



**FEMA**

**APR 10 2012**

Mr. Elmo Collins, Jr.  
Regional Administrator  
U.S. Nuclear Regulatory Commission, Region IV  
1600 East Lamar Boulevard  
Arlington, Texas 76011-8064

Dear Mr. Collins:

Enclosed with this letter is a copy of the final After Action Report and Improvement Plan for the Medical Drill, held on November 1, 2011, for the Palo Verde Nuclear Generating Station (PVNGS). The purpose of this exercise was to assess the level of state and local preparedness in responding to a radiological emergency. This final exercise report was prepared by the U.S. Department of Homeland Security's Federal Emergency Management Agency, Region IX, Radiological Emergency Preparedness Program staff.

No deficiencies were identified during this exercise for the state of Arizona and the affected local jurisdictions. There were three Areas Requiring Corrective Action (ARCA) identified as a result of the exercise; one ARCA was corrected. We will monitor the correction of the remaining ARCAs. A detailed discussion of these ARCAs can be found in Section 3.3 of the Final Report.

Based on the evaluation of the November 1, 2011 Medical Drill, the offsite radiological emergency response plans for the state of Arizona and the affected local jurisdictions, site-specific to PVNGS, can be implemented, and are adequate to provide reasonable assurance that appropriate measures can be taken offsite to protect the health and safety of the public, in the event of a radiological emergency at PVNGS.

Therefore, the Title 44 of the Code of Federal Regulations Part 350 approval of the offsite radiological emergency response plans and preparedness for the state of Arizona, site specific to PVNGS, will remain in effect.

I would also like to take this opportunity to acknowledge the many individuals who participated in this successful exercise. Their dedication to this program was clearly evident.

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Mr. Elmo E. Collins, Jr.

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If you have questions or need additional information, please contact me at (510) 627-7100. Your staff may also contact Mr. Paul Anderson, PVNGS Site-Specialist, at (510) 627-7093, or Mr. Farley Howell, Federal Preparedness Coordinator, at (510) 627-7121.

Sincerely,

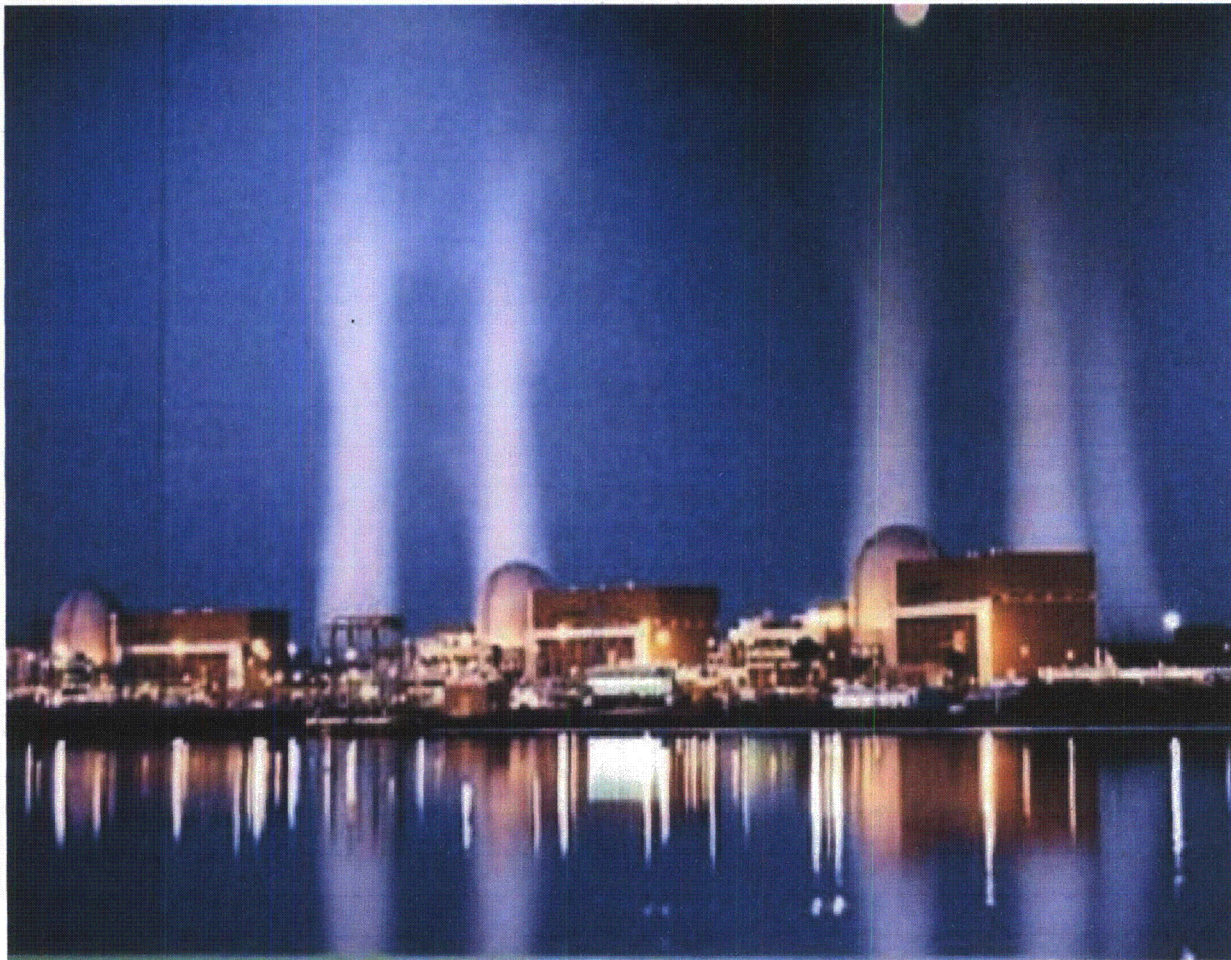


for Nancy Ward  
Regional Administrator  
FEMA Region IX

Enclosure

cc: NRC Headquarters Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555-0001

Vanessa Quinn, Chief  
Radiological Emergency Preparedness Branch  
FEMA Headquarters



# Palo Verde Nuclear Generating Station After Action Report/ Improvement Plan

Drill Date - November 01, 2011

Radiological Emergency Preparedness (REP) Program



**FEMA**

*Published March 8, 2012*

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## Palo Verde Nuclear Generating Station

# After Action Report/Improvement Plan

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## **Executive Summary**

The U.S. Department of Homeland Security (DHS) Federal Emergency Management Agency (FEMA) Region IX evaluated a Medical Drill for the 10-mile Emergency Planning Zone (EPZ) around the Palo Verde Nuclear Generating Station (PVNGS). The purpose of the drill was to assess the level of state and local preparedness in responding to medical emergencies involving radiologically contaminated, injured persons. The drill was held in accordance with FEMA's policies and guidance for exercising state and local Radiological Emergency Response Plans (RERP) and procedures.

