Objectives:

2.14.01 List the three factors which determine the actions taken in decontamination of personnel.

2.14.02 List the preliminary actions and notifications required by the RCT for an individual suspected to be contaminated.

2.14.03 List the actions to be taken by the RCT when contamination of clothing is confirmed.

2.14.04 List the actions to be taken by the RCT when skin contamination is confirmed.

2.14.05 List the steps for using cleansers of various strengths to decontaminate personnel.

INTRODUCTION

In our work environment, one of the major concerns of the radiological control organization is the prevention of personnel contamination. When personnel contamination has been identified, it is the responsibility of the RCT to perform or oversee the decontamination of the individual using the best methods available. The RCT is also required to document the decontamination effort and make any required notifications. This lesson will address the methods used to detect personnel contamination. In addition, it will address the factors which determine decontamination actions, the responsibilities of the RCTs and the approved methods for decontamination of personnel.

REFERENCES

1. 10 CFR 835 - Occupational Radiation Protection
3. PRD-183 - ICP Radiological Control Manual
4. MCP-148 - Personnel Decontamination
5. MCP-425 - Radiological Release Surveys and the Control and Movement of Contaminated Material
PERSONNEL CONTAMINATION

The potential for personnel contamination is normally monitored by one of the following methods:

External Contamination

- Hand Held Count Rate Meters
- Partial Body Monitors
- Personnel Contamination Monitors

Internal Contamination

- Air Samples
- Whole Body Counts/In Vivo Monitoring
- Bioassay Samples

When monitoring for external contamination, hand held count rate meters may be used in one of two ways. Personnel may survey themselves for contamination, or allow radiological control personnel to conduct the survey for them.

Another method of surveying for external contamination is using some type of contamination monitoring machine. Two basic types of monitors exist: partial body monitors and whole body monitors. Partial body monitors, such as hand-and-shoe monitors, a half body monitor, or a portal (walk through) monitor, monitor only a portion of the body. As such, partial body monitors should only be used for spot-checking for personnel contamination. To conduct a whole body survey, a personnel contamination monitor that surveys the entire body should be used.

Internal contamination may be monitored in one of two ways. The first method includes whole body counts and specific organ counts (lungs, thyroid, etc.). This type of internal monitoring is called in vivo monitoring. The other type of internal contamination monitoring uses some sample from the person to determine the presence of contamination. Methods may include urinalysis, fecal analysis, blood sampling and others. These methods are called in vitro monitoring.

In some cases based on the work situation, workers will be assumed to be contaminated until verified otherwise. The following list provides some examples of work situations that may result in personnel contamination.

- Exposure of the worker to known contaminated liquids
- Exposure of the worker to airborne contamination without proper respiratory protection.
- Improper work practices within Contamination Areas; such as:
Improper removal of protective clothing or devices
- Improper work practices with contaminated materials
- Failure to follow radiological control requirements set for work being performed
- Unknowingly working with material discovered to be contaminated.

2.14.01 List the three factors which determine the actions taken in decontamination of personnel.

BASIC FACTORS AFFECTING DECONTAMINATION

Once the RCT determines the worker is contaminated, the actions taken will be controlled by three basic radiological control factors. These factors include:

1. Physical condition of the worker
2. Location of the contamination on the worker
3. Activity of the nuclide(s) present.

Primary consideration should be given to the physical condition of the worker. All actions taken by the RCT will be based on the worker’s physical condition. The major concern should be whether or not the worker has a serious injury. When a worker sustains a serious injury, the primary concern is the first aid or assistance the worker needs. Since only properly trained personnel may provide first aid, medical assistance should be requested if first aid is required. When a worker sustains an injury, the extent of the injury needs to be determined. Conditions that should be investigated include open/puncture wounds, bruises, sprains, strains and fractures.

Once the physical condition of the worker has been identified, the location of the contamination needs to be determined. Questions requiring particular attention to answer include:

- Is contamination localized on general skin surface?
- Is contamination located on or near a body orifice?
- Is contamination located near a break in the skin?
- Is there a skin condition present in the vicinity of the contamination?
- Is the contamination on the clothing?

Finally, the amount and type of contamination needs to be determined. This will include determining the type of activity (alpha, beta or gamma) present and obtaining a sample of the activity for laboratory analysis.
SUSPECTED CONTAMINATION

When an RCT is notified of a contaminated or potentially contaminated individual, the individual should be told to remain where he or she is and the RCT should ensure the following actions are accomplished.

Obtain Instruments and Proceed to Location: The RCT should obtain the necessary instrumentation and proceed to the location of the individual with suspected contamination.

