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Nuclear Enterprise

QUALIFICATION TRAINING PACKAGE

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STS Line Item 6.8.1: Recommend countermeasures

TRAINER GUIDANCE

Proficiency Code:	3c
PC Definition:	Can do all parts of the task. Needs only a spot check of completed work. Can identify why and when the task must be done and why each step is needed.
Prerequisites:	None
Training References:	*Medical Management of Radiological Casualties*, Fourth Edition, July 2013
Additional Supporting References:	Radiation Emergency Medical Management Website, www.remm.nlm.gov
CDC Reference:	4B051
Training Support Material:	Two scenarios included in the notes section
Specific Techniques:	Conduct tabletop training and evaluation of researching, identifying, and recommending medical countermeasures for radiological casualties.
Criterion Objective:	Given a scenario and references, research, identify, and recommend appropriate medical countermeasures to medical providers and/or the incident commander (IC) after a radiological incident, successfully completing all checklist items with NO trainer assistance.

Notes:

Either of the abovementioned resources are great resources for determining medical countermeasures for internally deposited radioactive material. Trainee should be able to identify when medical countermeasures are beneficial and which countermeasures should be used (using the references) for which radioisotopes.

Scenarios:

1. A terrorist attack occurred at an Air Force Academy sporting event. Witness statements identify there was a large explosion in the middle of a crowded grandstand. There were immediate casualties, and when the responding fire department arrived and proceeded to rescue the wounded, their EPDs began to alarm. They were showing a dose rate of 10 mrem/hr. They immediately called Bio to respond. The trainee, as the Bio Team Lead, has responded and reported to the IC. At this time, the Bio Team Lead can ask any questions and/or use any available equipment to conduct any reconnaissance required.
    a. If trainee asks to use the SAM-940 to identify the isotope, the dirty bomb contained a substantial amount of cobalt-60.
    b. If trainee asks, the patients were decontaminated by disrobing and gross decontamination on scene prior to transport to the medical facility.
    c. If trainee asks, Bio performed a scan of the patient used the Victoreen 451P which came back with a dose rate of 4 mrem/hr near the chest of the patient. In addition, nasal swabs showed beta contamination.
    d. Based on above information, the trainee should recommend countermeasures which could include the preferred method, Diethylentriamene Pentaacetate (DTPA), or any of the following: Ethylenediaminetetraacetic Acid (EDTA), Succimer (DMSA), or N-acetyl cysteine (NAC).

2. A terrorist attack occurred during your base's annual air show. Witness statements identify there was a large explosion in the middle of a mostly empty parking lot. There were no immediate casualties; however, when the responding fire department arrived and put out the fire, their EPDs began to alarm. They were showing a dose rate of 15 mrem/hr. They immediately called Bio to respond. The trainee, as the Bio Team Lead, has responded and reported to the IC. At this time, the Bio Team Lead can ask any questions and/or use any available equipment to conduct any reconnaissance required.
    a. If trainee asks to use the SAM-940 to identify the isotope, the dirty bomb contained a substantial amount of cesium-137.

b. If trainee asks, the witnesses have undergone gross decontamination and have been quarantined in an area of the subway station. Witnesses are not exhibiting any signs/symptoms at this time.
c. If trainee asks, Bio performed a scan of all witnesses using the Victoreen 451P which came back with readings around background. In addition, nasal swabs showed no contamination.
d. Based on above information, the trainee should recommend no medical countermeasures; however, they may recommend follow-up evaluations of all witnesses at a later time to ensure no health risks were missed.

TASK STEPS

1. Determine radioisotope of concern based on the scenario and reconnaissance.[1]

2. Recommend decontamination of the patient.[2]

3. Determine if internal contamination occurred.[3]

4. Determine need and appropriate medical countermeasures.[4]

LOCAL REQUIREMENTS:

NOTES:

1. Medical countermeasures are based on specific isotopes. This step must be accomplished prior to any recommendations being made. Typically, this can be done with minimal risk to personnel as the SAM-940 requires a very small gamma signature to identify isotopes.

