Final Medical Drill Report

PALO VERDE NUCLEAR GENERATING STATION

Licensee: **Arizona Public Service Company**

Drill Date: **November 6, 2002**

Report Date: **March 26, 2003**

FEDERAL EMERGENCY MANAGEMENT AGENCY
REGION IX
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I. EXECUTIVE SUMMARY

The Federal Emergency Management Agency (FEMA), Region IX evaluated an Off-site Medical Drill on November 6, 2002, for the emergency planning zone (EPZ) around the Palo Verde Nuclear Generating Station (PVNGS). The purpose of the exercise and drill was to assess the level of State and local preparedness in responding to a radiological emergency. This exercise and drill was held in accordance with FEMA's policies and guidance concerning the exercising of State and local radiological emergency response plans (RERP) and procedures.

The most recent biennial exercise at this site was conducted on March 12, 2003. The most recent medical drill for Maryvale Hospital Medical Center was conducted on February 14, 2001. 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 of all the participants were evident during this drill.

The local organizations, except where noted in this report, demonstrated knowledge of their emergency response plans and procedures and adequately implemented them. There were two Areas Requiring Corrective Action (ARCA) identified as a result of this drill; one ARCA was corrected during the drill. Also, two ARCAs from previous medical drills were corrected.

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II. INTRODUCTION

On December 7, 1979, the President directed FEMA to assume the lead responsibility for all off-site nuclear planning and response. FEMA's activities are conducted pursuant to 44 Code of Federal Regulations (CFR) Parts 350, 351 and 352. These regulations are a key element in the Radiological Emergency Preparedness (REP) Program that was established following the Three Mile Island Nuclear Station accident in March 1979.

FEMA Rule 44 CFR 350 establishes the policies and procedures for FEMA's initial and continued approval of Tribal, State and local governments' radiological emergency planning and preparedness for commercial nuclear power plants. This approval is contingent, in part, on State and local government participation in joint exercises with licensees.

- FEMA's responsibilities in radiological emergency planning for fixed nuclear facilities include the following:

- Taking the lead in off-site emergency planning and in the review and evaluation of RERPs and procedures developed by State and local governments;

- Determining whether such plans and procedures can be implemented on the basis of observation and evaluation of exercises of the plans and procedures conducted by State and local governments;

- Responding to requests by the U.S. Nuclear Regulatory Commission (NRC) pursuant to the Memorandum of Understanding between the NRC and FEMA dated June 17, 1993 (Federal Register, Vol. 58, No. 176, September 14, 1993); and

- Coordinating the activities of Federal agencies with responsibilities in the radiological emergency planning process:

    - U.S. Department of Commerce,
    - U.S. Nuclear Regulatory Commission,
    - U.S. Environmental Protection Agency,
    - U.S. Department of Energy,
    - U.S. Department of Health and Human Services,
    - U.S. Department of Transportation,
    - U.S. Department of Agriculture,
    - U.S. Department of the Interior, and
    - U.S. Food and Drug Administration.

Representatives of these agencies serve on the FEMA Region IX Regional Assistance Committee (RAC) that is chaired by FEMA.

Formal submission of the RERPs for the Palo Verde Nuclear Generating Station to FEMA Region IX by the State of Arizona and the involved local jurisdictions occurred on May 31, 1988.

State and local Radiological Emergency Preparedness plans are required, in NUREG-0654/FEMA REP 1, Rev. 1 (November 1980), to designate primary and back-up medical facilities capable of providing appropriate care to injured/contaminated individuals originating from the off-site effects of an incident at a nuclear power plant. One or more of these facilities are usually exercised as part of the biennial State/Local REP exercise. Others may be exercised during the off-year period. At least one evaluated medical drill must be held each year at each nuclear facility, according to NUREG-0654 Planning Standard N.2.c.

FEMA Region IX evaluated an Off-site Medical Drill on November 6, 2002, to assess the capabilities of local emergency preparedness organizations in implementing their RERPs and procedures to protect the public health and safety during a radiological emergency involving the PVNGS. The purpose of this report is to present the results and findings on the performance of the off-site response organizations (ORO) during a simulated radiological emergency.

The findings presented in this report are based on the evaluations of the Federal evaluator team, with final determinations made by the FEMA Region IX RAC Chairperson, and approved by the Regional Director.

The criteria utilized in the FEMA evaluation process are contained in:

- NUREG-0654/FEMA-REP-1, Rev. 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," November 1980;

- FEMA Radiological Emergency Preparedness Exercise Evaluation Methodology, September, 2001; and

- FEMA Guidance Memoranda MS-1, "Medical Services," November 1986.

Section III of this report, entitled "Exercise Overview," presents basic information and data relevant to the exercise. This section of the report contains a description of the plume pathway EPZ, a listing of all participating jurisdictions and functional entities that were evaluated, and a tabular presentation of the time of actual occurrence of key exercise events and activities.

Section IV of this report, entitled "Exercise Evaluation and Results," presents detailed information on the demonstration of applicable exercise evaluation areas at each

jurisdiction or functional entity evaluated in a jurisdiction-based, issues-only format. This section also contains: (1) descriptions of all Deficiencies and ARCAs assessed during this exercise, recommended corrective actions, and the Tribal, State and local governments' schedule of corrective actions for each identified issue and (2) descriptions of unresolved ARCAs assessed during previous drills and the status of the OROs' efforts to resolve them.

III. OVERVIEW

Contained in this section are data and basic information relevant to the November 6, 2002, medical drill to test a portion of the off-site emergency response capabilities for the area surrounding the Palo Verde Nuclear Generating Station. This section of the report includes a description of the plume pathway EPZ, and a listing of all participating jurisdictions and functional entities that were evaluated.

