Swift & Staley Team

Paducah Site

General Access Orientation

This orientation booklet provides information on radiation hazards you may encounter as a visitor within controlled areas managed by the Swift & Staley Team (SST). You are classified as a visitor because you have been issued a visitor (non-picture) security badge. When you have read this booklet, had you questions answered, and signed the training roster, you will be authorized for escorted access into Paducah controlled areas. To enter these areas, your escort must have a minimum training qualification of General Employee Training. To enter some radiological-posted areas within the controlled area, your escort must be a person qualified with Radiological Work Training. The training for your escort is more extensive training than the orientation information contained in this booklet. When entering areas with an escort, you must read and sign any applicable radiation work permit (RWP) for the area. Your signature on the RWP means that you have read, understood, and will comply with the provisions of the RWP.

Visitors are required to read this booklet and sign the training roster each time they visit the site. If you expect to visit the site frequently, you may want to consider completing General Employee Training. Completion of this course will allow you unescorted access to some areas of the site for 2 years. If you want to take the course, you may notify your escort.

SST's Radiation Safety Professionals
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INTRODUCTION

As a visitor to the site, it is important that you are aware of and understand what radiation and radioactive materials are and to recognize the postings that are associated with radiological work at the site. This orientation booklet contains information about radiation and the controls in place, monitoring requirements, site emergency procedures, and exposure reports. Your understanding and enhanced awareness of this information will enable you to contribute to safe practices in the workplace.

RESPONSIBILITIES

Visitors, as well as employees, have an impact on maintaining exposures to radiation and radioactive material at an acceptable level. Responsibilities of all personnel on the site are listed below and discussed in the following sections of this booklet:

- Obey all signs/postings.
- Comply with all radiological and safety rules.
- Do not enter any radiological area unless escorted. NO entry into the following areas is permitted for personnel qualified at this orientation level:
  - ◊ High radiation and very high radiation areas,
  - ◊ High contamination areas, or
  - ◊ Airborne radioactivity areas.
- If visiting a radiological area with a trained escort:
  - ◊ Obey the instructions of your escort and the requirements of any radiation work permit or other radiation work authorization, as applicable.
  - ◊ Obtain and properly wear dosimeters, as instructed by procedure, Radiological Control personnel, or your escort.
- Keep your exposures to radiation and radioactive materials as low as reasonably achievable (ALARA) and know the administrative control levels and dose limits.

- Use ALARA techniques (i.e., time, distance, and shielding) to control your exposure.
- Be alert for and report unusual radiological situations. Unusual situations may include finding radioactive material outside a designated area or finding a compromised radiological barrier.
- Know where and/or how to contact Radiological Control personnel in your work area.
- Comply with emergency procedures for your work area.
- Know your cumulative and annual dose if monitoring is required for you.

RADIATION AND ITS SOURCES

Ionizing Radiation ~~~~~~~~~~

All matter is composed of atoms. Radiation is energy emitted through space and matter in the form of rays or particles. It is emitted from unstable atoms or various radiation-producing devices, such as televisions and x-ray machines. Atoms have three basic particles: protons, neutrons, and electrons.

Most atoms are stable and do not emit excess energy. Unstable atoms emit excess energy called radiation. Ionizing radiation has enough energy to remove electrons from electrically neutral atoms. Four types of ionizing radiation are alpha particles, beta particles, neutrons, and gamma rays.

Radioactive contamination is defined as noncontained radioactive material in an unwanted location. Exposure to radiation does **NOT** result in contamination of the worker. Only when an individual comes in direct contact with radioactive contamination is there a potential for the individual's skin or clothing to become contaminated.

Sources of Radiation ~~~~~~~~~~

People have always been exposed to radiation. Radiation occurs naturally in our environment, from man-made sources, and from materials inside our bodies. The average annual radiation dose to an individual is about 360 millirem (mrem) per year. This amount consists of both natural background radiation, such as cosmic radiation and radon, and man-made sources of radiation, such as medical uses or building materials, as shown in Figure 1.