2. This is the second most important step as treating a patient who is still contaminated risks the health of the providers as well as spreads contamination through the medical facility. Removing clothing, shoes, and washing the patients hair and head, removes 95% of the contamination.

3. Bio can collect nasal swabs and immediately screen the samples for alpha, beta and gamma/x-ray radiation to determine if any contamination was inhaled. In addition, the patient should also be checked for any open wounds which may absorb external contamination.

4. If internal contamination has occurred, medical countermeasures should be used. Trainee should utilize Table 5 of the Medical Management of Radiological Casualties reference or the Patient Management section of the Radiation Emergency Medical Management website to determine specific treatment based on the isotope of concern.

TRAINEE REVIEW QUESTIONS

STS Line Item 6.8.1: Recommend countermeasures

1. What is the first step in recommending countermeasures and why?

2. What is the best method of decontamination for radiological casualties?

3. What are some ways Bio can determine if internal contamination of a patient has occurred?

4. Match the medical countermeasure below with the isotope of concern it can treat. (some may be used more than once)

Americium-241 _____
Cobalt-60 _____
Iodine _____
Plutonium _____
Uranium _____
Cesium _____
Potassium _____
Cadmium _____
Lead _____
Sodium _____

a. Potassium Iodide
b. DTPA
c. DMSA
d. Prussian Blue
e. Bicarbonate
f. Beer (or other diuretic)

PERFORMANCE CHECKLIST

STS Line Item 6.8.1: Recommend countermeasures

Proficiency Code:	3c
PC Definition:	Can do all parts of the task. Needs only a spot check of completed work. Can identify why and when the task must be done and why each step is needed.

DID THE TRAINEE…		YES	NO
1. Determine radioisotope of concern based on the scenario and reconnaissance?			
2. Recommend decontamination of the patient?			
3. Determine if internal contamination occurred?			
4. Determine need and appropriate medical countermeasures?			
Did the trainee successfully complete the task?			

TRAINEE NAME (PRINT)

TRAINER NAME (PRINT)

ANSWERS

1. What is the first step in recommending countermeasures and why?

   A: Determining the isotope of concern because each type of medical countermeasure is isotope specific.

   (Source: Medical Management of Radiological Casualties, 4th Edition)

2. What is the best method of decontamination for radiological casualties?

   A: Removing all clothing and shoes may remove up to 90% of radiological contamination.

   (Source: DOD 3150.08-M Nuclear Weapon Accident Response Procedures (NARP) Internet Supplement)

3. What are some ways Bio can determine if internal contamination of a patient has occurred?

   A: The most effective way is to perform nasal swabs and use the ADM-300 to determine if the swab contains any alpha, beta or gamma/x-ray contamination.

   (Source: Step 3 of this training module)

4. Match the medical countermeasure below with the isotope of concern it can treat. Some may be used more than once.

   A:

Americium-241____B____	a. Potassium Iodide
Cobalt-60 ____B_____	b. DTPA
Iodine ____A_____	c. DMSA
Plutonium ____B____	d. Prussian Blue
Uranium _____E___	e. Bicarbonate
Cesium _____D_____	f. Beer (or other diuretic)
Potassium ___F_____	
Cadmium ___C_____	
Lead _____C_____	
Sodium ___F_____	

   (Source: Medical Management of Radiological Casualties, 4th Edition)

STS Line Item 6.15.5.1: Establish EPD alarm levels

TRAINER GUIDANCE

Proficiency Code:	3c
PC Definition:	Can do all parts of the task. Needs only a spot check of completed work. Can identify why and when the task must be done and why each step is needed.
Prerequisites:	None
Training References:	• Final Guidance Document for Use of the EPD Mk2 and EPD N2 Electronic Personal Dosimeters, Mar 2008
Additional Supporting References:	*AFI 48-148, Ionizing Radiation Protection*
CDC Reference:	4B051
Training Support Material:	• EPD MKII • EPD N2 • Computer with Easy EPD software and IR reader
Specific Techniques:	Conduct hands-on training and evaluation of programming and issue of equipment to radiation workers and/or radiological incident responders.
Criterion Objective:	Given EPDs and a computer with Easy EPD software, program appropriate alarm levels to the EPD, successfully completing all checklist items with NO instructor assistance.