A. Plume Emergency Planning Zone Description

The State of Arizona has designated an Emergency Planning Zone (EPZ) that extends out from a 10-mile circle around the plant. The EPZ includes the unincorporated areas of Maricopa County.

B. Exercise Participants

The following agencies, organizations, and units of government participated in the Palo Verde Nuclear Generating Station off-site medical drill on November 6, 2002.

RISK JURISDICTIONS

Arizona Radiation Regulatory Agency
Buckeye Valley Fire District
Maricopa County Sheriff's Office
Tonopah Valley Fire District

PRIVATE/VOLUNTEER ORGANIZATIONS

Maryvale Hospital Medical Center
Palo Verde Nuclear Generating Station

IV. EVALUATION AND RESULTS

Contained in this section are the results and findings of the evaluation of all jurisdictions and functional entities which participated in the November 6, 2002, medical drill to test the off-site emergency response capabilities of Tribal Nations, State and local governments in the 10-mile EPZ surrounding the Palo Verde Nuclear Generating Station

Each jurisdiction and functional entity was evaluated on the basis of its demonstration of criteria delineated in exercise evaluation area criteria contained in the FEMA REP Program Manual. Detailed information on the exercise evaluation area criteria and the extent-of-play agreement used in this exercise are found in Appendix 3 of this report.

A. Summary Results of Exercise Evaluation - Table 1

The matrix presented in Table 1, on the following page, presents the status of all exercise evaluation area criteria from the FEMA REP Program Manual. that were scheduled for demonstration during 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 Deficiency 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 Subsection B)

TABLE 1. SUMMARY RESULTS OF EVALUATION

DATE
November 6, 2002

SITE
Palo Verde Nuclear Generating Station

	Mobilization	Facilities	Direction & Control	Communications Equipment	Equipment & Supplies to Support Operations	Emergency Worker Exposure Control	Rad Assmt PARs Based on Avail Information	Rad Assmt PADs for General Public	Prot Action Decisions for Special Population's	Rad Assmt & Decision Making for Ingest Exposure	Rad Assmt & Dec Making for Relo/Re-entry/& Return	Implementation of Emergency Wrkr Exposure Control	Implementation of KI Decision	Implementation of PADs for Special Population's	Implementation of PADs for Schools	Implementation of Traffic Access & Control	Impediments to Evac & Traf are Identified & Resolved	Implementation of Ingestion Pathway Decisions	Impl of IP Decisions Show Strat & Instr Material	Impl of Relocation/Re-entry/Return Decisions	Plume Phase Measurement & Analysis Equip	Plume Phase Field Measurement & Analysis Mgmt	Plume Phase Fld Measurements & Analysis Proced	Post Plume Phase Field Measurements & Sampling	Laboratory Operations	Activation of Prompt Alert & Notification	Activation Prompt Alert & Notif in Exception Areas	Emerg Info & Instructions for the Public & Media	Monitoring/Decon/Registration of Evacuees & EWs	Monitoring & Decon of Emerg Worker Equipment	Temporary Care of Evacuees	Trans & Treatment of Contam Injured Individuals
	EMERGENCY OPNS MANAGEMENT					PROTECTIVE ACTION DECISION-MAKING						PROTECTIVE ACTION IMPLEMENTATION									FIELD MEASUREMENT & ANALYSIS					NOTIF & PUBLIC INFO			SUPPORT OPN/FACILITIES			
	1a1	1b1	1c1	1d1	1e1	2a1	2b1	2b2	2c1	2d1	2e1	3a1	3b1	3c1	3c2	3d1	3d2	3e1	3e2	3f1	4a1	4a2	4a3	4b1	4c1	5a1	5a3	5b1	6a1	6b1	6c1	6d1
Buckeye Valley Fire District					M							M																				M
Tonopah Valley Fire District					M							M																				M
Maricopa County Sheriff's Office					M							M																				M
Arizona Radiation Regulatory Agency					M							M																				A
Maryvale Hospital Medical Center					M							M																				M

M - Met (No Deficiency or ARCA(s) Assessed and no Unresolved ARCAs from Prior Exercises
N - Not Demonstrated as Scheduled (Reason Explained in Section IV.B)
D - Deficiency

A - ARCA(s) Assessed or Unresolved ARCA(s) from Prior Exercises
Blank - Not Scheduled for Demonstration

B. Status of Jurisdictions Evaluated

This subsection provides information on the evaluation of each participating jurisdiction and functional entity, in a jurisdiction based, issues only format. Presented below is a definition of the terms used in this subsection relative to objective demonstration status.

- **Met** - Listing of the demonstrated exercise evaluation area criteria under which no Deficiencies or ARCAs were assessed during this exercise and under which no ARCAs assessed during prior exercises remain unresolved.

- **Deficiency** - Listing of the demonstrated exercise evaluation area criteria under which one or more Deficiencies was assessed during this exercise. Included is a description of each Deficiency and recommended corrective actions.

- **Area Requiring Corrective Actions** - Listing of the demonstrated exercise evaluation area criteria under which one or more ARCAs were assessed during the current exercise or ARCAs assessed during prior exercises remain unresolved. Included is a description of the ARCAs assessed during this exercise and the recommended corrective action to be demonstrated before or during the next biennial exercise.

- **Not Demonstrated** - Listing of the exercise evaluation area criteria which were not demonstrated as scheduled during this exercise and the reason they were not demonstrated.

- **Prior ARCAs - Resolved** - Descriptions of ARCAs assessed during previous exercises that were resolved in this exercise and the corrective actions demonstrated.

- **Prior ARCAs - Unresolved** - Descriptions of ARCAs assessed during prior exercises that were not resolved in this exercise. Included is the reason the ARCA remains unresolved and recommended corrective actions to be demonstrated before or during the next biennial exercise.

The following are definitions of the two types of exercise issues that are discussed in this report.

