After Action Report

Watts Bar Nuclear Plant

Medical Services Drill for Roane Medical Center

Drill Date: November 14, 2023

FEMA

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EXECUTIVE SUMMARY

On November 14, 2023, the offsite response organizations within the Watts Bar Nuclear Plant 10-mile emergency planning zone participated in a medical services drill. FEMA Region 4 Radiological Emergency Preparedness Program staff evaluated Roane County Office of Emergency Services and Roane Medical Center during this drill.

The purpose of the drill was to assess the level of local preparedness in responding to a contaminated, injured individual within the Watts Bar Nuclear Plant emergency planning zone. This drill was conducted in accordance with FEMA's policies and guidance concerning the implementation of local radiological emergency response plans and procedures.

Officials and representatives from participating agencies and organizations demonstrated knowledge of their emergency response plans and procedures, and successfully implemented them during the drill. All participating agencies and organizations met the drill objective and successfully demonstrated the corresponding core capability identified in Section 2.2 of this report. FEMA staff did not identify any level 1 or level 2 findings during this drill.

It was apparent that a great deal of training and practice was conducted by the offsite response organizations to successfully demonstrate the ability to protect the health and safety of the public. They provided the necessary support and resources to respond to an incident at the Watts Bar Nuclear Plant.

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SECTION 1: OVERVIEW

Drill Name	2023 Watts Bar Nuclear Plant Medical Services Drill	
Type of Drill	Medical Services Drill	
Drill Date	November 14, 2023	
Program	Radiological Emergency Preparedness Program	
Mission Area	Response	
Scenario Type	Medical Services	
Participating Organizations	See Appendix B	
Evaluated Function/Facility	Roane County Office of Emergency Services Roane Medical Center	
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SECTION 2: DESIGN SUMMARY

1. Purpose and Design

FEMA administers the Radiological Emergency Preparedness Program pursuant to the regulations found in Title 44 of the Code of Federal Regulations (44 CFR) Parts 350, 351, 352, 353 and 354. 44 CFR Pt. 350 codifies 16 planning standards that form the basis for radiological emergency response planning for the licensee, state, local, tribal and territorial governments impacted by the emergency planning zones established for each nuclear power plant site in the United States. United States Nuclear Regulatory Commission regulations also codify the 16 planning standards for the licensee. 44 CFR Pt. 350 sets forth the mechanisms for the formal review and approval of state, local, tribal and territorial government radiological emergency response plans and procedures by FEMA. One of the Radiological Emergency Preparedness Program cornerstones established by these regulations is the conduct of annual medical services drills at each medical facility designated in the emergency plans. In these drills, affected state, local, tribal and territorial governments demonstrate their abilities to implement their plans and procedures to protect the health and safety of the public in the event of a radiological incident at a nuclear plant.

Radiological Emergency Preparedness Program Planning Standards L (Medical and Public Health Support) and N.4.b (Medical Emergency Drills) list the criteria for establishing medical care for the general public and conducting drills to verify the arrangements. The medical services drill involves a contaminated, injured individual (simulated) and contains provisions for participation by local support service agencies (i.e., offsite ambulance and medical treatment facility). The focus of these drills is decontamination and contamination control measures, not medical protocols. The exception pertains to modification of contamination control procedures and decisions on transportation to a medical facility when the individual has an urgent medical condition.

This drill was held in accordance with FEMA's policies and guidance concerning the exercise of state and local radiological emergency response plans and procedures as detailed in the December 2019 Radiological Emergency Preparedness Program Manual. The evaluation team conducted this drill using the Homeland Security Exercise and Evaluation Program methodology.

2. Core Capabilities and Objectives

Using the Homeland Security Exercise and Evaluation Program methodology, core capabilities-based planning allowed the drill planning team to develop the objective and observe associated outcomes through a framework of specific action items. Additionally, the objective and capability target assessed met Radiological Emergency Preparedness Program Manual guidance. The core capability demonstrated during this drill was:

- **Public Health, Healthcare, and Emergency Medical Services:** Provide lifesaving medical treatment via Emergency Medical Services and related operations and avoid additional disease and injury by providing targeted public health, medical, and behavioral health support, and products to all affected populations.