The most recent biennial exercise at this site was conducted on March 1-3, 2011. The qualifying emergency preparedness exercise was conducted on April 1, 1981. FEMA wishes to acknowledge the efforts of the many individuals who participated in this exercise.

Protecting the public health and safety is the full-time job of some of the exercise participants and an additionally assigned responsibility for others. Still others have willingly sought this responsibility by volunteering to provide vital emergency services to their communities. Cooperation and teamwork among the participants was evident during this exercise.

The local organizations, except where noted in this report, demonstrated knowledge of their emergency response plans and procedures and adequately implemented them. There were three Areas Requiring Corrective Action (ARCA) identified during this drill. One ARCA was corrected by redemonstration in the course of the drill. The two uncorrected ARCAs are listed in the Improvement Plan. Three planning issues were confirmed as corrected in this drill.

There were no outstanding, uncorrected ARCAs, from previous exercises.

## **Section 1: Exercise Overview**

### **1.1 Exercise Details**

**Exercise Name**

Palo Verde Nuclear Generating Station Medical Drill

**Exercise Date**

November 01, 2011

**Program**

Department of Homeland Security/FEMA Radiological Emergency Preparedness Program

**Scenario Type**

Radiological Emergency

### **1.2 Exercise Planning Team Leadership**

U.S. Department of Homeland Security, Federal Emergency Management Agency

Paul Anderson, Site Specialist

Arizona Division of Emergency Management

Bill Wolfe, Radiological Emergency Preparedness Program Coordinator

Maricopa County Department of Emergency Management

John Padilla, Emergency Services Planner

Arizona Public Service, Palo Verde Nuclear Generating Station

David Crozier, Emergency Planning Consultant

Banner Good Samaritan Medical Center

Mary Alice Witzel, Emergency Preparedness Coordinator

### **1.3 Participating Organizations**

Agencies and organizations of the following jurisdictions participated in the PVNGS exercise:

**State Jurisdictions**

Arizona Radiation Regulatory Agency

**Risk Jurisdictions**

Maricopa County Sheriff's Office

Buckeye Valley Fire Department

**Private Organizations**

Banner Good Samaritan Medical Center

Native American Air Ambulance

Palo Verde Nuclear Generating Station



## **Section 2: Exercise Design Summary**

### **2.1 Exercise Purpose and Design**

FEMA Region IX evaluated the medical drill to assess the capabilities of the Offsite Response Organizations (ORO) to protect public health and safety in the event of a radiological emergency at PVNGS. Player actions were evaluated against current RERPs and capabilities related to transportation and medical treatment of a contaminated injured person.

### **2.2 Exercise Objectives, Capabilities and Activities**

The 2011 Contaminated Injury Exercise planning team developed this medical drill based on the evaluation areas and associated sub-elements as defined in the FEMA Interim Radiological Emergency Preparedness (REP) Program Manual, August 2002. The Interim REP Program Manual evaluation areas are drawn from the ORO RERP requirements stated in the joint FEMA/US Nuclear Regulatory Commission (NRC) guidance document, which is also part of the NRC Regulations (NUREG), Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants (NUREG-0654/FEMA REP-1, Revision 1, November 1980). The Interim REP Program Manual evaluation area criteria restate, in a functional manner, the NUREG-0654 RERP requirements that can be demonstrated and observed in exercises and drills. The selected evaluation areas for demonstration are identified in FEMA Guidance Memorandum, MS-1, Medical Services, November 13, 1986.

The Interim REP Program Manual evaluation areas are associated with the capabilities listed in the U.S. Department of Homeland Security, Target Capabilities List (TCL), September 2007.

REP Evaluation Area 1 – Emergency Operations Management, REPP Criterion 1.e.1. Equipment, maps, displays, monitoring instruments, dosimetry, potassium iodide (KI) and other supplies are sufficient to support emergency operations. (NUREG-0654/FEMA REP-1, H.7, 10; J.10. a, b, e; J.11; K.3.a)

TCL activities, Response Mission Area: Emergency Triage and Pre-Hospital Treatment.

REP Evaluation Area 3 – Protective Action Implementation, REPP Criterion 3.a.1. The OROs issue appropriate dosimetry and procedures, and manage radiological exposure to emergency workers in accordance with the plans and/or procedures. Emergency workers periodically and at the end of each mission read their dosimeters and record the readings on the appropriate exposure record or chart. (NUREG-0654/FEMA REP-1, K.3.a, b)

TCL activities, Response Mission Area: Responder Safety and Health.

REP Evaluation Area 6 – Support Operations, Facilities, REPP Criterion 6.d.1. The facility/ORO has the appropriate space, adequate resources, and trained personnel to provide transport, monitoring, decontamination, and medical services to contaminated injured individuals. (NUREG 0654/FEMA REP-1, F.2; H.10; K.5.a, b; L.1, 4)

TCL activities, Response Mission Area: Emergency Triage and Pre-Hospital Treatment.

Elements of the core capabilities and capability targets provide the foundation for the integration of the REP Program objectives and the development of the exercise scenario.

