10 CFR 50.54(q)
10 CFR 50, Appendix E

Palo Verde
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aps

102-07839-CS/MA
December 6, 2018

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS)**
Units 1, 2, and 3 and Independent Spent Fuel Storage Installation
Docket Nos. 50-528, 50-529, 50-530 and 72-44
License Nos. NPF-41, NPF-51 and NPF-74
PVNGS Emergency Plan, Revision 63

Pursuant to Title 10 of the Code of Federal Regulations (10 CFR) 50.54(q) and 10 CFR 50 Appendix E, Section V, Arizona Public Service Company (APS) is forwarding a copy of the PVNGS Emergency Plan, Revision 63, effective November 15, 2018, and a summary of the 10 CFR 50.54(q) analysis for this plan revision. APS has evaluated the changes incorporated in this revision, and determined the changes do not reduce the effectiveness of the emergency plan and the plan continues to comply with the standards of 10 CFR 50.47(b) and the requirements of Appendix E to 10 CFR 50.

In accordance with 10 CFR 50.4(b), copies are being forwarded to the NRC Region IV administrator and the resident inspector. No commitments are being made to the NRC by this letter. Should you have any question regarding this submittal, please contact me at (623) 393-6769.

Sincerely,

Shields, Charlotte (Z05896)

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Charlotte Shields
Emergency Preparedness Manager

CS/MA

cc:	K. M. Kennedy	NRC Region IV Regional Administrator
	C. A. Peabody	NRC Senior Resident Inspector for PVNGS
	S. Hedger	NRC Region IV Senior EP Inspector

Enclosure 1 – PVNGS Emergency Plan, Revision 63
Enclosure 2 - Summary of the 10 CFR.54(q) Analysis on Emergency Plan Revision 63

Enclosure 1

PVNGS Emergency Plan, Revision 63

PVNGS EMERGENCY PLAN

Revision 63

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Effective Date: November 15, 2018

PVNGS EMERGENCY PLAN

Revision 63

Description of Changes

Page 123 – 383	Appendix A – corrected revision number from 61 to 63.
Page 123 – 383	Appendix A – corrected pagination error from “266 of 265” to “261 of 261.”

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INTRODUCTION

Palo Verde Nuclear Generating Station (PVNGS) is a jointly-owned three-unit Pressurized Water Reactor (PWR) power station operated by Arizona Public Service (APS). The station is located in Maricopa County, South of Wintersburg, Arizona.

THE PVNGS EMERGENCY PLAN:

- Describes the organization formed and facilities available to manage emergency situations;
- Classifies emergencies according to severity of consequences;
- Defines and assigns responsibilities for emergency response actions;
- Outlines courses of action and protective measures to mitigate the consequences of an accident and to safeguard station personnel and the public;
- Presents a general post-emergency plan and organization to restore the plant to a normal operating status;
- Defines methods and processes to inform the public.

The accidents which might occur at PVNGS are analyzed in Chapter 15 of the PVNGS UFSAR in terms of severity of consequence. The Independent Spent Fuel Storage Installation (ISFSI), which is stationary and centrally located within the PVNGS exclusion area boundary, is analyzed in the Cask UFSAR and satisfies the requirements for off-normal radiological dose. The PVNGS UFSAR analyzed accidents reflect the design characteristics of a Pressurized Water Reactor (PWR) and are addressed by PVNGS Emergency Operating Procedures (EOPs) and Emergency Plan Implementing Procedures (EPIPs). Postulated events concerning the ISFSI are encompassed by the scheme of EALs designated for PVNGS.

1.0 DEFINITIONS AND ABBREVIATIONS

1.1 DEFINITIONS

The following are definitions of terms commonly used in this Emergency Plan.

Area Radiation Monitoring System (ARMS)

An instrumentation system designed to detect abnormal area radiation levels and activate corresponding station alarms.

Assessment Actions

Are actions performed during or after an incident, to obtain and process information necessary to determine the character and magnitude of the incident and to implement specific emergency measures.

Committed Dose Equivalent (CDE)

CDE is the dose equivalent to organs or tissues of reference that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

Committed Effective Dose Equivalent (CEDE)

CEDE is the sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the CDE to these organs or tissues.

Controlled Area

An area outside of the Restricted Area but inside the Site Boundary access that can be limited by the licensee for any reason.

Corrective Actions

Measures taken to terminate an emergency situation at or near the source of the problem.

County Emergency Operations Center (County EOC)

The County EOC is located at the Maricopa County Department of Emergency Management (MCDEM) Headquarters at 5630 E. McDowell Road, Phoenix, Arizona, and is the primary point through which the Chairman, Maricopa County Board of Supervisors/designee exercises coordination over county emergency response actions conducted within the EPZ.

Deep-Dose Equivalent (DDE)

DDE is the dose equivalent at a tissue depth of 1 cm (1000 mg/cm2), which applies to external whole- body exposure.

Dose Equivalent (DE)

DE is the product of the absorbed dose in tissue, quality factor and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and Sievert (Sv).

Effective Dose Equivalent (EDE)

EDE is the sum of the products of the dose equivalent to each organ or tissue and a weighting factor applicable to each of the body organs or tissues that are irradiated.

Emergency Action Levels (EALs)

Parameters used to designate a particular classification of emergency. These parameters may include radiological dose rates, levels of airborne or waterborne activity, or instrument indications/plant parameter values.

Emergency Response Organization (ERO)

The individuals within the PVNGS organization designated to respond to an emergency.

Exclusion Area Boundary

An area surrounding the reactor in which the reactor licensee has the authority to determine all activities, including exclusion or removal of personnel and property from the area.

Full Participation

Full participation when used in conjunction with emergency preparedness exercises for a particular site means appropriate offsite local and State authorities and licensee personnel physically and actively take part in testing their integrated capability to adequately assess and respond to an accident at a commercial nuclear power plant. Full participation includes testing major observable portions of the onsite and offsite emergency plans and mobilization of State, local and licensee personnel and other resources in sufficient numbers to verify the capability to respond to the accident scenario.

Hostile Action

An act towards a nuclear power plant or its personnel that includes the use of violent force to destroy equipment, take hostages, and/or intimidates the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, projectiles, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. Hostile action should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on the nuclear power plant. Nonterrorist- based EALs should be used to address such activities, (e.g., violent acts between individuals in the owner controlled area).

Independent Spent Fuel Storage Installation (ISFSI)

A complex designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage. The PVNGS ISFSI is located approximately 605 feet northeast of the PVNGS Power Plant Protected Area.

Ingestion Exposure Pathway Emergency Planning Zone (IPZ)

The IPZ is the fifty-mile radius area (Figure 14), centered on the vertical axis of the Unit 2 Containment Building for which protective actions for the general population, farmers, dairy farmers, ranchers, food processors and distributors are planned.

Inplant

The area located within the confines of the PVNGS Power Plant Protected Area.

Joint Information Center (JIC)

Combined PVNGS/state/county function; located at 600 North Verrado Road, Building A, Buckeye, Arizona. The JIC is responsible for issuing news information during an Alert or higher level emergency classification.

Nuclear Administrative and Technical Manual (NATM)

The collection of onsite programs and procedures which prescribes how PVNGS is controlled, operated, maintained, and tested to meet the requirements of applicable licenses, standards, codes, and guides. It establishes effective management practices.

Offsite

Any position or area not located within the confines of the Site Boundary.

Offsite Response Organization (ORO)

The emergency Offsite Response Organization for state and local governments described in the Offsite Emergency Response Plan for the Palo Verde Nuclear Generating Station.

Offsite Emergency Response Plan for Palo Verde Nuclear Generating Station

Is the State of Arizona/ Maricopa County Plan for governmental response to emergencies at PVNGS? The Plan sets forth specific responsibilities and procedures for state, local and volunteer agencies responsible for offsite emergency operations and protection of the affected population.

On-Shift Emergency Response Organization

The emergency response positions on shift as designated in Table 1, Minimum Shift Staffing for Emergencies. Typically positions required by plant technical specifications, fire protection program, security plan and the radiological emergency plan designated to respond in the initial phase of an emergency.

Onsite

Any position or area located within the confines of the Site Boundary.

Onsite Emergency Response Organization

The augmented PVNGS emergency response organization used to staff the Technical Support Center, Operations Support Center, Emergency Operations Facility, Joint Information Center, etc.. Table 1, Minimum Shift Staffing for Emergencies denotes the required augmented positions.

Owner Controlled Area

The area owned by the licensee and located within the confines of the Site Boundary as shown in Figure 13.

Partial Participation

Partial participation when used in conjunction with emergency preparedness exercises for a particular site means appropriate offsite authorities shall actively take part in the exercise sufficient to test direction and control functions; i.e., (a) protective action decision making related to emergency action levels, and (b) communication capabilities among affected State and local authorities and the licensee.

Plant Property Line

The boundary enclosing the area owned by the licensee and corresponding to the Site Boundary, with the addition of purchased property located immediately north of the northwest corner of the Site Boundary and extending to the Buckeye-Salome Highway.

Plume Exposure Pathway Emergency Planning Zone (EPZ)

The Plume Exposure Pathway EPZ is the ten-mile radius area, centered on the vertical axis of the Unit 2 Containment Building, for which protective actions are planned.

Population-at-Risk

Persons for whom protective actions are being, or would be, implemented.

Process Radiation Monitoring System (PRMS)

An instrumentation system designed to detect abnormal radiation levels in process and effluent pathways, and to activate appropriate alarms.

Protective Actions

Emergency measures taken to avoid or reduce radiation dose. These commonly include sheltering, evacuation, and prophylaxis.

Protective Action Guides (PAGs)

The projected dose to individuals that would warrant consideration of protective action against an accidental release of radioactive material.

Protected Area(s) (PA)

An area, located within the PVNGS Exclusion Area Boundary, encompassed by physical barriers and to which access is controlled per 10 CFR 73.55. The PVNGS Power Plant Protected Area and the ISFSI Protected Area are two Protected Areas located within the PVNGS Owner Controlled Area.

Recovery Actions

Are post-emergency actions to restore the station to a normal operating condition.

Restricted Area

An area access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials.

Site Boundary

The boundary of a reactor site beyond which the land or property is not owned, leased, or otherwise controlled by the licensee.

State Emergency Operations Center (State EOC)

The State EOC is located at the DEMA Headquarters and is the primary point through which the Governor/designee exercises overall control and coordination of governmental offsite emergency response operations.

Technical Operations Center (TOC)

The TOC is co-located with the State EOC. The TOC is the offsite location that provides for overall control of radiological technical operations.

Total Effective Dose Equivalent (TEDE)

TEDE is the sum of the Deep-Dose Equivalent (for external exposures) and the CEDE (for internal exposures).

Unrestricted Area

An area access to which, is neither limited nor controlled by the licensee.

Vital Area

An area within the PVNGS Power Plant Protected Area encompassed by additional physical barriers and to which access is controlled per 10 CFR 73.55. Vital areas contain equipment considered vital to the operation of the plant.

1.2 ABBREVIATIONS

The following are abbreviations of terms commonly used at PVNGS.

ADEM	-	Arizona Division of Emergency Management
ADV	-	Atmospheric Dump Valve
APS	-	Arizona Public Service Company
ASU	-	Arizona State University
BOP	-	Balance of Plant
BPD	-	Buckeye Police Department
CDE	-	Committed Dose Equivalent
CEDE	-	Committed Effective Dose Equivalent
CEDMCS	-	Control Element Drive Mechanism Control System
CEO	-	Chief Executive Officer
CET	-	Core Exit Thermocouple
CFR	-	Code of Federal Regulations
CNO	-	Chief Nuclear Officer
CR	-	Control Room
CR	-	Condition Report
CRS	-	Control Room Supervisor
CTMT	-	Containment
DDE	-	Deep Dose Equivalent
DE	-	Dose Equivalent
DEMA	-	Department of Emergency and Military Affairs
DHS	-	Department of Homeland Security
AZDHS	-	(Arizona) Department of Health Services
DOE	-	Department of Energy
DPS	-	(Arizona) Department of Public Safety
EAL	-	Emergency Action Level
EAS	-	Emergency Alert System
EC	-	Emergency Coordinator

EDE	-	Effective Dose Equivalent
EDG	-	Emergency Diesel Generator
EMT	-	Emergency Medical Technician
ENS	-	Emergency Notification System
EOC	-	Emergency Operations Center
EOD	-	Emergency Operations Director
EOF	-	Emergency Operations Facility
EOP	-	Emergency Operating Procedure
EPA	-	Environmental Protection Agency
EPABX	-	Electronic Private Automatic Branch Exchange
EPD	-	Electronic Personal Dosimeter
EPIP	-	Emergency Plan Implementing Procedure
EPZ	-	Emergency Planning Zone
ERDS	-	Emergency Response Data System
ERFDADS	-	Emergency Response Facility Data Acquisition & Display System
ERF	-	Emergency Response Facility
ERO	-	Emergency Response Organization
ESF	-	Engineered Safety Features
FEMA	-	Federal Emergency Management Agency
FPS	-	Fire Protection System
FSS	-	Fire Suppression System
FTS	-	Federal Telecommunications System
FWLB	-	Feed-water Line Break
GPM	-	Gallons per Minute
HP	-	Health Physics
HPN	-	Health Physics Network
HPSI	-	High Pressure Safety Injection
I & C	-	Instrumentation and Control
INPO	-	Institute of Nuclear Power Operations
IPZ	-	Ingestion Pathway Zone

ISFSI	-	Independent Spent Fuel Storage Installation
JIC	-	Joint Information Center
JPIP	-	Joint Public Information Procedure
KI	-	Potassium Iodide
LAN	-	Local Area Network
LCO	-	Limiting Condition for Operation
LOAF	-	Loss of All Feed
LOCA	-	Loss of Coolant Accident
LPSI	-	Low Pressure Safety Injection
LWR	-	Light Water Reactor
MCDEM	-	Maricopa County Department of Emergency Management
MCPL	-	Management Counterpart Link
MCSO	-	Maricopa County Sheriff's Office
MSLB	-	Main Steam Line Break
NAN	-	Notification Alert Network
NATM	-	Nuclear Administrative and Technical Manual
NOAA	-	National Oceanic and Atmospheric Administration
NRC	-	Nuclear Regulatory Commission
NSSS	-	Nuclear Steam Supply System
NWS	-	National Weather Service
OBE	-	Operating Basis Earthquake
ODCM	-	Offsite Dose Calculation Manual
OSC	-	Operations Support Center
PAD	-	Protective Action Decision
PAG	-	Protective Action Guide
PAR	-	Protective Action Recommendation
PASP	-	Preplanned Alternate Sampling Program
PBX	-	Private Branch Exchange
PI	-	Plant Information
PIO	-	Public Information Officer

PMCL	-	Protective Measures Counterpart Link
PSIG	-	Pounds Per Square Inch Gauge
PVAR	-	Palo Verde Action Request
PVNGS	-	Palo Verde Nuclear Generating Station
PWR	-	Pressurized Water Reactor
QSPDS	-	Qualified Safety Parameter Display System
RAC	-	Radiological Assessment Coordinator
RACOMM	-	Radiological Assessment Communicator
RCS	-	Reactor Coolant System
REAT	-	Radiological Emergency Assistance Team
RFAT	-	Radiological Field Assessment Team
RMS	-	Radiation Monitoring System
RP	-	Radiation Protection
RPC	-	Radiological Protection Coordinator
RPM	-	Radiation Protection Monitor
RPS	-	Reactor Protection System
RSCL	-	Reactor Safety Counterpart Link
RSP	-	Remote Shutdown Panel
RVLMS	-	Reactor Vessel Level Monitoring System
SGTR	-	Steam Generator Tube Rupture
SIM	-	(Control Room) Simulator
SPDS	-	Safety Parameter Display System
SM	-	Shift Manager
STA	-	Shift Technical Advisor
STSC	-	Satellite Technical Support Center
SWMS	-	Site Work Management System
TEDE	-	Total Effective Dose Equivalent
TLD	-	Thermoluminescent Dosimeter
TOC	-	Technical Operations Center
TSC	-	Technical Support Center

UFSAR	-	Updated Final Safety Analysis Report
UPS	-	Uninterruptible Power Supply

2.0 SCOPE AND APPLICABILITY

This Emergency Plan is applicable to PVNGS. Specific procedures to implement the Emergency Plan are listed in Section 13.0, Emergency Plan Implementing Procedures.

There are also various supporting and complementing emergency plans, including those of Federal Agencies, the State of Arizona and Maricopa County.

3.0 SUMMARY OF THE PVNGS EMERGENCY PLAN

The Emergency Plan is designed to adhere to Nuclear Regulatory Commission (NRC) emergency planning regulations and guidelines applicable to commercial nuclear power stations. The Emergency Plan is based upon NRC and Federal Emergency Management Agency (FEMA) guidance as contained in NUREG-0654/FEMA-REP-1, Revision 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants", and EPA guidance as contained in EPA 400-R-92-001, "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" October, 1991. Radiological emergency planning for the PVNGS has been coordinated with state and local emergency response agencies.

The State of Arizona and local government agencies who may be involved in emergency response operations are aware of the emergency response measures described in the PVNGS Emergency Plan and are advised of changes or modifications to these measures resulting from plan reviews, audits, drills and/or exercises along with changes to Regulatory guidance.

Both the Offsite Emergency Response Plan for PVNGS and the PVNGS Emergency Plan contain clear-cut definitions of areas of authority and responsibility. The DEMA, acting under the direction and authority of the Governor, is responsible for overall coordination of offsite governmental emergency operations. The PVNGS Emergency Organization is responsible for onsite emergency operations and for providing timely and accurate plant status information to offsite emergency authorities. The Arizona Department of Health Services (AZDHS) has been assigned technical (radiological) responsibility for governmental response within Arizona. Emergency operations within the Plume Exposure Pathway EPZ are the responsibility of Maricopa County.

4.0 ORGANIZATIONAL CONTROL OF EMERGENCIES

In the event of an emergency, the normal station operational organization is supplemented with an organization specifically designed to respond to emergency situations. Depending on the severity of the emergency, the Emergency Organization may consist of an on-shift emergency response organization, or of an augmented emergency response organization. This section describes the On-shift, On-site and Off-site Emergency Organizations.

4.1 NORMAL ORGANIZATIONS

The Executive Vice President & Chief Nuclear Officer, reports to the APS President & Chief Executive Officer. The Executive Vice President & Chief Nuclear Officer has the overall responsibility and authority for the operation and technical support of PVNGS. The Executive Vice President & Chief Nuclear Officer and the nuclear organization have the overall responsibility and authority to ensure that all activities associated with APS' nuclear facilities are carried out with the highest standards of safety and ensuring the station is operated in accordance with (IAW) the licenses granted by the NRC, the Technical Specifications, and the requirements and commitments stated in the UFSAR.

The onsite station organization is divided into four main groups which report to the Executive Vice President & Chief Nuclear Officer.

Each group is divided into subordinate departments and sections. The four groups are as follows:

- Nuclear Site Operations
- Regulatory Affairs Oversight and Performance Improvement
- Operations Support
- Engineering

4.2 THE EMERGENCY RESPONSE ORGANIZATION [Ref. INPO IER L1 13-10, Recommendation 5g, IER L2 11-39, Recommendation 3]

The Emergency Response Organization (ERO) consists of personnel staffing in the Control Room/STSC, Operations Support Center (OSC), Technical Support Center (TSC), Emergency Operations Facility (EOF) and the Joint Information Center (JIC).

The PVNGS ERO is supported by designated facilities as described in Section 7.0, Emergency Facilities and Equipment. The on-shift emergency response organization is augmented at declaration of an Alert or higher emergency classification level.

In the event a member of the ERO minimum staff becomes incapacitated or is otherwise unavailable, they shall be replaced as soon as reasonably possible. Operating unit staff who are ERO members are governed by PVNGS Technical Specification 5.2 and its exceptions.

During normal station work hours, notification of on-site ERO may occur via PA announcement, emergency evacuation system and/or mobile devices.

During off-hours, notification of ERO is accomplished by activating the automated callout system. A manual system is also available if the automated system is not available.

For an Unusual Event classification, on-shift personnel respond to the emergency and the event is directed from the affected unit Control Room/ STSC. Command of the situation remains there with the on-shift Emergency Coordinator (EC) until termination/recovery or reclassification to a higher level emergency occurs. For events affecting all three units, command and control is in Unit 1. APS/Palo Verde Communications provides media interface during an Unusual Event.

In the event of an Alert or higher classification level, the on-shift EC orders the activation of the TSC, OSC, EOF, and JIC. The on-site ERO is directed by the EC-TSC. The EOD in the EOF provides overall coordination of the event and direction of the ERO.

4.2.1 ON-SHIFT EMERGENCY ORGANIZATION

Palo Verde Nuclear Generating Station on shift emergency organization is sufficient to permit the required mitigation response and effectively implement the Emergency Plan as required in 10CFR50 Appendix E.

Table 1 of the Emergency Plan reflects the results of the Palo Verde On-Shift Emergency Response Organization Staffing and Capabilities analysis as required by 10 CFR 50, Appendix E. The Palo Verde On-Shift Emergency Response Organization Staffing and Capabilities analysis is retained as Correspondence #090-05063 (RCTSAI 4164598).

The On-shift Emergency Organization (Figure 1) consists of the following positions:

4.2.1.1 Emergency Coordinator (EC) [Ref. INPO IER L1 13-10, Recommendation 5i]

The affected unit Shift Manager (SM) or designee initially assumes the responsibilities of the EC and is responsible for direction and coordination of the response. Members of the normal shift organization assume emergency positions to carry out actions as described below.

The EC has the responsibility and authority to immediately and unilaterally initiate emergency actions, including providing notification and Protective Action (PAR) Recommendations to governmental agencies responsible for implementing off-site emergency measures. The EC is also responsible for communication of plant status and radiological conditions including dose projection results as appropriate.

Procedures provide for accelerated calls and verbal notification to the NRC using the Emergency Notification System (ENS) of Security-based events considered to be a credible imminent threat or Hostile Action.

The affected unit Shift Manager may be relieved as EC by another qualified EC. At an Alert or higher emergency classification level, the EC directs the Security Director to initiate callouts to the ERO in accordance with the associated implementing procedure. Upon arrival of the designated EC-TSC, the EC-STSC conducts a briefing and is relieved as the Emergency Coordinator.

At the onset of an incident, the EC has the following responsibilities:

- Notification of offsite emergency response agencies and off-site emergency organizations (non-delegable duty until relieved by EOD)
- Making protective action recommendations as necessary to off-site emergency response agencies (non-delegable duty until relieved by EOD)
- Classification of emergency events (non-delegable)
- Determination of the necessity for site evacuation authorization for emergency workers to exceed 10CFR20 exposure limits
- Activation of on-site and off-site ERO organizations for an alert or higher emergency classification level

4.2.1.2 Control Room Supervisor

The Control Room Supervisor (CRS) located in the unit control rooms, reports to the EC. The CRS performs initial assessment and evaluation of any abnormal or emergency conditions. After the EC declares an emergency, the CRS maintains the normal duties of directing the Nuclear Operators and assisting the EC.

4.2.1.3 Fire Team

The Fire Team (minimum of 5 individuals) reports to the CRS and is maintained on-site at all times. The Leader of Fire Protection Department is responsible for ensuring sufficient members of the Fire Team are Emergency Medical Technician (EMT) qualified and available at all times.

4.2.1.4 Fire Team Advisor

The Fire Team Advisor is a Reactor Operator/Auxiliary Operator that supports the Fire Team during a fire. The Fire Team Advisor should have no collateral duties that interfere with the ability to support the Fire Team.

4.2.1.5 Control Room Operators

The Control Room Operators report to the CRS and conduct the safe and proper operation of the unit at all times, and respond to emergency conditions, as necessary.

4.2.1.6 Radiation Monitoring Technician

The Radiation Monitoring Technician reports to the Radiation Protection Monitor (RPM) and establishes a response area in the Radiation Monitoring office and conducts in-plant area surveys as necessary.

4.2.1.7 Radiation Protection Monitor (RPM)

The Radiation Protection Monitor (RPM) an ANSI 3.1 Senior Radiation Protection Technician responds to the STSC and reports to the EC. The RPM conducts offsite dose calculations until relieved. The RPM authorizes exposures up to 10CFR20 Limits, recommends potassium iodide administration to the EC and directs in-plant, onsite and offsite Radiation Monitoring Teams.

4.2.1.8 STSC Communicator

The STSC Communicator is filled by an Auxiliary Operator. Upon direction from the EC, the STSC Communicator makes the initial notifications to state and local agencies and the ERO.

4.2.1.9 Emergency Notification System (ENS) Communicator

The ENS Communicator is filled by an individual knowledgeable of the plant (e.g., RO, SRO, STA, previously licensed individual, etc.) and keeps an open line of communications with the NRC, as requested. This communicator should not have any other E-Plan collateral duties (or other duties that interfere with the communicator function).

4.2.1.10 Security Director

The Security Director initially responds to the Shift Manager/EC and then reports to the EC in the TSC. The Security Director (assumed by the on-shift Security Section Leader) provides for continued personnel accountability, site access control and requests offsite emergency assistance, upon direction from the EC.

4.2.1.11 Security Force

The Security Force reports to locations as directed by the Security Director and assists in performing assigned duties.

4.2.1.12 Shift Manager

The Shift Manager is also the EC-STSC until relieved by the EC-TSC. Following turnover the Shift Manager reports to the EC. The Shift Manager performs initial classification and declaration of an emergency, maintains control of unit operations, and mitigates accident conditions.

4.2.1.13 Shift Technical Advisor

The Shift Technical Advisor (STA) responds to the Control Room or STSC of the affected unit and reports to the EC. The affected unit STA advises the EC on activities that impact the safe operation of the unit, and independently verifies emergency classifications, as time permits. For events classified as an Alert or higher emergency classification level, the affected unit STA activates ERDS.

4.2.1.14 Shift Technical Advisor (Unaffected Unit)

The unaffected unit STA assesses core damage, and provides electrical and mechanical technical support until relieved by the TSC. The STA also monitors various data displays throughout the course of the emergency and provides assistance to the Control Room personnel.