- A **Deficiency** is defined in the FEMA REP Program Manual as "...an observed or identified inadequacy of organizational performance in an exercise that could cause a finding that off-site 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."

- An **ARCA** is defined in the FEMA REP Program Manual. as "...an observed or identified inadequacy of organizational performance in an exercise that is not considered, by itself, to adversely impact public health and safety."

FEMA has developed a standardized system for numbering exercise issues (Deficiencies and ARCAs). This system is used to achieve consistency in numbering exercise issues among FEMA Regions and site-specific exercise reports within each Region. It is also used to expedite tracking of exercise issues on a nationwide basis.

The identifying number for Deficiencies and ARCAs includes the following elements, with each element separated by a hyphen (-).

- **Plant Site Identifier** - A two-digit number corresponding to the Utility Billable Plant Site Codes.

- **Exercise Year** - The last two digits of the year the exercise was conducted.

- **Evaluation Area Criterion** - A letter and number corresponding to the criteria in the FEMA REP Program Manual.

- **Issue Classification Identifier** - (D = Deficiency, A = ARCA). Only Deficiencies and ARCAs are included in exercise reports.

- **Exercise Issue Identification Number** - A separate two (or three) digit indexing number assigned to each issue identified in the exercise.

TABLE 2
MEDICAL DRILL ISSUES

LOCATION	NEW ISSUE(S)	PREVIOUS ISSUE(S) RESOLVED	PREVIOUS ISSUE(S) UNRESOLVED
Buckeye Valley Fire District Ambulance	45-02-6.d.1-A-1	NONE	NONE
Maryvale Hospital Medical Center	45-02-6.d.1-A-2	45-02-6.d.1-A-2 45-01-21-A-1 45-98-21-A-5	NONE

Buckeye Valley Fire District Ambulance

There were three criteria identified for demonstration, observation, and evaluation. Two criteria were met, and one ARCA was identified. There are no uncorrected ARCAs from previous drills.

The availability of equipment, dosimetry, and supplies to support emergency operations was adequately demonstrated. The two Arizona Radiation Regulatory Agency (ARRA) representatives at the accident scene arrived with their occupational thermoluminescent dosimeters (TLD) and an adequate supply of direct-reading dosimeters (DRD) for themselves, the accident victim, and the emergency responders from the Buckeye Valley Fire District (BVFD) and the Tonopah Valley Fire District (TVFD). Each individual assigned DRDs received a 0-200 mR DRD and a 0-5 R DRD. All DRDs were calibrated in August 2002 and due for calibration in September 2003.

In addition, the ARRA representatives had two Ludlum Model 2241-3 radiation monitoring instruments. One instrument (calibrated on July 15, 2002 and due for calibration on July 15, 2003) was equipped with a Geiger-Mueller pancake probe. The other instrument (calibrated on January 22, 2002 and due for calibration on January 23, 2003) was equipped with a two-inch by two-inch sodium iodide gamma detector probe.

A third ARRA representative met the ambulance upon its arrival at the Maryvale Hospital Medical Center (MHMC). This individual did not possess any DRDs, but was wearing his occupational TLD. He also had a Ludlum Model 14C (calibrated on October 14, 2002 and due for calibration on October 15, 2003) radiation monitoring instrument equipped with a pancake probe.

All instruments were equipped with a speaker and their detector probes were covered in thin plastic. An operational check was performed on all instruments that included a battery check, proper instrument response to an identified radiation source, and a measurement of the background. The proper instrument response to a known radiation source was defined either on a label on the side of the instrument or on a label accompanying the source.

Implementation of emergency worker exposure control at the accident site was adequately demonstrated. The ARRA representatives at the accident scene explained to the TVFD emergency responders that since they were all working together within the hot zone and they, the ARRA representatives, had DRDs their DRDs would function as group DRDs. This would provide dosimetry for all emergency workers within the hot zone. The ARRA representative then provided the accident victim with a 0-200 mR DRD and a 0-5 R DRD.

In addition, the ARRA representative provided 0-200 mR and 0-5 R DRDs to the BVFD ambulance crew. The ARRA representative instructed them to read and record their DRD readings every 15 minutes and to turn-in their DRDs and DRD record forms to the ARRA representative who would meet them at MHMC.

A single vehicle accident was simulated at the intersection of the Palo Verde Road and the Buckeye Airport Road. The accident involved the driver of a delivery truck that was

transporting radioactively contaminated medical samples. No passengers were present. The accident resulted in non-life threatening injuries to the driver and the breaching of at least one of the medical sample containers. The breached medical sample container spilled contaminated liquid onto the driver.

The drill was initiated at 0730 when the Incident Scene Controller telephoned the Maricopa County Sheriff's Office (MCSO) to report the accident. A drill-related telephone number was used to simulate 911.

At 0800, a MCSO deputy arrived and immediately determined that the driver was injured and was probably contaminated by the radioactive medical sample. At 0803, the deputy, via the controller, notified the TVFD of the situation.

The deputy asked the driver if there was a Bill-Of-Lading. The Bill-Of-Lading that he obtained did not identify the radioactive contaminants. He asked the driver for her employer's name and telephone number so that he could identify the radioactive contaminants and if the material could be decontaminated with water. This was outside of the extent-of-play agreement. Therefore, it was not pursued.

A TVFD fire truck was pre-positioned nearby and arrived on-scene at 0805. Upon arrival the deputy briefed the TVFD personnel of the accident, extent of injuries, and the possible contamination of the accident victim and the vehicle with a radioactive medical sample. Then the deputy simulated blocking Palo Verde Road in both directions.