This core capability, when successfully demonstrated, met the drill objective. The objective for this drill was:

- **Objective 5:** Operate

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SECTION 3: ANALYSIS OF CAPABILITIES

1. Evaluation and Results

Each jurisdiction and functional entity were evaluated based on the demonstration of core capabilities, Radiological Emergency Preparedness Program objectives, and capability targets as delineated in the FEMA Radiological Emergency Preparedness Program Manual dated December 2019. Capability targets are listed by number and the demonstration status of those capability targets are indicated by the use of the following terms:

- **Met (M):** The jurisdiction or functional entity performed all activities under the objective/capability target to the level required per the work plan and/or the extent-of-play agreement, with no level 1 or level 2 findings evaluated under that objective/capability target during the current activity and no unresolved prior level 2 finding(s).
- **Level 1 Finding (L1):** An observed or identified inadequacy of organizational performance during an assessment activity that could cause a determination that offsite emergency preparedness is not adequate to provide reasonable assurance that appropriate protective measures can be taken in the event of a radiological emergency to protect the health and safety of the public living in the vicinity of a nuclear power plant.
- **Level 2 Finding (L2):** An observed or identified inadequacy of organizational performance during an assessment activity that is not considered, by itself, to adversely impact public health and safety.
- **Plan Issue (P):** An observed or identified inadequacy in the offsite response organizations' s emergency plan/implementing procedures, rather than in that of the offsite response organizations' s performance.
- **Not Demonstrated (N):** For a justifiable reason, the jurisdiction or functional entity did not perform assessment activities under the objective/capability target as specified in the extent-of-play agreement.

2. Summary Results of Evaluation

The Homeland Security Exercise and Evaluation Program methodology is an analytical process used to assess the demonstration of specific core capabilities during a drill. A core capability provides a means to perform one or more capability targets under specified conditions and to specific performance standards. Core capabilities form the foundation of the FEMA Region 4 Radiological Emergency Preparedness Program evaluations. The medical services drill capability summary is provided below.

3. Jurisdictional Summary Results of Evaluation

3.1. Risk Jurisdictions

3.1.1. Roane County

Public Health, Healthcare, and Emergency Medical Services Capability Summary:

The Roane County Emergency Medical Services staff successfully demonstrated the public health, healthcare, and emergency medical services core capability in response to a simulated radiological incident at the Watts Bar Nuclear Plant.

The medical services drill began at the Roane County Ambulance Services station. Through interview, two paramedics explained that they would report to the ambulance services station and each obtain an emergency worker kit prior to responding to a radiological incident. Each kit contained a permanent record dosimeter, direct reading dosimeter, potassium iodide, and an emergency worker exposure card. The paramedics were familiar with the kits contents and knew how to wear and use the provided dosimetry. Following guidance from the controller, both paramedics donned personal protective equipment, including a hooded coverall, two pairs of gloves, over boots, a mask, and eye protection.

The drill was initiated by the controller, and ambulance dispatch contacted the paramedics via radio about an injured person in a potentially contaminated area. Through interview, the paramedics explained that prior to their arrival on-scene, a fire department hazmat team would have established the contaminated and non-contaminated zones. The paramedics also explained that the HAZMAT team would have performed lifesaving measures, as appropriate, and moved the patient to the control line for transfer to the paramedics. Through interview, the paramedics described the process for moving the patient from the contaminated area to the non-contaminated area, while preventing or reducing cross contamination to the greatest extent possible along the control line.

Because the HAZMAT team was not present, the paramedics approached the patient to complete an initial assessment. The patient reported a hand laceration and complained of shoulder pain. The hazmat team would have surveyed the patient with a handheld survey meter and shared any readings, as well as the locations of the readings, with the paramedics. For this drill, the controller simulated surveying the patient and provided the paramedics readings. A reading of 400 counts per minute was identified when surveying the patient's laceration. Through controller inject, the paramedics learned that the wound was not bleeding so no bandage was applied prior to transporting the patient to the medical center.

The patient was cocooned in two sheets and secured to a stretcher. Prior to departure, both paramedics read their direct reading dosimeters; their dosimeters read zero. The patient was placed inside the ambulance and secured for transport. One of the paramedics called the medical center via radio to advise of an en route patient. The paramedic did not advise medical center staff that the patient was potentially contaminated, only the patient's injury was shared with staff.