4.2.1.15 Technicians

Technicians report to the EC and if necessary, may be assigned to Emergency Repair or Survey teams. The Chemistry Technicians, Maintenance Technicians (Mechanics, Electrical, Instrument and Control) respond to the OSC for assignment.

4.2.1.16 Operations Advisor

The Operations Advisor responds to the STSC and reports to the EC. The Operations Advisor provides technical and operational advice to the EC-STSC. Following TSC activation, the Operations Advisor maintains the flow of information between the EC-TSC and Control Room.

4.2.1.17 Survey/Environmental Teams

A Survey/Environmental Team is formed and responds to the OSC, upon request from the Radiation Protection Monitor (RPM). The team performs radiological monitoring activities and at least one member of the team is a Radiation Protection Technician.

4.2.1.18 Emergency Repair Teams

The Emergency Repair Team conducts repairs and may consist of Chemistry and Maintenance Technicians, Plant Operators and a Radiation Protection Technician, and reports to the EC.

4.2.2 TECHNICAL SUPPORT CENTER (TSC) ORGANIZATION (ONSITE)

The TSC Organization is located on-site and is illustrated in Figure 2 and consists of the following positions.

4.2.2.1 Emergency Coordinator TSC (EC-TSC)

The EC-TSC responds to the TSC and is responsible for direction and coordination of the onsite Emergency Organization.

4.2.2.2 Emergency Coordinator (EC) Technical Assistant

The EC Technical Assistant responds to the TSC and reports to the EC. The EC Technical Assistant follows procedures that the Control Room is using, and keeps the EC informed of the operational impact of events in progress. The EC Technical Assistant has no counterpart in the on-shift Emergency Organization.

4.2.2.3 Maintenance Manager

The Maintenance Manager responds to the TSC and reports to the EC. The Maintenance Manager coordinates the repair and damage control for all plant systems and directs the emergency response activities of the Emergency Repair Teams. The Maintenance Manager directs the OSC Manager to form and dispatch any team that is required and maintains communication with the OSC concerning repair team efforts.

4.2.2.4 Engineering Manager

The Engineering Manager responds to the TSC and reports to the EC. The Engineering Manager directs systems analysis, engineering and any procedure development as required by the emergency and maintains liaison with the Engineering Director in the EOF.

4.2.2.5 Mechanical Engineer

The Mechanical Engineer responds to the TSC and reports to the Engineering Manager. The Mechanical Engineer assumes the duties of Technical Support Mechanical from the STA in the STSC and provides mechanical engineering analyses.

4.2.2.6 Operations Manager

The Operations Manager responds to the TSC and reports to the EC. The Operations Manager receives technical and operational input from the Operations Advisor and maintains the flow of information between the TSC and Control Room.

4.2.2.7 Radiation Protection Coordinator

The Radiation Protection Coordinator (RPC) responds to the TSC and reports to the Emergency Coordinator. The RPC provides overall control and direction of inplant monitoring teams and radiological controls. The Radiological Protection Coordinator relieves the RPM of these responsibilities. The RPC maintains communications with the Radiation Protection Group Lead, the RPM (prior to Command and Control transfer) and the Radiological Assessment Coordinator. The RPC is responsible for recommending ways to reduce the radiological consequences of the event with the support of Engineering.

4.2.2.8 Security Director

The Security Director responds to the TSC once activated and reports to the EC-TSC. The on-shift Security Section Leader assumes the duties and responsibilities as the Security Director. The Security Director requests emergency off-site assistance upon direction of the EC-TSC and directs the onsite security force in the areas of personnel accountability, access control, site security, evacuation, medical transportation, and personnel and equipment security control.

4.2.2.9 Reactor Analyst

The Reactor Analyst responds to the TSC and reports to the Engineering Manager. The Reactor Analyst assumes responsibilities from the STA. The Reactor Analyst performs detailed analyses of core physics and heat transfer parameters to assess reactor core status and to evaluate the integrity of fuel cladding.

4.2.2.10 Radiation Protection Support Technician

The Radiation Protection Support Technician responds to the TSC and reports to the Radiation Protection Coordinator. The Radiation Protection Support Technician performs habitability surveys of the TSC.

4.2.2.11 Administrative Staff

The Administrative Staff responds to the TSC and assists the TSC Emergency Organization in all matters requiring clerical support.

4.2.2.12 Chemistry Coordinator

The Chemistry Coordinator responds to the TSC and reports to the Engineering Manager. The Chemistry Coordinator provides analysis and evaluation of coolant samples and air samples to aid in determination of reactor core conditions and release potentials, and provides chemical analyses for evaluation of plant systems.

4.2.2.13 ERF Communicator

The ERF Communicator responds to the TSC and reports to the Emergency Coordinator Technical Assistant. The ERF Communicator maintains communications with the ERF Communicators in the OSC, EOF and JIC, and provides information to the Emergency Coordinator Technical Assistant regarding the overall emergency activities and maintains Plant Status electronic media display and/or status boards.

4.2.2.14 Electrical Engineer

The Electrical Engineer responds to the TSC and reports to the Engineering Manager. The Electrical Engineer provides electrical engineering analyses and assumes the duties of Technical Support Electrical from the STA in the STSC.

4.2.2.15 ENS Communicator

The ENS Communicator responds to the TSC and reports to the Operations Manager. The ENS Communicator maintains continuous phone communications with the NRC, when requested, concerning operational events and reactor plant status.

4.2.3 OSC ORGANIZATION

The OSC Emergency Organization is illustrated in Figure 3.

4.2.3.1 OSC Manager

The OSC Manager responds to the STSC for a briefing and reports to the EC. Following the briefing, the OSC Manager responds to the OSC, coordinates available resources and upon direction from the Maintenance Manager in the TSC, assembles and dispatches emergency teams.

4.2.3.2 Radiation Protection Group Lead

The Radiation Protection Group Lead reports to the OSC Manager and provides overall control and direction of in-plant monitoring teams and radiological controls.

4.2.3.3 Repairs Coordinator

The Repairs Coordinator ensures that Maintenance Technicians and Repair Teams are dispatched at the direction of the OSC Manager. The Repairs Coordinator reports to the OSC Manager.

4.2.3.4 Repair Teams

Teams are formed if emergency repair operations are necessary. The teams may consist of Chemistry Technicians, Maintenance Technicians (Mechanical, Electrical, Instrumentation and Control), or Radiation Protection Technician as required to address conditions and Plant Operators.

4.2.3.5 RFAT Driver

The RFAT Driver responds to the RFAT vehicles and serves as a driver for the RFAT vehicle.

4.2.3.6 Radiation Protection Technicians

Radiation Protection Technicians respond to the OSC and report to the Radiation Protection Group Lead. As required, the RP Technicians may be assigned to Repair or Survey/Environmental Teams.

4.2.3.7 Chemistry Technicians

Chemistry Technicians respond to the OSC and report to the Radiation Protection Group Lead. As required, Chemistry Technicians may be assigned to Repair or Survey Teams, or to conduct sampling activities.

4.2.3.8 Mechanics

Mechanics respond to the OSC and report to the Repairs Coordinator. Mechanics may be assigned to repair teams as needed.

4.2.3.9 Electricians

Electricians respond to the OSC and report to the Repairs Coordinator. Electricians may be assigned to repair teams as needed.

4.2.3.10 I&C Technicians

I&C Technicians respond to the OSC and report to the Repairs Coordinator. I&C Technicians may be assigned to repair teams as needed.

4.2.3.11 ERF Communicator

The ERF Communicator responds to the OSC and reports to the OSC Manager. The ERF Communicator maintains communications with his counterparts in the TSC, EOF, and JIC, and provides information to the OSC Manager regarding the overall emergency activities.

4.2.3.12 Administrative Staff

The Administrative Staff responds to the OSC and assists the OSC Emergency Organization in all matters requiring clerical support.

4.2.4 EOF ORGANIZATION

The EOF Emergency Organization is illustrated in Figure 4. The interfaces between the Onsite and Offsite Emergency Organizations are shown in Figure 6.

4.2.4.1 Emergency Operations Director

The Emergency Operations Director (EOD) is in command of emergency operations and is responsible for:

- Overall coordination of onsite and offsite emergency functions.
- Interfacing with federal/state/county emergency response agencies.
- Communication of plant status updates and radiological release data including dose projection results as appropriate to NRC, State/County EOCs, TOC, and JIC personnel.
- Notification of state and county agencies concerning recommended protective actions.
- Directs administrative, technical, and logistical support to station emergency operations.
- Ensuring continuity of emergency organization resources.
- Establishing a recovery organization when appropriate.

Upon the assumption of this position the EOD accepts from the EC-STSC, the following non-delegable offsite organizational responsibilities:

- Notification of offsite emergency management agencies.
- Making protective action recommendations as necessary to offsite emergency management agencies.

4.2.4.2 Assistant Emergency Operations Director

The Assistant Emergency Operations Director (AEOD) responds to the EOF and reports to the EOD to assist with duties and responsibilities as assigned.

4.2.4.3 Radiological Assessment Coordinator

The Radiological Assessment Coordinator responds to the EOF and reports to the EOD. The Radiological Assessment Coordinator is the principal liaison of the emergency response organization with the ARRA. The Radiological Assessment Coordinator receives and evaluates dose projection information from the EOF Staff and provides protective action recommendations to the EOD.

4.2.4.4 Engineering Director

The Engineering Director responds to the EOF and reports to the EOD. The Engineering Director evaluates projected occurrences, coordinates engineering analysis with the TSC, recommends corrective actions and ensures the equipment status board is updated.

4.2.4.5 Security Manager

The Security Manager responds to the EOF and reports to the EOD. The Security Manager provides overall security support and coordinates closely with the Security Director in the TSC. The Security Manager also coordinates with the Administrative/Logistics Coordinator in providing site support to facilitate arrivals of offsite personnel.

4.2.4.6 ERF Communicator

The ERF Communicator responds to the EOF and reports to the Engineering Director. The ERF Communicator maintains communications with his counterparts in the TSC, OSC, and JIC. This position also monitors ERFDADS data displayed through PI, provides information to the Engineering Director regarding the overall emergency activities and maintains Plant Status boards.

4.2.4.7 Radiological Assessment Communicator

The Radiological Assessment Communicator responds to the EOF and reports to the Radiological Assessment Coordinator. The Radiological Assessment Communicator communicates with radiological assessment personnel at the TSC and directs the activities of the onsite/offsite Survey/Environmental Teams.

4.2.4.8 Administrative/Logistics Coordinator

The Administrative / Logistics Coordinator responds to the EOF and reports to the AEOD. The Administrative/Logistics Coordinator mobilizes offsite resources and obtains logistical support for the Emergency Organization.

4.2.4.9 Dose Assessment Health Physicist

The Dose Assessment Health Physicist responds to the EOF and reports to the Radiological Assessment Coordinator to perform radiological dose projections and other calculations or evaluations as directed.

4.2.4.10 Administrative Staff

The Administrative Staff reports to the Administrative/Logistics Coordinator in the EOF and assists the Emergency Organization in all matters requiring clerical support.

4.2.4.11 HPN Communicator

The HPN Communicator responds to the EOF and reports to the Radiological Assessment Coordinator. The HPN Communicator will maintain an open line with the NRC upon request.

4.2.4.12 NAN Communicator

The NAN Communicator responds to the EOF and reports to the AEOD. The NAN Communicator makes offsite notifications once the

EOF is activated and relieves the STSC Communicator of this responsibility.

4.2.4.13 Information Services (IS) Manager

The Information Services Manager responds to the EOF and reports to the AEOD. The Information Services Manager ensures that IT equipment located in the EOF remains in good working order and provides assistance to EOF personnel with IT equipment operation when needed.

4.2.4.14 RFAT Team

The RFAT Teams respond to the RFAT vehicle parking area and report to the Radiological Assessment Communicator in the EOF.

4.2.4.15 Offsite Technical Representative

The Offsite Technical Representative interfaces with state response agency personnel at the State EOC/TOC, provides up-to-date information on plant status, and clarifies how plant systems operate, via briefings and face-to-face contact with EOC staff, the TOC Shift Supervisor, and the TOC Technical Director. The Offsite Technical Representative is located at the TOC in Phoenix and reports to the AEOD.

4.2.5 EOF ORGANIZATION

The JIC Organization is illustrated in Figure 5.

4.2.5.1 JIC Manager

The JIC Manager is the PVNGS representative that oversees public information activities at the JIC including preparation of media statements, media briefings and the flow of information to the Rumor Control Unit. The JIC Manager reviews the technical content of media statements.

4.2.5.2 Spokesperson Coordinator

The Spokesperson Coordinator is the PVNGS representative in the JIC who coordinates the Spokespersons and advises and prepares materials for the Palo Verde Spokesperson in the preparation for media briefings.

4.2.5.3 Palo Verde Spokesperson

The Palo Verde Spokesperson is the representative within the JIC organization authorized to speak about actual emergency conditions at PVNGS.

4.2.5.4 ERF Communicator

The ERF Communicator is the JIC Palo Verde representative that provides any necessary technical explanations to the JIC Manager and the Palo Verde Spokesperson. The JIC ERF Communicator interfaces with the ERF Communicator in the EOF. The ERF Communicator, maintains communications with his counterparts in the TSC, OSC, and EOF, and provides information to the JIC Spokesperson Coordinator and the Palo Verde Spokesperson regarding the overall emergency activities.

4.2.5.5 Distribution Services Coordinator

The Distribution Services Coordinator coordinates the timely dissemination of accurate incident information to the media through electronic communication pathways (e.g., e-mail or fax) and the public via the Arizona Emergency Information Network Web site; and provides translation and other services for special needs and multilingual populations.

4.2.5.6 Rumor Control/Public Inquiry

The Rumor Control/Public Inquiry is operated by the Arizona Public Service Customer Care Center (CCC) Operators and augments State Public Inquiry and Rumor Control initiatives. CCC Operators provide information from approved media statements transmitted to the CCC from the JIC.

4.2.5.7 Video/Photo Coordinator

The Video/Photo Coordinator operates audio/video equipment at the JIC, including the EEC Auditorium. The Video/Photo Coordinator maintains copies of media briefings for archives.

4.2.5.8 Research/Writing Coordinator

The Research/Writing Coordinator writes materials such as media statements, fact sheets, flyers, and talking points for use by the JIC staff as needed.

4.3 NON-LICENSEE SUPPORT

Support from outside PVNGS consists of local service companies, institutions agencies, INPO, and contractor support.

4.3.1 LOCAL SERVICES SUPPORT

In emergency situations, PVNGS may need supplementary assistance from outside companies and service agencies. Such assistance may include transportation of injured and/or contaminated personnel, medical treatment and hospital facilities for station personnel, and fire suppression assistance.

4.3.2 CONTRACT SUPPORT

Contract support may include the Nuclear Steam Supply System (NSSS) supplier, the Architect Engineer, dosimetry, laboratory contractors, and decontamination and radwaste disposal firms. PVNGS has arranged for selected contract support firms to provide this assistance upon request.

4.4 COORDINATION WITH PARTICIPATING GOVERNMENT AGENCIES

For a complete discussion of authority, assigned responsibilities, capabilities, and activation and communication arrangements refer to the Offsite Emergency Response Plan for Palo Verde Nuclear Generating Station. PVNGS personnel coordinate emergency operations with state/ county government Emergency Operations Centers. The state, county, and city Emergency Operations Center Organization is shown in Figure 7. Safeguards and security team response are described in the PVNGS Security Plan and its implementing procedures.

4.4.1 STATE OF ARIZONA

The Governor of the State of Arizona is responsible for state government operations. The governor’s decision authority is assumed by a successor in his/her absence in accordance with the succession stipulated in the Arizona Revised Statutes, Title 26, Chapter 2, Article 1. Heads of state departments and agencies are responsible for the accomplishment of emergency and recovery tasks assigned by the governor or his/her authorized representative.

In addition to the support outlined in the Letters of Agreement, the Offsite Emergency Response Plan for Palo Verde Nuclear Generating Station provides for the following support functions for PVNGS in the event of an emergency from the indicated agencies. Also, mutual aid compacts and agreements between the State and other government and private entities defined in the Offsite Emergency Response Plan multiply the resources available to PVNGS in an emergency.

4.4.1.1 Arizona Department of Emergency and Military Affairs

The Arizona Department of Emergency and Military Affairs (DEMA) is assigned to coordinate the cooperative effort of all non-technical governmental agencies, including the Federal government, Arizona State government and its political subdivisions, and provides the necessary direction and control of state personnel and equipment for offsite response actions during radiological emergencies. It is referred to in the Offsite Emergency Response Plan for PVNGS as the Operations Directorate.

4.4.1.2 Arizona Division of Emergency Management

The Arizona Division of Emergency Management (ADEM) is a division of the DEMA and is located on the Papago Military Reservation at 5636 East McDowell Road, Phoenix, Arizona. The Director, ADEM, provides advice and assistance to the governor concerning emergency preparedness, operations and recovery. The director is responsible for coordinating the emergency planning, operations and recovery efforts of state agencies and political subdivisions on the governor’s behalf. The director is the designated Policy Chief for offsite government response to a radiological incident at PVNGS.

ADEM receives initial and follow up notifications from PVNGS and coordinates the collection, analysis and dissemination of information during an incident at the Palo Verde Nuclear Generating Station (PVNGS). This process is conducted in consort with the PVNGS, Maricopa County Dept. of Emergency Management (MCDEM), Arizona Department of Health Services (AZDHS) and other federal, state, local, Tribal Nation and volunteer agencies.

ADEM coordinates with AZDHS and MCDEM to ensure monitoring of evacuees for possible radioactive contamination and supervision and monitoring of any decontamination efforts. ADEM oversees requests for and coordination of federal technical support and exchanges of field data and accident assessment information with PVNGS.

An emergency classification or notification may require governmental or private sector emergency organizations to commit resources to onsite at the request of the PVNGS. Emergency resources may include, but are not limited to, law enforcement, firefighting, medical support and ground or air services. Assistance may be requested from other state governments and private sector resources in states adjoining Arizona. These resources may include medical capabilities, emergency response equipment, and emergency response personnel. The state Emergency Operations Center (EOC) Policy Chief or the Arizona Department of Health Services (AZDHS) Technical Director will initiate requests.

4.4.1.3 Arizona Department of Health Services

The Director, Arizona Department of Health Services (AZDHS) is responsible for providing technical support in response to a radiological incident and provides Protective Action Recommendations to the governor and IC. The AZDHS Director serves as the Technical Director in the state EOC. Arizona statutes require that the Emergency Response Plan be binding on other governmental agencies and therefore, Section 10.0 does not list separate letters of agreement with all agencies.

AZDHS is the agency with primary offsite responsibility for carrying out radiological emergency assessment actions, coordinating the technical offsite agency response and providing protective action recommendations to the Governor/designee. It is referred to in the Offsite Emergency Response Plan for PVNGS as the Technical Operations Center, the Radiological Emergency Assistance Team Center, and the Radiological Emergency Assistance Team Lab.

AZDHS receives initial and follow up notifications from PVNGS and provides for collection and analysis of data from the plant, field radiation surveys and sample collection. AZDHS representatives share information with EOF staff regarding field team locations, field data and protective action decisions and collects data to assess the accident, project dose and project plume.

AZDHS field monitors conduct radiation surveys to determine ambient radiation levels, track the plume and collect environmental and foodstuff samples for analysis and dispatches a mobile laboratory to

Buckeye Airport during the emergency (plume) phase for rapid evaluation of air samples.

AZDHS conducts "just-in-time" radiological training and provides equipment for alternate personnel prior to being deployed in response to a HAB incident.

4.4.1.4 Arizona Department of Public Safety

The Department of Public Safety (DPS) provides law enforcement support for ADEM and MCSO. DPS also serves as the 24 hour point of contact for the State of Arizona in the event of an emergency at the PVNGS.

4.4.2 MARICOPA COUNTY

Maricopa County is the only county within the 10-mile Plume Exposure Pathway Emergency Planning Zone. Portions of four other counties (La Paz, Pinal, Yuma, and Yavapai) are included in the 50-mile Ingestion Exposure Pathway EPZ. The Chairman of the Maricopa County Board of Supervisors is responsible for decision making at the county level. Maricopa County Department and Agency directors are responsible for the accomplishments of emergency and recovery tasks assigned by the Director of MCDEM.

4.4.2.1 Maricopa County Department of Emergency Management

The Director, Maricopa County Department of Emergency Management (MCDEM) provides technical and professional input to the Maricopa County Administrative Officer concerning planning, response and recovery activities in the event of an emergency. The director is also responsible for the coordination of emergency planning, response and recovery activities with other Maricopa County agencies as well as municipal entities.

Maricopa County Department of Emergency Management receives initial and follow up notifications from PVNGS and provides for the implementation of emergency measures, public warning, reception and care center operation.

4.4.2.2 Maricopa County Sheriff's Office

The Maricopa County Sheriff's Office (MCSO) receives initial and follow up notifications from PVNGS on a 24 hour basis. The Maricopa County Sheriff's Office (MCSO) performs the Emergency Public

Warning (alerting and public information), evacuation control and reentry, public protective action implementation, reception and care center security and support (KI transport and impound security), just in time radiological training, support control of food embargos.

MCSO provides coordinated on-site/offsite direction and control in accordance with the Maricopa County Peacetime Disaster Plan (PDP). The PDP authorizes the Sheriff to request assistance when an incident is beyond the ability of the Office to resolve and works under the Incident Command System (ICS) when responding to PVNGS Hostile Action Based (HAB) incidents.

MCSO is responsible for the initial and on-going assessment of the situation to determine if terrorism is involved or responsible for the HAB incident. If and when this determination is made, the Federal Bureau of Investigation (FBI) will be notified.

4.4.3 FEDERAL GOVERNMENT

4.4.3.1 Nuclear Regulatory Commission (NRC)

The NRC is responsible for licensing and regulating nuclear facilities and materials. These responsibilities include protecting the public health and safety, protecting the environment, and protecting and safeguarding materials and nuclear plants in the interest of national security. The NRC Incident Response Plan objectives are to provide for protection from the effects of radiological incidents that may occur at licensed facilities or which involve licensed materials. In addition to fulfilling its regulatory responsibilities, it is expected that the NRC will provide technical assistance and recommendations.

The NRC acts as the lead federal agency regarding technical matters during a nuclear incident, with the Chairman of the Commission as the senior NRC authority for all response aspects. The Chairman can transfer control of emergency response activities when deemed appropriate.

Incident Response Centers have been established at each of the four NRC regional offices and at NRC Headquarters to centralize and coordinate NRC's emergency response. Each NRC Region is prepared to send a team of qualified specialists to an accident scene. For Site Area and General Emergencies, a NRC Region IV site team is expected to be dispatched to PVNGS with arrival in four to eight hours following notification. Office space, telephones, and other equipment is provided for NRC personnel at the TSC, EOF and JIC.

4.4.3.2 Federal Emergency Management Agency (FEMA)

By the National Response Framework, FEMA is responsible for the overall coordination of a multi-agency Federal response to a significant radiological incident. The primary role of FEMA is to support the states by coordinating the delivery of federal non-technical assistance. FEMA coordinates state and tribal requests for federal assistance, identifying which federal agency can best address specific needs. If deemed necessary, FEMA will establish a nearby Federal Response Center from which it will manage its assistance activities.

4.4.3.3 US Department of Energy (DOE)

The DOE has agreed to provide radiological assistance upon request, and has radiological monitoring equipment and personnel resources that it can assemble and dispatch to the scene of a radiological incident. Following a radiological incident, DOE operates as outlined in the Federal Radiological Monitoring and Assessment Plan (FRMAP). DOE has the responsibility to establish the Federal Radiological Monitoring and Assessment Center (FRMAC), which would provide comprehensive post-accident radiological monitoring and assessment.

4.4.3.4 Federal Bureau of Investigation (FBI)

Support from the FBI is available through its statutory responsibility, based in Public Law and the US code, and through a memorandum of understanding for cooperation with the NRC. Notification to the FBI of emergencies in which they would have an interest will be through the provisions of the PVNGS Security Plan, or by the NRC.

4.4.3.5 National Weather Service (NWS)

NWS provides meteorological information during emergency situations, if required. Data available will include existing and forecasted wind directions, wind speeds, and ambient air temperatures.

4.4.3.6 Environmental Protection Agency (EPA)

The EPA can assist with field radiological monitoring, sampling, and nonplant related recovery and reentry guidance.

4.5 INSTITUTE OF NUCLEAR POWER OPERATIONS (INPO)

INPO aids nuclear utilities in obtaining resources beyond their usual capabilities during recovery from an emergency. As one of its roles, INPO will assist affected utilities by applying the resources of the nuclear industry to meet the needs of an emergency.

4.6 LETTERS OF AGREEMENT (LOAs)

Letters of Agreement (LOAs) are not necessary with federal and state agencies that are legally required to respond to an emergency; however, agreements are necessary if an agency is expected to provide assistance not required by law. Written agreements have been developed which establish the extent of operations between PVNGS and other support organizations which have an emergency response role consistent with this plan. These agreements identify the emergency measures to be provided, the mutually accepted criteria for implementation, and the arrangements for exchange of information. PVNGS has obtained LOAs with private contractors and others who provide emergency support services. LOAs, as a minimum, state that the cooperating organization will provide their normal services in support of an emergency at PVNGS. Letters of Agreement are referenced in Section 10 and the actual letters are maintained on file.