## 2.3 Scenario Summary

The 2011 Contaminated Injury Exercise involved the transportation and treatment of radiologically contaminated injured persons from two separate locations:

The first person was injured and contaminated while working onsite at the PVNGS. The PVNGS Fire Department responded to the incident scene and provided initial care. Due to the serious condition of the patient, and failing to completely decontaminate the patient's wounds, the PVNGS Fire Department contacted Native American Air Ambulance (NAAA) for helicopter transport to the Banner Good Samaritan Medical Center Emergency Department (BGSMC ED). The PVNGS Fire Department prepared a body map showing the contamination levels for the injured areas. They wrapped the patient in blankets for transport and briefed NAAA on the patient's condition. NAAA transported the contaminated injured patient to the hospital where BGSMC stabilized the patient, decontaminated the wounds and admitted the patient on to the hospital ward.

The second person was a contractor who became injured and contaminated while working onsite at PVNGS. Although injured and contaminated, the contractor's condition was stable enough for transportation to the hospital by ground ambulance. The ambulance transporting the injured contractor was involved in an automobile accident while in route. An observer reported the accident and the Maricopa County Sheriff's Office (MCSO) dispatched an officer to secure the accident scene. MCSO requested Emergency Medical System (EMS) support from the Buckeye Valley Fire Department (BVFD) and on learning of the radiological contaminated injured person, also requested assistance from the Arizona Radiation Regulatory Agency (ARRA). BVFD extracted the injured contractor. After extraction, the BVFD transported the injured contractor to BGSMC ED by ground ambulance. BGSMC ED received this second injured patient, completing the exercise.

## **Section 3: Analysis of Capabilities**

### **3.1 Exercise Evaluation and Results**

This section contains the results and findings of the evaluation of the OROs that participated in the medical drill on November 1, 2011, to test the offsite RERP capabilities of state and local governments in the EPZ surrounding the PVNGS. The OROs were evaluated on the basis of their demonstration of criteria delineated in the exercise evaluation areas of the August 2002, Interim REP Program Manual.

### **3.2 Summary Results of Exercise Evaluation**

The matrix presented in Table 3.1, presents the status of all exercise evaluation area criteria which were scheduled for demonstration, during the plume phase of this exercise, by all participating jurisdictions and functional entities. Exercise evaluation area criteria are listed by number and the demonstration status of those evaluation area criteria is indicated by the use of the following letters:

M – Met (No deficiencies or ARCAs assessed and no unresolved ARCAs from prior exercises)

D – Deficiency assessed

A – ARCA(s) assessed or unresolved ARCA(s) from prior exercise(s)

N – Not Demonstrated (Reason explained in Appendix D, extent of play agreement)

P – Plan Issue

Table 3.1 – Summary of Exercise Evaluation

DATE: 2011-11-01 SITE: Palo Verde Nuclear Generating Station, AZ M: Met, A: ARCA, D: Deficiency, P: Plan Issue, N: Not Demonstrated		BGSMC	NAAA	ARRA	BVFD	MCSO
<b>Emergency Operations Management</b>						
Mobilization	1a1					
Facilities	1b1					
Direction and Control	1c1					
Communications Equipment	1d1					
Equip & Supplies to support operations	1e1	M		M	A	M
<b>Protective Action Decision Making</b>						
Emergency Worker Exposure Control	2a1					
Radiological Assessment and PARs	2b1					
Decisions for the Plume Phase -PADs	2b2					
PADs for protection of special populations	2c1					
Rad Assessment and Decision making for the Ingestion Exposure	2d1					
Rad Assessment and Decision making concerning Relocation, Reentry, and Return	2e1					
<b>Protective Action Implementation</b>						
Implementation of emergency worker exposure control	3a1	M		M	A	M
Implementation of KI decision	3b1					
Implementation of protective actions for special populations - EOCs	3c1					
Implementation of protective actions for Schools	3c2					
Implementation of traffic and access control	3d1					
Impediments to evacuation are identified and resolved	3d2					
Implementation of ingestion pathway decisions - availability/use of info	3e1					
Materials for Ingestion Pathway PADs are available	3e2					
Implementation of relocation, re-entry, and return decisions.	3f1					
<b>Field Measurement and Analysis</b>						
Adequate equipment for plume phase field measurements	4a1					
Field Teams obtain sufficient information	4a2					
Field Teams manage sample collection appropriately	4a3					
Post plume phase field measurements and sampling	4b1					
Laboratory operations	4c1					
<b>Emergency Notification and Public Info</b>						
Activation of the prompt alert and notification system	5a1					
Activation of the prompt alert and notification system - Fast Breaker	5a2					
Activation of the prompt alert and notification system - Exception areas	5a3					
Emergency information and instructions for the public and the media	5b1					
<b>Support Operations/Facilities</b>						
Mon / decon of evacuees and EWs, and registration of evacuees	6a1					
Mon / decon of emergency worker equipment	6b1					
Temporary care of evacuees	6c1					
Transportation and treatment of contaminated injured individuals	6d1	M	M		M	

### 3.3 Evaluation Summaries

#### 3.3.1 Arizona Jurisdictions

##### 3.3.1.1 Arizona Radiation Regulatory Agency

The Arizona Radiation Regulatory Agency (ARRA) demonstrated its capability to respond to a vehicle accident scene involving a radiologically contaminated, injured person. ARRA brought appropriately calibrated radiological survey equipment and dosimetry to the accident site and implemented appropriate procedures to manage emergency worker exposure. In accordance with the extent of play agreement, law enforcement secured the scene of an ambulance vehicle accident during the rescue operations. After emergency medical operations concluded, ARRA surveyed the level of contamination at the scene. After surveying the accident scene, ARRA determined that radioactive contamination was at normal background levels for the area. ARRA's determination allowed other agencies to remove the accident debris and to complete the accident scene cleanup.

All activities were completed in accordance with plans and procedures as they would have been in an actual emergency, except as noted in the extent of play agreement.

- a. MET: 1.e.1, 3.a.1
- b. AREAS REQUIRING CORRECTIVE ACTION: None
- c. DEFICIENCY: None
- d. PLAN ISSUES: None
- e. NOT DEMONSTRATED: None
- f. PRIOR ISSUES - RESOLVED: None
- g. PRIOR ISSUES - UNRESOLVED: None

#### 3.3.2 Risk Jurisdictions

##### 3.3.2.1 Buckeye Valley Fire Department

The Buckeye Valley Fire Department (BVFD) demonstrated the capability to respond to a vehicle accident that involved a radiologically-contaminated, injured person, to medically treat the injured person and to transport the injured person to an appropriate medical facility. Since BVFD does not have a Standard Operating Procedure for responding to a radiologically contaminated accident injury, the Engine Company firefighters relied on hazardous materials response procedures and radiological response training. Some Areas Requiring Corrective Action (ARCA) were observed and are detailed below. BVFD personnel corrected the ARCA related to monitoring radiological contamination on an injured person, criterion 6d1, by redemonstrating the correct monitoring procedure, after an exercise controller provided on the spot retraining.