Assess Conditions: Arriving at the location, the RCT should make a quick assessment of the condition of the individual and of the possibility of spreading contamination. Determine the extent of any injuries. If injury is evident, the RCT must immediately notify, or designate someone to notify, Medical staff. If the individual is not injured, a preliminary survey will give the RCT a quick indication of the extent and location of contamination that may be present. This quick assessment is to determine the immediate course of action and whether additional help is needed or whether an emergency must be declared.

Upon verification of a personnel skin or clothing contamination, notify RadCon supervisor and facility line management.

While performing the assessment survey, the RCT may question the individual to gain information regarding the event that may have caused the contamination. The RCT may elect to notify the Radiological Control supervisor to ask for additional support if, in the judgment of the RCT, the support is needed. For events where there is cause to believe an internal deposition may have occurred or there is extensive contamination, a second RCT may be necessary to record readings and to take and count smears (including nose blows or nasal smears). Another example of when an RCT could ask for additional support would be if there were indications that contamination control had been lost in an area frequented by other workers. A second RCT might be needed to ensure immediate posting, traffic control, and to investigate the radiological conditions.

High levels of contamination found on the skin or clothing during the preliminary survey should be removed immediately to reduce dose. Securely bag and retain removed contamination for analysis. Actions for lower levels of confirmed contamination on skin or clothing may proceed in a more methodical manner as described below.

2.14.02 List the preliminary actions and notifications required by the RCT for an individual suspected to be contaminated.
Perform a Personnel Survey: After the quick assessment survey, a thorough whole body survey should be performed of the entire exposed surface area (protective clothing if worn, personal clothing and/or skin) for both alpha and beta-gamma contamination.

ICP Specific Information
Perform the thorough whole body survey as directed by PRD-183, Appendix 3D, Guidelines for Personnel Contamination Monitoring with Hand-Held Instruments. Using hand held count rate type instruments, an individual may be released if contamination is not detected while performing an entire body survey.

Control Contamination: If the contaminated individual must be moved to another location (such as a decontamination facility or hospital), contain the contamination as much as possible before allowing the person to move by:

1. Removing and bagging shoes and/or covering feet with plastic shoe covers or booties.
2. Covering the hands of the individual with gloves (preferably latex gloves).
3. Donning a clean set of protective clothing coveralls over contaminated clothes or merely wrapping the individual with a suitable covering.

Respond to reports of personnel contamination as directed by MCP-148 “Personnel Decontamination.” Upon verification of a personnel skin or clothing contamination, notify RadCon supervisor and facility line management. Document survey data to aid in dose reconstruction.

See section 4, Prerequisites of MCP-148 for general RCT considerations for personnel decontamination.

See section 5 Instructions of MCP-148 for the initial RCT response to potentially contaminated individuals.

2.14.03 List the actions to be taken by the RCT when contamination of clothing is confirmed.

CONTAMINATED CLOTHING

Clothing contamination should be treated just as seriously as skin contamination until the clothing has been removed and it has been verified that no skin contamination is present. When the clothing of an individual is found contaminated, advise the individual to refrain from moving around or touching the contaminated area and follow the specified procedures for decontamination. At a minimum, the following should be accomplished.
Control Contamination: Contain and remove areas of gross contamination including hot particles by pulling off with tape or cutting out the area and securely bagging the contamination.

Remove Clothing: Carefully remove and securely bag all contaminated clothing. Properly store and save the contaminated clothing worn by the individual for analysis if there is skin contamination or a possible uptake of radioactive material.

Resurvey the Individual: Perform a whole body survey after removal of contaminated clothing to determine that the individual is not re-contaminated.

1. If contamination persists, consider moving the individual to a decontamination facility.

2. Assess potential for internal deposition (airborne, puncture) by surveying outside and inside of masks, surveying facial area, and taking mouth or nasal smears.

ICP Specific Information
Upon verification of clothing contamination, notify radiological control supervisor and facility line management.

Document incidents of clothing contamination on Form 441.02, Personnel Skin/Clothing Contamination Record. To aid in dose reconstruction, be sure to record initial survey data.

Retain contaminated clothing for evaluation of contamination and dose levels, if decontamination efforts will not be impaired by their retention. Decontamination of personal effects (clothing, shoes, jewelry, etc.) may be attempted as follows. Decontamination will be most successful on non-porous materials having accessible surfaces. Do not decontaminate porous materials without the consent of Radiological Control management. Decontaminated personal effects must be cleared for uncontrolled release in accordance with MCP-425 “Radiological Release Surveys and the Control and Movement of Contaminated Material.” Take care to reduce the spread of contamination during the decontamination effort.

Using one or more of the following methods, the RCT may decontaminate personal effects by:

1. Firmly pressing duct tape or masking tape over the affected area and slowly peeling it off to remove the contamination. Use each piece of tape only once.