A parking area was designated for the arriving ambulance behind Roane Medical Center, near an exterior door that led into a decontamination room. The parking area was marked off with cones and barrier tape and a caution sign warning of radiation was posted. Upon arriving at the medical center, the ambulance driver backed the ambulance into the designated parking area. Once parked, both paramedics exited the ambulance still wearing their personal protective equipment and removed the patient from the ambulance. The patient was rolled on a stretcher through the exterior door and into the decontamination room. The paramedics provided the awaiting nurses with vital signs and other patient information like injuries, and then, advised of possible contamination.

The patient was lifted from the ambulance stretcher to a medical center bed and the paramedics exited the room with the ambulance stretcher in hand. A radiological safety officer was waiting to complete a whole-body survey of both paramedics, and to survey

the stretcher and ambulance. Because the exterior portion of the radiological emergency area was not set-up there was some confusion as to where the paramedics should stand to remove their personal protective equipment; where they should discard their personal protective equipment; who was responsible for collecting their dosimetry and emergency worker exposure card; what to do with the radiological waste if it began to accumulate; and which areas were considered contaminated and not contaminated. These questions were answered via interview after consulting with the controller, supervisor, and their procedure.

The radiological safety officer surveyed one of the paramedics as part of the drill. The radiological safety officer surveyed the paramedic much faster than the recommended 1 inch per 1 to 2 seconds. Additionally, the radiological safety officer gripped the probe head with the palm of their gloved hand leaving their fingers extended past the probe head by a half inch. As a result, the paramedic and survey meter could have become contaminated or read as contaminated because the probe and gloves of the radiological safety officer were contaminated.

Decontamination of the stretcher and ambulance were not demonstrated in accordance with the extent-of-play agreement. The radiological safety officer attempted to explain the decontamination process through interview; however, the procedure outlined only seven generic steps for how the radiological emergency area would be decontaminated. None of the steps mentioned exterior equipment like stretchers, ambulances, etc.

The medical center had a dedicated decontamination room with a separate entrance from the ambulance bay. Additional supplies on a large rolling storage cart were available for use by the decontamination room team. The room was equipped with several shower areas, a treatment table, and waste containers. After notification of the inbound patient, a code “orange” radiological emergency was announced over the medical center intercom for the decontamination team to prepare the radiological emergency area. A code orange was announced only because the team knew it was a scheduled drill, and not because they were advised of an arriving potentially contaminated patient.

Team members from the nuclear medicine department acted as radiological safety officers and performed operational checks of the calibrated handheld survey meters using an appropriate source. One radiological safety officer was responsible for the inside radiological emergency area, while the other radiological safety officer was responsible for the outside radiological emergency area. The inside radiological safety officer determined the background radiation level and surveyed the decontamination room before allowing decontamination staff to enter the room and prepare for arrival of the patient.

The decontamination room team consisted of two nurses and a radiological safety officer. Other support staff were available outside the room in a non-contaminated area or buffer zone. Team members inside the room were given a permanent record dosimeter and direct reading dosimeter appropriate for reading contamination exposure. The team assessed the status of the patient as the patient was being transferred into the decontamination room. The emergency medical services stretcher was rolled into the decontamination room, and the patient was transferred to a medical center bed while strapped to a backboard.

The inside radiological safety officer began surveying the patient and found contamination levels above the 300 counts per minute action level on the left hand. The team made numerous attempts to decontaminate the hand wound using saline solution and disposable materials to irrigate the wound until the contamination level was below 300 counts per minute. Wastewater was controlled using sterile gauze to collect the saline rinse, and an absorbent pad was placed underneath the wound to reduce wastewater runoff on the bed. The radiological safety officer performed a final survey of the patient, and confirmed all readings were at background.

The patient was independently transferred to a wheelchair in the non-contaminated area and released for further medical treatment. All team members demonstrated doffing of personal protective equipment, and a whole-body survey was completed by the outside radiological safety officer. The inside radiological safety officer re-entered the decontamination room after doffing personal protective equipment to perform a contamination survey of the medical center bed and floors. No contamination was found, and the radiological safety officer explained that a recommendation would be made to clear the room for normal operations. Throughout the exercise, the staff verbalized frequent glove changes and dosimeter checks.