A BVFD Engine company and medical response team arrived at the vehicle accident scene equipped to respond to a medical emergency. The Engine company captain sized up the accident scene on arrival and

received a quick briefing on the incident from the Maricopa County Sheriff's Officer who was the first responder at the site. Based on information about the radiological contamination, the captain ordered his crew to don appropriate Personal Protective Equipment (PPE). Self contained breathing apparatus was available in addition to turnout PPE. The paramedic and the emergency medical technician on the medical team had thermoluminescent dosimeters (TLD) to record their radiological exposure. None of the firefighters had TLDs during the drill, however TLDs were available at the fire station. None of the responders had Direct Reading Dosimeters to monitor personal exposure to radiation. The medical team was aware that procedures, equipment and trained staff were available for personnel monitoring and decontamination from the Arizona Radiation Regulatory Agency and the Nuclear Medicine Department at Banner Good Samaritan Medical Center.

Firefighters provided initial medical response to the contaminated injured person. They used a radiation survey meter from the Engine company equipment to create a body map of the contaminated areas. The survey meter calibration date had expired and the initial survey technique required retraining as detailed in the ARCA's below. The firefighters used damp bandages to isolate and contain the contamination in preparation for extracting the injured person from the wrecked vehicle. Once safely extracted, the injured person was transferred to the medical team for ambulance transport to the hospital. The paramedic and the emergency medical technician on the medical team maintained communication with the hospital during ambulance transport. During transport, the medical team administered appropriate treatment and maintained contamination control. The BVFD medical team briefed the hospital emergency room charge nurse on the medical condition of the injured person during transport. When the BVFD medical team arrived at the hospital emergency room, they provided emergency room staff the body map, showing the areas of contamination and the levels of contamination as part of the patient transfer process.

All activities were completed as they would have been in an actual emergency except as noted in the extent of play agreement.

a. MET: 6.d.1.

b. AREAS REQUIRING CORRECTIVE ACTION: 1.e.1, 3.a.1, 6.d.1.

ISSUE NO.: 45-11-1e1-A-1

CRITERION: Equipment, maps, displays, dosimetry, potassium iodide (KI), and other supplies are sufficient to support emergency operations. (NUREG-0654, H7, 10; J.10.a, b, e; J.11; K.3.a)

CONDITION: The BVFD Engine Company was equipped with a radiation detection instrument, a Ludlum Model 2241-2 instrument with a 44-9 probe, that had been calibrated on January 16, 2009 with a calibration expiration date of January 16, 2010.

POSSIBLE CAUSE: The instrument provided to the Buckeye Valley Fire Department was not maintained within current calibration.

REFERENCE: NUREG 0654, H7, H10

EFFECT: There was no assurance that contamination levels would be accurately determined when an instrument that was out of calibration was used.

RECOMMENDATION: Maintain instruments provided to the Buckeye Valley Fire Department

within current calibration.

ISSUE NO.: 45-11-3a1-A-2

**CRITERION:** The OROs issue appropriate dosimetry and procedures, and manage radiological exposure to emergency workers in accordance with the plan and procedures. Emergency workers periodically and at the end of each mission read their dosimeters and record the readings on the appropriate exposure record or chart. (NUREG-0654, K.3.a, b)

**CONDITION:** The BVFD Engine Company did not have Permanent Record Dosimeters and none of the emergency responders had Direct Reading Dosimeters as required by NUREG 0654, K.3. They were not familiar with the Environmental Protection Agency (EPA) Protective Action Guides (PAG) and without direct reading dosimetry they had no way of determining if any of the EPA PAGs were being exceeded. The Arizona RERP has a 0.2 R reporting value for emergency workers.

**POSSIBLE CAUSE:** The BVFD does not have a written SOP for responding to an emergency involving radioactivity the includes the use of Permanent Record Dosimeters, Direct Reading Dosimeters, and the radiation exposure limits for Emergency Workers.

**REFERENCE:** NUREG 0654, K.3

**EFFECT:** Unmonitored excessive exposure could result

**RECOMMENDATION:** Provide appropriate dosimetry and prepare a procedure that clearly defines the use of dosimetry during an emergency involving radioactivity. This procedure should define when dosimetry is to be used, the frequency that dosimetry should be read, reporting levels, how dosimetry reading will be documented and who has authority to approve excess exposure above the general public PAG. After the procedure has been prepared, training must be conducted to assure that all responders understand their responsibilities.

ISSUE NO.: 45-11-6d1-A-3

**CRITERION:** The facility/ORO has the appropriate space, adequate resources, and trained personnel to provide transport, monitoring, decontamination, and medical services to contaminated injured individuals. (NUREG-0654, F.2; H.10; K.5a, b; L.1, 4)

**CONDITION:** One fire fighter was equipped with a radiation detection instrument, a Ludlum Model 2241-2 instrument, 44-9 probe, that had been calibrated on January 16, 2009 and expired on January 16, 2010. The instrument was not inspected, or operationally checked before use. The heavy plastic protective cover over the probe was left in place. The fire fighter surveyed the area near the vehicle, the vehicle, and the patient. Inadequate survey techniques were observed. The protective cover prevented any detection. The survey probe was moved too fast and was too far from surfaces.

**POSSIBLE CAUSE:** BVFD does not have a written SOP for responding to an emergency involving radioactivity and the proper use of radiation and radioactivity detecting instruments.

**REFERENCE:** F.2, H.10, K.5

**EFFECT:** Inaccurate results would have been measured

**CORRECTIVE ACTION DEMONSTRATED:** After on the spot training by the Controller, the fire

fighter redemonstrated appropriate monitoring techniques. A written procedure should be developed for future use by the BVFD.

