



# Contamination Control

# Definition

Contamination is radioactive material in an unwanted or undesirable location (i.e., on the floor of a work area, on a worker's clothing, on the outside of a radioactive package, etc.)

# BASIC GOAL OF CONTAMINATION CONTROL

- Minimize contaminated areas
- Maintain contamination levels As Low As Reasonably Achievable



# Types of Contamination

- **Fixed Contamination**

Radioactive material that **CANNOT** be readily removed from surfaces by nondestructive means, such as casual contact, wiping, brushing, or laundering.

- **Removable Contamination**

Radioactive material that **CAN** be removed from surfaces by non-destructive means, such as casual contact, wiping brushing, or washing.

# Measurement of Contamination

- Removable Contamination
  - Swipes, large area wipes: qualitative (cpm)
  - Disk smears: quantitative (Bq/cm<sup>2</sup>)
- Fixed Contamination
  - Direct Survey Instruments
  - Used to measure presence of contamination on floor or other surfaces
  - Will detect both fixed and removable contamination
  - Fixed = Total - Removable

# Measurement of Contamination



# Contamination Control Program: Monitoring

Effective program includes:

- Constant monitoring
- Area and Equipment surveys
- External personnel surveys
- Personnel internal dosimetry

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Provides both visual and audible information to warn personnel of airborne conditions

Continuous Air Monitor (CAM)





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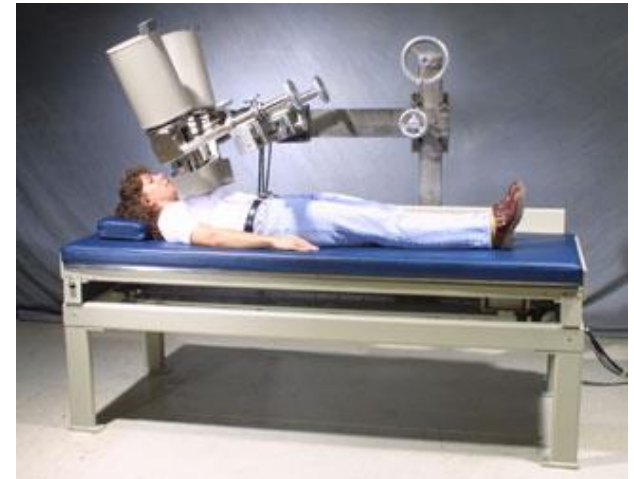
Portal monitors, hand and foot monitors, friskers



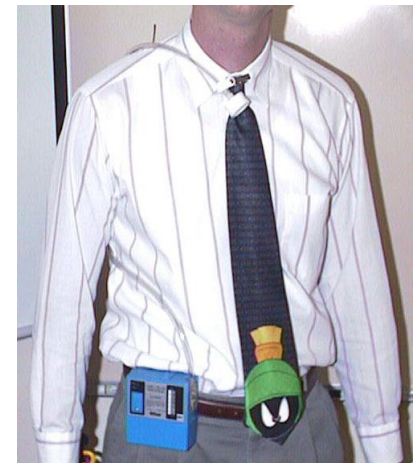
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- **Personnel internal dosimetry**



In vivo bioassay, in vitro bioassay (urine, fecal samples),  
lapel air samplers



# BASIC GOAL OF CONTAMINATION CONTROL

- Actions Contributing to Success
  - Controlling material taken into and out of Contamination Areas
  - Routine surveys in and around Contamination Areas
  - Be alert for potential violations to basic contamination control
    - Improper contamination control methods
    - Bad work practices
    - Procedure violations
    - Radioactive material releases or dry/liquid spills



# CONTAMINATION CONTROL MEASURES

- Access/Admin Control
  - Boundary to controlled areas clearly marked with radiological postings/signs and rope
  - Items labeled with radiological tags
  - Step Off Pads create a sharp line of distinction between a contaminated area and “clean” areas



# CONTAMINATION CONTROL MEASURES

- Preventive Methods
  - When conducting pre-job briefs
    - discuss measures that will help reduce or prevent contamination spread
  - Change gloves or protective clothing as necessary to prevent cross-contamination
  - Cover piping/equipment below work area to prevent spreading contamination into less contaminated areas.

# CONTAMINATION CONTROL MEASURES

- Preventive Methods
  - Cover/tape tools or equipment to minimize decontamination efforts after the job.
  - Follow good work practices
    - **GOOD HOUSEKEEPING**
    - Cleaning up after the jobs
    - Control and minimize all material taken into/out of contaminated areas.

# CONTAMINATION CONTROL MEASURES

- Engineered Controls - Ventilation
  - Permanent or temporary
  - Air flow
    - from Clean to Controlled Areas
    - Low or moderate contamination to higher contamination
  - Exhaust system filtered





# BASIC GOAL OF CONTAMINATION CONTROL

- Decontamination not always possible:
  - Economic Conditions
  - Radiological Conditions
  - Operating Conditions
- Other means of control must be initiated
  - Allow time for natural decay of short lived isotopes
  - Engineered controls
  - Administrative controls
    - Procedures
    - Radiological Posting
  - Personal Protective Equipment (PPE)

# Protective Clothing Considerations

- Factors to consider:
  - type & form of contamination
    - liquid
    - dust
    - surface vs. airborne
    - vapor/gas
  - level of contamination
  - nature of the work being performed



# Protective Clothing (Cont.)

- Additional factors to consider:
  - potential for increase in contamination levels
  - body part(s) at risk for contamination
  - competing hazards
    - Heat stress
    - Asbestos
    - Chemicals
    - Fire hazards, etc.