SHIFT STAFFING (Immediate Response)

MAJOR FUNCTIONAL AREA	POSITION/FUNCTION TITLE	Staffing/Unit	Shared Site Staffing	Site Staffing Totals
Plant Operations and Assessment of Operational Aspects	Shift Manager/Emergency Coordinator	1		**3**
	Control Room Supervisor	1		**3**
	Control Room Operators	2		**6**
	Fire Team Advisor		1	**1**
	Auxiliary Operators	4		**12**
	Radiation Protection Monitor		1	**1**
	Shift Technical Advisor		2	**2**
Notifications/ Communications	STSC Communicator (Covered by Affected Unit)	See AO above		
	ENS Communicator		1	**1**
Support Staff	Chemistry Technician (OSC)		2	**2**
	Electrical Technician (OSC)		3	**3**
	Mechanical Technician (OSC)		2	**2**
	I&C Technician (OSC)		1	**1**
	RFAT Driver (Water Res Facility)		1	**1**
	Radiation Protection Technician (OSC)		3	**3**
	Radiation Monitoring Technician		1	**1**
	RM or RP Technician (OSC)		1	**1**
	Survey Qualified Position (OSC)		1	**1**
	Security Section Leader/Director (TSC) (not committed to armed response)		1	**1**
Fire Suppression/ Rescue Operations and First Aid	Plant Fire Department/Emergency Medical Technicians (At least 2 Fire Team Members are EMT qualified)		5	**5**
Site Access Control and Personnel Accountability	Plant Security		Staffing per Security Plan	Staffing per Security Plan
	TOTALS	**8/Unit = 24**	**26 Shared**	**Total 50**

AUGMENTATION STAFFING

Major Functional Area	Position Title	ON SHIFT	Normal Hours 60 MINUTES	Off Hours 120 MINUTES
Emergency Direction and Control	Emergency Coordinator (TSC)		1	1
	Emergency Operations Dir (EOF)		1	1
Plant System Engineering/ Repair and Corrective Actions Protective Actions	Technical Support Electrical (TSC)		1	1
	Technical Support Mechanical (TSC)		1	1
	Reactor Analyst (TSC)		1	1
	Radiation Protection Technicians (OSC)		6 – Immediate During Normal Hours	**6**
	Engineering Director (EOF)		1	1
Communications	NAN Communicator (EOF)		1	1
Fire Suppression	Offsite Fire Department		Offsite Support 45 Minutes from time of request	
Rescue Operations and First Aid	Offsite Ambulance		Offsite Support 45 Minutes from time of request	
	TOTALS		**13**	**13**

TABLE 1 MINIMUM SHIFT STAFFING FOR EMERGENCIES

CONTROL ROOM/STSC

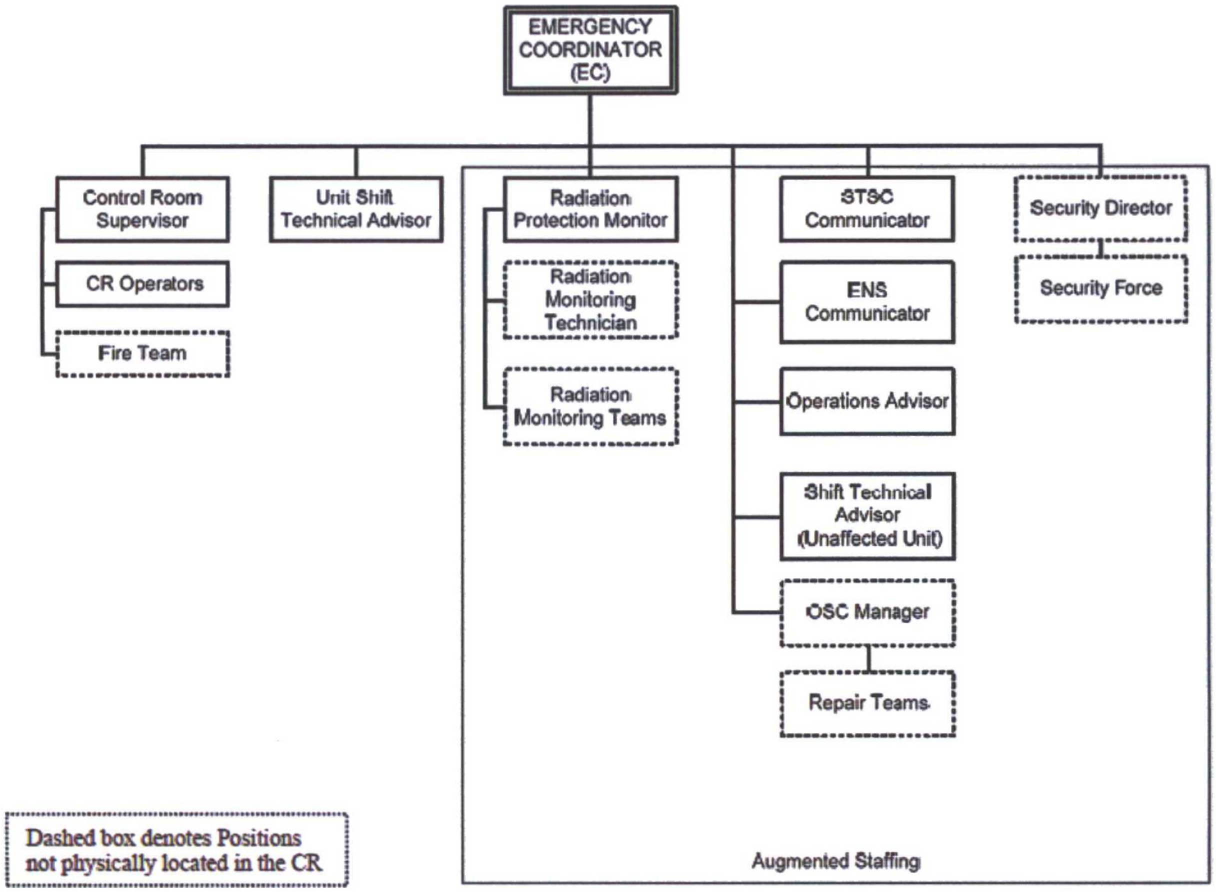

FIGURE 1 ONSHIFT EMERGENCY ORGANIZATION

TECHNICAL SUPPORT CENTER (TSC)

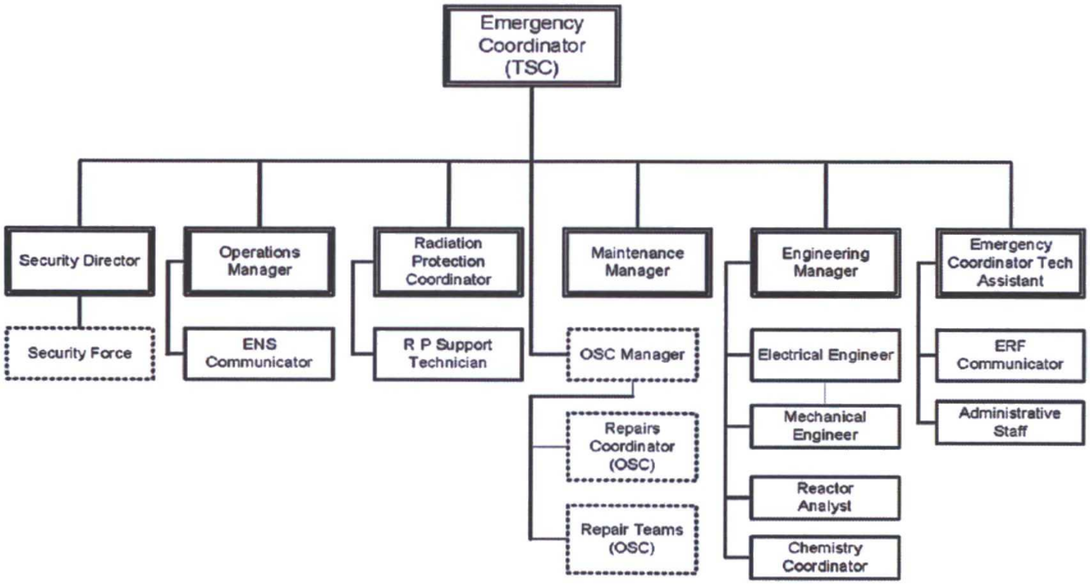

FIGURE 2 TECHNICAL SUPPORT CENTER ORGANIZATION

OPERATIONS SUPPORT CENTER (OSC)

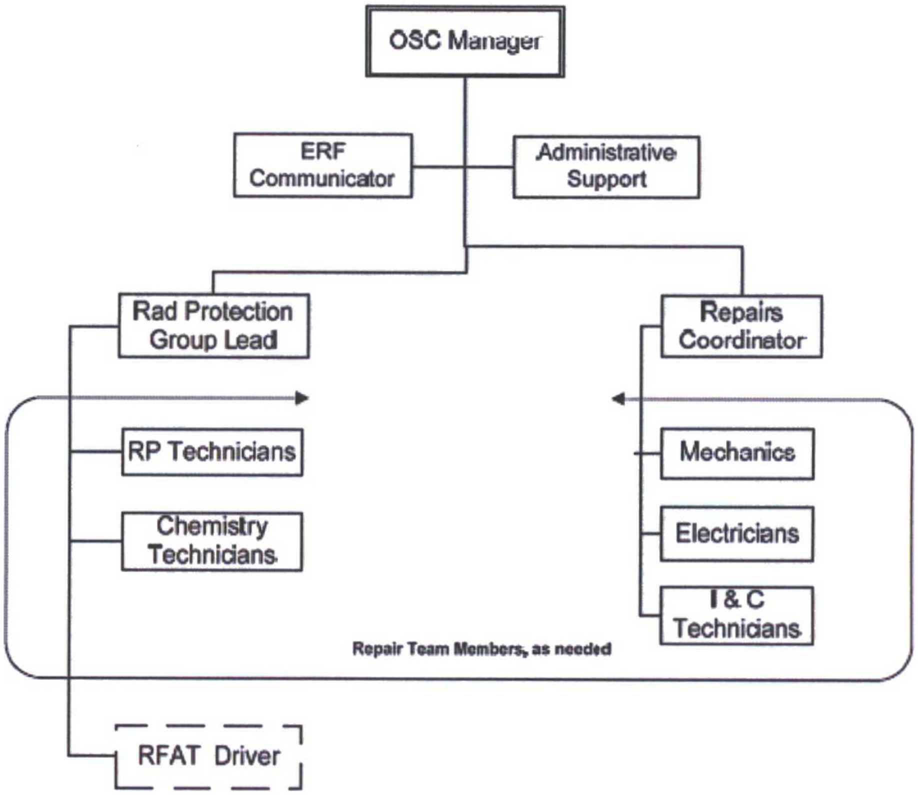

FIGURE 3 OPERATIONS SUPPORT CENTER ORGANIZATION

EMERGENCY OPERATIONS FACILITY (EOF)

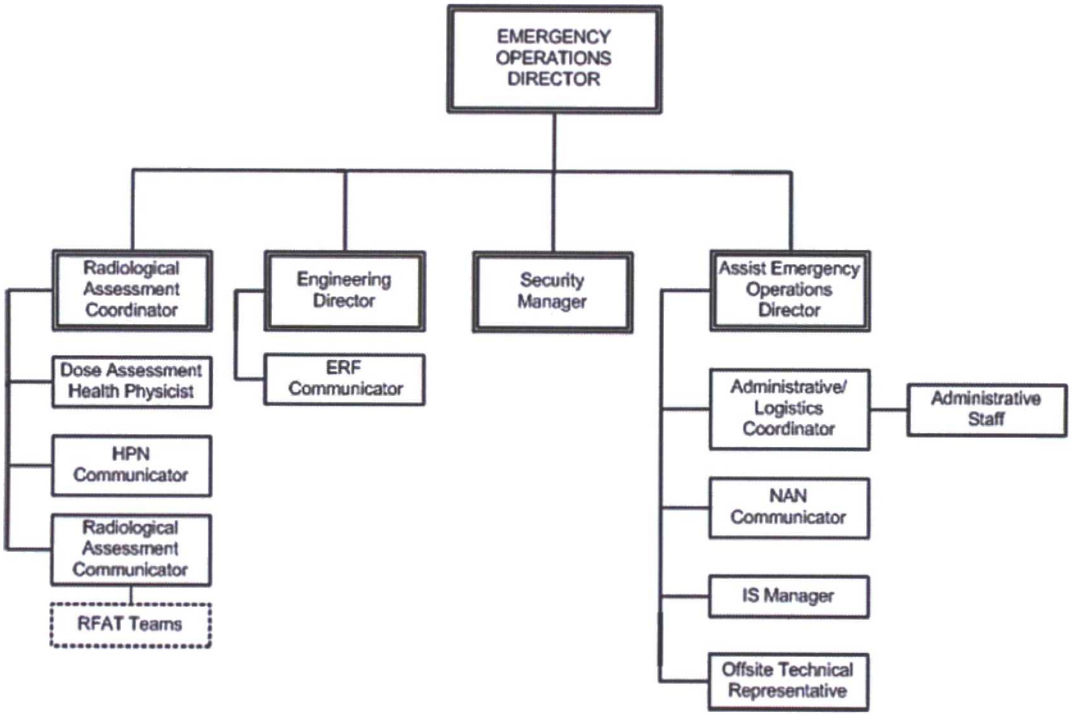

FIGURE 4 EMERGENCY OPERATIONS FACILITY ORGANIZATION

JOINT INFORMATION CENTER (JIC)

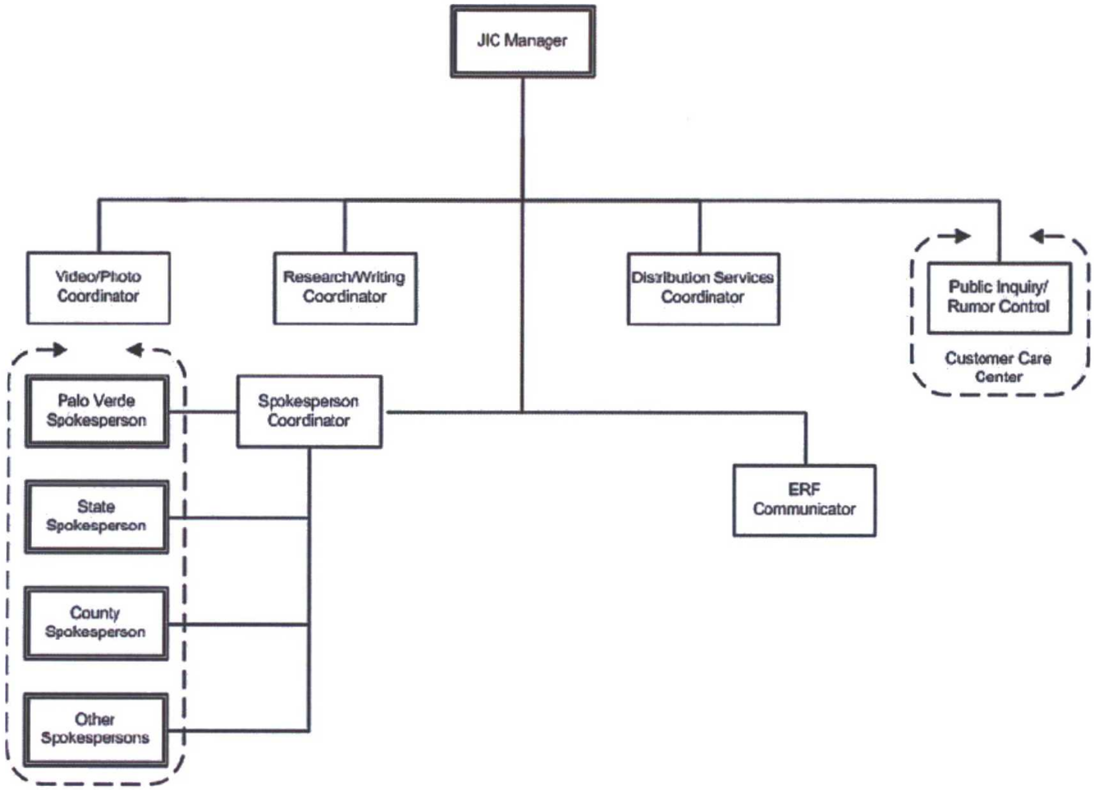

FIGURE 5 JOINT INFORMATION CENTER ORGANIZATION

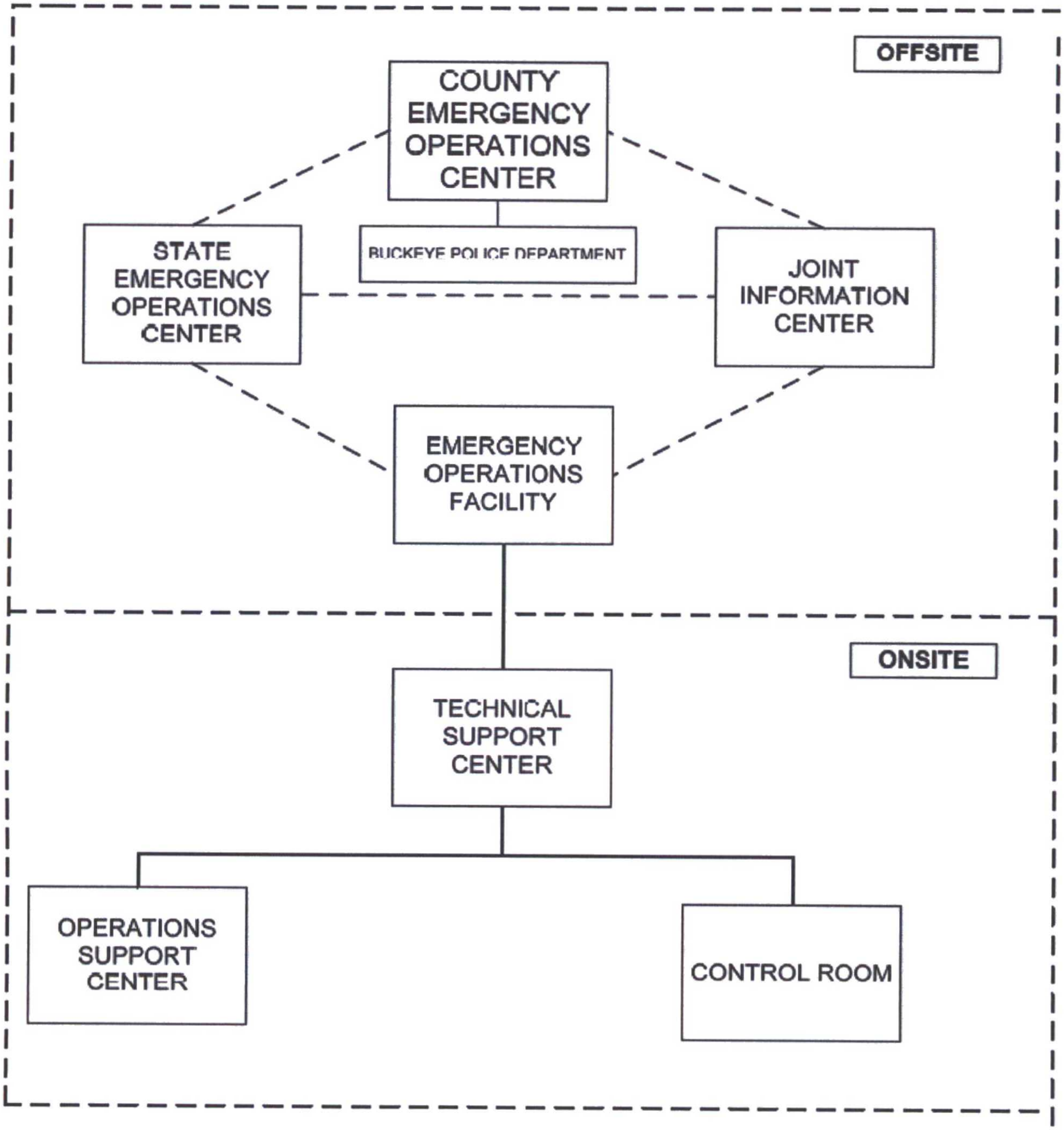

FIGURE 6 ONSITE/OFFSITE EMERGENCY ORGANIZATION INTERFACE

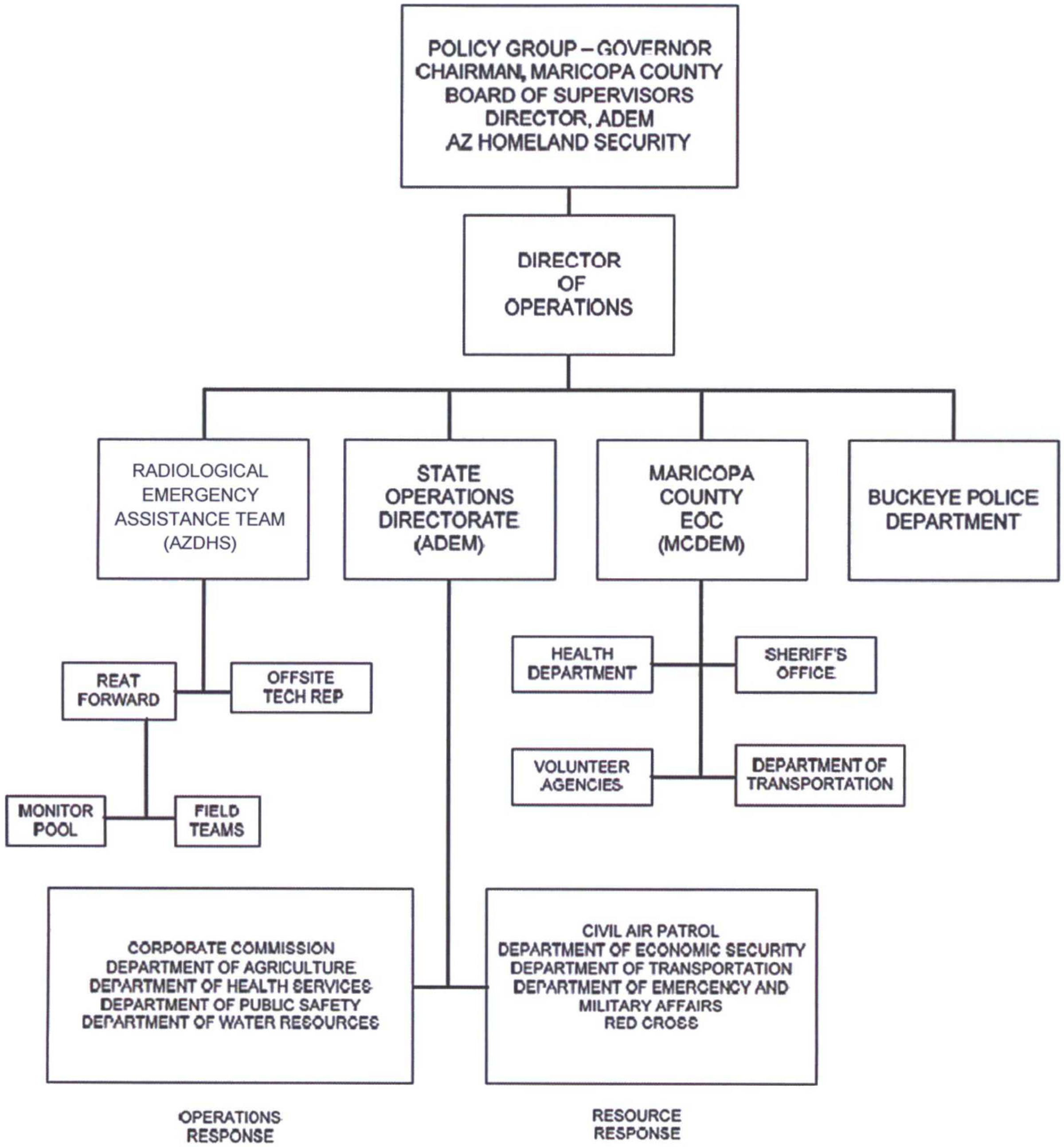

FIGURE 7 STATE, COUNTY & LOCAL EMERGENCY OPERATIONS CENTER ORGANIZATION

5.0 EMERGENCY CONDITIONS AND CLASSIFICATIONS

5.1 EMERGENCY CONDITIONS

Emergency classification is divided into four classification levels. Emergency Action Levels (EALs), based on indications available in the control room and correlated to the emergency classifications, are provided to the operator.

The EALs were discussed and agreed upon by Palo Verde and state and county governmental authorities, and approved by the NRC. EALs are reviewed with the State and local governmental authorities on an annual basis.

PVNGS has and maintains the capability to assess, classify, and declare an emergency condition within 15 minutes after the availability of indications to plant operators that an EAL has been exceeded. Upon identification of the appropriate emergency classification level the emergency condition will be promptly declared.

The four emergency classification levels are described in the following sections:

EMERGENCY CLASSIFICATION LEVEL DESCRIPTIONS

There are three considerations related to emergency classification levels. These are:

1) The potential impact on radiological safety, either as known now or as can be reasonably projected;

2) How far the plant is beyond its predefined design, safety, and operating envelopes; and

3) Whether or not conditions that threaten health are expected to be confined to within the site boundary.

The ICs deal explicitly with radiological safety impact by escalating from levels corresponding to releases within regulatory limits to releases beyond EPA Protective Action Guideline (PAG) plume exposure levels.

UNUSUAL EVENT (UE)

Events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring off-site response or monitoring are expected unless further degradation of safety systems occurs.

ALERT

Events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA PAG exposure levels.

SITE AREA EMERGENCY (SAE):

Events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts; 1) toward site personnel or equipment that could lead to the likely failure of or; 2) that prevent effective access to, equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA PAG exposure levels beyond the site boundary.

GENERAL EMERGENCY (GE):

Events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA PAG exposure levels off-site for more than the immediate site area.

5.2 BASIS FOR PALO VERDE NUCLEAR GENERATING STATION (PVNGS) CLASSIFICATION CRITERIA

EMERGENCY ACTION LEVELS (EALs)

The site specific implementation of the guidance was approved by the NRC in a safety evaluation dated September 8, 2016 and incorporated into Appendix A of the PVNGS Emergency Plan Revision 59 and in the Emergency Preparedness Implementing Procedures.

Palo Verde Generating Station’s Emergency Classification and Emergency Action Level (EAL) scheme is based on the U.S. Nuclear Regulatory Commission (NRC) Amendment No. 198 to Renewed Facility Operating License No. NPF-41, Amendment No. 198 to Renewed Facility Operating License No. NPF-51 and Amendment No. 198 to Renewed Facility Operating License No. NPF-74 for the Palo Verde Generating Station, Units 1, 2, and 3, respectively. The amendments consist of changes to the emergency action level (EAL) scheme in response to a Palo Verde Generating Station application dated October 9, 2015, as supplemented by letter dated May 12, 2016.