- c. DEFICIENCY: None
- d. PLAN ISSUES: None
- e. NOT DEMONSTRATED: None
- f. PRIOR ISSUES - RESOLVED: None
- g. PRIOR ISSUES - UNRESOLVED: None

### **3.3.2.2 Maricopa County Sheriff's Office**

The MCSO demonstrated the capability to use dosimetry, in accordance with MCSO procedures, to manage the radiological exposure to its officers in the performance of their duty. An on-duty officer would carry both a thermoluminescent dosimeter (TLD) as a permanent record of radiological exposure, and a Canberra UltraRadiac electronic dosimeter to monitor exposure. The officer, who responded to a motor vehicle accident, involving a radiologically contaminated injured person, carried a hard copy of the MCSO Emergency Response to PVNGS plan. That plan has dosimetry reporting requirements for on-duty officers. The responding officer was familiar with the details of the MCSO plan.

In response to the report of a vehicle accident, involving an ambulance that was carrying a radiologically contaminated, injured person, MCSO dispatched an officer to secure the scene of the accident. As the first responder, the MCSO officer was the incident commander at the accident scene. She assessed the situation and requested EMS support through the dispatcher at the MCSO Command Post. She also requested that the ARRA be notified. ARRA would be responsible to monitor radiological contamination at the accident scene. When the BVFD responded to provide EMS support, she provided an incident briefing to the fire engine captain. She maintained perimeter security during the EMS response and ARRA radiological monitoring. The officer demonstrated that during an incident response, she would monitor her electronic dosimeter and report her exposure to the dispatcher at the Command Post as required by the MCSO plan.

All activities were completed in accordance with plans and procedures as they would have been in an actual emergency, except as noted in the extent of play agreement.

- a. MET: 1.e.1, 3.a.1.
- b. AREAS REQUIRING CORRECTIVE ACTION: None
- c. DEFICIENCY: None
- d. PLAN ISSUES: None
- e. NOT DEMONSTRATED: None
- f. PRIOR ISSUES - RESOLVED: None
- g. PRIOR ISSUES - UNRESOLVED: None



### 3.3.3 Private Organizations

#### 3.3.3.1 Banner Good Samaritan Medical Center

The Emergency Department (ED) staff at BGSMC demonstrated appropriate use of dosimetry, radiation monitoring equipment, personal protective equipment and contamination control while providing medical treatment to a contaminated injured person. Radiological survey instruments were operationally checked for current calibration, response and accuracy against a known source. This step cleared the equipment planning issue 45-10-1e1-P-01. Immediate medical treatment and radiological decontamination was demonstrated in a controlled area that prevented the spread of contamination within the hospital. Nuclear Medicine Technicians (NMT) ensured that hospital personnel understood and followed contamination control procedures. Medical staff took care to ensure that medical treatment took priority over radiological monitoring, decontamination and contamination control efforts.

Upon notification that a contaminated injured person would be flown in for medical treatment in the ED, emergency room staff roped off a Radiation Control Area (RCA) in two adjoining examination bays. The Palo Verde Nuclear Generating Station maintains a portable storage cabinet that is stored in the ED decontamination room. It was stocked with medical supplies and equipment for treating radiologically contaminated, injured persons. The RCA staff, a trauma physician, a trauma nurse and a NMT donned Personal Protective Equipment (PPE) in preparation to treat the contaminated injured person. A wall poster in the buffer zone adjoining the RCA illustrated the correct procedure to don and doff PPE. PPE for RCA staff included OREX coveralls and booties, lead apron, plastic apron, 2 pair of surgical gloves, outer rubber gloves and a face shield. Thermoluminescent permanent record dosimeters (TLD) and electronic personal dosimeters (EPD) were signed out and worn on lanyards outside the lead apron, under the plastic apron. The EPDs were set to alarm at an exposure of 5 rem per hour or 1 rem integrated dose. This method of tracking the RCA staff accumulated radiological exposure corrects planning issue 45-10-3a1-P-02. RCA procedure requires team replacement at this level of exposure.

Patient treatment procedures controlled radiological contamination while focusing on medical treatment. The patient transported by air ambulance was wheeled next to the RCA on a gurney then transferred to a decontamination gurney at the edge of the RCA. The air ambulance crew and their gurney were surveyed for radiological contamination before being released. The path of travel from the helicopter, air ambulance to the RCA was controlled at patient arrival and surveyed after patient transfer. Using similar care, X-ray equipment was managed to capture images of the patient without contaminating the equipment or X-ray image plates. The trauma physician ordered the removal of as much material as possible surrounding the contaminated leg injury without raising the patient's legs in case of a spinal injury. Wound decontamination with saline solution and absorbent chux limited the spread of radiological material. The care demonstrated in limiting the spread of contamination corrects planning issue 45-08-6d1-P-01. After decontamination and initial treatment, the patient could be transferred to the hospital ward.

The second contaminated, injured patient, transported by ground ambulance from a vehicle accident, was received at the RCA. Treatment of the second patient was not demonstrated since the treatment of the first patient satisfied the demonstration requirements. When patient treatment in the RCA was complete, the area would be thoroughly decontaminated. All equipment would be wiped down and surveyed. The floor would

also be mopped and radiologically surveyed until residual contaminated material was removed. When clean, the area could be restored for other ED use.

All activities described in the demonstration criterion were carried out in accordance with the plan, procedures, and extent of play agreement.

- a. MET: 1.e.1, 3.a.1, 6.d.1.
- b. AREAS REQUIRING CORRECTIVE ACTION: None
- c. DEFICIENCY: None
- d. PLAN ISSUES: None
- e. NOT DEMONSTRATED: None
- f. PRIOR ISSUES - RESOLVED: 1.e.1, 3.a.1, 6.d.1.

ISSUE NO: 45-10-1e1-P-01

ISSUE: The response checks performed on the survey instruments provided by PVNGS consist of exposing the instruments to a known radioactive source and observing if the instrument responds. There is no range identified for the response to ensure that the instrument is functioning properly.