Source:  
[http://www.weiku.com/products/12099728/Nuclear\\_radiation\\_Lakeland\\_protective\\_clothing.html](http://www.weiku.com/products/12099728/Nuclear_radiation_Lakeland_protective_clothing.html)

# BASIC FACTORS for Consideration of Personnel Decontamination

- Three factors which determine the actions taken in decontamination of personnel.
  1. Physical condition of the individual
  2. Location of the radioactive contamination
  3. How much contamination is present

# BASIC FACTORS

- Physical condition of the individual
  - Is the individual suffering from a life threatening illness or injury?
  - If YES → **MEDICAL TREATMENT TAKES PRIORITY**
  - If no, identify conditions
    - any open or puncture wounds
    - sprains
    - bruises
    - strains
    - simple fractures or multiple fractures?

# BASIC FACTORS

- Location of contamination
  - Once physical (non-life threatening) condition of individual has been identified, location of contamination must be determined, is contamination
    - localized on general skin surface?
    - located at a body orifice or is a body orifice in close proximity?
    - located in or around a break in skin?

# BASIC FACTORS

- Determine how much radioactive contamination is present:
  - Beta-gamma emitters
  - Alpha emitters
- Save a sample if possible for lab analysis

# Performing Personnel Survey

- Establish a contaminated area at person's location
- Use floor coverings or decontamination pool
- Restrict access
- Take actions to prevent cross-contamination of other areas of body and surfaces
- Contain and collect ALL decontamination materials



# Radiological Incident Response Considerations

- Performing Survey
  - Perform detailed survey of exposed surfaces.
  - Start at head and proceeding to feet
    - Nose, mouth, head
    - Hands, elbows and arms
    - Knees, legs, and feet
    - pay particular attention to
      - skin folds
      - injured area/open wounds if possible

# Radiological Incident Response Considerations

- Performing Survey (cont.)
  - 1 cm from surface being surveyed for beta contamination, approximately 0.5 cm from surface being surveyed for alpha contamination
  - Move probe slowly over surface
    - 2 – 5 cm/s
  - If count rate increases
    - pause for 5 - 10 seconds over area to verify presence of contamination

# Response to Contaminated Personnel Clothing

- Carefully remove any clothing, coverings, etc., necessary to expose contaminated skin/hair
- Bag and identify owner of contaminated clothing (as available) for further analysis
- When clothing has been removed, perform an additional whole body survey to determine contamination has spread to the skin.

# Decontamination of Personnel

- Avoid abrading or breaking skin by not brushing or rubbing affected areas
- Ensure that all personnel involved don appropriate PPE before starting.
  - Wipe from clean areas towards contaminated areas
  - If contamination is located near an open wound or body orifice – Wipe *AWAY* from wound or orifice

# Decontamination of Personnel

- Perform cursory decontamination of skin and/or hair:
  - Ensure that all water, wipes, and other decontamination materials are collected and analyzed if necessary;
  - Use only lukewarm (body temperature) water and mild soap to clean/decontaminate affected areas.
    - Alternative - alcohol-free wipes may be used or tape presses may be used

# Decontamination of Personnel

- Perform cursory decontamination of skin and/or hair:
  - Stop decon process if skin becomes irritated
  - Gently pat dry affected area(s) and resurvey for residual contamination.

# Decontamination of Personnel

- Repeat previous steps, as necessary.
  - If contamination levels do not continue to decrease with repeated cleanings, or affected areas become irritated, stop;
- Cover and identify (as appropriate) any contaminated skin/hair;
- Address modesty concerns as necessary

# Contaminated Personnel

- If decon successful or not successful
  - recommend individual report to their supervision/medical personnel for additional evaluation and/or paperwork
- Recommend contacting REAC/TS for assistance at 001-202-581-8100



# Discrete “Hot Particle” Concerns

- Decontaminate - Discrete “hot particles” not directly associated with injuries should be removed immediately using tape or similar non-abrasive methods. Ensure “hot particles” are retained for analysis. **DO NOT** attempt to decontaminate the area around any wound.

# Post Incident Surveys

- At conclusion of response/treatment/decontamination activities, perform contamination surveys of all individuals who were directly involved, as well as any vehicles, stretchers, blankets, etc., used in transporting injured individual to medical facilities.

# PERSONNEL DECONTAMINATION SUMMARY

- Personnel Decontamination
  - Rule of Thumb
    - 90% of contamination is removed by proper removal of protective clothing
    - Another 7% of contamination is removed with the first shower using lukewarm water and a mild soap
    - Avoid using a decontamination method that will harm the skin
    - Pay attention to skin folds, body openings and under the finger nails
    - Control the waste water to prevent the spread of contamination

# DECONTAMINATION

- Area/Equipment Decontamination
  - Vacuuming
  - Strippable Paint
  - Tape/Sticky Rollers
  - Water and Cleanser
  - Abrasive Techniques

# Considerations for First Aid

- First Aid is applied **PRIOR** to contamination control whenever it is considered to have life-saving value, or for the relief of pain or prevention of disability.



Questions?