At 0807, via the controller, the TVFD Incident Commander notified ARRA of the incident. Two ARRA representatives who had been on-duty close-by at the Radiological Emergency Assistance Team Forward facility located at the Buckeye Airport arrived at 0810. The Incident Commander briefed the ARRA personnel of the situation and requested that they monitor the accident victim, the vehicle, the ground around the vehicle, and establish a Hot Zone. The Hot Zone was identified as any area with an exposure rate of greater than 2 mR/hour plus a buffer area.

At 0813, the ARRA personnel, wearing gloves and simulated booties, monitored the accident victim for contamination. Contaminated areas of 250 counts per minute (cpm) or greater would require decontamination. Contamination was identified on her right hand and forearm of approximately 100,000 cpm, approximately 50,000 cpm on her face, and 80,000 cpm on her pants. They documented their measurements on a body map that depicted the areas and magnitude of contamination. Two DRDs, 0-200 mR and 0-5 R, were provided to the accident victim. No contamination was identified on the ground around the delivery vehicle. Therefore, at a Hot Zone was established that provided sufficient space to manage the accident victim.

At 0818, the Incident Commander notified MHMC that they would be receiving an injured accident victim who was radiologically contaminated in approximately 45 minutes. This notification was made using a cellular telephone and the actual telephone number listed in his procedures. The extent-of-play agreement did not specify that he should contact the hospital through the Incident Scene Controller. The Incident Commander than notified the BVFD for an ambulance.

The two TVFD emergency response personnel dressed in booties, two pairs of gloves, and Tyvek anti-contamination clothing prior to entering the Hot Zone. The TVFD personnel provided initial medical assistance that included treating her possible broken right wrist and stabilizing the victim. They covered the ground with a rubberized ground tarp and placed a long board in the middle of the ground trap. They then removed the accident victim from the vehicle, created a cocoon around her using an emergency warming blanket for contamination control, and secured her to the long-board for transport.

At 0822, the BVFD ambulance, that was pre-positioned nearby, arrived on-scene. Upon arrival, an ARRA representative briefed the ambulance crew consisting of two emergency medical technicians (EMT) that the accident victim had been provided with DRDs. The ARRA representative provided each crew member with DRDs, instructed them to read and record the DRD readings every 15 minutes, change gloves if they think that they might be contaminated, and to give the accident victim's and their DRDs along with their exposure documentation to the ARRA representative at the hospital. Also, before they leave the hospital, they and the ambulance should be monitored for contamination.

The Incident Commander briefed the EMTs on the accident victim's medical condition and that she was stable.

With the BVFD ambulance crew standing outside of the Hot Zone and the TVFD emergency response personnel inside, the TVFD emergency response personnel lifted the accident victim strapped to the long board and handed her from the Hot Zone over to the ambulance crew in the uncontaminated area. Prior to placing the accident victim onto the ambulance's gurney, the gurney was covered with an emergency warming blanket for additional contamination control. The accident victim on the long board was strapped to the ambulance gurney and loaded into the ambulance. One of the ARRA representatives gave the accident victim's body map to the EMT with instructions to give it to the Emergency Room Staff upon arrival. The ambulance departed for the hospital at 0843.

Since the MCSO deputy had been near the accident victim and in the area later defined as the Hot Zone, ARRA personnel monitored the deputy and found him free of contamination. The ARRA representatives then provided instructions to the TVFD emergency response personnel working in the Hot Zone on the proper procedures to remove their personal protective clothing and exit the Hot Zone. The ARRA representatives provided assistance to the TVFD emergency response personnel and monitored each individual prior to their stepping into the clean area. The activity was accomplished successfully and the TVFD emergency response personnel were found to be free of contamination after all their personal protective clothing were removed.

While in the ambulance, the EMT monitored the accident victim's condition and verified that she was stable. At 0902, the EMT telephoned the MHMC Emergency Room and provided a briefing that included the nature of the accident, that the accident victim was a female, her age, her vital signs, her medical condition, possible fracture of her right wrist, and that she was contaminated with radioactive material and the area of contamination. In addition, the EMT stated that their estimated time of arrival was in 10 to 15 minutes. He also provided a call-back telephone number.

At 0908, the ambulance received a call from the MHMC Emergency Room to verify that they were in route.

At 0915, the ambulance arrived at the hospital and was given directions as to where to park and unload the accident victim within a contamination control area.

Upon parking, an ARRA representative started to monitor the ambulance. Prior to completing the monitoring of the vehicle, he began monitoring the ambulance driver and the EMT. The ambulance driver was found to be free of contamination. However, contamination was identified on the chest area of the EMT (10,000 cpm). After simulated removal of his shirt, his chest was found to be free of contamination. Contamination was also identified on his gloved right hand (10,000 cpm). Upon removal of his gloves, his right hand was found to be contaminated (5,000 cpm). After washing his hands with soap and water, he was found to be free of contamination. By interview, if contamination had persisted, he would have been decontaminated at the hospital. The EMT's contamination was documented on a Personnel Decontamination Log.

Meanwhile, the accident victim remained strapped to the gurney inside the ambulance. Although she did not have life-threatening injuries, she had previously stated that she was in pain from her broken wrist and facial injuries. Partially monitoring the ambulance and monitoring the ambulance driver and EMT prior to unloading the accident victim resulted in an 8-minute delay in getting her into the emergency room. In addition, the ambulance crew had to be re-monitored after they handled the gurney holding the accident victim.

The EMT provided to the emergency room staff the body map developed by the ARRA representatives at the accident scene showing the areas of contamination and the radioactivity detected in cpm and a copy of the BVFD EMT Incident Report. The EMT gave the accident victim's DRDs to the ARRA representative at the hospital.

The ARRA representative monitored the outside and inside of the ambulance and found contamination inside the ambulance on the floor near the right rear door. Simulated washing with soap and water decontaminated the ambulance and it was available to return to service.

The ambulance's gurney was returned from the emergency room, monitored, and found to be contamination free.