The amendments revised Palo Verde Generating Station's EAL scheme based on the Nuclear Energy Institute (NEI) guidance document NEI 99-01, Revision 5, "Development of Emergency Action Levels for Non-Passive Reactors," to one based on NEI 99-01, Revision 6. NEI 99-01, Revision 6, which was endorsed by the NRC by letter dated March 28, 2013 (Agency-wide Documents Access and Management System Package Accession No. ML13091A209).

6.0 EMERGENCY MEASURES

This section establishes the methodology of emergency response and is the basis for the EPIPs which define the emergency actions to be taken during an emergency. Emergency measures follow a sequential process which contains the following definable elements:

- Event Assessment
- Classification and Declaration
- Notification
- Mobilization
- Consequence Assessment
- Protective Actions
- Corrective Actions

6.1 EVENT ASSESSMENT

Initial recognition of emergency conditions should normally occur in the Control Room. Emergency conditions may be indicated by alarms, instrument readings or reports to the Control Room. The Control Room Supervisor (CRS) should provide initial evaluation of the indicators and notify the Shift Manager (SM). The SM evaluates the conditions against the established EALs to determine if an EAL has been reached or exceeded.

6.2 CLASSIFICATION AND DECLARATION

An emergency shall be classified and declared if the SM finds that a specific EAL has been reached, exceeded, or if the SM determines that it is imminent that the specific EAL set-point will be reached or exceeded.

When the SM declares an emergency to the Control Room personnel, an announcement will be made over the unit public address system, and the other Control Rooms and Security will be notified.

For those abnormal situations potentially involving more than one unit, the Unit 1 SM is responsible for initially classifying and declaring the emergency and assuming the position of EC. Exceptions are considered for selected security events.

6.3 NOTIFICATION

Initial notifications are made to state and local warning points and the NRC in accordance with established procedures. The procedures include a means of message verification. The initial notifications to state and county warning points are made within 15 minutes of the declaration of the emergency. The Notification Alert Network (NAN) is the dedicated voice and data circuit designed for this purpose (Figures 7 and 8).

The licensee shall notify the NRC immediately after notification of the appropriate State or local agencies and not later than one hour after the time the licensee declares one of the Emergency Classes.

Initial notification of state and county warning points consists of the following mutually agreed to information:

- Plant identification
- Emergency Classification (or termination)
- Date and Time of Classification (or termination)
- Current Emergency Action Level
- Wind speed and direction
- Authentication
- Current release status
- Protective Actions Recommendations (if any)

6.4 MOBILIZATION

The emergency organization for an Unusual Event consists of normal shift personnel. Augmentation of this organization may occur at the discretion of the EC. At an Alert or higher level emergency classification, the ERO is augmented. ERO personnel will be notified via an automated callout system, Group Paging System, and site PA system.

6.5 CONSEQUENCE ASSESSMENT

Assessment actions will continue throughout the emergency. Continued assessment may result in reclassification of the emergency and alteration of emergency response actions.

Priority will be given to continuing assessment actions that result in:

- Protective Action Recommendations for the health and safety of the general public
- Protective Actions for onsite personnel
- Maintaining control of the plant
- Resolving an emergency situation
- Corrective actions to reduce the consequences of an emergency

6.5.1 Assessment Action for Control of Plant Operations

The existence of any emergency condition causes increased monitoring of Control Room instrumentation to monitor trends of appropriate parameters, particularly the indicated values that triggered the emergency and those that may be related. Additional monitoring equipment may be used to assess the nature of the emergency condition. A Safety Parameter Display System (SPDS) display console is in the Control Room and is accessible to Control Room personnel.

6.5.2 Environmental Assessment for Protection of the Health & Safety of the Public

PVNGS has the responsibility to perform a preliminary assessment of the offsite consequences of an incident. Environmental Assessment for Protection of the Health and Safety of the Public is performed by PVNGS using two methods:

- Dose Assessment
- Environmental Surveys

Dose Assessment is performed by trained personnel using computer generated dose projections or other approved methodologies based on plant parameters and/or site effluent release data. The initial assessment will be performed within 30 minutes of the declaration of any emergency classification. EPIP's provide recommendations for protective action recommendations when indicated by dose assessment results.

Environmental Surveys will be initiated as a minimum following the declaration of Alert or higher. An Environmental Team will be deployed within 30 minutes to support these surveys. Environmental Teams measure dose rate readings and noble gas and iodine concentrations.

PVNGS maintains fully equipped and dedicated vehicles to support Environmental Teams. Air monitoring equipment has the capability to detect under field conditions, radioiodine concentrations in air as low as E-7 microcuries per cubic centimeter.

PVNGS deploys Survey Teams offsite at least until AZDHS has mobilized its Radiological Emergency Assistance Team (REAT). Approximately three (3) hours is estimated for REAT deployment. Long-term offsite assessments and dose to the public (ingestion pathway EPZ) are the responsibility of AZDHS and supported by Federal resources.

Radiological data developed by either of these techniques is used to assess appropriateness of Classification and Protective Action Recommendations.

Environmental assessment is supported by a permanent meteorological installation which continuously indicates and records wind speed, direction and temperature differentials. Meteorological data may be obtained from the National Weather Service. This system is described in section 7.3.1.1.

6.5.3 In-plant Radiological Controls

During the course of an emergency, elevated radiation or contamination levels may be experienced. It may then be necessary to impose additional radiological controls beyond the controls established by the normal in-plant radiological controls program.

In-plant radiological controls in an emergency situation may differ from normal radiological control activities in the following aspects:

- Maintaining strict access control into affected plant areas
- Availability and use of augmented dosimetry
- Additional use of portable radiation monitoring devices, particularly high range monitoring devices, for monitoring contamination and area radiation levels
- Increased availability and use of protective clothing and respiratory devices
- Increased air sampling for the purpose of limiting the number of persons subject to exposure
- Increased whole body counting and other bio-assays

Initial assessment of the need for in-plant radiological controls may be based on plant readings, RMS readings, in-plant EPD readings and system status reports. Additional information concerning in-plant radiological conditions may be gained during the debriefing of personnel deployed with Emergency Repair and Survey Teams.

6.5.4 Reactor Core Damage Assessment

Initial assessment of the status of the reactor core is performed by the STA. Initial assessment of core conditions is based on readings of Control Room instrumentation and assessment of SPDS data.

Prior to TSC activation, the STA in the STSC provides additional capability for assessment of reactor core damage.

When the TSC is activated, the Reactor Analyst assesses core conditions under the direction of the Engineering Manager. Information is obtained from the SPDS and critical parameter values from ERFDADS.

Palo Verde's Core Damage Assessment program was developed based on the Combustion Engineering Owners Group Task 467, Development of the Comprehensive Procedure Guidelines for Core Damage Assessment.

6.6 CORRECTIVE ACTIONS

PVNGS procedures contain steps for preventive and/or corrective actions to avoid or mitigate serious consequences of an incident. These steps are contained in AOP, EOP, and other plant procedures.

6.7 PROTECTIVE ACTIONS

A range of protective actions has been developed for emergency workers and the public. The guidelines for emergency workers are consistent with EPA emergency worker and lifesaving activity protective action guides.

Protective actions are emergency measures taken during and after an emergency so that onsite personnel and the general public are alerted and actions are initiated for the protection of their health and safety. Protective actions are initiated if radiation or airborne radioactivity levels exceed predetermined values or when situations threaten the health and safety of onsite personnel or the general public.

The responsibility for the determination of Protective Actions for Workers and the General Public is implemented as follows:

- Protective actions for onsite personnel and visitors are the responsibility of the PVNGS Emergency Coordinator.
- Protective Actions for Emergency Workers operating under the State or County Emergency Plan are the responsibility of the AZDHS. Measures for the protection of

these Emergency Workers are detailed in the Offsite Emergency Response Plan for PVNGS.

- Protective Measures for the General Public are directed by the Governor of Arizona and implemented by Maricopa County. It is the responsibility of PVNGS to provide Protective Action Recommendations for the Evacuation and/or Shelter of the General Public within the 10 Mile EPZ in addition to a recommendation for Potassium Iodide when appropriate. PVNGS in coordination with the State of Arizona (ADEM and AZDHS) along with Maricopa County have formulated a protective action strategy consistent with the guidance contained within *"NUREG 0654, Supplement 3, Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, Guidance for Protective Action Strategies, November 2011."*

The current evacuation time estimate (and annual updates as necessary) is used to assist in formulating protective actions by the offsite authorities. Measures for the protection of the general public are detailed in the Offsite Emergency Response Plan for PVNGS. The communications flow path associated with Protective Action Recommendations is illustrated in Figure 10.

6.7.1 PROTECTIVE ACTION FOR ONSITE PERSONNEL

Protective actions for onsite personnel may include alerting, personnel assembly, accountability, and evacuation as well as security procedures, access control, monitoring and decontamination. Protective actions may also be taken for onsite personnel for emergencies such as fires or natural disasters where personnel safety is threatened.

6.7.1.1 Hostile Action

Onsite protective of employees during a hostile action involves a combination of restricted movement, movement to safe locations, and site evacuation depending on the nature of the hostile event and advance warning. Site procedures provide specific actions to take during hostile action based events.

6.7.1.2 Alerting

Unit personnel are alerted by an audible signal and an announcement over the unit public address system. Site personnel are alerted by activation of an audible signal followed by public address system announcements. Evacuation/accountability is assured in high noise work areas by the use of audible alarms, flashing lights, and/or administrative measures.

The PVNGS Site Warning Siren/Public Address System consists of electronic sirens with four distinct sounds: (1) assembly signal, (2) evacuation signal, (3) fire signal, and (4) all-clear signal. These signals are introduced prior to initial site access and are available on a phone recording. The emergency signal can be activated from the Control Room, and the TSC.

6.7.1.3 Assembly

Personnel assembly is mandatory at the Site Area Emergency or higher level classification. Assembly of site personnel outside of the Protected Areas is accomplished by all personnel reporting to designated assembly areas. Assembly may be initiated at any time site management deems it appropriate for personnel safety reasons. In the case of a hostile action threat or event, designated assembly points will be announced via the Public Address System. The designated assembly points may include on-site assembly points or offsite mustering points. Assembly may also be used as a tool to initiate the Two-Man Rule during Security events.

6.7.1.4 Accountability

Personnel accountability within the Protected Area is mandatory at the Site Area Emergency. Accountability may be initiated at other times at the discretion of the EC to support worker safety.

Accountability of personnel within the Protected Areas is accomplished within 30 minutes of the declaration of Site Area Emergency or higher, and maintained continuously thereafter, using Protected Area(s) boundary access control as described in the PVNGS Security Plan. If there are station personnel who are unaccounted for, the Unit Evacuation System and sitewide page are used to locate them, or, in extreme cases (fire, toxic gas release, explosions, structural damage, etc.), trained search and rescue personnel are deployed to search for and assist the missing personnel.

6.7.1.5 Evacuation

The decision to evacuate non-essential personnel is made by the EC. Nonessential personnel must be evacuated in the event of a Site Area Emergency or General Emergency. However, in certain situations it may be desirable to evacuate earlier to enhance worker protection.

6.7.1.6 Security and Access Control

PVNGS Security personnel at Security Access Control Points are instructed to admit only emergency personnel and designated County, State and NRC personnel. Special onsite security measures have been developed to facilitate rapid access by emergency response personnel. In case of a Security contingency event such as a direct armed attack, Security's response actions may be primarily focused on the Security event and take precedence over emergency response duties.

6.7.1.7 Monitoring and Decontamination

Personnel are monitored for contamination at the Security Access Points as they depart the Power Plant Protected Area by portal monitors. Personnel located outside the Power Plant Protected Area are monitored as required by radiological conditions. If decontamination of personnel is required, they are decontaminated by trained personnel.

Onsite emergency personnel are monitored for contamination at their respective emergency stations. Decontamination of onsite emergency personnel is conducted at onsite decontamination facilities.

6.7.1.8 Protective Equipment and Supplies

A variety of protective equipment is available onsite to minimize radiological exposures, contamination problems and fire fighting hazards.

6.7.1.8.1 Respiratory Protection Equipment

Respiratory protection equipment includes full face canister respirators, self-contained breathing apparatus and air-fed respirators. Radiation Protection personnel determine when the use of respiratory protection equipment is appropriate and select the correct type of equipment for conditions expected to be encountered.

6.7.1.8.2 Protective Clothing

Protective clothing is maintained onsite for routine use and is available for use during emergencies.

6.7.1.8.3 Thyroid Blocking Agent

The EC is the only individual who may authorize the voluntary use of potassium iodide (KI) for emergency personnel. The EC-TSC authorizes the use of KI with the advice of the Radiation Protection Coordinator. The use of KI is based on the potential for release, or on the magnitude of an actual release, of iodine. KI is distributed to emergency workers when its use is authorized.

6.7.1.8.4 Emergency Dosimetry

Dosimetry is located in close proximity to all emergency centers and available for issue to emergency personnel as necessary by Radiation Protection personnel.

6.7.2 OFFSITE PROTECTIVE ACTIONS

Protective Actions for the General Public in response to radiological emergencies include sheltering or evacuation of the public and the issuance of Potassium Iodide based on consideration of the relative benefits of each action. The action which affords the higher level of dose avoidance, when offsite doses are expected to exceed Protective Action Guides, is preferred. However, other factors such as release duration, mobilization time or adverse weather are important considerations affecting offsite protective action recommendations. Evacuation route sections and evacuation routing are shown in Figure 11. It is the responsibility of PVNGS to make Protective Action Recommendations, the Governor of the State of Arizona to make Protective Action Decisions and Maricopa County to implement the Protective Action Decision.

PVNGS has performed an Evacuation Time Estimate as required by 10CFR50, Appendix E. PVNGS will estimate EPZ permanent resident population changes during the years between decennial censuses using U. S. Census Bureau data. State and local government population data is used if available. These estimates shall occur no more than 365 days apart and the results provided to state and local emergency management agencies for factoring into protective actions as needed. Licensees shall maintain these estimates available for NRC inspection during the period between censuses and shall submit these estimates to the NRC with any updated ETEs. If at any time during the decennial period, the population increases so that the ETE for the 2-mile zone or 5-mile zone, including all affected ERPAs, or for the entire EPZ, increases by 25 percent or 30 minutes, whichever is less, for the scenario with the longest ETE, the ETE analysis will be updated to reflect the impact of that population increase.

6.7.2.1 Protective Actions for the General Public

The basis for developing and providing Protective Action Recommendations is EPA-400, "Manual of Protective Action Guides and Protective Actions For Nuclear Incidents." Protective action recommendations for the general public consider the time required for notification of offsite authorities, for public alerting and for implementation of protective actions. In the case of a core melt situation, evacuation of at least a two-mile radius around the plant site and at least five miles downwind for affected sectors is recommended. A Shelter recommendation may be made if known impediments to evacuation exist or the release conditions dictate. Governmental officials will also be advised to consider the use of Potassium Iodide (KI) as a protective measure. When evacuation is ordered, the Offsite Emergency Response Plan for Palo Verde Nuclear Generating Station provides, as a minimum, for evacuation by 22.5 degree sectors considering first the sector in which the central axis of the plume is located and then the adjacent sector on each side. Implementation of protective actions for the general public is described in the Offsite Emergency Response Plan for Palo Verde Nuclear Generating Station. Time estimates for evacuation within the Plume Exposure Pathway Emergency Planning Zone are maintained in the files of Emergency Preparedness Department. The demography within the Plume Exposure Pathway is shown in Figure 12.

Offsite authorities receive an immediate notification for:

- Change in emergency classification
- Change in the release status
- Change in Protective Action Recommendations
- Change in the Protective Action zone

6.7.3 CONTAMINATION CONTROL MEASURES

6.7.3.1 Plant Site

Specific area limits have been established for control of contamination within the PVNGS facility. The basis for these limits is that contamination shall be controlled so that hazards to personnel are minimized and compliance with personnel exposure limits (internal and external) is assured. As necessary, Contamination Areas are established and posted. Details of contamination control measures for onsite personnel and equipment are contained in the PVNGS Radiation Protection Program.

6.7.3.2 Offsite

Criteria and measures for contamination control in offsite areas are detailed in the Offsite Emergency Response Plan for Palo Verde Nuclear Generating Station.

6.8 AID TO AFFECTED PERSONNEL

6.8.1 EMERGENCY PERSONNEL DOSE CRITERIA

Emergency workers carry electronic alarming dosimeters in addition to Thermoluminescent Dosimeters (TLDs). Dosimeters are read at intervals dependent upon radiation levels in accordance with PVNGS Nuclear Administrative and Technical Manual Procedures. In addition to self readout capability, the dosimeters are capable of alarming on dose or dose rate.

Emergency dosimetry is provided on a 24-hour basis by Radiation Protection personnel. Every effort is made to minimize emergency worker doses through the use of protective equipment and supplies and by minimizing exposure time. Emergency exposures above administrative guidelines are authorized by the Radiation Protection Monitor (RPM), Radiation Protection Coordinator or the EC. The RPM or Radiation Protection Coordinator may authorize exposures up to the 10 CFR 20 limits, and the EC authorizes exposures above 10 CFR 20 limits, in accordance with procedures. Emergency worker dose criteria are based on three categories of actions: sampling under accident conditions, lifesaving actions, and corrective/protective actions.

The EC is notified of accidental or emergency dose in excess of occupational limits. Decisions to accept doses in excess of occupational limits in life-saving situations are on a voluntary basis.

6.8.2 DECONTAMINATION AND FIRST AID

Provisions exist to assist personnel who are injured and who have received high radiation doses, or who have been contaminated. Decontamination materials and portable first aid kits are available at strategic locations throughout the station and offsite. There are personnel trained in first aid and decontamination procedures. In addition, onsite decontamination areas equipped with decontamination facilities, supplies, and other specialized equipment are located near the access control point on the 140 ft. elevation in the Auxiliary Building of each unit. Personnel found to be externally contaminated are decontaminated. Where contamination of large, open wounds is involved, personnel are transported to Banner University Medical Center or Banner Estrella Medical Center. Contaminated PVNGS evacuees are decontaminated at the offsite relocation area. Waste fluids and wastes from decontamination of personnel or material are collected and handled as radioactive wastes in accordance with the PVNGS Nuclear Administrative and Technical Manual, except at the offsite relocation area, where radioactive wastes are handled under the guidance of AZDHS.

6.8.3 MEDICAL TRANSPORTATION

Injured/externally contaminated personnel who require medical attention are transported to Banner University Medical Center or Banner Estrella Medical Center by an available onsite or offsite air or ground ambulance.

6.8.4 MEDICAL TREATMENT

Letters of agreement for treating externally contaminated patients exist for Banner University Medical Center and Banner Estrella Medical Center.

Treatment of individuals injured may occur at the onsite medical facility during normal working hours or by EMT qualified personnel on weekends or backshift. Serious injuries may require the patient to be transferred to the nearest offsite treatment facility appropriate to the injury.

6.9 MEDIA RELATIONS

Provisions for media relations during the course of an emergency are detailed in the Joint Public Information Procedure. When an Unusual Event is declared, news media relations are conducted from APS/Palo Verde Communications. At the Alert or higher classification level, the Joint Information Center is activated at 600 North Verrado Way, Building A, Buckeye, Arizona, in accordance with the guidelines of the Joint Public Information Procedure. The Public Inquiry Center at the State EOC and the Rumor Control Center at the APS Customer Care Center respond to public inquiries.

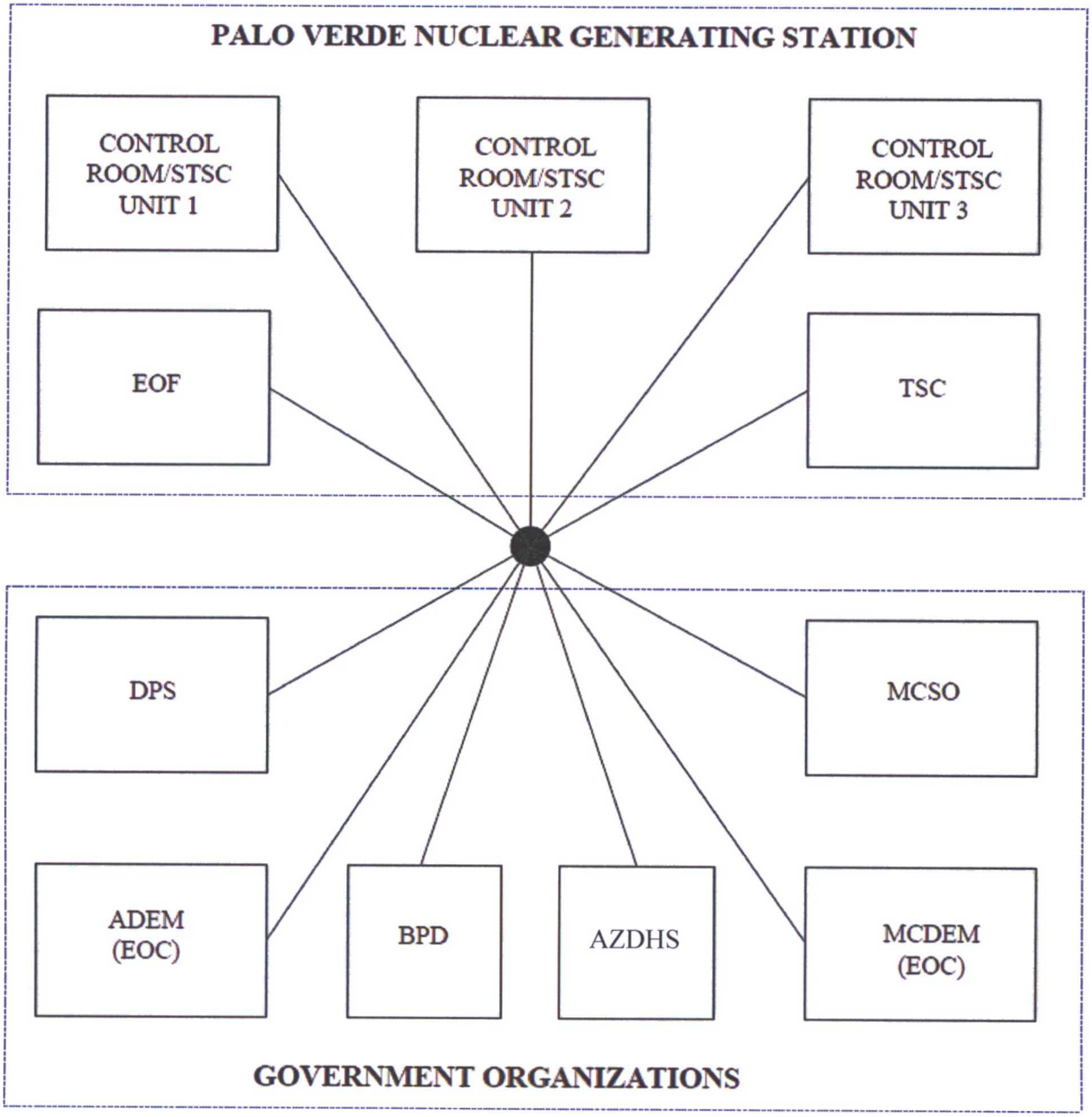

FIGURE 8 NOTIFICATION ALERT NETWORK (NAN)