2. Gently washing the contaminated area with water and bar or dispenser hand soap and then wiping the contaminated area with a paper towel. Again, use the paper towel only once before discarding. Repeat as necessary.

3. Spraying a commercial cleaner directly onto a paper towel, then wiping the contaminated surface. The paper towel should be used only once. This method can be repeated as necessary.

After a decontamination attempt, allow the material to air dry as needed before resurveying for contamination.
SKIN DECONTAMINATION

When the skin of an individual is found contaminated, follow the specified procedures for decontamination. Stop the decontamination effort if the skin becomes irritated or the individual complains of discomfort. At a minimum, the following should be accomplished.

Remove High Levels of Contamination: Hot particles and high levels of contamination should be removed as soon as possible. The time spent to determine the activity and area of contamination should be minimized when high doses are possible.

Notify Supervision: Notify Radiological Control supervision and area supervision.

Decontaminate if Appropriate: Determine the condition of the skin (cuts, sores, abrasions, irritations, etc.) and decontaminate if appropriate. Treatment of contaminated skin with skin conditions (including wounds) is done by medical personnel. Flushing minor wounds with plain tepid water may be permitted. Keep in mind that a wound in a contaminated area may require a wound count to determine the dose from the wound.

Intact skin can be decontaminated by wiping with moist towelettes, flushing with plain tepid water, or washing with mild non-abrasive soap and tepid water. Tape should only be used in areas where there is minimal hair. (Hair can only be trimmed with permission of the individual.) The use of duct tape is discouraged because it may remove not only the contamination but also some of the skin.

Retain particles or other samples of contamination for analysis and dose assessment.

Assess the Possibility of Internal Contamination: Assess potential for internal deposition (airborne, puncture) by surveying outside and inside of masks, surveying facial area, and taking mouth or nasal smears.

ICP Specific Information

Respond to confirmed skin contamination as directed by MCP-148 “Personnel Decontamination.” See section 5, Instructions for RCT directions for performing localized area decontamination, large area decontamination, ear or eye decontamination, and hair decontamination.
Decontamination of an open wound may only be performed under the direction of, or by Occupational Medical Program personnel.

DOCUMENTATION

After decontamination has been completed, it is essential that the proper documentation is completed for proper records.

Typical documentation includes an estimate of the skin area and location affected and the activity involved. In addition, a description of the decontamination process including levels and iterations is also required.

ICP Specific Information

Document incidents of skin and clothing contamination on Form 441.02, Personnel Skin/Clothing Contamination Record. Record initial survey data and survey data after each decontamination attempt.

DECONTAMINATION MATERIALS

Generally the following applies:

• Soaps and detergents dissolve and suspend contamination and are frequently all that are needed for decontamination of skin. Decon towlettes are also used for minor decontamination. The first attempts for decontaminating should always begin with the least irritating agent (soap and water) before proceeding to stronger techniques. Sweating may also be used to dislodge contamination by applying gloves, wraps, or warm baths.

• Sticky tapes may also be used but the potential for irritating the skin must be kept in mind. It is a common mistake to under-estimate the potential for skin irritation until too late. Particular care should be taken on the more sensitive and thin skin areas. At times, if the skin becomes irritated, decontamination may have to wait until the skin heals before proceeding with decontamination.

• Stronger soaps and more abrasive materials (Tide, Clorox, or cornmeal) may dislodge the contamination but are generally only used by medical personnel because of their potential for damaging the skin.
Stronger chemical techniques such as those using potassium permanganate (KMnO$_4$), sodium bisulfite (NaHSO$_3$), DTPA (as a wash), or CaDTPA (as a wash) are not often needed, but when they are, they should be used only by medical personnel.

ICP Specific Information
Refer to MCP-148 “Personnel Decontamination”, for direction on the use of cleansing agents. To prevent use of materials that are not approved for personnel decontamination, use materials from supplied personnel decontamination kits or cabinets. Soaps and detergents are the only cleansers authorized for use without medical approval.

Determine if the contaminated individual is allergic or sensitive to decontamination solutions that may be used in the course of decontamination. Stop decontaminating any skin surfaces if reddening occurs during decontamination efforts.

Generally, cleansers for decontamination should be used in the following order:

1. Flush contaminated area with mild soap and lukewarm water.
2. Make a paste of powdered detergent and water. Rub the paste on the contaminated area and flush with lukewarm water.
3. Use commercially available skin cleansers or wipes.

SUMMARY
In this lesson we have covered the basic principles of personnel decontamination. Our main subjects are the actions taken in the event of potential personnel contamination, notifications required in the event of personnel injury, proper methods for identification and location of contamination, proper action to be taken once contamination has been confirmed and the approved methods for decontamination of personnel. Also discussed were the types of materials utilized for personnel decontamination, and the precautions associated with each.