Notes:

*Any EPD a flight has is calibrated on a recurring basis by the Radiation Dosimetry Laboratory at USAFSAM. Calibration and all maintenance should only be performed by USAFSAM/Radiation Dosimetry Lab personnel. This includes all battery replacements, as standard AA batteries should only be installed under emergency situations. Under normal operations, if an EPD is low on batteries, the EPD should be returned to USAFSAM for maintenance.

Both models of EPD should be calibrated every six months if they are used on a routine basis such as NDI surveys. However, if the EPDs are primarily stored in the off position, annual calibration is recommended. This decision should be made by the shop's leadership.

The EPD Mk2 displays four different values, both deep and shallow dose and deep and shallow dose rates. BE Personnel should be able to explain the difference between the deep dose and shallow dose equivalents and the impact the two numbers have on their health risk assessment.

TASK STEPS

1. Determine appropriate dose and rate alarm levels.[1]

2. Program the EPD utilizing Easy EPD software:[2]

LOCAL REQUIREMENTS:

NOTES:

1. Recommended reference material is the Final Guidance Document for EPDs which can be found on the EESOH Service Center. Additionally, this decision can be based on mission specific requirements (i.e. broken arrow alarm levels may have to be increased based on IC/Team Lead recommendations). The Final Guidance Document provides predetermined set points for both WMD and Homeland Security situations. These set points should be used unless intelligence and/or the scenario require modifications based on IC and Team Lead recommendations.

Select appropriate EPD (Mk2 vs N2) based on the scenario/situation. Program appropriate display menus based on EPD end user role (BE may have more options than SFS personnel). Ensure appropriate alarm levels are programmed based on results of step 1. Issue the EPD to an individual or group of individuals based on the situation and available resources. Programming checklists are available in the Final Guidance Document and provide step-by-step instructions on using the Easy EPD software.

PERFORMANCE CHECKLIST

STS Line Item 6.15.5.1: Establish EPD alarm levels

Proficiency Code:	3c
PC Definition:	Can do all parts of the task. Needs only a spot check of completed work. Can identify why and when the task must be done and why each step is needed.

DID THE TRAINEE…		YES	NO
1. Determine appropriate dose and dose rate alarm levels?			
2. Properly program the EPD utilizing the Easy EPD software?			
Did the trainee successfully complete the task?			

TRAINEE NAME (PRINT)

TRAINER NAME (PRINT)

STS Line Item 6.17: Develop sampling analysis strategy (Air, water, soil, vegetation sampling strategies)

TRAINER GUIDANCE

Proficiency Code:	3c
PC Definition:	Can do all parts of the task. Needs only a spot check of completed work. Can identify why and when the task must be done and why each step is needed.
Prerequisites:	None
Training References:	*BE Guide to Radiological Emergencies*, February 2013 (Can be found on the ESOH Service Center) Laboratory Sampling Guide, 11 May 2012
Additional Supporting References:	DOD 3150.08-M "Nuclear Weapon Accident Response Procedures" (NARP) Internet Supplement
CDC Reference:	4B051
Training Support Material:	Scenario in questions
Specific Techniques:	Conduct table top training and evaluation of analysing radiation sampling strategy during radiological response operations.
Criterion Objective:	Given references, a scenario, a developed sampling analysis strategy and a site picture, evaluate a comprehensive sampling strategy, to include air, water, soil, and vegetation sampling as required, to determine if the sampling strategy is sound, comprehensive, and accomplishes all mission objectives.

Notes:

The intent of this QTP is to ensure trainees have the ability to evaluate a comprehensive sampling strategy to determine whether the sampling strategy is sound and complete.