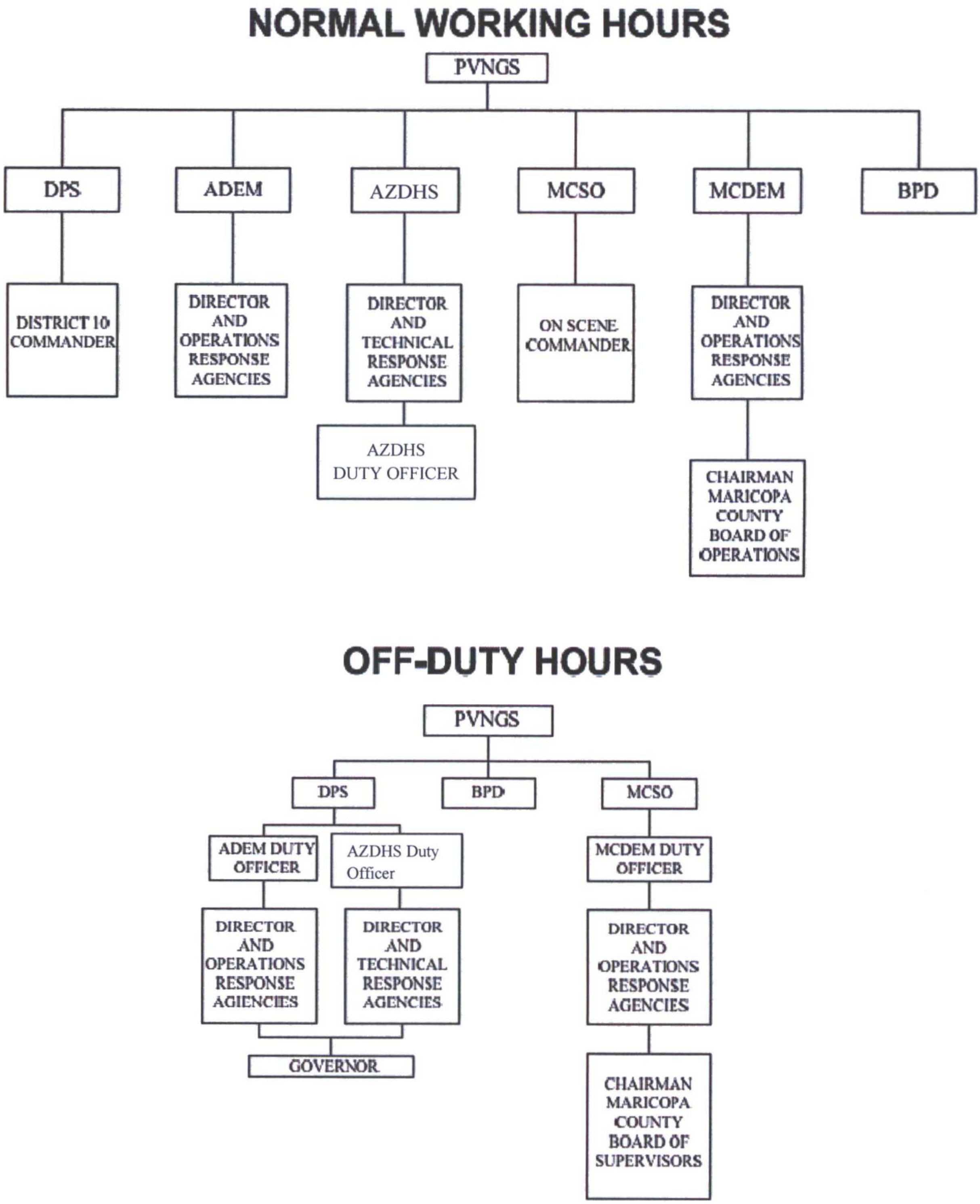

FIGURE 9 NAN NOTIFICATION FLOW

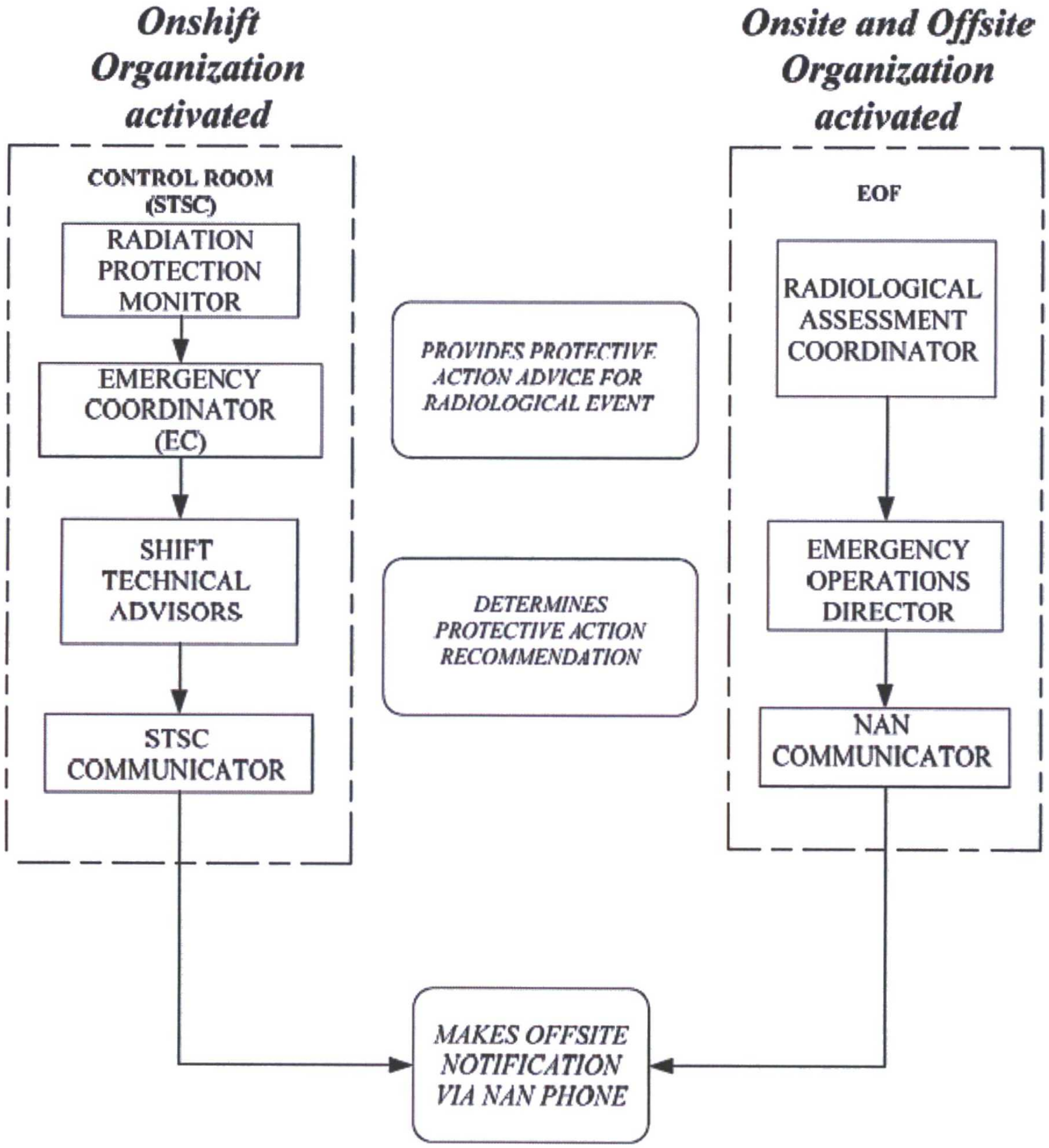

FIGURE 10 COMMUNICATIONS LEADING TO PROTECTIVE ACTION RECOMMENDATION (PAR)

7.0 EMERGENCY FACILITIES AND EQUIPMENT

This section describes emergency response facilities, onsite and offsite communications system links, assessment equipment and facilities, first aid and medical facilities, and damage control equipment.

7.1 EMERGENCY CENTERS

7.1.1 CONTROL ROOM (CR)

The CR is in the Control Building on the 140-foot level and is designed to be habitable during Design Basis Accidents. The CR, which includes the Shift Manager's office, contains full plant instrumentation, ERFDADS/SPDS, a Qualified SPDS display, and communication links as described in Table 3 and Section 7.2, and technical drawings. Protective breathing apparatus, emergency radiological monitoring equipment, and protective clothing are stored in the emergency kit outside the CR.

7.1.2 REMOTE SHUTDOWN PANEL ROOM (RSP)

An emergency requiring the evacuation of the CR results in shutdown control from the RSP. The RSP has two redundant and independent sets of plant controls. Each redundant control area has its own Radio Console and administratively dedicated phone line, as well as EPABX telephone and sound-powered phone as described in Table 3 and Section 7.2.

7.1.3 SATELLITE TECHNICAL SUPPORT CENTER (STSC)

It provides direct technical support to the CR personnel in the areas of:

- Engineering and technical analytical support
- Reactor analytical support
- Radiological analytical support

An ERFDADS/SPDS display and various communications equipment, as described in Table 3 and Section 7.2, are available in the STSC.

7.1.4 OPERATIONS SUPPORT CENTER (OSC)

The OSC is the entire 140' level of the Auxiliary Building and Operations Support Building of each unit. Emergency equipment required is stored in emergency kits in the OSC. The OSC also includes the Radiation Protection area which provides a decontamination facility, a fixed radiological counting facility, and access to the station's radiation protection records and forms. The OSC serves as the point of origin for Environmental Teams and Repair Teams. Various communications links, as described in Table 3 and Section 7.2, are available in the OSC.

In the event the OSC becomes uninhabitable, an unaffected unit OSC may be used as an alternate OSC.

7.1.5 TECHNICAL SUPPORT CENTER (TSC)

The TSC is the focal point for onsite emergency operations and for directing and assisting the Control Room during unit emergency conditions. Key station management and technical personnel are stationed at the TSC during the emergency to provide the guidance required for accident termination and mitigation.

The TSC is staffed and activated during an Alert, Site Area Emergency, or General Emergency and is located below grade immediately southwest of Bldg. "D" inside the Protected Area.

The TSC is centrally located within ten minutes walking time from the CR of each of the three Palo Verde units. The functions performed in the TSC include:

- Manage onsite emergency response
- Direct in-plant radiological protection activities
- Direct emergency maintenance
- Direct personnel accountability and site security
- Coordinate safety and hazards control through the Control Room and the Onsite Fire Dept.
- Perform engineering and technical analyses for control room support
- Perform reactor analyses for control room support
- Provide I & C technical support
- Coordinate computer technical support
- Provide chemistry technical support

The TSC has ERFDADS/SPDS computer terminals, which display CR parameters for each unit, the Radiation Monitoring System (RMS), the station meteorological system, and other parameters. Capability exists in the TSC to rapidly retrieve plant documents, drawings, procedures and plans. The TSC (when activated) is the central location for the receipt and analysis of in-plant radiological monitoring data. The TSC has various communications links available as described in Table 3 and Section 7.2. The TSC has shielding and ventilation to ensure habitability following design basis accidents.

The TSC contains an area with a microwave and refrigerator, conference room, an emergency supply storage area, and an area reserved for NRC personnel. The TSC contains equipment required for emergency response. The TSC is also equipped with an airborne radiation monitor.

In the event the TSC becomes uninhabitable, the TSC command function will operate out of the affected unit's STSC (Unit 1, if multiple units are impacted) and the support staff will be relocated to an OSC.

7.1.6 EMERGENCY OPERATIONS FACILITY (EOF)

The EOF is located approximately 20 miles east of PVNGS at 600 North Verrado Way, Building A, Buckeye, Arizona.

The EOF is the focal point for coordination of onsite and offsite emergency response activities. Management and technical personnel assigned to the EOF are responsible for protective action recommendations, liaison with offsite governmental organizations and response facilities, and overall coordination of the Emergency Organization.

The EOF has space allocated for housing emergency personnel and space for NRC, FEMA and state/county emergency personnel. The EOF has various communications links available as described in Table 3 and Section 7.2. The EOF is staffed and activated for an Alert or higher level emergency classification. The EOF also has ERFDADS data displayed through PI computer capability. The capability exists in the EOF to rapidly retrieve plant documents, drawings, procedures and plans.

7.1.7 ALTERNATIVE FACILITY

The EEC-EOF is designated as the Alternative Facility for staging of ERO personnel, in the event of a Security or Hostile Action Based threat or event. The EEC-EOF may also serve as a re-location area for TSC and OSC personnel. The Alternative Facility has the capability to communicate with the Control Room, Security and the EOF. The EOF may also be used as an Alternate facility for any event where site access is not possible i.e. Beyond Design Bases External Event (BDBEE) or FLEX event.

7.1.8 JOINT INFORMATION CENTER (JIC)

The JIC, located at 600 North Verrado Way, Building A, Buckeye, Arizona, serves as the primary point for dissemination of information to the news media representatives for an Alert or higher emergency classification level.

Provision is made at the JIC to allow media personnel to communicate with their base facilities. State, county and federal agency officials share office space with the staff at the JIC.

The communications links available at the JIC are described in Table 3 and Section 7.2.

7.1.9 PALO VERDE AND APS EXTERNAL COMMUNICATIONS DEPARTMENTS

Palo Verde Communications and APS External Communications are responsible for developing media statements and coordinating media briefings during Unusual Event classifications. At Alert and higher classification level, the JIC assumes the responsibility for this function. At Alert or Site Area Emergency classifications involving non-radiological events, Palo Verde Communications will work with the JIC to coordinate plant visits and briefings. Palo Verde Communications is equipped with EPABX telephones and fax machines for onsite and offsite communications.

7.1.10 STATE EMERGENCY OPERATIONS CENTER (STATE EOC)

The State EOC is the primary point from which the Governor/designee exercises overall coordination of offsite emergency response operations through the ADEM. The State EOC is located at ADEM Headquarters in Phoenix at 5636 East McDowell Road. Staffing of the State EOC consists of authorized representatives of:

- Office of the Governor
- Arizona Department of Emergency and Military Affairs (DEMA)
- Arizona Division of Emergency Management (ADEM)
- Arizona Department of Health Services (AZDHS)
- Arizona Department of Public Safety (AZ DPS)
- Arizona Department of Transportation (ADOT)
- Arizona Department of Economic Security (AZ DES)

- Maricopa County Department of Emergency Management (MCDEM)
- PVNGS (Utility Technical Representative)
- Others (as notified/required).

PVNGS communications links with ADEM are described in Table 3.

7.1.11 THE MARICOPA COUNTY EMERGENCY OPERATIONS CENTER (EOC)

The Maricopa County EOC is the focal point of the local government emergency response activity. It is located at 5630 E. McDowell Road, Phoenix. Emergency response actions of the Maricopa County Sheriff's Office, Health Department and Department of Transportation, together with emergency response actions of volunteer agencies, are coordinated by the MCDEM at the County EOC.

7.2 COMMUNICATIONS SYSTEMS

The PVNGS communications system is designed to ensure the reliable, timely flow of information and action directives between all parties designated and empowered to mitigate emergencies. To ensure the reliability of the communications systems, the following provisions have been designed into these systems:

- Redundancy
- Alternative radio communications
- Telephone ring down circuits (voice and data) to offsite emergency organizations, to preclude delays due to system overload
- Routine use of many of the systems, which lowers the probability of undetected system failures

Communication systems are tested at the frequency specified by 10 CFR 50 Appendix E, as a minimum. Onsite emergency telephone lines are divided among three onsite EPABX switches. Each EPABX switch is provided with a backup battery for reliability.

This system will function during emergencies as it does during normal operations. Telephones have the capability of trunk access (via local provider) and the APS owned private communications system which provides direct dial capabilities to the entire APS voice system via the company owned private communications system. The PVNGS telephone EPABX Systems through which all PVNGS telephone calls pass, are equipped with uninterruptible power supplies (battery chargers and batteries) and dedicated priority switching to ensure the reliability of the telephone system. The PVNGS EPABXs are the primary links for PVNGS phones. There are also administratively dedicated lines for the CR, STSC, TSC, EOF, and OSC.

The CR, TSC, and OSC each have dedicated phone lines that can be used to connect between any two of the facilities. In addition, each of these facilities can use these dedicated lines to connect to the following dedicated phones for the listed EOF positions:

• Radiological Assessment	Coordinator Environmental Assessment Line
• Radiological Assessment	Coordinator Control Room Line
• Engineering Director	Technical Line
• Admin and Logistics Coordinator	OSC Line
• Radiological Assessment Communicator	TSC Line

Each of the phones on the dedicated lines also functions as a normal in-plant PVNGS phone. These lines are discussed in more detail in the applicable subsections that follow.

The EC/EOD Line, Maintenance Line, and Radiological Line are administratively dedicated lines that are also available for use in an emergency and are discussed in the subsections that follow. The phones listed below consist of single line and multi-line phones. The multiline phones are equipped with a power fail line and a PBX line.

7.2.1 CONTROL ROOM LINE

The Control Room Line has a dedicated primary line providing communications links with conference capability between the Control Room, the TSC, the Unit STSC, the EOF, the OSC, and the RSP.

7.2.2 ENVIRONMENTAL ASSESSMENT LINE

The Environmental Assessment Line has a dedicated primary and backup line providing communications links with conference capability between the TSC, EOF, the Unit and the RSP.

7.2.3 EC/EOD LINE

The EC/EOD line has a separate dedicated primary line with conference capability among the EOF, TSC, the Unit, and the RSP.

This line provides a communications link between the ECs. It also permits three-way conversations between the EC-TSC, EOD and the Shift Manager.

7.2.4 EOF LINE

The EOF Line has a dedicated primary line providing communications links with conference capability between the EOF, the Control Room, the TSC, the Unit STSC, the OSC, and the RSP.

7.2.5 MAINTENANCE CONTROL LINE

The Maintenance Control Line has a dedicated primary line providing a communications link with conference capability between the TSC, OSC, Control Room, and RSP.

7.2.6 OSC LINE

The OSC Line has an administratively dedicated primary line providing communications links with conference capability between the OSC, the Control Room, the TSC, the Unit STSC, the EOF, and the RSP.

7.2.7 RADIOLOGICAL LINE

The Radiological Line has a dedicated primary line providing communications links with conference capability between the RP Office, TSC, the Unit, the OSC, and the RSP.

7.2.8 STSC LINE

The STSC Line has a dedicated primary line providing communication links with conference capability between the Unit STSC, the Control Room, the TSC, the EOF, the OSC, and the RSP.

7.2.9 TECHNICAL LINE

The Technical Line has a dedicated primary line providing communications links with conference capability between the TSC, the Unit STSC, the EOF, the RSP, and the Control Room.

7.2.10 TSC LINE

The TSC Line has an administratively dedicated primary line providing communications links with conference capability between the TSC, the EOF, the Control Room, the Unit STSC, the OSC, and the RSP.

7.2.11 REMOTE SHUTDOWN PANEL (RSP) LINE

The RSP Line has an administratively dedicated primary line providing communications links with conference capability between the TSC, the EOF, the Control Room, the Unit STSC, and the OSC.

7.2.12 NRC EMERGENCY NOTIFICATION SYSTEM (ENS)

The NRC ENS is a Federal Telecommunications System (FTS) telephone that connects PVNGS with the NRC Headquarters Operations Center. NRC Headquarters has the capability to patch in the Region IV office on this line. It is to be used for reporting emergencies. Commercial telephone lines are available as backup communications. Transmittal of operations related data should be on this system. The purpose of this line is to provide reliable communications with the NRC. The ENS phones are located at each Unit STSC, the TSC, and the EOF.

7.2.13 NRC HEALTH PHYSICS NETWORK (HPN)

The NRC HPN is a Federal Telecommunications System (FTS) telephone that connects PVNGS with the NRC Headquarters Operations Center. The HPN is designed to provide health physics and environmental information to the NRC in the event of an emergency. Other commercial telephone lines are available as backup communications. The HPN phones are located in both the TSC and EOF.

7.2.14 NRC LOCAL AREA NETWORK (LAN)

The NRC has a data link available as part of the FTS network in the EOF and TSC. The lines are tested by PVNGS and maintained by the NRC.

7.2.15 NRC MANAGEMENT COUNTERPART LINK (MCPL)

The MCPL is a dedicated NRC communication link between the NRC in the EOF, TSC and NRC Headquarters personnel. The lines are tested by PVNGS and maintained by the NRC.

7.2.16 NRC PROTECTIVE MEASURES COUNTERPART LINK (PMCL)

The PMCL is a dedicated NRC communication link between the NRC in the EOF, TSC, and NRC Headquarters personnel. The lines are tested by PVNGS and maintained by the NRC.

7.2.17 NRC REACTOR SAFETY COUNTERPART LINK (RSCL)

The RSCL is a dedicated NRC communication link between the NRC in the EOF, TSC, and NRC Headquarters personnel. The lines are tested by PVNGS and maintained by the NRC.

7.2.18 EOD/CEO (FIBER OPTIC)

The EOD/CEO circuit is a fiber optic link between the EOF/JIC and the APS Executive Floor Corporate.

7.2.19 NOTIFICATION ALERT NETWORK (NAN)

NAN is a dedicated telephone/radio system that provides a communications link among the Unit STSCs, TSC, EOF, ADEM, AZDHS, MCDEM, MCSO, DPS, and Buckeye Police Dept.

NAN's primary function is to provide a communications link for notifications to offsite agencies. In the event of NAN failure, a channel on the APS Corporate radio system or the commercial phone lines is used to make initial notifications.

7.2.20 OPERATIONS #1 (HARDWIRED)

The Operations #1 circuit is a hardwired ring-down line with connections to the ADEM, AZDHS, EOF, Unit STSC and the TSC.

7.2.21 OPERATIONS #2 (HARDWIRED)

The Operations #2 circuit is a hardwired ring-down line with connections to the ADEM, the EOF, and the TSC.

7.2.22 OPERATIONS #3 (FIBER OPTIC)

The Operations #3 circuit is a fiber optic ring-down line with connections to the ADEM, the EOF, and the TSC.

7.2.23 OPERATIONS #4 (FIBER OPTIC)

The Operations #4 circuit is a fiber optic ring-down line with connections to the ADEM, the AZDHS, the EOF, and the TSC.

7.2.24 PUBLIC INFORMATION RING-DOWN CIRCUIT #1

The PI #1 circuit is an intercom link from the EOF to the JIC.

7.2.25 PUBLIC INFORMATION RING-DOWN CIRCUIT #2

The PI #2 circuit is an intercom link between the EOF to the JIC.

7.2.26 CELLULAR PHONE

ERO Responders assigned to each STSC, the TSC, and the EOF have a company provided cellular phone to provide an additional independent line of communication. In addition, each STSC, the TSC, and the EOF have a cellular phone to provide an additional independent line of communication.

7.2.27 FACSIMILE TRANSMISSION

Facsimile transmission provides “hard copy” communications to:

- TSC (through PVNGS EPABX)
- EOF
- Ring-down Facsimile Machine Circuits #1 (Fiber Optic) and #2 (Hardwire) link the EOF, TSC, STSCs, JIC, ADEM, AZDHS and APS Corporate Offices.

7.2.28 PVNGS RADIO SYSTEM

PVNGS operates a trunked radio system, with separate talk groups available for departments such as Operations, Security, Fire Protection, Radiation Protection, Emergency Preparedness, the Water Reclamation Facility, etc. This system includes base station consoles at various locations and emergency facilities throughout the site. Some of the radios used during emergencies are portable radios at various site locations, mobile radios in the RFAT vehicles, and base station consoles at the TSC, EOF, Unit OSCs, Unit, and Unit Control Rooms. PVNGS Fire Protection also maintains radios that are used to contact the air ambulance service to provide landing instructions.

7.2.29 TELEPHONE RINGDOWN CIRCUITS

These voice circuits serve as a primary communications link for providing technical information to offsite agencies, public information communications, and the communication of protective action recommendations to offsite authorities.

7.2.30 RADIOLOGICAL EMERGENCY ASSISTANCE TEAM (REAT) RADIO SYSTEM

The APS Corporate 800 MHZ Radio system provides a communications link between the State and State deployed field monitoring teams. Field monitoring information will be transmitted over the radio system. The State's EOF representative has access to the 800 MHZ radio system from the EOF. Hard copy of data is transmitted via FAX from the EOF to REAT Forward.

7.2.31 MOBILE DEVICES

Mobile devices are provided to key members of the emergency response organization. This provides a reliable means of contact with key members 24 hours a day, 7 days a week.

7.2.32 AREA PAGING SYSTEM

The area paging system provides a reliable means of notifying and providing instructions to personnel. Access to this system is through the EPABX system telephones by use of dedicated numbers.

7.2.33 ALARMS

Audible alarms are a quick and effective means of communicating emergency warnings. The alarm systems are described in the following sections.

7.2.33.1 Emergency Evacuation Alarm System/Public Address System/Area Paging System

The Emergency Site Evacuation Alarm System consists of pole-mounted electronic outdoor warning sirens. They are located outside each power block and are provided to alert personnel within the security boundaries of PVNGS. These sirens are initiated from a siren command module in each unit's control room. A microphone is provided to permit announcements over this system. Accountability/evacuation is assured in high noise work areas (>95 dB) by use of audible alarms, flashing lights and/or administrative measures.

The Public Address (PA) System consists of sirens and speakers that serve to alert personnel within a unit area. The Emergency Evacuation Alarm System consoles in the control rooms are used to send announcements to the PA system. Telephones located inside and outside of the power block may also send announcements to the PA system. The Public Address System also has voice capability using microphone in each control unit, and is cross- connected to the Area Paging System to permit site-wide announcements.

There are distinct signals provided for assembly, evacuation, fire and all-clear.

7.2.34 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) WEATHER BROADCASTS

Weather broadcasts can be monitored for “weather alert” information at CR, TSC and EOF.

7.2.35 AUTOMATED CALLOUT

An automated callout system is used to call out emergency response personnel. The system can also be activated from any touch tone telephone with offsite access capability. The servers are located offsite at two different remote locations and can place multiple calls simultaneously. Telephone numbers to be contacted and notification messages are pre-programmed on the system. If proper acknowledgment does not occur, the system periodically redials the number.

7.2.36 ADDITIONAL OFFSITE COMMUNICATION LINKS

Communication Links in Addition to Those Described Above Include:

- Public Information Unlisted Dial-up Telephone Circuit – ADEM to JIC
- High speed internet connections – JIC
- Public Information Unlisted Dedicated Dial-up Facsimile Machine Circuit #2 – ADEM to JIC
- PVNGS Emergency Alert System (EAS) Ring-down Telephone Circuit – hardwire from MCDEM and MCSO to AM Broadcast Station KTAR and to FM Broadcast Station KPKX
- Public Information Unlisted Dedicated Dial-up Telephones – JIC (4 general circuits)
- Public Information Unlisted, Receive-only Telephone Circuits – JIC (6 circuits
- Public Information Media Dial-up Telephone Circuits – JIC (30 circuits)
- Unlisted Dedicated Dial-up Facsimile – ADEM (EOC) to MCDEM
- Public Information Unlisted Dial-up Telephone Circuit – JIC to MCDEM
- ADEM Business Dial-up Telephone – ADEM general use (24 circuits), ADEM Public Inquiry (3 circuits)
- Public Information Unlisted Dial-Up Facsimile Machine Circuit – MCDEM to JIC

Facility	Communication and Date Links			
Control Room	EOF Line	Maintenance Line	OSC Line	RSP Line
	STSC Line		Technical Line	TSC Line
	Radio Base Station	ENS	ERFDADS	Fax
STSC	Control Room Line	Environmental Line	EC Line	EOF Line
	OSC Line	Radiological Line	Technical Line	TSC Line
	RSP Line	NAN Line	Ops #1	Ops #3
	Cellular Phone	ERFDADS	Fax	Radio Base Station
Technical Support Center	Control Room Line	Environmental Line	STSC Line	EOF Line
	Maintenance Line	OSC Line	Radiological Line	EC/EOD Line
		Technical Line	RSP Line	ENS
	NAN Line	Ops #1	Ops #2	Ops #3
	Ops #4	Radio Base Station	HPN	LAN (NRC)
	MCPL (NRC)	PMCL (NRC)	RSCL (NRC)	ERFDADS
	Fax	Cellular Phone		
Operations Support Center	Control Room Line	EOF Line	Maintenance Line	STSC Line
	Radiological Line		TSC Line	RPS Line
Emergency Operation Facility	Control Room Line	Environmental Line	EC/EOD Line	OSC Line
	STSC Line		Technical Line	TSC Line
	RSP Line	HPN (NRC)	ENS (NRC)	LAN
	MCPL (NRC)	PMCL (NRC)	RSCL (NRC)	EOD/CEO Line
	NAN Line	Ops #1	Ops #2	Ops #3
	Ops#4	Public Info #1	Public Info #2	Cellular Phone
	ERFDADS via PI	Fax	Radio Base Station	REAT Radio
Joint Information Center	EOD/CEO Line	Public Info #1	Public Info #2	Fax
Remote Shutdown Panel	Control Room Line	Environmental Line	EC/EOD Line	EOF Line
				Sound-powered phone
	Maintenance Line	OSC Line	Radiological Line	STSC Line
		Technical Line	TSC Line	Radio Base Station
ADEM	NAN Line	Ops #1	Ops #2	Ops #3
	Ops #4	Fax	REAT Radio	Radio Base Station
AZDHS	NAN Line	Ops #1	Ops #4	Fax
	REAT Radio	Radio Base Station		
DPS	NAN Line	Radio Base Station		
MCDEM	NAN Line	Radio Base Station		
MCSO	NAN Line	Radio Base Station		
Buckeye PD	NAN Line	Radio Base Station		

TABLE 3 EMERGENCY RESPONSE FACILITY COMMUNICATIONS

7.3 ASSESSMENT EQUIPMENT

This section describes onsite and offsite facilities and monitoring equipment used for initial and continuing assessment.