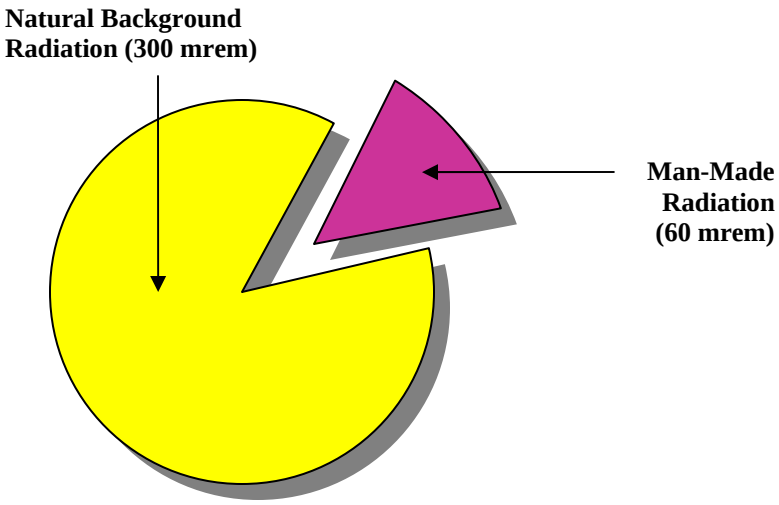

Figure 1. Average Annual Individual Radiation Dose Received from Nonoccupational Sources

The risk of working with or around sources of ionizing radiation can be compared to risks we accept as a part of everyday life. The following activities create a risk of a "one in a million chance" of dying:

- Smoking 1.4 cigarettes (lung cancer)
- Spending 2 days in New York City (air pollution)

- Driving 40 miles in a car (accident)
- Flying 2,500 miles in a jet (accident)
- Canoeing for 6 minutes (accident)
- Receiving 2.5 mrem of radiation (cancer). This is based on extra-polarization of the current DOE Dose Model.

Types of Radioactive Material at Paducah ~~~~~~~~~~

The main radioactive elements at Paducah are uranium and technecium. In some site areas, transuranic elements are also present. Transuranics are a special class of radioactive elements that are man-made and include neptunium, plutonium, and americium. The use of recycled uranium during the Cold War led to the presence of small quantities of transuranic material at Paducah. Due to the physical properties of transuranics, these materials are primarily considered an internal exposure hazard. As such, additional measures are used to prevent the inhalation or ingestion of transuranic materials.

During your visits, you are not likely to encounter transuranic materials. However, should you require entry into areas where transuranic materials are present, the RWP for the area will specify the proper controls to prevent exposure.

RADIOLOGICAL CONTROLS

Radiological controls are established at the site to protect you from unplanned or uncontrolled exposures to radiation and from ingestion, inhalation, or absorption of radioactive material. These controls include, but are not limited to, a unique system for identifying radiological materials. This system includes the use of certain colors and/or symbols and radiological postings, implementation of controls to maintain radiation exposures ALARA, and training on radiation safety and emergency responses.

Identification of Radioactive Materials ~~~~~~~~~~

Only specially trained/qualified workers are permitted to enter areas that are controlled for radiological purposes or to handle radioactive material. All areas or material controlled for radiological purposes are identified by one or more of the following methods:

- Signs that have the standard radiation symbol colored magenta or black on a yellow background.
- Yellow and magenta rope, tape, chains, or other barriers to designate the boundaries of posted areas.
- Tags and labels with a yellow background and with either magenta or a black standard radiation symbol to identify radioactive material with the words, "CAUTION – RADIOACTIVE MATERIAL."
- Yellow plastic wrapping, yellow plastic bags, and labeled containers to package radioactive material.
- Designated areas to store radioactive material.
- Protective clothing, which is yellow and/or distinctively marked, to prevent personnel contamination.
- Markings for potentially contaminated tools and portable equipment that are used for radiological work.

Postings alert you of potential or known radiological conditions and aid you in controlling exposures and preventing the spread of contamination.

Shown are examples of postings you may see at the site, along with the action you should take when you see one.

Hazard: Radiation exposure in area.
Action: Cannot enter without a written permit and proper training.

Posted at the boundary of a radiological area. Will include information about the type of hazard, entry requirements, and other instructions.

Controlled areas are established around radiological areas for managing personnel access to the radiological areas and for providing a warning of the existence of radiological hazards in the area. This orientation will permit you to have escorted entry into controlled areas for your short visit provided your escort has a minimum of General Employee Training.

Contamination control zones may be established within controlled areas to provide secondary boundaries for minimizing exposures to contamination. This orientation alone WILL qualify or permit you to have escorted access to these areas provided your escort has a minimum of Radiological Worker II training.

Radioactive material areas are areas where radioactive material in excess of specified quantities is located. This orientation alone will qualify or permit you to have escorted access to these areas provided your escort has a minimum of Radiological Worker I training.