The resources included, the *BE Guide to Radiological Emergencies* as well as the Laboratory Sampling Guide, 11 May 2012, provide a substantial guide to developing the strategy, prompting all applicable questions and advising on sampling requirements (Figure 9-1, page 119 of BE Guide and Section 3.4 and 3.5, pages 61-71 of the Sampling Guide). The trainee can use the Laboratory Sampling Guide, 11 May 2012 reference to determine quantity for each sample, or they can reference that they would contact the ESOH Service Center for verification of how much material the lab requires for analysis.

In addition, the trainee should evaluate the existing sample strategy to determine if it fulfills all the mission requirements and will provide adequate sample to the laboratory for analysis (Laboratory Sampling Guide, 11 May 2012 page 85).

During development of sampling strategy, ESOH Service Center can typically be utilized as reachback support.

TASK STEPS

1. Evaluate sampling requirements.[1]
2. Evaluate sampling action lLeve.l[2]
3. Evaluate the type of analysis required.[3]
4. Evaluate sample procedures.[4]

LOCAL REQUIREMENTS:

NOTES:

1. Trainee should identify areas of concern that require sampling following a radioactive incident. Sampling sites may include vegetation, surface water, food stuffs, dead animals, etc.

2. Determine level of contamination which would induce future actions. This should be based off of baseline contamination as well as the isotope of concern. Typically action levels are determined by your flight commander and/or Incident Commander. Generally accepted practice is anything greater than twice background readings require further action.

3. The type of analysis can be determine by contacting the ESOH Service Center or by referencing section 4.4 and 4.5 of the Laboratory Sampling Guide, 11 May 2012 on pages 90-95.

4. Trainee should research collection methods on pages 99-112 of the Laboratory Sampling Guide, 11 May 2012. The sample collection method should match the sample requirements identified in both Step 1 and Step 3.

TRAINEE REVIEW QUESTIONS

6.17 Develop sampling analysis strategy (Air, water, soil, vegetation sampling strategies)

1. For the following questions, refer to the scenario below.

15 miles from your base, a C-130 carrying a nuclear asset crashed. All base agencies have responded to the broken arrow. The perimeter has been secured, EOD has safed the weapon and reported minimal damage to the asset. Initial radeco samples showed some airborne contamination, and that has been reported to the IC. In response, the IC is wanting to determine the extent of contamination as the aircraft went down on a farm, near a running drainage ditch which feeds into a local creek. You assigned one of your Senior Airmen to develop a sampling strategy as you were directing on scene actions. The sampling plan developed is as follows.

Current Time: 6 hours after aircraft crash

Air: Continue with current locations of the RADeCOs (1 at the ECP, 1 upwind of site, 1 immediately downwind of site, and 1 2 miles downwind of site) sampling 20 lpm for 60 minutes at a time.
Soil: Conduct systematic grid sampling of the entire crash site, totaling 240 samples (grid is 200' by 480', each grid section is 20' x 20') Each sample will be 100 grams.
Water: There is enough water to collect samples at the incident site. Samples will be taken in the drainage ditch at the front of the fuselage and at the rear of the fuselage. Minimum of 2 liters per sample.
Vegetation: Since the incident occurred on a farm, food stuffs will be sampled to ensure there was no uptake of radioactive material into the foodstuffs. One liter of densely packed material in a plastic ziplock bag.

Analysis for each will be gross alpha counting. We will be looking for anything that comes back above twice our background reading.

a. Is the action level established adequate for the scenario?

b. Is the type of analysis requested adequate for your scenario?

c. Are the sampling methods used to collect the samples adequate and appropriate for laboratory requirements?

PERFORMANCE CHECKLIST

STS Line Item 6.17: Develop sampling analysis strategy (Air, water, soil, vegetation sampling strategies)

Proficiency Code:	3c
PC Definition:	Can do all parts of the task. Needs only a spot check of completed work. Can identify why and when the task must be done and why each step is needed.

DID THE TRAINEE…		YES	NO
1. Evaluate sampling requirements?			
2. Evaluate sampling action level?			
3. Evaluate the type of analysis required?			
4. Evaluate sample procedures?			
Did the trainee successfully complete the task?			