CORRECTIVE ACTION DEMONSTRATED: Successful operations checks were conducted on all monitoring instruments. The checks consisted of exposing the instruments to a disc source containing a thorium-tungsten alloy containing 2% Th-232 (plus radioactive progeny). The source case contained a notation that the GM pancake probes should respond within a range of 700-900 counts per minute. This procedure for checking the instrument readings corrects planning issue 45-10-1e1-P-01.

ISSUE NO: 45-10-3a1-P-02

ISSUE: The procedure does not specify the frequency of reading the electronic dosimeters worn by hospital personnel.

CORRECTIVE ACTION DEMONSTRATED: TLDs and EPDs were signed out and worn on lanyards outside the lead apron, under the plastic apron. The EPDs were set to alarm at an exposure of 5 rem per hour or 1 rem integrated dose. This method of tracking the RCA staff accumulated radiological exposure corrects planning issue 45-10-3a1-P-02.

ISSUE NO: 45-08-6d1-P-01

ISSUE: The patient was placed on a decontamination table on top of a pad with cloth covering. She was then monitored and decontaminated on top of the cloth covering. Contamination was found and decontamination was performed on the face, left arm and left leg. During the decontamination process, the pad, the cloth covering, and the patient's clothing became wet with the wash water used for rinsing the contaminated areas. The water spread under the patient and a large area of the cloth covering under the patient was wet. A large area of the patient's clothing was also wet. Procedures do not include the removal of padding and covering before decontamination.

CORRECTIVE ACTION DEMONSTRATED: The trauma physician ordered the removal of as

much material as possible surrounding the contaminated leg injury without raising the patient's legs in case of a spinal injury. Wound decontamination with saline solution and absorbent chux limited the spread of radiological material. The care demonstrated in limiting the spread of contamination corrects planning issue 45-08-6d1-P-01.

g. PRIOR ISSUES - UNRESOLVED: None

### 3.3.3.2 Native American Air Ambulance

The NAAA demonstrated coordinated patient transport and treatment during the November 1, 2011 PVNGS Medical Drill. The NAAA flight crew consisted of a helicopter pilot, a nurse and a paramedic. NAAA picked up the contaminated injured patient from the PVNGS Fire Department. The PVNGS Fire Department provided initial assessment and treatment. PVNGS briefed NAAA on the patient's injuries and included a patient body map showing the radiologically contaminated areas. PVNGS also provided dosimetry for the flight crew. NAAA called the BGSMC ED, advising the ED that they were transporting a seriously injured patient by helicopter to the ED.

When the NAAA helicopter landed, the paramedic accompanied the patient for the gurney transfer to the ED. He briefed ED staff on the patient's vital signs. The NAAA paramedic also provided ED staff with the body map of the patient's radiological contamination. Crew dosimetry was transferred to the ED staff during patient transfer. At the conclusion of patient transfer, a BGSMC safety officer conducted a radiological survey of NAAA equipment and of the flight crew. The NAAA flight crew confirmed that they and their equipment were free of contamination before leaving the ED for their next assignment.

All activities described in the demonstration criterion were carried out in accordance with the plan, procedures, and extent of play agreement.

- a. MET: 6.d.1
- b. AREAS REQUIRING CORRECTIVE ACTION: None
- c. DEFICIENCY: None
- d. PLAN ISSUES: None
- e. NOT DEMONSTRATED: None
- f. PRIOR ISSUES - RESOLVED: None
- g. PRIOR ISSUES - UNRESOLVED: None

## Section 4: Conclusion

FEMA evaluated an off-site medical drill on November 1, 2011 for the jurisdictions in the 10-mile EPZ around the PVNGS. The purpose of the exercise was to assess the level of state and local preparedness in response to a radiological emergency. This medical drill was held in accordance with FEMA's policies and guidance concerning the exercise of state and local RERPs and procedures.

The medical drill participants demonstrated knowledge of their emergency response plans and procedures and, except for the ARCAs explained in the narrative, adequately demonstrated the ability to follow those plans to protect the health and safety of the public. There were no Deficiencies and three ARCAs identified during the course of the exercise. No planning issues were identified in this medical drill. Three outstanding planning issues from prior exercises were demonstrated as corrected. No uncorrected planning issues remain from previous medical drills. One ARCA was cleared during exercise play by correct redemonstration after re-training. The two remaining ARCAs are detailed in the Improvement Plan for correction.

## Appendix A: Improvement Plan

Issue Number: 45-11-1e1-A-1		Criterion: 1e1	
ISSUE: The Buckeye Valley Fire Department (BVFD) Engine Company was equipped with a radiation detection instrument, a Ludlum Model 2241-2 instrument with a 44-9 probe, that had been calibrated on January 16, 2009 with a calibration expiration date of January 16, 2010.			
RECOMMENDATION: Maintain instruments provided to the BVFD within current calibration.			
CORRECTIVE ACTION DESCRIPTION: The Arizona Radiation Regulatory Agency (ARRA) will calibrate both of the BVFD instruments for the 2012 and 2013 calendar years and will provide a “loaner” instrument to the BVFD while calibration is taking place. The BVFD will assume the responsibility for calibration after that. The Palo Verde Nuclear Generating Station (PVNGS) will consider a proposal to assist BVFD with the responsibility to maintain radiation detection instruments within current calibration.			
CAPABILITY: Equipment and supplies to support operations		PRIMARY RESPONSIBLE AGENCY: Buckeye Valley Fire Department	
CAPABILITY ELEMENT: Equipment		START DATE: February 22, 2012	
AGENCY POC: Mark Alexander		COMPLETION DATE: April 30, 2012	