Fixed Contamination Areas, **Soil Contamination Areas**, and **Underground Radioactive Material Areas** are other low hazard areas where this orientation alone will qualify or permit you to have escorted access provided your escort has a minimum of General Employee Training.

Radiological Areas, described below, are areas established within the controlled areas.

- The terms "Contamination Areas" and "High Contamination Areas" identify the areas where hazards exist from accessible loose radioactive contamination. Personnel trained at this orientation level are **NOT** permitted to enter Contamination Areas unless escorted by a person with Radiological Worker II training. **NO** entry (escorted or unescorted) into High Contamination Areas is permitted for personnel qualified at this orientation level.
- The terms "Radiation Areas," "High Radiation Areas," and "Very High Radiation Areas" identify the areas where the hazards are exposures to ionizing radiation. The different designations denote increasing levels of hazards (i.e., increasing dose rates). Personnel trained at this orientation level are **NOT** permitted to enter radiation areas unless escorted by a person qualified with Radiological Worker I. **NO** entry into High Radiation Areas or Very High Radiation Areas is permitted for personnel qualified at this orientation level.
- The term "Airborne Radioactivity Area" indicates the potential for radioactive contamination in the air. NO entry into an Airborne Radioactivity Area is permitted for personnel qualified at this orientation level.
- If you must enter an area that requires a thermoluminescent dosimeter (TLD) or an optically stimulated luminescent (OSL) dosimeter, signified by a posting "TLD Required," **in addition** to the requirements outlined above, you **must** wear a TLD for entry.

ALARA Program ~~~~~~~~~~

DOE and SST are firmly committed to having a Radiological Control Program of the highest quality. Therefore, maintaining occupational doses from radiation and radioactive materials to ALARA levels is an integral part of all SST site activities. The purpose of the ALARA Program is to control radiation doses in consideration of the overall benefit of the activity causing the dose. A few basic practices are used to maintain radiation exposures at ALARA levels.

- ***Time*** – Reduce the amount of time spent near a source of radiation.
- ***Distance*** – Stay as far away from the source as possible.
- ***Shielding*** – Shielding is placed between workers and the source.
- ***Control*** – Radioactive contamination is controlled using engineered ventilation, containments, decontamination, and personal protective equipment to minimize the potential for inhalation, ingestion, or absorption of radioactive material.

Monitoring (Dosimetry) ~~~~~~~~~~

You or someone in your group may be provided with and required to wear a Personal Nuclear Accident dosimeter (PNAD) to access almost all Paducah site areas. The PNAD is used to monitor for radiation exposure in the extremely unlikely event of a nuclear criticality accident.

Since radiation cannot be detected with the human senses, special detection devices must be used. Monitoring is required only if you are likely to receive a dose in excess of 100 mrem in a year or if an area is posted “TLD required for entry.” Therefore, it is possible, based on your job function and location, that you will not be provided with a dosimeter. Some workers are monitored for intakes of radioactive material (e.g. inhaling or ingesting radioactive material). This is typically done by either using an apparatus (e.g., whole body counter) to detect the material or by analyzing a sample that the individual provides (e.g., urinalysis). This orientation **WILL NOT** authorize you to enter areas that require this type of monitoring for intakes of radioactive material.

EMERGENCY PROCEDURES

In the unlikely event that a radiological incident occurs, it is important for you to recognize the emergency conditions and to follow the appropriate emergency procedures. Emergencies must be reported to the site shift superintendent. In all cases, you must follow the instructions of your escort.

Abnormal Conditions ~~~~~~~~~~

If you discover radioactive material where it does not belong (e.g., discarded in a clean trash receptable, outside of radiological areas, loose outside, or in a building corridor), you should take the following actions to minimize your exposure to radiation and to minimize the potential for contaminating yourself and others:

- Do not touch or handle the material.
- Warn other personnel not to approach the area.
- Guard the area, moving a safe distance away, and have someone immediately notify Radiological Control personnel at 441-5397 or 331-1949.
- Wait for the arrival of Radiological Control personnel.

Facility Alarms ~~~~~~~~~~

Three types of alarms are used to alert you to a possible emergency in your work area or at the site. The types of alarms and the action required are described below:

- If you hear a continuous, shrill sound from a clarion alarm, **immediately** evacuate to the assembly station.
- If you hear an alarm signal with an alternating high-low tone, STOP work and listen carefully because an announcement about emergency response or actions is about to be made over the public address system.