TRAINEE NAME (PRINT)

TRAINER NAME (PRINT)

ANSWERS

1. For the following questions, refer to the scenario below.

   15 miles from your base, a C-130 carrying a nuclear asset crashed. All base agencies have responded to the broken arrow. The perimeter has been secured, EOD has safed the weapon and reported minimal damage to the asset. Initial radeco samples showed some airborne contamination, and that has been reported to the IC. In response, the IC is wanting to determine the extent of contamination as the aircraft went down on a farm, near a running drainage ditch which feeds into a local creek. You assigned one of your Senior Airmen to develop a sampling strategy as you were directing on scene actions. The sampling plan developed is as follows.

   Current Time: 6 hours after aircraft crash

   Air: Continue with current locations of the RADeCOs (1 at the ECP, 1 upwind of site, 1 immediately downwind of site, and 1 2 miles downwind of site) sampling 20 lpm for 60 minutes at a time.
   Soil: Conduct systematic grid sampling of the entire crash site, totaling 240 samples (grid is 200' by 480', each grid section is 20' x 20') Each sample will be 100 grams.
   Water: There is enough water to collect samples at the incident site. Samples will be taken in the drainage ditch at the front of the fuselage and at the rear of the fuselage. Minimum of 2 liters per sample.
   Vegetation: Since the incident occurred on a farm, food stuffs will be sampled to ensure there was no uptake of radioactive material into the foodstuffs. One liter of densely packed material in a plastic ziplock bag.
   Analysis for each will be gross alpha counting. We will be looking for anything that comes back above twice our background reading.

   a. Is the action level established adequate for the scenario?

      A: For this scenario, looking for anything above twice background would be sufficient. The one that may require additional investigation is the air samples, that would be based on the derived air concentrations. These would not be able to be calculated until after results were acquired via ADM-300 analysis with the alpha probe.

      (Source: Note #2 above in this training module)

   b. Is the type of analysis requested adequate for your scenario?

      A: The analysis strategy requested was gross alpha, however according to pages 94 and 95, when sampling for uranium it is best to request both gamma and alpha spectroscopy.
      (Source: Laboratory Sampling Guide, 11 May 2012, page 94-95)

   c. Are the sampling methods used to collect the samples adequate and appropriate for laboratory requirements?

      A:
      Soil – when requesting Gamma spectroscopy, a minimum of 2 kg of soil is required

      Surface Water – The quantity is correct, however samples should be collected downstream of the accident site as well as downstream of any turbulence. Depending on how long the drainage ditch is, the samples should be collected a sufficient distance from the site in the drainage ditch, or after the ditch joins the creek.
      Vegetation – minimum of 3 liters of densely packed sample and should be double plastic bagged or packed in a 1 gallon wide mouth plastic jar with screw cap. For foodstuffs collection, trainee should reference that they would contact the ESOH Service Center for more guidance.

      (Source: Laboratory Sampling Guide, 11 May 2012)

STS Line Item 6.20: Recommend decontamination procedures (personnel, equipment, vehicles, aircraft, buildings)

TRAINER GUIDANCE

Proficiency Code:	3c
PC Definition:	Can do all parts of the task. Needs only a spot check of completed work. Can identify why and when the task must be done and why each step is needed
Prerequisites:	None
Training References:	DoDM 3150.08, August 22, 2013 DoD 3150.8-M NARP Internet Supplement_Rev1.122211
Additional Supporting References:	http://www.acq.osd.mil/ncbdp/narp/pdf/NARP_InternetSupplement_010512.pdf
CDC Reference:	4B051
Training Support Material:	
Specific Techniques:	
Criterion Objective:	Given scenarios of potentially contaminated items, recommend proper decontamination procedures successfully completing all task steps with limited trainer assistance.
Notes: Trainer will need to choose items and contamination levels for trainee to recommend decontamination on.	

TASK STEPS

1. Set up Contamination Control Station (CSS) for personnel and vehicles IAW NARP.

PERSONNEL

2. Check all personnel without life-threatening injuries with ADM-300 for contamination.[1]
3. Wash exposed areas of contaminated personnel and resurvey.