7.3.1 ONSITE SYSTEMS AND EQUIPMENT

Onsite equipment is described below.

7.3.1.1 GEOPHYSICAL DATA

(1) Meteorology Program

The PVNGS meteorology atmospheric transport and diffusion assessment program has been established using the guidance of NUREG-0654 and Regulatory Guide 1.23, Rev. 0. The PVNGS meteorological tower has the following instrumentation: temperature, differential temperature (between top and bottom sensors), precipitation, dew point, wind speed, and wind direction. Display of meteorological indications is available in the Control Room on ERFDADS. MET data is available in the TSC, the Units STSC, and the EOF. In the event the PVNGS meteorological monitoring system is unavailable, National Weather Service broadcasts can be monitored from the Control Rooms, EOF, and TSC. Meteorological data can be obtained from the National Weather Service in the event that PVNGS instrumentation is insufficient or out of service during an emergency.

(2) Seismic Instruments

Information is obtained from passive and active instruments giving absolute peak ground acceleration in three mutually orthogonal directions. The system determines whether operating basis or safe shutdown maximum accelerations are exceeded in any of three directions. Recorded information is available in the Unit 1 Control Room.

7.3.1.2 RADIATION MONITORING SYSTEMS (RMS)

The Radiation Monitoring System is divided into three basic groups of detector systems.

(1) Process Monitoring System

Process monitors provide information to Control Room operators to assure proper functional performance of the monitored system, provide for the early detection of radioactive leakage into non-radioactive systems, provide continuous remote indication and recording of airborne radioactivity levels in areas where personnel have routine access, and provide a means of process sample collection.

(2) Effluent Monitoring System

The Effluent Monitoring System provides continuous sampling, recording and indications of gaseous activity levels and, as a minimum, provides continuous representative sampling of particulate and radioiodine activity levels at principal effluent discharge points, provides for monitoring, alarm annunciation, and automatic closure of the gaseous waste discharge valve to maintain releases from the waste gas decay tanks below ODCM limits, provides radiation level indication and alarm annunciation to Control Room operators whenever Technical Specification limits are approached or exceeded, and provides a means for collection of samples for laboratory analyses at effluent points.

(3) Area Monitoring System

The area monitoring system immediately notifies plant personnel entering or working in non-radiation or low-radiation areas of abnormally high or increasing radiation levels to prevent inadvertent overexposure, and informs Control Room Operators of the occurrence and location of abnormal radiation level increases in non-radiation or low-radiation areas.

7.3.1.3 SYSTEM MONITORS

These monitors detect and/or control problems within plant systems and include pressure detectors, heat detectors, heat rise detectors, or similar devices designed to monitor plant parameters. Many of these detectors are capable of initiating control actions to prevent and mitigate damage or release of radioactive material.

7.3.1.4 FIRE PROTECTION SYSTEM

The Fire Protection System (FPS) and Fire Suppression System (FSS) detect, contain, and extinguish fires in the unit. The FPS for each unit has monitoring, detection, alarm, suppression, and extinguishing facilities specifically selected to protect the area or equipment from damage by fire. A computer terminal is provided in the Control Room of each unit for incoming FPS/FSS alarms (including identification of affected areas and suppression actions initiated by the FSS system).

7.3.1.5 RADIOACTIVITY ANALYSIS

Liquid samples are drawn in the individual Units via the Nuclear Sampling System. A built-in sample bomb is in each primary sample sink. Containment air samples are taken via Containment Air Monitor XJSQBRU0001**INTCPM.

Grab samples are drawn and diluted as necessary, utilizing procedural direction to minimize operator dose. The grab samples are analyzed in the radiochemistry laboratory via a gamma energy analytical detector system.

In the event the affected unit cannot perform the analysis, backup analysis is done in one of the unaffected units. The Arizona Department of Health Services is equipped to do isotopic analysis as an offsite backup to PVNGS capabilities.

7.3.1.6 PORTABLE SURVEY INSTRUMENTS

These instruments provide flexibility and backup capability for radiation measurements in areas not served by installed monitors, or where installed monitors may be inoperative.

7.3.1.7 EMERGENCY RESPONSE FACILITY DATA ACQUISITION AND DISPLAY SYSTEM (ERFDADS)

The ERFDADS provides a centralized location within the CR for display of plant parameters from which the safety status of operations can be assessed.

Displays of data, including graphical displays, available on demand include plant temperatures, pressures, and flow rates; equipment and valve status, i.e., on, off, open, closed; process and area RMS readings; meteorology system data; and in-core parameters.

In addition to the above parameters, the SPDS portion of ERFDADS contains a graphical display which provides immediate indication of deviation from safe operating values. From this display, additional specific data concerning the system in question is accessed on demand. The ERFDADS is designed to include the data acquisition system requirements of NUREG-0696. ERFDADS displays are available at each Unit Control Room, each Unit STSC and the TSC. ERFDADS displays are available in the EOF via PI displays.

7.3.1.8 PORTABLE SURVEY INSTRUMENTS

The QSPDS is designed to provide indications to detect the approach to, the existence of, and the recovery from inadequate core cooling. It also provides a minimum set of seismically qualified parameters from which abnormal plant operating conditions may be quickly assessed.

7.3.1.9 EMERGENCY RESPONSE DATA SYSTEM (ERDS)

The ERDS is a direct electronic transmission system to NRC Operations Center. The system is intended to provide to the NRC, on a near real-time basis, selected parameters from plant computer systems whose values indicate the condition of the plant during an emergency condition of Alert or higher. ERDS is tested quarterly to verify system availability and operability.

Any hardware or software changes that affect the transmitted data points identified in the ERDS data point library, must be submitted to the NRC within 30 days after changes are completed. Hardware or software changes that could affect the transmission format and computer communication protocol to the ERDS must be provided to the NRC as soon as practicable and at least 30 days prior to the modification.

7.3.2 OFFSITE SYSTEMS AND EQUIPMENT

The Offsite Dose Calculation Manual (ODCM) refers to the location of the environmental radiological monitoring sampling stations, as well as Thermoluminescent Dosimeter (TLD) stations. Environmental samples routinely collected and analyzed include: water, vegetation, food products and milk. Backup and cross-check environmental surveillance are performed by AZDHS.

7.4 PROTECTIVE FACILITIES AND EQUIPMENT

Control Room shielding and ventilation allow personnel habitability during Design Basis Accident conditions. The TSC has shielding and ventilation similar to the CR for habitability during an incident. Communications equipment, respiratory protection equipment and protective clothing are available in, or near the CR, STSC, TSC, and OSC. Portable radiation monitoring instrumentation is located near the unit RP Islands.

7.5 FIRST AID MEDICAL FACILITIES

A first aid treatment center is maintained onsite. In addition, a first aid room is located in each unit at the 140-foot level of the Auxiliary Building. First aid treatment of injured individuals is administered by trained personnel. Advanced medical care, if required, is obtained by transporting the individuals to an offsite medical facility.

7.6 DAMAGE CONTROL EQUIPMENT AND SUPPLIES

Fire hose stations, extinguishers and hydrants are strategically located throughout the station for use in fire. PVNGS maintains self-contained breathing apparatus storage areas throughout station to be used for firefighting, entry into airborne radioactivity areas, or entry into toxic gas areas.

7.7 PROMPT NOTIFICATION SIREN SYSTEM

PVNGS maintains the Prompt Alert and Notification Systems as approved by FEMA in the PVNGS Alert and Notification System (ANS) FEMA 350 Report.

The Prompt Notification Siren System consists of high sound output sirens located throughout the 10-mile Plume Exposure Pathway Emergency Planning Zone. Its operation is at the discretion of the state and county governmental agencies responsible for notification and alerting of the public. This system alerts the people within the 10-mile EPZ to monitor radio or TV emergency broadcasts for specific information regarding the situation at PVNGS and/or protective actions. This system is operated from any of the four control point locations:

- Maricopa County Emergency Operations Center
- Arizona Department of Public Safety
- Maricopa County Sheriff’s Office
- Building “E”

Normally the sirens are activated from the Maricopa County Emergency Operations Center or from the Maricopa County Sheriff's Office. The system is tested periodically to ensure its readiness.

In the event of a failure of the Prompt Notification System, a FEMA approved backup notification method is available and is implemented by Offsite Response Organizations.

8.0 MAINTAINING EMERGENCY PREPAREDNESS

8.1 ORGANIZATIONAL PREPAREDNESS

The emergency preparedness program consists of (1) ERO training, (2) drills and exercises, and (3) regular emergency plan review and evaluation by personnel and management.

8.1.1 TRAINING

The Emergency Response Training Program ensures that personnel who are in the emergency response organization are familiar with the contents and responses in the Emergency Plan and associated implementing procedures. The Emergency Preparedness Manager is responsible for ensuring that the Emergency Response Training Program meets the requirements of the Plan.

Personnel assigned key duties in the Emergency Response Organization receive initial training and annual continuing training.

New personnel or existing ERO members assigned to fill an ERO position in which they have not previously qualified, complete initial and continuing training for that position.

Emergency Preparedness Training is developed using a process similar to that described within the Nuclear Training Department Administrative Procedures or other approved training program guidance.

As necessary, additional continuing training of individuals should be conducted when significant changes to the Emergency Preparedness Program occurs as determined by the Emergency Preparedness Manager and the Nuclear Training Department Leader.

The Emergency Response Training Program includes specific training and indicates, where applicable, qualification requirements for key members of the Emergency Organization.

Evaluated training drills and evolutions provide for critiques in order to identify weak or deficient areas. Weaknesses or deficiencies that are identified are corrected.

Training for the Emergency Preparedness Staff is completed in accordance with Emergency Preparedness Department processes.

8.1.1.1 Site Access Training for Emergency Preparedness

Personnel requiring unescorted access into the Protected Area(s) receive general instructions on the Emergency Plan prior to receiving unescorted access. Reinforcement of the actions to take in the event of an emergency are conveyed throughout the year via periodic updates (e.g., department meetings, electronic display signs, posters and security badge information cards).

8.1.1.2 Specialized Training for Key Emergency Organization Personnel

Specialized training is provided annually to key personnel involved in emergency response actions. This special training includes instruction and review in the technical and practical aspects of emergency response actions.

In addition to training, drills and exercises are conducted to develop and maintain emergency response skills. Specialized training for designated ERO position categories is listed below.

<u>Directors and/or Coordinators of the Plant Emergency Organization</u>

Initial training to provide for classification and notification processes and requirements. Continuing training to provide program/procedure/equipment change and industry events updates.

<u>Personnel Responsible for Accident Assessment, Including CR Shift Personnel</u>

Initial training to provide accident identification, appropriate procedural responses and support organization activity on criteria. Continuing training provides program/procedure/equipment change and industry events updates.

<u>Radiological Monitoring Teams</u>

Initial training to provide for emergency radiological monitoring procedures, techniques and emergency communications. Continuing training to provide program/procedure/equipment change and industry events updates.

Fire Control Teams (Fire Brigades)

Fire Control Teams (Fire Brigades) PVNGS utilizes a full time onsite Fire Department. Fire personnel are trained in fire and medical emergency response in accordance with the Fire Protection Program. Additionally they are provided training in basic radiological control concepts. Continuing training to provide program/procedure/equipment change and industry events updates.

Repair and Damage Control Teams

Initial training provides for emergency radiological and industrial safety, communications. Continuing training to provide program/procedure/equipment change and industry events updates.

First Aid and Rescue Teams

PVNGS utilizes a full time onsite Fire Department. Fire personnel are trained in fire and medical emergency response in accordance with the Fire Protection Program. Additionally they are provided training in basic radiological control concepts. Continuing Training to provide program/procedure/equipment change and industry events updates.

Medical Support Personnel

Initial training of medical support personnel in addition to Fire Department personnel provided with basic radiological control concepts. Onsite medical staff, excluding administrative support personnel, receives training similar in content to that which is provided to offsite hospitals. Continuing Training to provide program/procedure/equipment change and industry events updates.

Licensee's Headquarter Support Personnel

Some headquarters support personnel respond to the Joint Information Center. These personnel receive initial training prior to qualification. Continuing training is provided on an annual basis.

Security Personnel

Emergency response training is incorporated into the initial Member of the Security Force training received by new security force members during initial qualifications. Additional initial training is provided to Security members assigned to staff positions within the Emergency Response Facilities in support of Emergency Preparedness. The additional training includes lines of communication with offsite support organizations as well as logistics support. Continuing training to provide program/procedure/equipment change and industry events updates.

Offsite Organization Training

As appropriate, training for the members of selected offsite support organizations shall occur on an annual basis.

Briefings are specific to the agencies response assignment(s) and, at a minimum, include the following:

- Basic radiation protection
- Emergency response procedures
- Interface with the PVNGS Emergency Response Organization

Lesson Plans and examinations are not required for offsite support organization training. PVNGS maintains records associated with offsite support organization training. A radiological orientation training program is made available to local services personnel; e.g., local emergency services/MCDEM, local law enforcement personnel, local news media persons.

8.1.1.3 Training for Participating Agencies

Training for participating agencies is provided by the individual agencies. Training personnel are available to describe the special conditions and constraints involved in dealing with PVNGS emergency radiological release situations. Radiological orientation continuing training is available annually for local services personnel, including local news media personnel.

8.1.1.4 Public Education

PVNGS, ADEM, AZDHS, and MCDEM jointly prepare an educational calendar for distribution to the public within the Plume Exposure Pathway EPZ. The calendar is mailed annually to residents within a 10-mile radius of the station, using postal procedures that ensure maximum distribution. The calendar outlines, in lay language, the station's operational concept, lists the various classifications of emergencies, summarizes the emergency plan developed to safeguard the general public, reviews appropriate protective actions including Potassium

Iodide (KI), and indicates public warning signals. The calendar also contains material on radiation, contacts for additional information and means for advising governmental authorities about special needs of EPZ residents.

In addition to this written material, PVNGS conducts public information seminars and meetings as needed or requested with local groups within the 10-mile EPZ. Local groups may be invited to participate in drills and exercises to maintain emergency preparedness and to test specific segments of emergency plans and procedures that are affected by, or may affect, 10-mile EPZ residents.

Methods are also established to provide emergency and protective information to the transient population within the PVNGS 10-mile EPZ. Inserts are placed in telephone books. Information is posted in local stores, businesses, schools, churches, post offices, truck stops, and recreational vehicle parks.

8.1.1.5 Media Familiarization

Annual programs are provided to acquaint media personnel with the PVNGS Emergency Plan, information concerning basic nuclear plant operation and radiation, and the locations and means employed to disseminate public emergency information.

8.1.1.6 Documentation

All emergency preparedness training is documented and training records are maintained in accordance with established procedures.

8.1.2 EXERCISES

PVNGS conducts drills and exercises over a wide range of accident conditions that tests a major portion of the basic elements existing within the emergency plan and supporting organizations. Exercises shall test the adequacy of timing and content of implementing procedures and methods, test emergency equipment and communications networks, test the public notification system, and ensure that emergency organization personnel are familiar with their duties.

The scenarios for the drills and exercises are diverse and include a wide spectrum of radiological conditions and events including hostile actions. The scenarios used over the eight year cycle will be sufficiently varied to ensure that essentially all of the emergency action levels are included in performance enhancing drills or exercises. To the extent practical, initiating conditions and failed equipment should be varied to minimize preconditioning of the emergency response organization.

No more than one EAL should be shared with the previous exercise or any practice drill or exercise leading up to the biennial exercise. Drill scenarios should not be used for any biennial exercise within two years. To the extent practical, scenario should be held in confidence from the participating ERO team members until after the exercise. While an ERO team may be aware of the nature of the upcoming drills (i.e. hostile action based exercise), the specific elements of the drill should be held in confidence and the initiating event varied so the same conditions are not used from the practice to evaluated exercise.

Joint participation exercises between PVNGS and the offsite response agencies are conducted to ensure the appropriate integration of the emergency plans and identify areas of weakness and opportunities for improvement. A post drill or exercise critique is conducted to aid in the identification of weaknesses and improvement opportunities. Consistent with NRC and FEMA regulation, a full participation exercise is conducted once every two years, PVNGS, the State of Arizona (ADEM and AZDHS) and Maricopa County will jointly exercise their emergency plans. The full participation biennial exercise is evaluated by the NRC and FEMA and is used in determining reasonable assurance that PVNGS and the supporting offsite emergency plans can protect the health and safety of the public, plant staff and emergency workers. The biennial exercises are varied over the eight year period (starting with the year of the first hostile action exercise in 2015) to include the following:

- Hostile action directed at the plant site involving the integration of offsite resources with onsite response; (See RCTSAI 2831902 and contact Reg. Affairs for any change to this commitment.)
- An initial classification of, or rapid escalation to, a Site Area Emergency or General Emergency;
- No radiological release or an unplanned minimal radiological release that requires the site to declare a Site Area Emergency, but does not require declaration of a General Emergency.
- Ingestion Pathway Exercise

PVNGS will submit the scenario used for the biennial exercise to the NRC in accordance with 10CFR50.4 sixty (60) days before its use in a full scale biennial exercise. The scenario will be held in confidence until after the exercise is completed. PVNGS will maintain adequate records to demonstrate the exercises and scenarios used over the eight year exercise cycle.

Each biennial exercise conducted by PVNGS will include the opportunity to demonstrate the following key skills:

- Timely classification of events;
- Timely notification of offsite authorities;
- Assessment of radiological releases onsite and offsite;
- Development of protective action recommendations;
- Dissemination of information to the public via media channels;
- Engineering assessment, repair plan development, and repair of critical equipment under emergency conditions;
- Mitigative action implementation;
- Protection of workers during emergency response, including medical care;
- Response to operational transients while implementing the emergency plan;
- Coordination with offsite response organizations.

Each biennial exercise at PVNGS will include the following elements at a minimum:

- Event classification.
- Timely notification of offsite authorities.
- PAR development (development of PARs involving public evacuation or sheltering is required only in exercises that include a General Emergency).
- Radiological assessment.
- Shift staff response to accident transients or other events that meet EAL criteria while implementing the emergency plan.
- ERO response and ERF activation following declared emergencies.
- Integration of licensee response with OROs to include briefings, coordination of worker protection, and, as appropriate to the scenario, coordination of public protective actions, radiological release monitoring, and offsite response to the site.
- Communications that support response between onsite and offsite ERFs.
- Dissemination of information to the public via media channels and press briefings.
- Development and implementation of radiological or physical protection (i.e., in response to hostile action) protective actions for onsite workers as appropriate to the scenario.
- Operational and engineering assessment of accident sequences.

- Accident mitigation through the simulated repair of equipment.
  - This must include mechanical, electrical, and/or instrumentation and control activities.
  - The scenario should be designed to allow some repairs to be successful, but must provide the opportunity to demonstrate mitigation planning and repair execution.
- Radiological control activities must support some repair teams.

In addition to the biennial exercise, PVNGS conducts a partial scale off year exercise that involves an integrated testing of the key emergency response facilities. The off year exercise may also be a full scale exercise not evaluated by FEMA or NRC. During the off year exercise, the offsite response organization will be encouraged to participate in order to maintain key ERO skills between the onsite and offsite organization.

The principal functional areas of emergency response include activities such as management and coordination of emergency response, accident assessment, event classification, notification of offsite authorities, and assessment of onsite and offsite impact of radiological releases, protective action recommendation development, protective action decision making, plant system repair and mitigative action implementation.

During routine drills, activation of all of the PVNGS emergency response facilities (Technical Support Center (TSC), Operations Support Center (OSC), and the Emergency Operations Facility (EOF)) would not be necessary, PVNGS may use these drills for the opportunity to consider accident management strategies, supervised instruction, operating staff in all participating facilities would have the opportunity to resolve problems (success paths) rather than have controllers intervene, and the drills may focus on the onsite exercise training objectives in lieu of a broader set.

The PVNGS ERO shall be provided the opportunity to develop and maintain key emergency response skills in response to the following scenario elements during the conduct of biennial exercises over the course of the eight year exercise cycle:

- Response to hostile action, including interface with LLEAs.
  - Hostile action scenarios should realistically include collateral damage that may occur (e.g., loss of offsite power and loss of use of certain onsite facilities and areas).

- Engineering assessment, repair plan development, and simulated repair of critical equipment damaged by hostile action after the active attack, but before the site is fully secured by LLEAs.
- Prioritization of repair team dispatch and protection in the aftermath of hostile action through coordination with site security and LLEAs to determine when the site is secure enough to allow limited movement of personnel.

- Response to one scenario with no radiological release or an unplanned minimal radiological release that does not require evacuation or sheltering of the public.
- Response to scenarios with radiological releases that require evacuation and/or sheltering of the public.
- Response to a scenario that begins with a Site Area Emergency or General Emergency, or escalates rapidly (within 30 minutes) to a Site Area Emergency or General Emergency.
- The successful simulated repair of simulated damaged equipment to prevent or mitigate core damage, reactor pressure boundary loss, and/or containment loss.
- Demonstration of the ability to mitigate an accident caused by hostile action or other initiators, through the simulated use of equipment, procedures, and strategies developed in compliance with 10 CFR 50.54(hh)(2).

All PVNGS ERO teams (not necessarily each individual) shall be provided the opportunity to develop and maintain key emergency response skills within the scope of their duties during each exercise cycle. Additionally, the ERO (not necessarily each ERO team) shall be provided the opportunity to demonstrate key skills in response to the following scenario elements in drills or exercises during each exercise cycle. Drills are considered to be performance-enhancing experiences (exercises, drills, functional drills, tabletop drills, mini-drills, etc.) that reasonably simulate the interactions between appropriate ERFs and/or individuals that would be expected to occur during emergencies.

- All functions in each ERF (e.g., all ERFs that are responsible for dose assessment perform those duties in response to a radiological release).
- Use of alternative facilities to stage the ERO for rapid activation during hostile action.
- Real-time staffing of facilities during off-hours (i.e., 6:00 p.m. to 4:00 a.m.). Some drills or exercises should be unannounced.
- Providing medical care for injured, contaminated personnel (every two years).
- Response to essentially 100 percent of initiating conditions identified in the site emergency plan implementing procedure for classification of emergencies.

- Response to actual industry event sequences appropriate for the nuclear plant technology (e.g., BWR or PWR).
- All licensee ERO teams must be provided the opportunity to demonstrate key skills within the scope of their duties.
- Use of procedures developed in response to an aircraft threat and in compliance with 10 CFR 50.54(hh)(1).
- Use of the strategies associated with 10 CFR 50.54(hh)(2) to mitigate spent fuel pool damage scenarios (all strategies, such as makeup, spray, and leakage control, but not every variation of a given strategy).
- Use of the strategies associated with 10 CFR 50.54(hh)(2) to mitigate reactor accidents and maintain containment (7 strategies for pressurized water reactors, but not every variation of a given strategy).

Following exercises and drills, a critique is held to identify deficiencies, weakness, and improvement opportunities. Deficiencies and weaknesses will be corrected and improvement opportunities will be incorporated as deemed appropriate by the Emergency Preparedness Manager. Critiques shall use the Palo Verde Condition Reporting process for capturing items identified during drills and exercises.

Remedial exercises will be required if the emergency plan is not satisfactorily tested during the biennial exercise, such that NRC, in consultation with FEMA, cannot find reasonable assurance that adequate protective measures can be taken in the event of a radiological emergency. The extent of state and county participation in remedial exercises must be sufficient to show that appropriate corrective measures have been taken regarding the elements of the plan not properly tested in the previous exercise.

8.1.3 DRILLS

Drills for the emergency organization are conducted periodically to test response and familiarity with implementing procedures and methods, to test emergency equipment, and to ensure that members of the emergency organization are familiar with their duties and develop and maintain key skills.

Instructional emergency drills are conducted as scheduled, with emphasis placed upon orderly implementation of activities prescribed within the Emergency Plan and its implementing procedures.

Drill performance is critiqued by the emergency response organization involved and personnel acting as drill controllers who may offer on-the-spot corrections to erroneous performance. Each controller is assigned a specific area for evaluation and receives written drill instructions. Written evaluations of drill performance are provided to appropriate management personnel. Follow-up action is then taken by the responsible Department Leaders to upgrade areas where shortcomings are noted; they report their progress to the Emergency Preparedness Manager.

Following all drills, a drill controller critique is held and all aspects of drill performance are discussed. All significant deficiencies are incorporated into action items and tasked to the affected department.

Certain drills (i.e., fire, and medical emergency), and tests (i.e., communications and notification), are coordinated with offsite participating agencies. The Emergency Preparedness Manager has overall responsibility for meeting all drill requirements. Specific tasks may be delegated to operating departments.

Communications links and notification procedures with offsite state and county agencies are tested periodically using a simulated emergency message transmitted offsite for subsequent fan-out alerting by state/county authorities. NRC communications links are tested in accordance with 10CFR50, Appendix E. Communications tests also evaluate the understanding of the content of the messages.

Fire drills are conducted in accordance with the Fire Protection Program and PVNGS Updated Final Safety Analysis Report (UFSAR).

Health Physics (HP) Drills are conducted semi-annually, and may be in connection with exercises or Environmental Monitoring Drills. These drills involve response to, and analysis of, simulated elevated radioactivity in airborne samples and direct radiation measurements in the plant.

Medical Emergency Drills with Offsite Medical Facilities involving treatment of a simulated externally contaminated person are conducted annually with provision for participation by an offsite ground or air ambulance.

Environmental Monitoring Drills are conducted annually for both onsite and offsite Environmental Team personnel. These drills include collection and analysis of appropriate sample media, e.g., vegetation, soil, and air, communications, and record keeping. Since PVNGS is located in a desert area and there are no nearby bodies of water, liquid environmental samples are not collected or analyzed during Radiological Monitoring or Health Physics drills. These drills are coordinated with offsite organizations where appropriate.