Facility Evacuation Procedures ~~~~~~~~~~

When you evacuate your area, immediately proceed to an assembly station. An assembly station is a safe area designated for site workers and visitors to meet, report in, and receive more emergency information and instructions. These areas are identified in the Facility Safety Plan. To locate the assembly station for the area you will be visiting, you may ask your escort.

RISKS IN PERSPECTIVE

Radiation comes from background and man-made sources. This is separate from occupational exposure received on the job. The potential risks from this exposure can be compared to other risks that we accept every day.

Occupational dose – Risks associated with occupational doses are very small and are considered to be acceptable when compared to those of other occupational health risks (i.e., coal mining or working at a construction site).

- ***Radiation Dose Limit*** – The DOE whole-body radiation dose limit for general employees is 5,000 mrem/year.
- ***Administrative Control Levels*** – Sites typically have administrative control levels below the DOE limit. The Administrative Control Level ceiling is 2,000 mrem/year Total Effective Dose Equivalent (TEDE). DOE radiological workers who received measurable radiological doses at SST sites had an average dose of less than 30 mrem in the calendar year 2007.

Biological effects from radiation exposure may occur in the exposed individual.

- ***Exposed individual*** – Scientific evidence exists for health effects (primarily cancer) from radiation doses greater than 10,000 mrem per year. This is two times the annual limit of 5,000 mrem/year for occupational exposure. For very large doses received over a short period, prompt effects (i.e., effects that appear shortly after the exposure) may result. These doses are received typically under accident conditions, such as the doses that firefighters received in responding to the Chernobyl accident. These effects may include reddening of the skin, vomiting, hair loss, or even death.

- ***Future children of the exposed individual*** – Heritable effects from ionizing radiation (i.e., genetic changes to the parent's sperm and/or eggs that result in an observed effect on their offspring) have been found in plants and animals, but have not been observed in human populations. The risks of heritable effects from ionizing radiation are considered very small when compared to other naturally occurring heritable effects and are difficult to detect over the natural background rate of birth defects.

- ***Prenatal effects*** – A developing embryo/fetus is especially sensitive to ionizing radiation. Radiation is one of many agents that may cause harm to the embryo/fetus (i.e., chemicals, heat, etc.). Significant radiation doses (greater than 10,000 mrem) to the embryo/fetus may increase the chances that the child will develop a small head size, a lower birth weight, childhood cancer, and/or slower mental growth.

DOE Limits – Special protective measures for the embryo/fetus of a declared pregnant woman minimize the risk of these effects occurring. The limit for the embryo/fetus is 500 mrem from conception to birth. A worker may voluntarily notify her employer, in writing, when she is pregnant. DOE's Radiological Control Standard recommends that the employer provide options for reassignment of work tasks to a declared pregnant worker, without loss of pay or promotional opportunity, so that further occupational radiation exposure is unlikely. (**Note:** If you are or think your are pregnant, please consult with the SST ES&H Manager.)

BENEFIT VERSUS RISK

In summary, the estimated risk associated with occupational radiation dose, when compared to other occupational risks, is considered within the normal range of risk tolerance by national and international scientific groups who have studied these issues. Clearly, the acceptance of risk is a personal matter that you must make, and it is best made with accurate information.

EXPOSURE REPORTS

Although personnel who are trained only at the orientation level are not expected to receive occupational doses above the monitoring threshold, they may be monitored for exposure in any case. This could occur during escorted entries into radiologically controlled areas or in other circumstances. If you are monitored for exposure at SST, you have the right to request reports of that exposure as follows:

- Detailed information concerning your exposure will be made available to you upon request.
- Upon the request from an individual terminating employment, records of radiation exposure dose will be provided by the SST facility within 90 days. If requested, a written estimate of radiation exposure received by the terminating employee will be provided at the time of termination.
- Each individual who is required to be monitored for radiation exposure at a DOE facility will receive a report of that exposure on an annual basis. (Note: As previously discussed, you may be monitored with a dosimeter even though you are not required to be monitored. In this case, an annual report is not required to be sent.)
- When a DOE contractor is required to report any exposure of an individual to radiation and/or radioactive material that exceeds reporting thresholds in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information,* or planned special exposure, the contractor will also provide that individual with a report on his/her exposure data. This report will be transmitted no later than the transmittal to the Department.

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