EQUIPMENT AND VEHICLES

4. Check all equipment and vehicles for contamination.
5. Remove contamination from equipment with wipe or damp cloth and resurvey.
6. Utilize LRS vehicle decontamination line and resurvey.

BUILDING

7. Using an ADM-300, survey any building that is deemed critical and needs to be cleared for contamination.
8. Mark all areas that you find contamination and clean with wet mopping.
9. Any building deemed not critical within the contamination area should be left evacuated.
10. Make special considerations for medical treatment facilities which could be contaminated by patients.

AIRCRAFT

11. Survey exterior and interior to determine contamination levels.
12. Determine isotope, if possible.[2]
13. Wash exterior contamination with water and detergent and resurvey.
14. Mark areas of interior contamination and work with maintenance to determine cleaning procedures.

LOCAL REQUIREMENTS:

NOTES:

1. Strip outermost layers of clothes and perform life saving measures on critical causalities before performing decontamination.

2. Short half-life isotopes should be allowed to decay.

TRAINEE REVIEW QUESTIONS

STS Line Item 6.20: Recommend decontamination procedures (personnel, equipment, vehicles, aircraft, buildings)

1. Describe the process for casualties with life threatening injuries?

   Remove outer most clothing layers and perform lifesaving. Notify MTF or hospital of possible contamination; determine need for plan to decontaminate treatment facility.

2. On a blank sheet of paper, draw a basic personnel CCS.

3. Do all vehicles need to be immediately decontaminated after each use?

   No, vehicles should stay on scene for continued use and do not require decontamination until response is complete. Priority should be for decontamination of Fire Trucks and Ambulances.

PERFORMANCE CHECKLIST

STS Line Item 6.20: Recommend decontamination procedures (personnel, equipment, vehicles, aircraft, buildings)

Proficiency Code:	3c
PC Definition:	Can do all parts of the task. Needs only a spot check of completed work. Can identify why and when the task must be done and why each step is needed

DID THE TRAINEE…		YES	NO
1. Set up Contamination Control Station (CSS) for personnel and vehicles IAW NARP?			
PERSONNEL			
2. Check all personnel without life-threatening injuries with ADM-300 for contamination?			
3. Wash exposed areas of contaminated personnel and resurvey?			
EQUIPMENT AND VEHICLES			
4. Check all equipment and vehicles for contamination?			
5. Remove contamination from equipment with wipe or damp cloth and resurvey?			
6. Utilize LRS vehicle decontamination line and resurvey?			
BUILDING			
7. Using an ADM-300, survey any building that is deemed critical and needs to be cleared for contamination?			
8. Mark all areas that you find contamination and clean with wet mopping?			
9. Any building deemed not critical within the contamination area should be left evacuated?			
10. Make special considerations for medical treatment facilities which could be contaminated by patients?			
AIRCRAFT			
11. Survey exterior and interior to determine contamination levels?			
12. Determine isotope, if possible?			
13. Wash exterior contamination with water and detergent and resurvey?			

14. Mark areas of interior contamination and work with maintenance to determine cleaning procedures?			
Did the trainee successfully complete the task?			

TRAINEE NAME (PRINT)

TRAINER NAME (PRINT)

ANSWERS

1. Describe the process for casualties with life threatening injuries?

   A: Remove outer most clothing layers and perform lifesaving. Notify MTF or hospital of possible contamination; determine need for plan to decontaminate treatment facility.

   (Source: DoDM 3150.08 (NARP) page 34 – 35 and DoD 3150.8-M NARP Internet Supplement_Rev1.122211 Medical Treatment Facility decontamination)

2. On a blank sheet of paper, draw a basic personnel CCS.

   (Trainer must review drawing.)

   (Source: DoD 3150.8-M NARP Internet Supplement_Rev1.122211 Figure 1 Personnel CCS)

3. Do all vehicles need to be immediately decontaminated after each use?

   A: No, vehicles should stay on scene for continued use and do not require decontamination until response is complete. Priority should be for decontamination of Fire Trucks and Ambulances.

   (Source: DoD 3150.8-M NARP Internet Supplement_Rev1.122211 page 117)