Issue Number: 45-11-3a1-A-2		Criterion: 3a1
ISSUE: The BVFD Engine Company did not have Permanent Record Dosimeters and none of the emergency responders had Direct Reading Dosimeters as required by NUREG 0654, K.3. They were not familiar with the EPA PAGs and without direct reading dosimetry they had no way of determining if any of the EPA PAGs were being exceeded. The Arizona RERP has a 0.2 R reporting value for emergency workers.		
RECOMMENDATION: Provide appropriate dosimetry and prepare a procedure that clearly defines the use of dosimetry during an emergency involving radioactivity. This procedure should define when dosimetry is to be used, the frequency that dosimetry should be read, reporting levels, how dosimetry reading will be documented and who has authority to approve excess exposure above the general public PAG. After the procedure has been prepared, training must be conducted to assure that all responders understand their responsibilities.		
CORRECTIVE ACTION DESCRIPTION: The BVFD has distributed pocket dosimetry cards provided by the ARRA to engine company personnel. A joint working group led by the Arizona Division of Emergency Management REP Program Manager and comprised of representatives of the BVFD, ARRA, PVNGS, Maricopa County Department of Emergency Management and Banner Health Arizona, will draft a radiological incident response procedure for BVFD that can be adapted for use by any EMS agency responding to an incident in the 10-mile EPZ. Additionally, ARRA will make radiological emergency response training available to BVFD in the 2 <sup>nd</sup> quarter of 2012. PVNGS has offered to provide and maintain at least one radiation detection device for BVFD use as a group dosimeter to monitor emergency worker radiation exposure.		
CAPABILITY: Responder Safety and Health		PRIMARY RESPONSIBLE AGENCY: Buckeye Valley Fire Department
CAPABILITY ELEMENT: Exposure Monitoring		START DATE: February 22, 2012
AGENCY POC: Mark Alexander		COMPLETION DATE: August 31, 2012

## Appendix B: Drill Evaluators and Team Leaders

LOCATION	EVALUATOR	AGENCY
Arizona Radiation Regulatory Agency	*Joseph Keller	ICFI
Buckeye Valley Fire Department	Dennis Wilford	ICFI
Maricopa County Sheriff's Office	*Joseph Keller	ICFI
Banner Good Samaritan Medical Center	Thomas Essig	ICFI
Native American Air Ambulance	*Daryl Thome	ICFI
	Thomas Essig	ICFI
* Team Leader		

## Appendix C: Acronyms

ARCA	Areas Requiring Corrective Action
ARRA	Arizona Radiation Regulatory Agency
BGSMC	Banner Good Samaritan Medical Center
BVFD	Buckeye Valley Fire Department
DHS	U.S. Department of Homeland Security
ED	Emergency Department
EMS	Emergency Medical System
EPA	US Environmental Protection Agency
EPD	Electronic Personal Dosimeter
EPZ	Emergency Planning Zone
FEMA	Federal Emergency Management Agency
GM	Geiger Mueller radiation detector
MCSO	Maricopa County Sheriff's Office
NAAA	Native American Air Ambulance
NMT	Nuclear Medicine Technician
PAG	Protective Action Guide
PPE	Personal Protective Equipment
NRC	Nuclear Regulatory Commission
NUREG	US Nuclear Regulatory Commission Regulation
OROs	Offsite Response Organizations
PVNGS	Palo Verde Nuclear Generating Station
R	Roentgen
RCA	Radiation Control Area
REP	Radiological Emergency Preparedness
REPP	Radiological Emergency Preparedness Program
RERP	Radiological Emergency Response Plan
SOP	Standard Operating Procedure
TCL	Target Capabilities List
TLD	Thermoluminescent Dosimeter



## Appendix D: Extent of Play Agreement

STATE OF ARIZONA/MARICOPA COUNTY OFFSITE CRITERIA & EXTENT OF PLAY 2011 Evaluated Contaminated Injury Exercise Palo Verde Nuclear Generating Station
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All play, demonstrations, and interviews will be conducted in accordance with the *2010 State of Arizona – Maricopa County Offsite Emergency Response Plan for the Palo Verde Nuclear Generating Station* and other applicable procedures, and/or checklists related to contaminated injury response unless specifically stated in this Extent of Play.

Controllers and/or Evaluators can request re-demonstration of any response activity as long as it does not impede play.

### DEMONSTRATIONS AND ACTIVITIES

Activity	Date	Location
Contaminated injury occurs at Palo Verde Nuclear Generating Station (PVNGS). Victim is transported offsite by air ambulance	November 1, 2011	5801 S. Wintersburg Road Tonopah, AZ
Banner Good Samaritan Medical Center (BGSMC) receives and treats contaminated injury from PVNGS	November 1, 2011	1111 E. McDowell Road Phoenix, AZ
Contaminated injury occurs as result of traffic accident east of PVNGS. Victim is transported by local ground ambulance to BGSMC.	November 1, 2011	Buckeye Municipal Airport 3000 S Palo Verde Rd. Buckeye, AZ
Banner Good Samaritan Medical Center receives and treats contaminated injury from offsite traffic accident.	November 1, 2011	1111 E. McDowell Road Phoenix, AZ

### EVALUATION AREA 1—EMERGENCY OPERATIONS MANAGEMENT

#### Sub-Element 1.e.1—Equipment and Supplies to Support Operations

Intent: This sub-element derives from NUREG-0654, which provides that Offsite Response Organizations (ORO) have emergency equipment and supplies adequate to support the emergency response. (NUREG-0654, H.7; H.10; K.3.a)

Criterion 1.e.1: Equipment, maps, displays, dosimetry, potassium iodide (KI), and other supplies are sufficient to support emergency operations. (NUREG-0654, H.7; H.10; K.3.a)

EXTENT OF PLAY: The following activities will be demonstrated during the 2011 Contaminated Injury Exercise.

- 1) Air and ground transport, law enforcement, and Banner Good Samaritan Medical Center (BGSMC) will demonstrate the availability and use of radiological monitoring, contamination control, and decontamination equipment as appropriate consistent with their role in the scenario. In those cases where a demonstration is not practical, this capability will be demonstrated by interview.
- 2) Air and ground transport personnel will be issued dosimetry as appropriate consistent with the radiation levels in the scenario. In those cases where a demonstration is not practical, this capability will be demonstrated by interview.
- 3) All capabilities will be demonstrated consistent with current plans and procedures.