The ambulance driver and EMT turned in their DRDs and exposure record forms to the ARRA representative at the hospital. They and their ambulance were released at 0932.

Evaluation Area Criteria Met

1.e.1; 3.a.1;

Deficiencies

None

Areas Requiring Corrective Action

45-02-6.d.1-A-1. Victim transfer to Emergency Room

CONDITION: Upon the ambulance's arrival at the hospital, the accident victim was not immediately transferred to the Emergency Room. An ARRA representative at the hospital initiated monitoring of the ambulance. Prior to completing the monitoring of the ambulance, he began monitoring the ambulance driver and the EMT. During this time, the accident victim remained strapped to the gurney inside the ambulance. Although, she did not have life-threatening injuries, she was in discomfort from the broken wrist and facial injuries. Partially monitoring the ambulance and monitoring the ambulance driver and EMT prior to unloading the accident victim resulted in an 8-minute delay in getting her into the emergency room.

POSSIBLE CAUSE: The ARRA representative meeting the ambulance at the MHMC failed to give priority to the care and well-being of the accident victim.

REFERENCE: L.4.

EFFECT: Although, she did not have life-threatening injuries, the accident victim stated that she was in pain from her broken wrist and facial injuries. Partially monitoring the ambulance and monitoring the ambulance driver and EMT prior to unloading the accident victim resulted in an 8-minute delay in getting her into the emergency room.

RECOMMENDATION: Provide additional training to ARRA personnel that may respond to a hospital in support of radiologically contaminated and injured individuals that the first priority is transferring the injured to the emergency room.

Prior Areas Requiring Corrective Action – Corrected

None

Prior Areas Requiring Corrective Action – Uncorrected

None

Maryvale Hospital Medical Center

There were three criteria identified for demonstration, observation, and evaluation. All criteria were met, and two ARCAs from previous drills were corrected. There are no uncorrected ARCAs from previous drills.

The adequacy of equipment, dosimetry, and other supplies to support emergency operations relating to care and treatment of a contaminated injured patient was demonstrated by members of the staff of the Maryvale Hospital Medical Center at 51st Avenue and Campbell Avenue in Phoenix, Arizona.

Two Eberline Model RM-20 radiation monitoring instruments (range 0-500,000 cpm) with attached pancake Geiger-Mueller probes were used by the staff. Last calibration dates for the instruments were May 21 and May 22, 2002. A check source was available and used.

Each of the staff members was equipped with a Panasonic TLD exhibiting a turn-in date of November 22, 2002 and a "MGP" DMC-2000S Electronic Personal Dosimeter (EPD) with a next calibration date of November 22, 2002. Existing procedures, which specify the use of "self-reading dosimeters, film badges, and ring and pocket dosimeters," were stated by the Lead Controller (at the pre-exercise meeting) and the radiation technician to be in the process of revision to reflect the use of the EPDs in lieu of these devices.

A job-aid sign was posted on the wall of the Radiological Emergency Area (REA) that showed the protective clothing required and indicated the donning and doffing sequences.

A Radiation Decontamination Cart, which is a gurney that has been designed to accommodate decontamination of a contaminated patient, was used. Decontamination fluids from this cart are routed to contaminated liquid waste containers, and the cart is fabricated of readily decontaminated materials.

A Radiation Decontamination Locker and Sample-Taking Kit containing supplies and equipment for (1) assessing contamination extent and degree and (2) decontaminating contaminated injured patients were brought into the REA for use by the patient treatment staff. A complete inventory of the materials specified for these units was conducted. All items were in place except two bottles of potassium iodide that, although specified by the inventory sheet, are maintained by the hospital pharmacy.

Also available was a mobile X-ray machine, which was positioned just outside the REA for use by the treatment staff, if so ordered by the attending physician.

The issuance of appropriate dosimetry to personnel involved in the treatment of radioactively contaminated injured patients was demonstrated by members of MHMC.

Dosimetry consisted of a Panasonic TLD with a turn-in date of November 22, 2002 and an "MGP" DMC-2000S EPD with a next-calibration date of November 22, 2002. These items

differ from the procedure-specified "self-reading dosimeters, film badges, and ring and pocket dosimeters" for issuance to personnel in the patient treatment area; however, it was stated by the Lead Controller (at the pre-exercise meeting) and radiation protection staff personnel that current procedures are being revised to specify the use of these dosimeters. The EPDs can be converted, by push of a button, from a dose-recording instrument (with a "chirp" at 1/10 mR increments) to a dose-rate instrument, and vice-versa. Dose and dose-rate data are displayed digitally. Although alarm points are adjustable, no alarm point was set for the issued EPDs, because, for this application they were used primarily to indicate accumulated gamma dose, and secondarily for audible indication of dose rate. The TLDs are processed by the Palo Verde Nuclear Generating Station (PVNGS), and the EPDs are calibrated by PVNGS at six-month intervals. Appropriate records were prepared for the issuance of the TLDs and EPDs.

The capability to provide appropriate space, adequate resources, and trained personnel for the monitoring, decontamination, and medical care of contaminated injured individuals was demonstrated by staff members of MHMC.

The initial notification to the hospital that an ambulance with a "possibly" contaminated patient was on its way was received at MHMC Registration at 0821 and delivered by a member of the nursing staff to the Charge Nurse in the Emergency Department (ED). The call did not specify the caller, the transporting agency, nor did Registration ask for a call-back number. Per procedure, the call should have been transferred to the Charge Nurse for appropriate action. (This lack of strict observance of the procedures did not substantively affect the demonstration of the criterion.)