Observation: Area for Improvement: The pre-staged area was not conducive to response efforts and did not include the appropriate response agencies.

References:
1. Radiological Emergency Preparedness Program Manual, December 2019
2. Roane Medical Center, Code Orange – Hazardous Exposure, March 2023

Analysis: The drill began at the ambulance services station and the ambulance was pre-staged in small space at the station. Additionally, the patient, as well as radiological supplies and equipment necessary for the response were also pre-staged in the same small area. This made it difficult to assess how response efforts would actually unfold during a real-world radiological incident. It is unlikely that the ambulance, paramedics, their radiological equipment, and patient would be in one small space, prepped and ready. Furthermore, a fire department HAZMAT team was referenced multiple times, yet their roles and responsibilities were simulated as no HAZMAT team members were present.

Recommendations:
1. A more realistic drill scenario should be designed, developed, and used during the next evaluated medical services drill.
2. All agencies with roles/responsibilities related to transportation of an injured and potentially contaminated patient should be involved in the drill.

Observation: Area for Improvement: Medical center staff were not advised the patient was potentially contaminated.

References:
1. Radiological Emergency Preparedness Program Manual, December 2019
2. Roane Medical Center, Code Orange – Hazardous Exposure, March 2023

Analysis: One of the paramedics called the medical center via radio to advise of an en route patient. The paramedic did not advise medical center staff that the patient

was potentially contaminated, only the patient's injury was shared with staff. After notification of the inbound patient, a code "orange" radiological emergency was announced over the medical center intercom for the decontamination team to prepare the radiological emergency area. A code orange was announced only because the team knew it was a scheduled drill, and not because they were advised of an arriving potentially contaminated patient. As a result, medical center staff were not ready to accept a potentially contaminated patient, which meant, the radiological emergency area was not fully set-up and much of the treatment of the contaminated patient was simulated.

Recommendations:
1. Always advise medial center staff of the potential for contamination.
2. Consider including a step in the procedure that directs medical center staff to ask if the patient is potentially radiologically contaminated.

Observation: Area for Improvement: The radiological emergency area, both interior and exterior, were not set-up fully.

References:
1. Radiological Emergency Preparedness Program Manual, December 2019
2. Roane Medical Center, Code Orange – Hazardous Exposure, March 2023

Analysis: The scenario unfolded much faster than anticipated and medical center staff were not notified of a potentially contaminated patient prior to the ambulance arriving at the medical center. With such short notice, staff, facilities, and security were unable to fully set-up the radiological emergency area, both interior and exterior. Instead of taking the time to fully set-up the radiological emergency area, staff proceeded with the drill and began simulating aspects of the response like personal protective equipment, designated contaminated and non-contaminated areas, equipment and supplies, etc., This level of simulation created much artificiality which resulted in confusion, multiple instances of cross contamination, and performance of processes not in accordance with the procedure. It also did not reinforce best practices or help staff identify gaps in processes, equipment, and/or the procedure.

Recommendations:
1. Follow the signed, approved extent-of-play agreement.
2. Fully set-up the radiological emergency area regardless of how fast or slow the scenario unfolds.
3. Reduce simulation and artificialities to the greatest extent possible in order to identify best practices, as well as gaps in processes, equipment, and/or the procedure.

Observation: Area for Improvement: The procedure did not include steps for monitoring or decontaminating the outside portion of the radiological emergency area or storing radiological waste collected in this area.

References:
1. Radiological Emergency Preparedness Program Manual, December 2019
2. Roane Medical Center, Code Orange – Hazardous Exposure, March 2023

Analysis: Through interview with the radiological safety officer, it was explained that the paramedics, stretcher, and ambulance would be monitored and decontaminated, as appropriate, by the radiological safety officer prior to the ambulance being placed back into service. However, the procedure did not outline steps for how or where this process would occur. The procedure also did not outline where radiological waste, like discarded personal protective equipment would be stored until it could be placed inside the decontamination room. This could become a concern if the outside portion of the radiological emergency area begins to exceed 300 counts per minute.