### EVALUATION AREA 3—PROTECTIVE ACTION IMPLEMENTATION

#### Sub-Element 3.a.1—Implementation of Emergency Worker Exposure Control

Intent: This sub-element derives from NUREG-0654, which provides that Offsite Response Organizations (ORO) have the capability to provide for the following: distribution, use, collection, and processing of direct-reading dosimetry and permanent record dosimetry; the reading of direct-reading dosimetry by emergency workers at appropriate frequencies; maintaining a radiation dose record for each emergency worker; and establishing a decision chain or authorization procedure for emergency workers to incur radiation exposure in excess of protective action guides, always applying the ALARA (As Low As Reasonably Achievable) principle as appropriate. (NUREG-0654, K.3.a, b)

Criterion 3.a.1: The OROs issue appropriate dosimetry and procedures, and manage radiological exposure to emergency workers in accordance with the plans and procedures. Emergency workers periodically and at the end of each mission read their dosimeters and record the readings on the appropriate exposure record or chart. (NUREG-0654, K.3.a, b)

EXTENT OF PLAY: The following activities will be demonstrated during the 2011 Contaminated Injury Exercise.

- 1) Individual dosimetry will be issued to air and ground transport personnel and other responders as appropriate consistent with the radiation levels in the scenario. In those cases where a demonstration is not practical, this capability will be demonstrated by interview.
- 2) Banner Good Samaritan Medical Center (BGSMC) will use facility and Palo Verde Nuclear Generating Station (PVNGS) supplied dosimetry and monitoring equipment to manage exposure, contamination, and decontamination activities. In those cases where a demonstration is not practical, this capability will be demonstrated by interview.
- 3) All capabilities will be demonstrated consistent with current plans and procedures.

## EVALUATION AREA 6—SUPPORT OPERATIONS/FACILITIES

### Sub-Element 6.d—Transportation and Treatment of Contaminated Injured Individuals

Intent: This sub-element derives from NUREG-0654, which provides that Offsite Response Organizations (ORO) should have the capability to transport contaminated injured individuals to medical facilities with the capacity to provide medical services. (NUREG-0654, F.2; H.10; K.5.a, b; L.1, 4)

Criterion 6.d.1: The facility/ORO has the appropriate space, adequate resources, and trained personnel to provide transport, monitoring, decontamination, and medical services to contaminated injured individuals. (NUREG-0654, F.2; H.10; K.5.a, b; L.1, 4)

EXTENT OF PLAY: The following activities will be demonstrated during the 2011 Contaminated Injury Exercise.

- 1) Offsite Response Organizations (OROs) will demonstrate the capacity to transport contaminated injured individuals to Banner Good Samaritan Medical Center (BGSMC) for treatment.
  - a) An air ambulance will be used to transport the victim from the Palo Verde Nuclear Generating Station (PVNGS) to BGSMC.
    - i) The contaminated injury will be pre-staged at the PVNGS landing zone.
    - ii) During the transportation process, the condition of the victim will remain constant. Prior to transferring the victim to the air ambulance, an evaluation of the victim's radiological condition will be conducted by Palo Verde Radiation Protection personnel and a determination made that the issuance of dosimetry and protective clothing for air ambulance personnel is not necessary. The dosimetry will be available for issue and for Evaluator inspection.
  - b) Ground transport will be used to transport the offsite vehicle accident victim to BGSMC.
    - i) Ground transport resources normally responding to the 10-mile EPZ will be utilized.
    - ii) Should a real world incident occur necessitating the diversion of available ground transport; a substitute vehicle may be used once initial communication occurs between the ground transport and BGSMC.
    - iii) It is anticipated that space will be available for the Evaluator to accompany the victim by ground transport to BGSMC.
    - iv) Ground transport and local law enforcement will be pre-positioned near, but not at, the offsite accident location to minimize travel time and safety concerns.
- 2) Normal communications between the air and ground ambulance/dispatchers and the BGSMC Trauma Center will be demonstrated unless this interferes with real world incident communications. These calls may be simulated as necessary.
- 3) Air and ground ambulance crews will demonstrate, by interview, knowledge of where the ambulance and crew would be monitored and decontaminated, if required, or whom to contact for such information.
- 4) Monitoring of the victims may be performed before transport, done enroute, or deferred to the medical facility.
  - a) Before using a monitoring instrument(s), the instrument will be checked for current calibration and will be source checked.
  - b) All monitoring activities will be completed as they would be in an actual emergency.
  - c) Appropriate contamination control measures should be demonstrated before and during transport and at BGSMC.

- 5) The Banner Good Samaritan Medical Center (BGSMC) will demonstrate the capability to activate and set up a radiological emergency area (REA) for treatment per current BGSMC procedures.
- a) Equipment and supplies will be available for the treatment of contaminated injured individuals.
  - b) The receipt, processing, contamination control, decontamination and handling of the contaminated injury arriving by air transport to the point of transfer to a ward will be demonstrated.
  - c) The receipt, processing and contamination control of the contaminated injury arriving by ground transport to the point of transfer of the individual to the REA will be demonstrated.
  - d) BGSMC will demonstrate the capability to make decisions on the need for
  - e) decontamination of the individual, to follow their decontamination procedures, and to maintain records of survey measurements and samples taken.
  - f) Decontamination and medical response will be demonstrated to the extent practical. Clothing will not fully be removed from the injured individuals and no actual medical procedures will be conducted.
  - g) Procedures for the collection and analysis of samples (nasal smears, etc.) and the decontamination of the individual will be demonstrated or described to the Evaluator.
  - h) For safety reasons the transfer of the victims from one gurney to another may be simulated. This transfer process can be demonstrated by interview.
  - i) Post incident disposition of contaminated materials/fluids and clean-up of the BGSMC REA will be demonstrated by interview.
  - j) The primary helipad at BGSMC will be out of service for re-surfacing for several weeks prior to and following the exercise. An alternate landing zone at the facility will be utilized. The path from this landing zone is two elevator systems and two walkway/bridges from the Trauma Center. To ensure that this exercise does not disrupt or interfere with normal BGSMC operations, the survey process for the route between the helipad and the Trauma Center will be demonstrated by interview. The handoff from the air ambulance to BGSMC personnel will be demonstrated at the helipad. The victim will then be pre-positioned just outside the Trauma Center and exercise play will continue.
  - k) Should a real-world incident require the exercise to vacate the BGSMC Trauma Center, exercise activities will be relocated, pending available hospital staff, to an adjacent treatment room for continued demonstration.
- 6) All capabilities will be demonstrated consistent with current plans and procedures.

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