The Charge Nurse immediately began making his notification calls and completed them in accordance with the MHMC External Radiation Emergency Preparedness Plan (Plan) in approximately ten minutes. Among those notified either by the Charge Nurse or the Nursing Supervisor, after she arrived in the ED, were as follows: the ED physician on duty, the ED nursing staff, the Administrator on-call, Environmental Services, Medical Imaging (which in turn notified the Radiation Safety Officer and Nuclear Medicine Technician on-call), Security, Public Relations, and the Safety Officer. Members of the Arizona Radiation Regulatory Agency, present to assist with monitoring of the transporting vehicle and its crew, were pre-positioned in accordance with the extent-of-play agreement.

At approximately 0825, staff members began preparing Trauma Room 1, and areas adjacent to and immediately outside, to receive a contaminated injured patient from an ambulance vehicle. Plastic was placed on the floor of the outside receiving area and on that of the patient treatment area within the trauma room of the REA. Stanchions and magenta-and-yellow rope were used to cordon off the patient treatment area. Non-essential equipment was removed from the trauma room. The Radiation Decontamination Locker and the Sample-Taking Kit containing supplies and equipment for (1) assessing contamination extent and degree and (2) decontaminating contaminated injured patients were moved into the REA. Containers for contaminated solid and liquid wastes were provided, and the Radiation Decontamination Cart was brought into the REA. A mobile X-ray machine was positioned just outside the REA for use by the medical staff, if so ordered by the attending physician.

The medical staff (one physician, two nurses, and a radiation technician) donned full protective clothing and equipment, including gloves, boots, coveralls, headgear, and face shields. All were equipped with dosimetry that consisted of a Panasonic TLD with a turn-in date of November 22, 2002 and an "MGP" DMC-2000S EPD with a next calibration date of November 22, 2002. This EPD can be converted, by push of a button, from a dose-recording instrument (with a "chirp" at 1/10 mR increments) to a dose-rate instrument, and vice-versa. Dose and dose-rate data are displayed digitally. Although alarm points are adjustable, no alarm point was set for the issued EPDs, because, for this application they are used primarily to indicate cumulative gamma dose, and secondarily for audible indication of dose rate. The TLDs are processed by PVNGS, and the EPDs are calibrated by PVNGS at six-month intervals. Appropriate records were prepared for the issuance of the TLDs and EPDs.

Two Eberline Model RM-20 radiation monitoring instruments [range 0-500K cpm] with attached pancake Geiger-Mueller probes were checked for battery condition and source-checked to ensure operability. Last calibration dates for the instruments were May 21 and May 22, 2002. Probes were covered with thin plastic. Instruments were equipped with speakers. Background readings were taken.

The hospital staff was ready to receive the patient at 0845. At 0905, a message from the ambulance crew was received by the Charge Nurse that contained an estimated time before arrival at the hospital ED of 10 to 15 minutes. At 0907, the Charge Nurse briefed the awaiting emergency treatment staff with the following information which he said he had received in the message: name and gender of the patient, her injury (closed fracture of wrist) and the fact that it had been immobilized, medication and allergy information, and the statement that she was "possibly contaminated."

At 0915, the ambulance, operated by a two-person crew from BVFD, arrived at the entrance to the REA. Security personnel immediately cordoned off the entire area around the ambulance and the area through which the patient would be transported by gurney into the REA. Transfer of the patient to the care of the hospital staff was made at 0923, eight minutes after arrival of the ambulance. (The ARRA radiation technicians took time to survey part of the ambulance exterior and crewmembers before the patient was removed from the ambulance.)

The patient was placed onto the Radiation Decontamination Cart within the cordoned-off patient treatment area. The physician examined the patient to ensure that she was responding normally. Vital signs (pulse rate, blood pressure, respiration rate) were determined. The patient was questioned by the physician regarding her pain level, following which a pain-relieving drug was administered (simulated). The staff was aware that urgent medical care of a patient takes precedence over any decontamination efforts. A total body radiation survey was then conducted by the staff radiation technician within the patient treatment area, during which it was found that the patient was contaminated on the right hand and forearm (100,000 cpm), which had an open wound, on the face in the immediate area of the nose and mouth (50,000 cpm), and on her jeans (80,000 cpm). Wound swabs were taken and checked by use of one of the Eberline RM-20 radiation survey meters. The controller had no data for the wound swabs, but it was assumed, and so communicated by the controller, that they exhibited low-level contamination. Wounds were irrigated by the use of saline solution and, after three decontamination efforts for each

wound, were found to be background. The staff was aware of the decontamination action level of 100 cpm above background. The patient was given another complete body radiation survey, during which it was found that all survey readings were background. The radiation technician informed the physician that the patient was radiologically ready to be removed from the REA and released to the hospital; the physician concurred in this conclusion.

At this point, the evaluator asked the controller to interrupt demonstration play and question the physician regarding the need to obtain nasal swabs, since much of the contamination had been in the nose and mouth areas. On-the-spot re-demonstration then included swabs of the nostrils, mouth, both ears, both eyes; and simulated blood and urine sampling. Swab samples were labeled, and it was explained by the radiation technician that they would be taken to the hospital laboratory for closer examination and analysis to determine if there was a possibility of significant internal contamination of the patient. This action and wound sampling corrected ARCA 45-98-21-A-5. Records were kept of patient vital signs, radiation monitoring results, and the fact that swabs of the aforementioned areas were taken. Therefore, ARCA 45-01-21-A-1 was corrected.

At approximately 1000, the patient was transferred from the Radiation Decontamination Cart in the patient treatment area to a clean gurney immediately outside that area. Adequate care was taken to preclude contact of the patient with potentially contaminated surfaces of the Cart. A complete radiation survey of the patient's body was conducted to ensure background conditions before the patient was released for assignment to other areas of the hospital.

Good contamination control practices and monitoring techniques were used to transfer needed items to and from the patient treatment area and to monitor staff personnel as they exited the patient treatment area. Removal of anti-contamination clothing was in accordance with a job aid posted on the wall of the REA.