Recommendations:

1. Revise the procedure to include steps that address monitoring the outside portion of the radiological emergency area to ensure it does not exceed the 300 counts per minute action level.
2. Revise the procedure to include steps for how and where to store radiological waste, like personal protective equipment, until it can be stored inside the decontamination room.

Observation: Area for Improvement: Radiological monitoring and contamination control.

References:

1. Radiological Emergency Preparedness Program Manual, December 2019
2. Roane Medical Center, Code Orange – Hazardous Exposure, March 2023

Analysis: Contamination surveys were performed at a rate of 3 to 4 inches per second with a probe distance of 3 inches from the contaminated surface. Excepted standards as outlined in FEMA-REP-22 recommends a survey speed of 1 to 2 inches per second with the probe being no more than 1 inch from the contaminated surface. Surveying techniques were performed too quickly and at a distance too far away to effectively locate contamination using a pancake detector. Also, the radiological safety officers gripped the probe head with the palm of their gloved hands leaving their fingers extended past the probe head by a half inch. This could potentially result in the spread of radiological contamination as the radiological safety officer's fingertips frequently encountered potentially contaminated surfaces while completing whole-body surveys.

Recommendation:

1. Conduct additional training with staff members on effective surveying techniques specific to their assigned roles.

Observation: Area for Improvement: Doffing of personal protective equipment.

References:

1. Radiological Emergency Preparedness Program Manual, December 2019
2. Roane Medical Center, Code Orange – Hazardous Exposure, March 2023

Analysis: The inside radiological safety officer re-entered the decontamination room after having doffed personal protective equipment to survey the bed and floor for contamination. No contamination was found; however, the radiological safety officer was not wearing any dosimetry or personal protective equipment to minimize exposure to contamination or the spread of contamination. This could

potentially result in excessive exposure to radiation, and the spread of radiological contamination in non-contaminated areas of the medical center.

Recommendations:

1. Complete all monitoring and decontamination activities prior to doffing personal protective equipment. If the situation necessitates re-entering the decontamination room, then complete donning of personal protective equipment before entering the area again.
2. Review "as low as reasonably achievable" principles for minimizing exposure to ionizing radiation.

For this core capability the following radiological emergency preparedness capability target was met: 5.3

- **Level 1 Finding:** None
- **Level 2 Finding:** None
- **Not Demonstrated:** None
- **Prior Level 2 Findings – Resolved:** None
- **Prior Level 2 Findings – Unresolved:** None

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SECTION 4: CONCLUSION

FEMA assesses offsite response organization preparedness on an ongoing basis which meets the intent of the 44 CFR Pt. 350 planning standards and, through the assessment of selected core capabilities, the National Preparedness Goal. This report is used to document biennial demonstration-based assessment activities, such as a medical services drill, and will be used to inform the Biennial Preparedness Report in December 2024.

The analysis of capabilities above described the state of Tennessee and Watts Bar Nuclear Plant offsite response capabilities. Overall, the drill was a success. The demonstration-based assessment activities evaluated by core capabilities, objectives, and capability targets were successfully demonstrated, and no level 1 or level 2 findings were identified. All offsite response organizations demonstrated knowledge of their emergency response plans and procedures, and successfully demonstrated the ability to protect the health and safety of the public in the event of an incident involving the Watts Bar Nuclear Plant.

Despite other ongoing real-world response efforts, the professionalism and teamwork of the participants was evident throughout all phases of the drill. FEMA wishes to acknowledge the efforts of the many individuals who participated and made this drill a success.

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APPENDIX A: EVALUATOR ASSIGNMENTS

Location/Venue	Evaluation Team	Core Capability
Roane County Office of Emergency Services	Randi Hendrix	Public Health, Healthcare, and Emergency Medical Services
Roane Medical Center	Irvin Gibson Erica Houghton	Public Health, Healthcare, and Emergency Medical Services

APPENDIX B: PARTICIPATING ORGANIZATIONS

Participating Organizations
State of Tennessee
Tennessee Military Department, Tennessee Emergency Management Agency
Roane County
Roane County Office of Emergency Services
Private Sector
Roane Medical Center
Federal
U.S. Department of Homeland Security, Federal Emergency Management Agency, Region 4