8.1.4 SCENARIOS

Drill and exercise scenarios are written to allow a certain amount of free play for decision making. Controllers are instructed at pre-drill and pre-exercise briefings as to which portions of the scenario permit free play and which portions require strong controller management. The Emergency Preparedness Manager is responsible for overall drill and exercise control.

8.2 ORGANIZATION FOR MAINTAINING EMERGENCY PREPAREDNESS

The Executive Vice President Nuclear & Chief Nuclear Officer has overall responsibility and authority for all nuclear activities, including emergency response planning. The Emergency Preparedness Manager has been assigned the responsibility to develop and maintain a coordinated PVNGS, Federal, State, and local government emergency preparedness program. The Emergency Preparedness Manager participates in meetings, seminars, and conferences that are aimed at maintaining a current and accurate Emergency Plan, and current knowledge of regulations and guidelines. The Emergency Preparedness Manager is responsible for the Emergency Plan, and implements Plan revisions and updates.

8.3 REVIEW AND UPDATING OF THE EMERGENCY PLAN

The Emergency Plan is reviewed annually and updated as needed. The update takes into account changes identified by drills and exercises. The Emergency Preparedness Manager maintains documentation substantiating the annual review. Special attention is devoted to reviewing PVNGS/governmental agency interfaces, updating offsite response agreements, maintaining effective communication channels, and, on a quarterly basis, ensuring up-to-date contact and notification lists. Liaison with state and local agencies ensures uniform updating. Independent audits/reviews by individuals who have no direct responsibility for the implementation of the Emergency Preparedness Program are conducted at least once every 24 months using the performance-based option permitted by 10 CFR 50, Appendix E and 10 CFR 50.54(t), or more frequently when necessary to meet these regulations.

The Emergency Preparedness Manager is responsible for ensuring that EPIPs are updated and revised as necessary.

Emergency Plan revisions and changes are conducted in accordance with PVNGS Administrative Policies and Procedures. Plan changes will be reviewed for any reduction in effectiveness per 10CFR50.54 (q).

The revised Emergency Plan and procedures are handled in accordance with document control procedures. Changes to the Emergency Plan and procedures are approved by the

Emergency Preparedness Manager, or designated alternate, and transmitted to the Executive Vice President Nuclear and Chief Nuclear Officer, and to the Offsite Safety Review Committee. Changes to the Emergency Plan shall be submitted to the NRC within 30 days of such changes.

8.4 MAINTENANCE AND INVENTORY OF EMERGENCY EQUIPMENT AND SUPPLIES

Quarterly inspections of the operational readiness of emergency equipment and supplies are conducted by PVNGS. Deficiencies noted during inspections are corrected. The use of inspection procedures with checklists and follow-up actions ensures that equipment is ready for use. Sufficient reserves of instruments/equipment are maintained to replace those undergoing calibration or repair. Calibration of equipment is conducted at intervals set forth in the UFSAR. In addition, planned use of communications, first aid, firefighting, and radiation measuring equipment during scheduled drills further ensures the availability and operability of emergency equipment.

9.0 RECOVERY

Recovery operations include long term post-emergency efforts that follow a major incident. These operations are performed by station personnel, contract experts and specialists, and qualified engineers under the direction of the recovery organization. Post-accident recovery actions are designed to identify the extent of plant damage, prepare specific plans and programs for station repair and restoration, implement recovery plans and programs, and return the plant to a normal operating status.

The following plant status conditions serve as general guidelines for decisions on the initiation of post-emergency recovery efforts:

- Radiation levels are stable or decreasing with time
- Releases of radioactive materials to the environment have ceased or are controlled within permissible license limits
- Fire or similar emergency conditions no longer constitute a hazard to the plant or station personnel
- Measures have been successfully instituted to correct or compensate for malfunctioning equipment.

Based on consideration of these criteria, as well as other pertinent items, the EOD

determines when to activate the recovery organization. Manpower and equipment resources supporting the individual functional segments of the recovery organization may vary according to the severity of damage and specific situational needs.

Entering into recovery will not necessarily result in de-escalation of the emergency classification in that, the loss of a fission product barrier may not be recoverable until recovery is complete. Entering into recovery denotes the plant is stable and further degradation is unlikely. Repair and restoration of plant systems will be needed to fully exit the recovery phase.

9.1 RECOVERY ORGANIZATION

The responsibilities and functions of the Recovery Organization Managers are summarized as follows:

- The Recovery Manager has overall corporate responsibility for restoring the station to a normal operating configuration.
- The Station Operations Manager manages day-to-day inplant operations and, during recovery, is responsible for ensuring that repairs and modifications optimize post-recovery plant operational effectiveness and safety.

- The Nuclear Support Manager focuses necessary engineering, design, and construction resources on those aspects of plant recovery requiring redesign, modification, or new construction; directs and coordinates NSSS and Balance-of- Plant (BOP) engineering and construction/repair work.
- The Radiological Services Manager develops plans and procedures to process and control liquid, gaseous, and solid wastes to minimize adverse effects on the health and safety of the public and station recovery personnel. In addition, the Radiological Services Manager coordinates the activities of staff Radiological Engineers and radiation protection personnel engaged in waste treatment operations.
- The Technical Support Manager provides analyses, plans, schedules, and procedures in direct support of plant operations.
- The Quality Assurance Manager assures that the overall conduct of recovery operations is performed in accordance with corporate policy and rules and regulations governing activities which affect public health and safety.
- The Planning/Scheduling Manager prepares plans and schedules, and tracks/expedites recovery operations.
- The Administrative/Logistics Manager supplies administrative, logistic, communications, and personnel support for the recovery operation.
- PVNGS Communications coordinates the flow of media information concerning recovery operations.

9.2 RECOVERY EXPOSURE CONTROL

The Recovery Manager, via the Recovery Organization, is responsible for evaluating the advisability of initiating recovery and reentry. Information on existing conditions, interviews with employees evacuated during the emergency, regulatory exposure guidelines, and counsel from recognized experts are used to formulate decisions on reentry and recovery.

During recovery operations, actions are preplanned to limit exposures. Access to areas is controlled and exposure to personnel documented. Estimates of total population dose are available if any releases are required or occur during recovery operations.

9.3 RE-ENTRY

If a site evacuation is ordered, re-entry to the site is controlled in accordance with established procedures. Respiratory protection equipment, protective clothing, and thyroid blocking agent are maintained onsite for the use of individuals remaining or arriving onsite before, during, or after the emergency.

10.0 AGREEMENT LETTERS

This section lists written agreements referring to the concept of operations developed between Federal, State, and local agencies and other support organizations having an emergency response role within the EPZ. Original copies of agreements are maintained in the files of Emergency Preparedness Department. The agreements are listed below.

- **Letter of Agreement from National Weather Service (NWS), Weather Forecast Office (WFO)**

  The NWS provides general weather forecasts, severe weather and flood warnings, transport and dispersion plume forecasts, and localized weather forecasts. The NWS also provides broadcasts of tone alarmed and encoded public emergency messages on NOAA Weather Radio. If available, a meteorologist will be detailed to the Arizona Emergency Operations Center (EOC) or Maricopa County EOC or the PV EOF and WFO Phoenix will coordinate with Department of Energy meteorologists assigned to the Federal Radiological Monitoring Assessment Center (FRMAC) to support the state, county and PVNGS emergency efforts.

- **Letter of Agreement from Institute of Nuclear Power Operations (INPO)**

  Coordinates technical information from PV to the nuclear industry and government agencies, coordinates the procurement and shipping of equipment and supplies, locates personnel with technical expertise, facilitates industry vendor and commercial supplier support, obtains technical information and operating experience on plant components and systems, and provides an INPO liaison to facilitate interface.

- **Westinghouse Contract Change Notice #5 to PV81-4765 (renumbered_500261566 Nuclear incident Emergency Agreement)**

  Westinghouse furnishes technical assistance as requested in the event of an emergency arising from a nuclear incident at PVNGS.

- **Letter of Agreement from Banner University Medical Center**

  Banner BUMC provides hospital treatment for victims of radiological and hazardous materials incidents including contaminated individuals from PVNGS, maintains response capacity as a support facility, and makes appropriate personnel available for training and participation in medical drills and exercises.

- **Letter of Agreement from Banner Estrella Medical Center**

  Banner Estrella Medical Center provides hospital treatment for victims of radiological and hazardous materials incidents including contaminated individuals from PVNGS, maintains response capacity as a support facility, and makes appropriate personnel available for training and participation in medical drills and exercises.

- **Letter of Agreement from City of Phoenix Fire Department**

  Provides fire suppression, Emergency Medical Services (EMS), Hazardous Materials (HAZMAT) and other technical services when requested at their discretion and maintains a contingency in place to provide services for >24 hours if necessary. Phoenix Fire Department coordinates the valley-wide Fire Department Automatic Aid Agreement.

- **Letter of Agreement from Air Evac air ambulance service**

  Air Evac provides transportation for victims of radiological materials accidents including contaminated individuals and makes appropriate personnel available for training and participation in medical drills and exercises.

- **Letter of Agreement from Native air ambulance service**

  Native American Air Ambulance provides transportation for victims of radiological materials accidents including contaminated individuals and makes appropriate personnel available for training and participation in medical drills and exercises.

- **Letter of Agreement from Tonopah Valley Fire District**

  Tonopah Valley Fire District provides back-up fire protection, haz-mat decontamination assistance, mass casualty Emergency Medical System (EMS), wildland fire suppression and technical rescue assistance to PVNGS. The initial response includes a Basic Life Support (BLS) fire engine and/or a BLS squad with at least 2 persons. Tonopah also allows storage of PVNGS firefighting resources at Tonopah fire station 341.

- **Letter of Understanding from Salt River Project**

  SRP agrees to have SRP personnel assigned to the PV switchyard for >5 days site access training and provide SRP employees with site evacuation and emergency planning info.

10.1 OFFSITE EMERGENCY RESPONSE PLAN FOR PALO VERDE NUCLEAR GENERATING STATION

In addition to the support outlined in the Letters of Agreement, the Offsite Emergency Response Plan for Palo Verde Nuclear Generating Station provides for the following support functions for PVNGS in the event of an emergency from the indicated agencies. Also, mutual aid compacts and agreements between the State and other government and private entities defined in the Offsite Emergency Response Plan multiply the resources available to PVNGS in an emergency.

10.1.1 The Maricopa County Sheriff’s Office (MCSO) performs the following:

Emergency Public Warning:

When initial notification is a Site Area Emergency or General Emergency:

- Warning message preparation
- Activation of siren system
- Dissemination of warning using the EAS and/or Media Alert System
- Implementation of protective actions if required
- Backup Route Alerting by MCSO response vehicles

Denial of entry into evacuated areas and patrol evacuated areas to determine effectiveness.

Control of evacuee and access traffic on county and farm roads is the responsibility of MCSO, which coordinates with Arizona Department of Public Safety (AZ DPS) for traffic movement from county/farm roads to state highways and to Interstate-10. MCSO will provide security within the evacuated area.

Based on the location of the Reception and Care Center(s) (RCC), MCSO, AZ DPS or local jurisdiction law enforcement will provide RCC security and crowd control as necessary.

MCSO or local law enforcement will provide temporary impound security for contaminated vehicles and personal effects while the RCC is operational.

MCSO will transport KI to designated Reception and Care Centers.

MCSO and AZ DPS may assist the AZ Department of Agriculture in enforcing produce and food project check points and embargos.

MCSO conducts “just-in-time” radiological training and provides equipment for alternate personnel prior to being deployed in response to a Hostile Action Based event.

MCSO provides coordinated on-site/offsite direction and control in accordance with the Maricopa County Peacetime Disaster Plan (PDP). The PDP authorizes the Sheriff to request assistance when an incident is beyond the ability of the Office to resolve and works under the Incident Command System (ICS) when responding to PVNGS Hostile Action Based (HAB) incidents.

MCSO is responsible for the initial and on-going assessment of the situation to determine if terrorism is involved or responsible for the HAB incident. If and when this determination is made, the Federal Bureau of Investigation (FBI) will be notified.

10.1.2 DPS provides traffic control on portions of evacuation routes comprising state highways and maintains denial of reentry into evacuated areas.

MCSO and AZ DPS will jointly coordinate access to the boundaries of the evacuated area based on whether the access points are on county/farm roads or state highways or Interstate-10.

The AZ DPS Remote Mobile Investigation Unit (RMU) can work in contaminated areas and is available for 24-hour use.

10.1.3 The State of Arizona provides the following support to PVNGS in an emergency:

Monitoring of evacuees for possible radioactive contamination and supervision and monitoring of any decontamination effort.

Requests for and coordination of federal technical support.

Exchanges field data and accident assessment information with PVNGS from Field Monitors.

Any classification or notification may require governmental or private sector emergency organizations to commit resources onsite at the request of the facility. Emergency resources may include, but are not limited to, law enforcement, firefighting, medical support and ground or air services. Assistance may be requested from other state governments and private sector resources in states adjoining Arizona. These resources may include medical capabilities, emergency response equipment, and emergency response personnel. The State Emergency Operations Center Policy Chief (EOC PC) or Technical Director (TD) will initiate requests.

The Arizona Department of Health Services (AZDHS) provides for collection and analysis of data from the plant, field radiation surveys and sample collection. AZDHS representatives share information with EOF staff regarding field team locations, field data and protective action decisions and collects data to assess the accident, project dose and project plume.

AZDHS field monitors conduct radiation surveys to determine ambient radiation levels, track the plume and collect environmental and foodstuff samples for analysis and dispatches a mobile laboratory to Buckeye Airport during the emergency (plume) phase for rapid evaluation of air samples.

ADEM coordinates the collection, analysis and dissemination of information during an incident at PVNGS. This process is conducted in consort with the PVNGS, MCDEM, AZDHS and other federal, state, local, Tribal Nation and volunteer agencies.

For HAB incidents where Offsite Response Organizations (ORO) receive pre-incident intelligence information, applicable OROs will contact the PVNGS Security Central Alarm Station or Security Director.

General response capabilities for a HAB incident are as follows:

- PVNGS: Armory; pre-established unit locations; personnel
- MCSO: SWAT Teams; armored vehicles; personnel
- AZ DPS: SWAT Teams; armament as necessary; helicopter and fixed wing aircraft
- National Guard/ Military: ground forces and aircraft as necessary
- AZDHS conducts "just-in-time" radiological training and provides equipment for alternate personnel prior to being deployed in response to a HAB incident.

10.1.4 Maricopa County provides the following support:

- Emergency Public Warning
- Warning message preparation
- Activation of siren systems
- Dissemination of EAS warning messages
- Provides direction and control for county level activities
- Installation of evacuation route signs on county and farm roads and installation of barricades and signs for entry control of evacuated areas.
- Coordinates RCC operations and registers evacuees.
- The county directs thyroid protection operations for county emergency workers.

11.0 REFERENCED INTERFACING EMERGENCY PLANS

- State of Arizona/Maricopa County Offsite Emergency Response Plan - PVNGS
- National Response Framework, Third Edition

12.0 MAPS

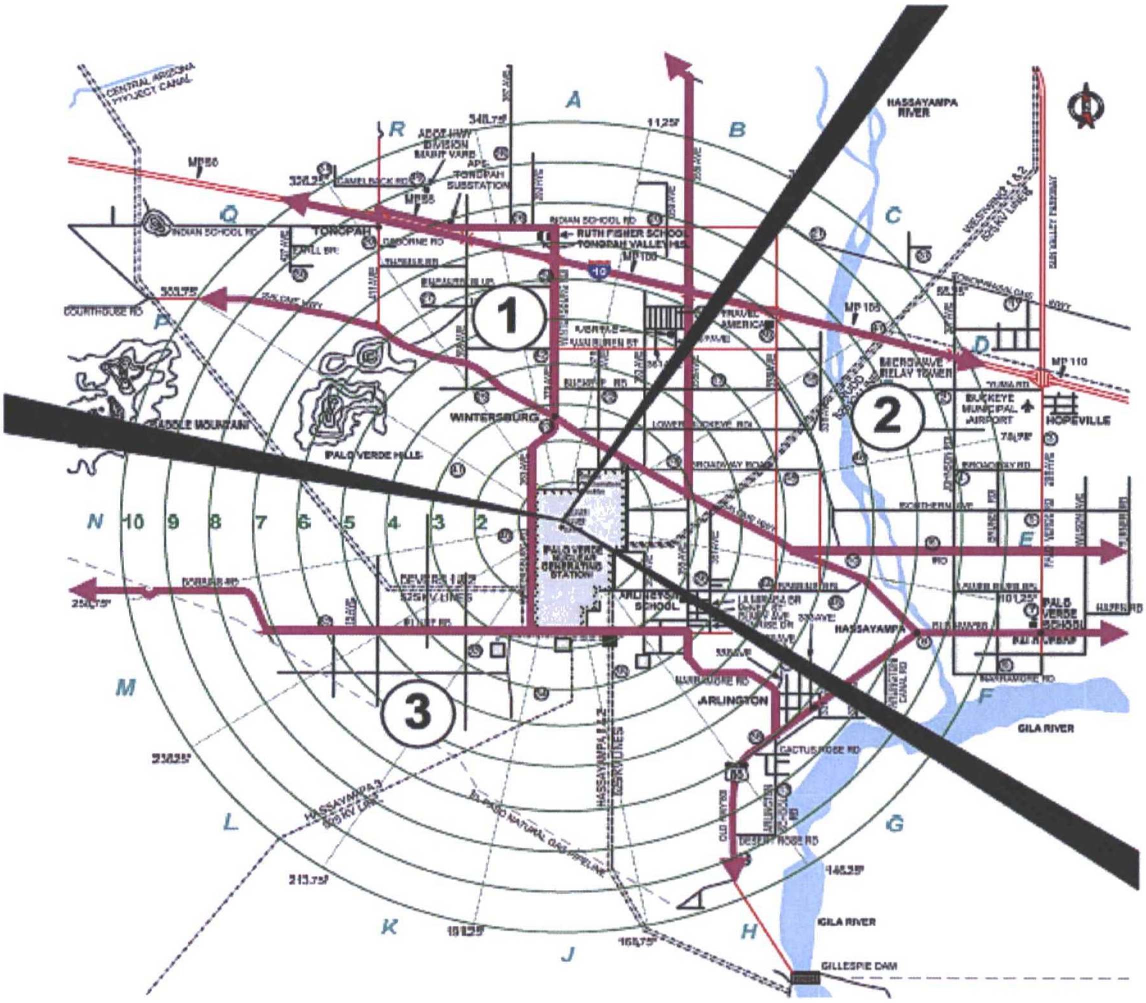

FIGURE 11 POPULATION EVACUATION ROUTE SECTIONS AND EVACUATION ROUTING

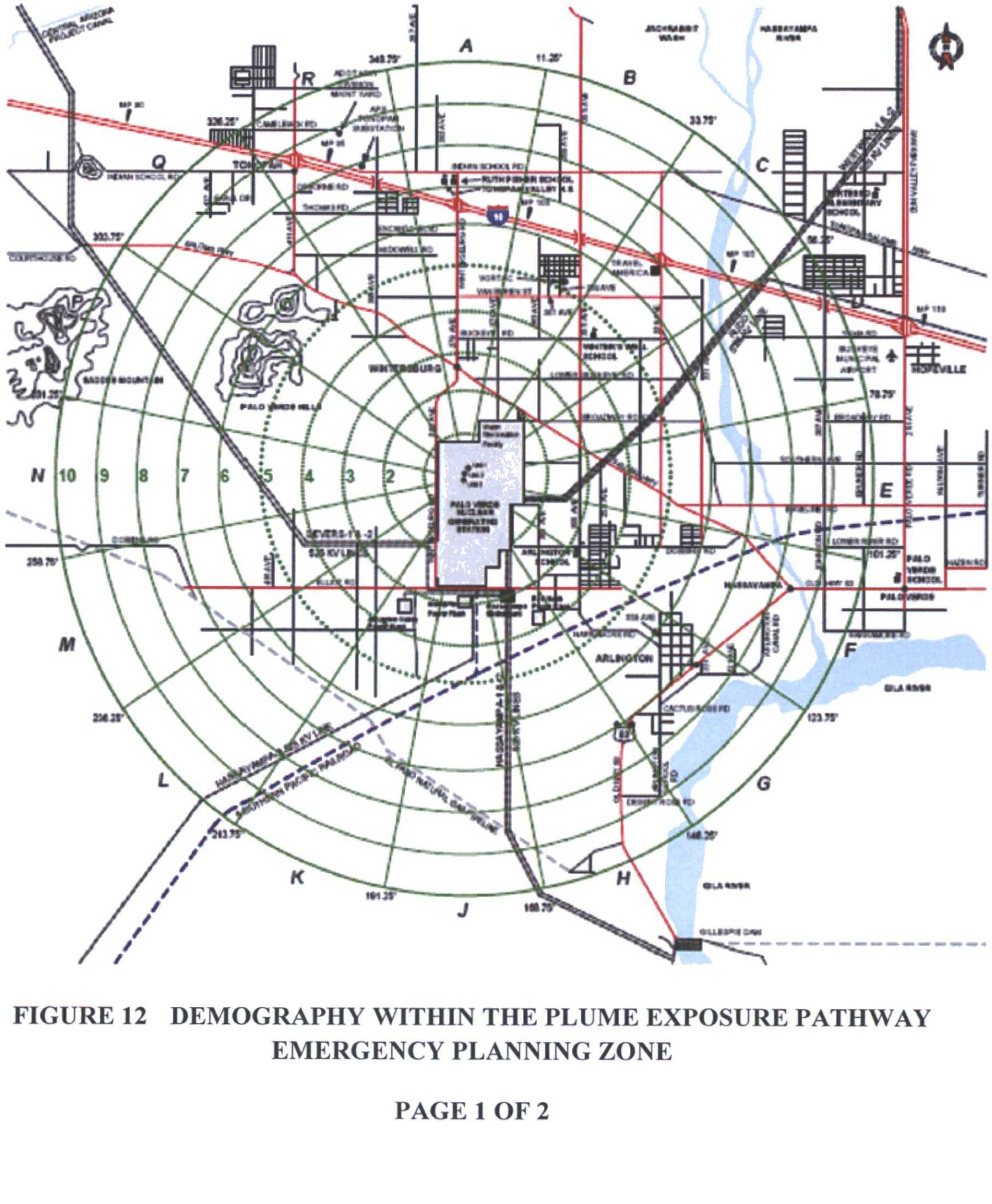

FIGURE 12 DEMOGRAPHY WITHIN THE PLUME EXPOSURE PATHWAY EMERGENCY PLANNING ZONE

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Palo Verde Population Survey

October 2017

Sector	1	2	0-2 Miles	3	4	5	0-5 Miles	6	7	8	9	10	0-10 Miles
A	0	128	128	727	94	276	1225	182	86	141	90	88	1820
B	0	43	43	145	415	177	780	115	62	219	79	16	1270
C	0	3	3	81	139	431	653	333	60	44	63	38	1191
D	0	0	0	75	119	279	472	419	168	0	44	314	1417
E	0	0	0	34	50	148	232	295	69	22	180	44	841
F	0	0	0	0	234	111	345	91	47	13	19	33	547
G	0	0	0	0	70	59	129	0	161	75	0	0	365
H	0	0	0	0	0	0	0	0	0	3	34	25	65
J	0	0	0	0	0	0	0	0	0	0	0	0	0
K	0	0	0	0	6	0	6	0	0	0	0	0	6
L	0	3	3	3	14	11	31	0	3	0	0	0	31
M	0	28	28	0	0	25	53	27	8	0	0	0	88
N	10	0	10	4	0	0	14	0	0	0	0	0	14
P	14	0	14	0	0	0	14	0	0	0	0	0	14
Q	0	17	17	0	0	8	25	14	11	15	52	239	356
R	0	24	22	9	230	119	382	8	31	31	516	50	1018
Mile Ring Total	23	245	**268**	1081	1369	1641	**4360**	1483	702	562	1086	847	**9040**

	Students	Staff	Total
Arlington School	263	49	312
Palo Verde School	495	80	575
Ruth Fisher School	710	40	750
Tonopah High School	510	90	600
Crossroads Academy	14	2	16
Winters Well	12	1	13
Total	**2004**	**262**	**2266**