The exercise was terminated at approximately 1015.

Evaluation Area Criteria Met

1.e.1; 3.a.1; 6.d.1

Deficiencies

None

Area Requiring Corrective Action

45-02-6.d.1-A-2. Assessment of Internal Contamination

CONDITION: The attending staff physician did not direct the taking of nasal or mouth swabs to determine if internal contamination of the patient's body may have occurred. Such action would have been indicated, particularly because significant levels of contamination had been determined to be on the face in the immediate vicinity of the nose and mouth.

POSSIBLE CAUSE: This was stated by the physician to be his first experience as the physician-in-charge of a contaminated injured patient treatment area at this hospital.

REFERENCE: NUREG-0654, F.2; H.10; K.5.a, b; L.1, L.4

EFFECT: Patient may have been released without attention being given to the potential for internal exposure to radioactive materials.

RECOMMENDATION: Stress, in training sessions, the need to consider the possibility of internal contamination at any time external contamination is found on a patient, particularly in the areas of the head and face.

CORRECTIVE ACTION: The evaluator asked the controller to interrupt demonstration play and question the physician regarding the need to obtain nasal swabs, since much of the contamination had been in the nose and mouth areas. On-the-spot re-demonstration then included swabs of the nostrils, mouth, both ears, both eyes; and simulated blood and urine sampling. Swab samples were labeled, and the radiation technician explained that they would be taken to the hospital laboratory for closer examination and analysis to determine if there was a possibility of significant internal contamination of the patient.

Prior Areas Requiring Corrective Action – Corrected

45-01-21-A-1. Monitoring Results Not Recorded

NUREG-0654 Reference: L.1.3

Objective #21
Demonstration Criterion 5

1. **Description:** Records of monitoring activities applied to the patient were not kept, as required by the MHMC External Radiation Emergency Preparedness Plan, Section IV.B.8.b.2, during the monitoring of the patient of during decontamination efforts.

2. **Recommendation:** Emphasize recordkeeping during training.

3. **Corrective Action:** Records were kept of patient vital signs, radiation monitoring results, and the fact that swabs of the nostrils, mouth, both ears, both eyes; and simulated blood and urine sampling were taken

45-98-21-A-5. Lack of Swabs and Wound Samples

NUREG-0654 Reference: L.1.

Objective #21
Demonstration Criterion 3

1. **Description:** During the decontamination process, the staff did not obtain wound samples or swabs. It is important to obtain swabs of mouth and nasal areas if the potential exists for inhalation of radioactive materials. Samples of the wounds are also important for potential medical follow-up on the patient.

2. **Recommendation:** Emphasize during training the need to obtain samples from wounds and swabs from the mouth and nasal areas. Perhaps a job aid in the form of a sign could be posted to remind staff of the critical steps to be taken.

3. **Corrective Action:** The evaluator asked the controller to interrupt demonstration play and question the physician regarding the need to obtain nasal swabs, since much of the contamination had been in the nose and mouth areas. On-the-spot re-demonstration then included swabs of the nostrils, mouth, both ears, both eyes; and simulated blood and urine sampling. Swab samples were labeled, and the radiation technician explained that they would be taken to the hospital laboratory for closer examination and analysis to determine if there was a possibility of significant internal contamination of the patient.

Prior Areas Requiring Corrective Action – Uncorrected

None

APPENDIX 1

ACRONYMS AND ABBREVIATIONS

The following is a list of the acronyms and abbreviations that were used in this report.

ARCA	Area Requiring Corrective Action
ARRA	Arizona Radiation Regulatory Agency
BVFD	Buckeye Valley Fire District
CD-V	Civil Defense - Victoreen
CFR	Code of Federal Regulations
cpm	Counts Per Minute
DRD	Direct-Reading Dosimeter
EPD	Electronic Personal Dosimeter
ED	Emergency Department
EMT	Emergency Medical Technician
EPZ	Emergency Planning Zone
ETA	Estimated Time of Arrival
FEMA	Federal Emergency Management Agency
FR	Federal Register
GM	Guidance Memorandum
MCSO	Maricopa County Sheriff's Office
MHMC	Maryvale Hospital Medical Center
mR	milliroentgen
mR/h	milliroentgen per hour
NMT	Nuclear Medicine Technician
NRC	U.S. Nuclear Regulatory Commission
NUREG-0654	NUREG-0654/FEMA-REP-1, Rev. 1, *"Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," November 1980*
ORO	Off-site Response Organization
PVNGS	Palo Verde Nuclear Generating Station

R	Roentgen
REA	Radioactive Emergency Area
REM	Roentgen Equivalent Man
REP	Radiological Emergency Preparedness
RERP	Radiological Emergency Response Plan
R/h	Roentgen(s) per hour
RO	Radiological Officer
RPT	Radiological Protection Technician
TL	Team Leader
TLD	Thermoluminescent Dosimeter
TVFD	Tonopah Valley Fire District

APPENDIX 2

EVALUATORS AND TEAM LEADERS

The following is a list of the personnel who evaluated the Maryvale Hospital Medical Center medical drill on November 6, 2002. The organization which each evaluator represents is indicated by the following abbreviations:

ICF - ICF Consulting

EVALUATION SITE	EVALUATOR	ORGANIZATION
Buckeye Valley Fire District	Daryl Thome	ICF
Maryvale Hospital Medical Center	Lyle Slagle	ICF

APPENDIX 3

EVALUATION AREA CRITERIA AND EXTENT-OF-PLAY AGREEMENT

This appendix lists the exercise evaluation area criteria that were scheduled for demonstration in the Off-site Palo Verde Nuclear Generating Station Medical Drill on November 6, 2002, and the extent-of-play agreement approved by FEMA Region IX.

