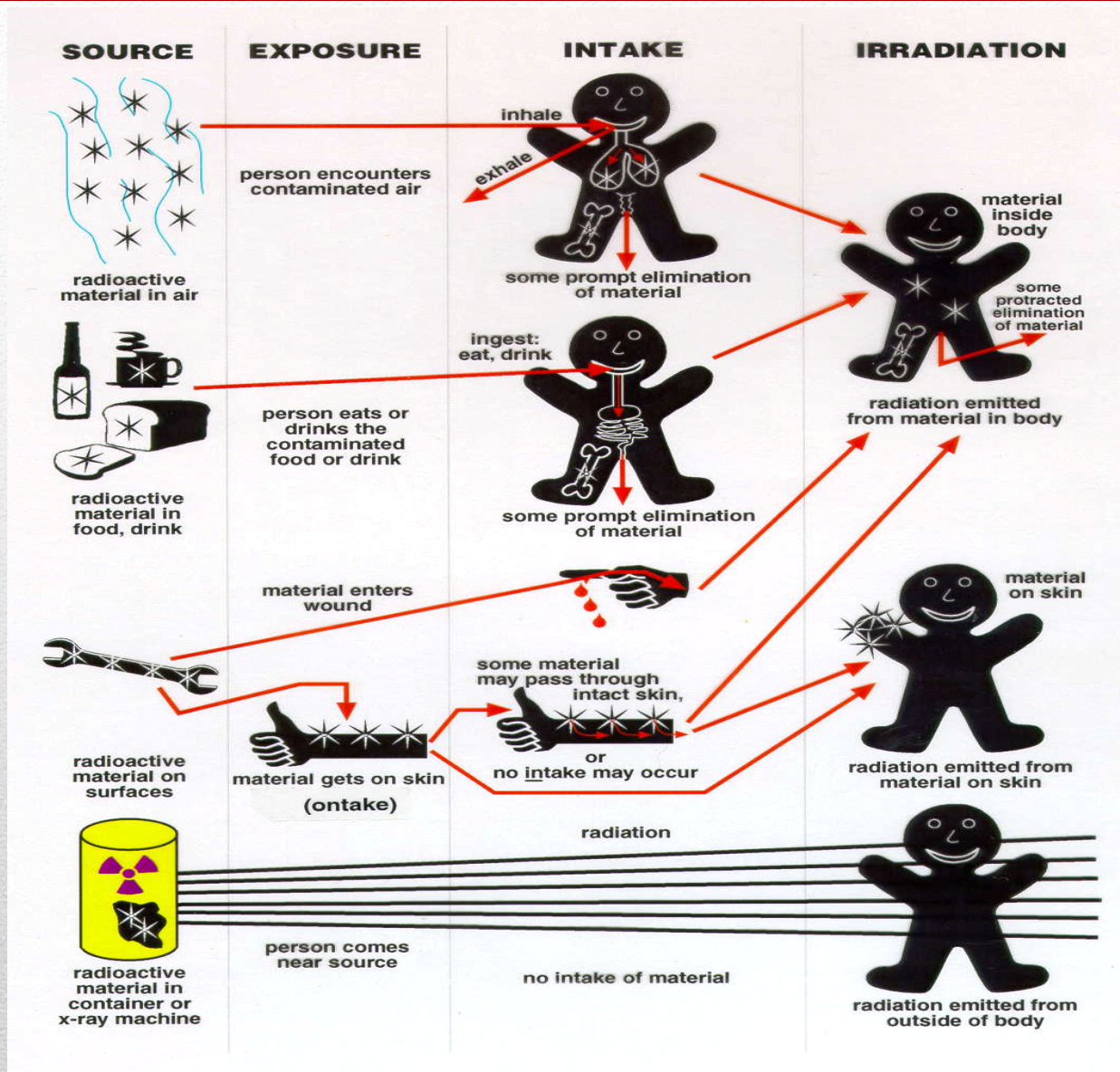
Shielding reduces the amount of radiation dose to the worker. Different materials shield a worker from the different types of radiation.

- Take advantage of permanent shielding, such as non-radiological equipment/structures.
- Use shielded containments when available.
- Wear safety glasses/goggles to protect your eyes from beta radiation, when applicable.
- 4) Temporary shielding (e.g., lead or concrete blocks)

Shielding

- Pathways
 - Internal dose is a result of radioactive materials entering the body through one or more of the following pathways:
 - Inhalation
 - Ingestion
 - Absorption through the skin
 - Absorption through wounds

Internal Radiation Basic Protective Measures



- Methods to reduce internal radiation dose
PPE or Personal Protective Equipment is the last choice for controlling internal exposure. In addition, the following are methods the worker can use.
 - 1) Wear respirators properly when required. Respirators should only be used by personnel qualified to wear them.
 - 2) Make sure all wounds or cuts (including scratches and scabs) are protected from potential contamination sources.
 - 3) Comply with the requirements of the Radiation Work Permit, WKU Radiation Safety Manual, and applicable regulations.
 - 4) Do not eat, drink, smoke, or chew gum in Radioactive Materials Areas, Contamination Areas, High Contamination Areas, or Airborne Radioactivity Areas, as dispersible radioactive materials may be present.

Internal Radiation Basic Protective Measures

- *Radiological Worker Training*, DOE Handbook, DOE-HDBK-1130-98, October 1998, Reaffirmation with Errata May 2004, Change Notice No. 1, February 2005.
- 902 KAR 100:015. General requirements., <http://www.lrc.state.ky.us/kar/902/100/015.htm>
- WKU Radiation Safety Manual, Revised 2011
- WKU Radiation Producing Machines Safety Manual, 2006, Revised 2011

References