The exercise evaluation area criteria, contained in the "Radiological Emergency Preparedness Exercise New Methodology" represent a functional translation of the planning standards and evaluation criteria of NUREG-0654/FEMA-REP-1, Rev. 1, "Criteria for the Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," November 1980.

Because the evaluation area criteria are intended for use at all nuclear power plant sites, and because of variations among off-site plans and procedures, an extent-of-play agreement is prepared by the State and approved by FEMA to provide evaluators with guidance on expected actual demonstration of the Evaluation area criteria.

A. Evaluation Area Criteria

Listed below is the specific radiological emergency preparedness evaluation area criteria scheduled for demonstration during this drill.

EVALUATION AREA 1: EMERGENCY OPERATIONS MANAGEMENT

Sub-element 1.e - Equipment and Supplies to Support Operations

Criterion 1.e.1: Equipment, maps, displays, dosimetry, potassium iodide (KI), and other supplies are sufficient to support emergency operations. (NUREG-0654, H., J.10.a.b.e.f.j.k., 11, K.3.a.)

EVALUATION AREA 2: PROTECTIVE ACTION DECISION-MAKING

Sub-element 3.a - Implementation of Emergency Worker Exposure Control

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.)

EVALUATION AREA 6: SUPPORT OPERATION/FACILITIES

Sub-element 6.d - Transportation and Treatment of Contaminated Injured Individuals

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.)

B. Extent-of-Play Agreement

The extent-of-play agreement on the following pages was submitted by the Palo Verde Nuclear Generating Station, and was approved by FEMA Region IX, in preparation for the Off-site Palo Verde Nuclear Generating Station Medical Drill on November 6, 2002. The extent-of-play agreement includes any significant modification or change in the level of demonstration of each exercise evaluation area criterion listed in Subsection A of this appendix.

2002 Off-Site Contaminated Injury Drill
Maryvale Hospital Medical Center

This scenario contains data for the Off-site contaminated injury medical training drill for Maryvale Hospital Medical Center, Maricopa County Sheriff's Office, Tonopah Fire Department, Buckeye Valley Fire Department, and Arizona Radiation Regulatory Agency.

The drill will consist of a simulated medical/contamination incident. Tonopah Fire Department will respond to the event and provide medical attention and contamination control. Buckeye Fire Department will be utilized for ground transportation to Maryvale Hospital Medical Center.

The drill will end when the contaminated injured individual is cleared for admission to a ward at the Maryvale Hospital Medical Center and the staff, and equipment have been surveyed and released.

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2002 Off-Site Contaminated Injury Drill
Maryvale Hospital Medical Center
OBJECTIVES

In accordance with FEMA Guidance, the following objectives will be demonstrated in this drill and evaluated by the Federal Emergency Management Agency (FEMA) Additionally, Areas Requiring Corrective Actions (ARCAs) as noted in the FEMA drill report for the February 14th, 2001 Evaluated Drill at Maryvale Hospital Medical Center will be re-evaluated for closure.

ARCA 45-01-21-A-1	**Monitoring Results Not Recorded**
Recommendation	Emphasize record keeping during training
ARCA 45-98-21-A-5	**Lack of Swabs and Wound Samples**
Recommendation	Emphasize the need to obtain samples from wounds and swabs from the mouth and nasal areas.

EVALUATION AREA 1: EMERGENCY OPERATIONS MANAGEMENT

Sub-element 1e - Equipment and Supplies to Support Operations
Criterion 1.e.1: Equipment, maps, displays, dosimetry, potassium iodide (KI), and other supplies are sufficient to support emergency operations. (NUREG-0654, H.7, 10; J.10.a, b, e, J.11; K.3.a)

EVALUATION AREA 2: PROTECTIVE ACTION DECISION-MAKING

Sub-element 2a - Emergency Worker Exposure Control
Criterion 2.a.1: OROs use a decision-making process, considering relevant factors and appropriate coordination, to insure that an exposure control system, including the use of KI, is in place for emergency workers including provisions to authorize radiation exposure in excess of administrative limits or protective action guides. (NUREG-0654K.4, J.10.e, f)

EVALUATION AREA 6: SUPPORT OPERATIONS/FACILITIES

Sub-element 6.d - Transportation and treatment of Contaminated Injured Individuals
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)

APPENDIX 4

SCENARIO

This appendix contains a summary of the simulated sequence of events -- Scenario -- that was used as the basis for invoking emergency response actions by OROs in the Off-site Palo Verde Nuclear Generating Station Medical Drill on November 6, 2002.

This scenario was submitted by the Palo Verde Nuclear Generating Station, and approved by FEMA Region IX.

2002 Off-Site Contaminated Injury Drill
Maryvale Hospital Medical Center

Medical Emergency Scenario Guide	Anticipated Actions
General Situation: A delivery driver is simulated to have had an accident with her truck while leaving the Buckeye airport. This truck was carrying radioactive medical samples. The driver was wearing her seat belt and shoulder strap. When the driver's airbag deployed it caused the driver to sustain a fracture of the right wrist and multiple cuts and bleeding of the upper torso. The force of the impact broke the container holding the medical samples. Subsequently the driver came into contact with the sample. A volunteer will play the victim, and the scenario will be played out to include an initial response by the Maricopa County Sheriff's Office. Additionally the Tonopah Fire Department will respond to the accident scene and provide medical support. The Buckeye Valley Fire District will transport the victim to Maryvale Hospital Medical Center for treatment. The victim, Tonopah, and Buckeye Fire will be pre-staged at the accident scene. As the drill begins the victim will be sitting in her vehicle crying in pain and trying to stop the bleeding.	Medical Emergency Scene Palo Verde road and the entrance to the Buckeye airport. The driver will make the initial call for assistance. Message - M1 The Incident Scene Controller (C-2) should initiate the drill by calling MCSO. This will simulate a 911 call.