FIGURE 12 DEMOGRAPHY WITHIN THE PLUME EXPOSURE PATHWAY EMERGENCY PLANNING ZONE

PAGE 2 OF 2

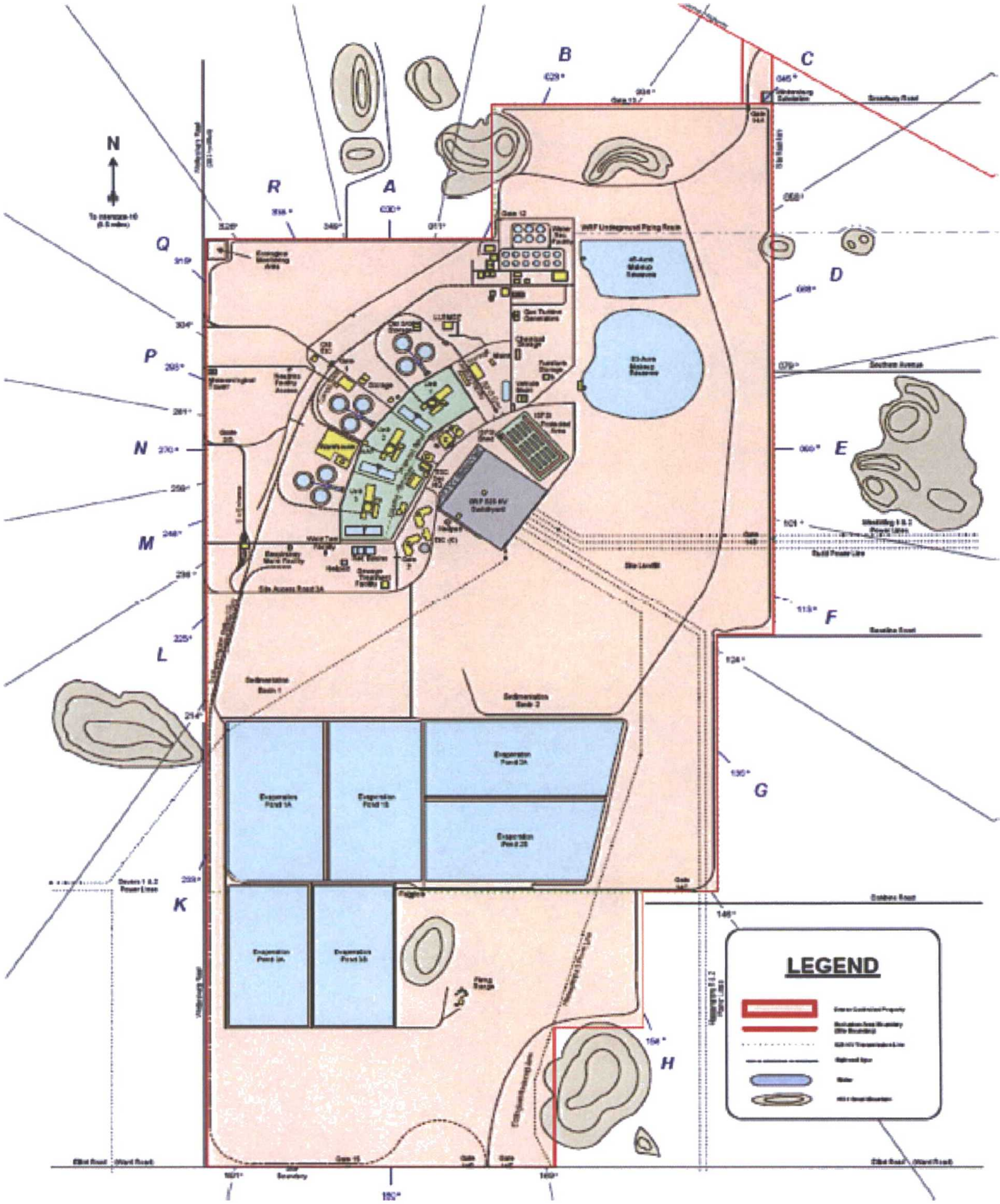


FIGURE 13 SITE EXCLUSION AREA BOUNDARY AND PROPERTY BOUNDARY

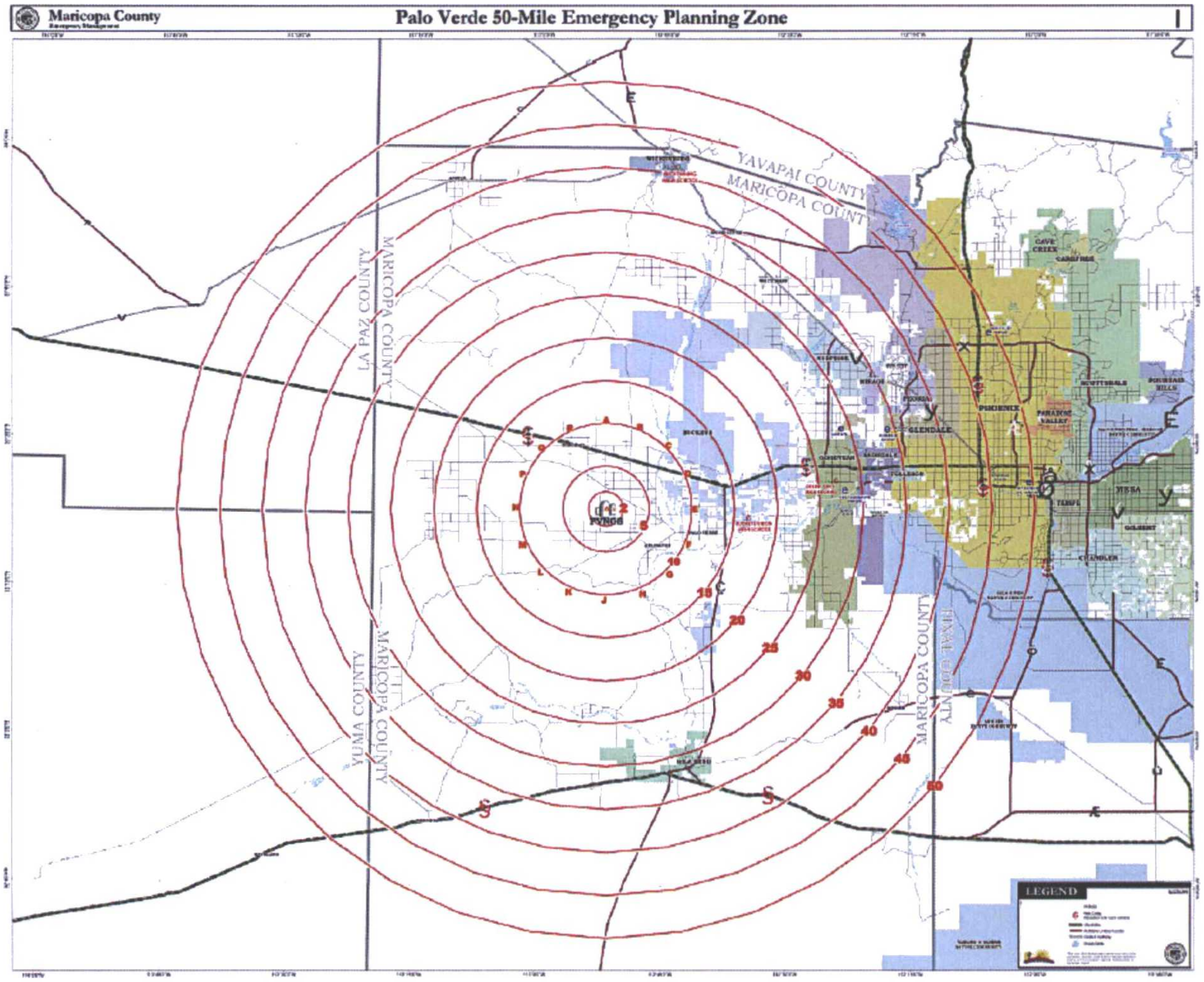
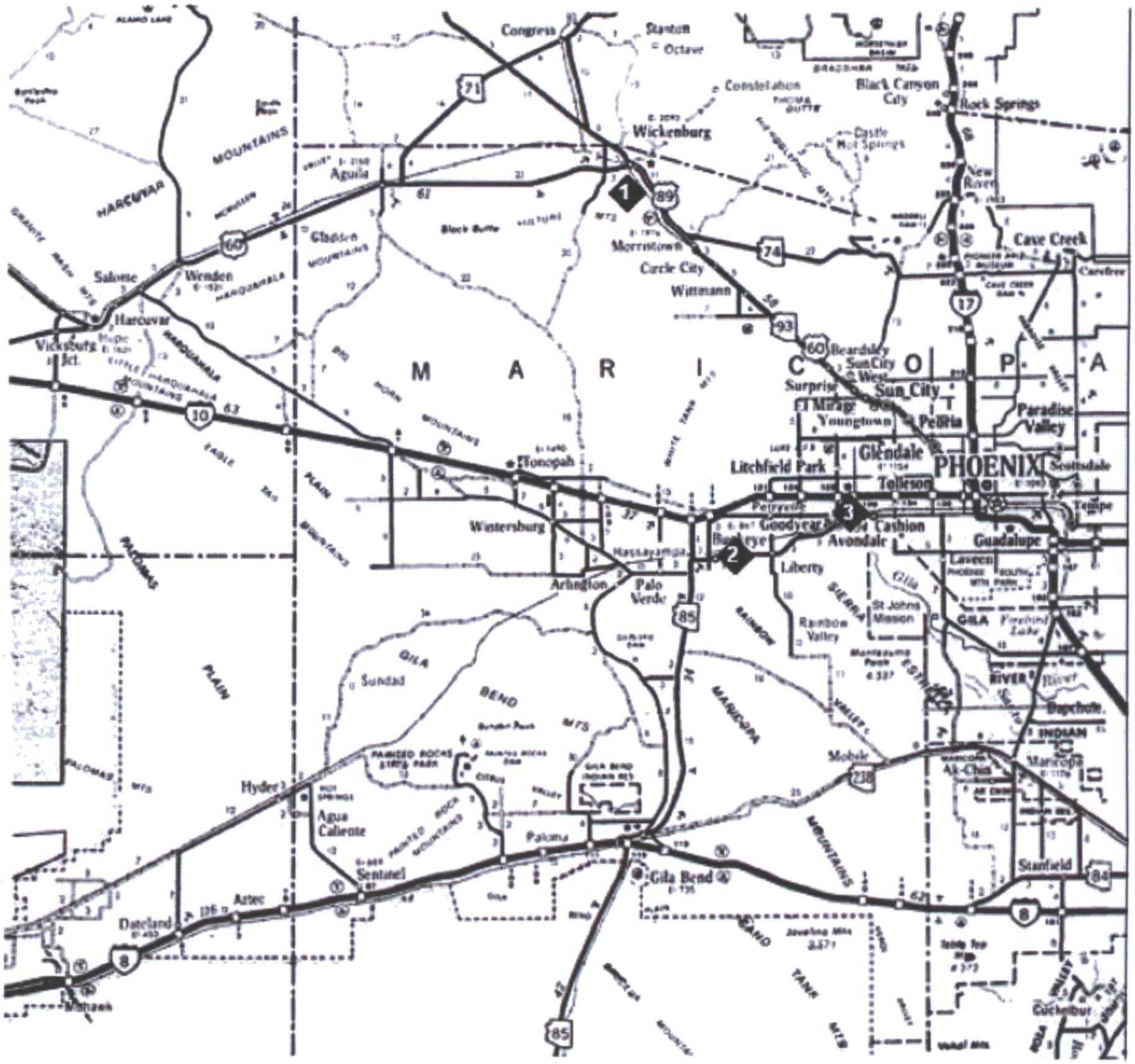


FIGURE 14 INGESTION EXPOSURE PATHWAY EMERGENCY PLANNING ZONE



1. **Wickenburg High School**
   1090 S. Vulture Mine Road
   Wickenburg, AZ 85390
2. **Youngker High School**
   3000 S. Apache Road
   Buckeye, AZ 85326
3. **Desert Edge High School**
   15778 W. Yuma Road
   Goodyear, AZ 85338

FIGURE 15 RECEPTION AND CARE CENTERS

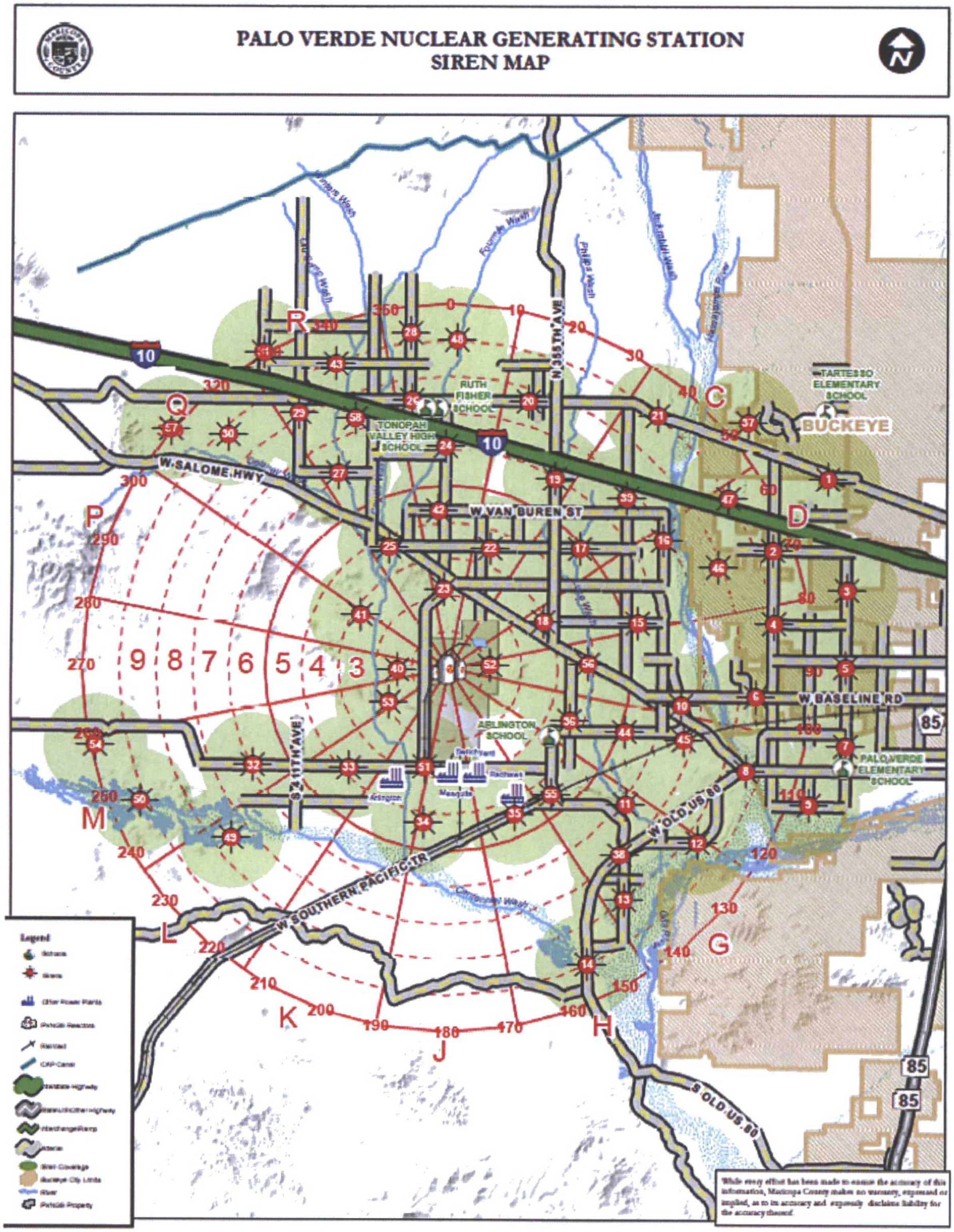


FIGURE 16 PROMPT NOTIFICATION SYSTEM SIREN LOCATIONS

13.0 EMERGENCY PLAN IMPLEMENTING PROCEDURES

Designator	Title	Plan Section
EP-0900	ERO Position Checklists	4
EP-0901	Emergency Classification	5, 6
EP-0902	Notification	6, 7
EP-0903	Accident Assessment	6, 7
EP-0904	ERO/ERF Activation and Operation	4, 7
EP-0905	Protective Actions	6, 15
EP-0906	Termination and Recovery	5, 9
40AO-9ZZ24	Deliberate Acts Against PVNGS	6

14.0 IDENTIFICATION OF EMERGENCY KITS BY GENERAL CATEGORY

Kit Equipment	TSC OSC	STSC	Offsite RFAT	Ambulance	EOF	Medical Facility, Evacuation Decon	Hospitals	Units (1-3) Near RP Island
Protective Equipment	X	X		X		X		
Communications Equipment	X	X	X	X	X			
Radiological Monitoring Equipment							X	X
Emergency Supplies	X	X	X	X		X	X	

15.0 ACCIDENT DOSE PROJECTION AND SOURCE TERM ESTIMATION

The method used for dose projection at PVNGS is the Raddose computer software program, which runs on several computers throughout the plant.

15.1 DOSE ASSESSMENT MODEL

PVNGS uses a site-specific version of the Raddose dose assessment computer software. The Raddose software meets the requirements of NUREG 0654, Appendix 2, and uses a variable trajectory, puff advection model. Calculations can be performed using multiple release points or accident types from multiple units.

Based on EPA 400; *MANUAL OF PROTECTIVE ACTION GUIDES AND PROTECTIVE ACTIONS FOR NUCLEAR INCIDENTS* dated 1991 dose conversion factors and the source term provided in the PVNGS Updated Final Safety Analysis Report (based on TID-14844, "Calculation of Distance Factors for Power and Test Reactors").

The Raddose dose assessment software is designed to:

- Estimate source terms based on high range Containment radiation monitors, effluent process radiation monitors, and steam line radiation monitors under anticipated accident conditions.
- Estimate source terms using alternate monitors or default values when the primary instruments are off-scale or inoperable.
- Estimate source terms based on grab sample results and back-calculation using field monitoring team data.
- Estimate atmospheric effluent transport and diffusion during and immediately following an accidental airborne radioactive release using actual or estimated meteorology.
- Adjust atmospheric diffusion rates based on atmospheric stability.
- Report plume dimensions, position, and expected arrival time at various downwind distances.
- Calculate TEDE, Thyroid Committed Dose Equivalent, committed EDE from inhalation, external EDE due to plume exposure, and exposure to ground deposition at various downwind locations.
- Calculate deposition estimates at various downwind locations.
- Report maximum integrated values and rates at the Site Boundary, 2 miles, 5 miles, and 10 miles for TEDE, Thyroid Committed Dose Equivalent, external EDE, and ground deposition.
- Report effluent release rate data and plume ground level airborne concentration.
- Raddose provides Protective Action Recommendations based on radiological data. Actual Protective Action Recommendations are derived from Emergency Plan Implementing Procedures.

16.0 CROSS REFERENCE TO NUREG 0654

Cross reference between NUREG-0654 and the Palo Verde Nuclear Generating Station Emergency Plan.

A. Assignment of Responsibility (Organizational Control)

A.1.a Section 4.2, 4.3

A.1.b Section 4

A.1.c Figures 1 through 6

A.1.d Section 4.2.1.1, 4.2.2.1, 4.2.4.1

A.1.e Section 4.2.1

A.2.a NA

A.2.b NA

A.3 Section 10

A.4 Section 4.2.4

B. Onsite Emergency Organization

B.1 Section 4.1, 4.2

B.2 Section 4.2.1.1

B.3 Section 4.2.1.1, 4.2.2.1, 4.2.4.1

B.4 Section 4.2.1.1, 4.2.2.1, 4.2.4.1

B.5 Section 4.2, Figures 1 through 6, Table 1

B.6 Section 4.2, 4.3, Figures 1 through 6

B.7 Section 4.2

B.7.a Section 4.2.4

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B.7.c Section 4.2.4

B.7.d Section 4.2.4, 18

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C.1.b Section 4.4.3

C.1.c Section 7.1, 7.2, Table 3

C.2.a NA

C.2.b Section 4.2.5.5

C.3 Section 7.3.1.5

C.4 Section 4.2.4, 10

D. Emergency Classification System

D.1 Appendix A

D.2 Section Appendix A

D.3 NA

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E.1 Section 6.3

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E.4.a Section 6.3

E.4.b Section 6.3

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E.4.d Section 6.3

E.4.e Section 6.3

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E.4.i Section 6.3

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E.4.l Section 6.3

E.4.m Section 6.3

E.4.n Section 6.3

E.5 NA

E.6 Section 6.3, 6.7.2, 7.7, Figure 16

E.7 Section 6.3, 6.7.2

F. Emergency Communications

F.1.a Section 6.3, 7.2.21, Figures 7 & 8

F.1.b Section 6.3, 7.2.21, Figures 7 & 8

F.1.c Section 4.2.4, 4.3, 6.3, 7.2.14

F.1.d Section 7.2, Table 3

F.1.e Section 6.3

F.1.f Section 7.2

F.2 Section 7.2

F.3 Section 8.1.3, 8.3

G. Public Education and Information

G.1 Section 8.1.1.4

G.2 Section 8.1.1.4

G.3.a Section 7.1.8

G.3.b Section 7.1.8

G.4.a Section 4.2.5, 18

G.4.b Section 18

G.4.c Section 6.9

G.5 Section 8.1.1.5

H. Emergency Facilities and Equipment

H.1 Section 7.1.3, 7.1.4, 7.1.5

H.2 Section 7.1.6

H.3 NA

H.4 Section 6.3, 6.4

H.5.a Section 7.3.1.1

H.5.b Section 7.3.1.2, 7.3.1.6

H.5.c Section 7.3.1.3

H.5.d Section 7.3.1.4

H.6.a Section 7.3.1.1

H.6.b Section 7.3.2

H.6.c Section 7.3.1.5

H.7 Section 7.3.2

H.8 Section 6.5.2, 7.3.1.1

H.9 Section 7.1.4

H.10 Section 8.3

H.11 Section 14

H.12 Section 7.1.6

I. Accident Assessment

I.1 Appendix A

I.2 Section 7.3.1.2, 7.3.1.5

I.3.a Section 15

I.3.b Section 15

I.4. Section 15

I.5 Section 6.5.2, 7.1.3, 7.1.5, 7.1.6, 7.3.1.1, 7.3.1.9

I.6 Section 15

I.7 Section 6.5.2

I.8 Section 6.5.2

Note: PVNGS is a dry site and has no monitored liquid release pathways

I.9 Section 6.5.2

I.10 Section 6.5.2, 15

I.11 NA

J. Protective Response

J.1.a Section 6.7.1.1

J.1.b Section 6.7.1.1

J.1.c Section 6.7.1.1

J.1.d Section 6.7.1.1

J.2 Section 6.7.1.4

J.3 Section 6.8.2

J.4 Section 6.7.1.4, 6.8.2

J.5 Section 6.7.1.3

J.6.a Section 6.7.1.7.1, 9.2

J.6.b Section 6.7.1.7.2, 9.2

J.6.c Section 6.7.1.7.3, 9.2

J.7 Section 6.7.2.1, Figure 9

J.8 Section 6.7.2.1

J.9 NA

J.10.a Figures 11 & 15

J.10.b Figure 12

J.10.c Section 6.7.2.1, 7.7, Figure 16

J.10.d Section NA

J.10.e Section NA

J.10.f Section NA

J.10.g Section NA

J.10.h Section NA

J.10.i Section NA

J.10.j Section NA

J.10.k Section NA

J.10.l Section NA

J.10.m Section 6.7.2, 6.7.2.1

J.11 Section NA

J.12 Section NA

K. Radiological Exposure Control

K.1.a Section 6.8.2, 6.8.3, 6.8.4

K.1.b Section 6.8.2, 6.8.3, 6.8.4

K.1.c Section 6.8.2, 6.8.4, 6.8.4

K.1.d Section 6.8.2, 7.5

K.1 e Section 6.8.2

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K.2 Section 6.8.1

K.3.a Section 6.7.3.1, 6.7.3.2, 6.8.1

K.3.b Section 6.8.1

K.4 NA

K.5.a Section 6.8.1, 6.8.2

K.5.b Section 6.8.1, 6.8.2

K.6.a Section 6.7.3

K.6.b Section 6.7.3,

K.6.c Section 6.7.3, 9.0

K.7 Section 6.8.2, 6.8.4

L. Medical and Public Health

L.1 Section 6.8.2, 6.8.3, 6.8.4

L.2 Section 6.8.2, 7.5

L.3 NA

L.4 Section 6.8.3

M. Recovery and Reentry Planning and Post Accident Operations

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M.2 Section 9.1

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N. Exercises and Drills

N.1.a Section 8.1.2

N.1.b Section 8.1.2

N.2.a Section 8.1.3

N.2.b Section 8.1.3

N.2.c Section 8.1.3

N.2.d Section 8.1.3

N.2.e.1 Section 8.1.3

N.2.e.2 Section 8.1.3

N.3.a Section 8.1.2, 8.1.3

N.3.b Section 8.1.2, 8.1.3

N.3.c Section 8.1.2, 8.1.3

N.3.d Section 8.1.2, 8.1.3

N.3.e Section 8.1.2, 8.1.3

N.3.f Section 8.1.2, 8.1.3

N.4 Section 8.1.2, 8.1.3

N.5 Section 8.1.2, 8.1.3

O. Radiological Emergency Response Training

O.1 Section 8.1.1

O.1.a Section 8.1.1, 10

O.1.b NA

O.2 Section 8.1.1.2, 8.1.3

O.3 Section 4.2.1.3, 6.8.2

O.4.a Section 8.1.1

O.4.b Section 8.1.1

O.4.c Section 8.1.1

O.4.d Section 8.1.1

O.4.e Section 8.1.1

O.4.f Section 8.1.1

O.4.g Section 8.1.1.3

O.4.h Section 8.1.1

O.4.i Section 8.1.1

O.4.j Section 8.1.1

O.5 Section 8.1.1.2

P. Responsibility for the Planning Effort: Development, Periodic review and Distribution of Emergency Plans

P.1 Section 8.1.1

P.2 Section 8.1.5

P.3 Section 8.1.5

P.4 Section 8.2

P.5 Section 8.2

P.6 Section 11.0

P.7 Section 13.0

P.8 Table of Contents, Section 16

P.9 Section 8.2

P.10 Section 8.2

17.0 CORPORATE EMERGENCY SUPPORT

The EOD will request and coordinate required support.

18.0 PUBLIC INFORMATION

18.1 INTRODUCTION

The purpose of this section is to briefly summarize the responsibilities, operation and staffing of the Palo Verde Communications, APS External Communications Department and the Joint Information Center (JIC). A detailed Joint Public Information Procedure is provided.

18.2 ACTIVATION AND OPERATION

The purpose of the Palo Verde Communications, APS External Communications Department and the JIC is to provide information about an emergency at PVNGS to the news media and the general public. At an Unusual Event, Palo Verde Communications and APS External Communications Department provide the media interface for the site. At an Alert or higher classification level, the JIC is activated and assumes responsibility for the public information function.

18.3 STAFFING AND LOCATION

Palo Verde Communications Department personnel are located at PVNGS and the APS External Communications Department personnel are located at the APS Corporate Headquarters, 400 N. 5th Street, Phoenix, AZ.

The JIC is located at 600 North Verrado Way, Buckeye, AZ. The JIC staff consists of APS/PVNGS and government public information and support personnel. PVNGS coordinates and releases information with government authorities. Each principal organization represented at the JIC has a designated spokesperson that has access to all necessary information. JIC procedures are designed to allow the timely exchange of information among spokespersons.

19.0 DEVELOPMENTAL REFERENCES

1. 10 CFR 50.47(B) "Emergency Plans,"
2. 10 CFR 50.54(q), Conditions of Licenses, Decrease in Effectiveness
3. APPENDIX E TO 10CFR PART 50 "Emergency Planning and Preparedness for Production and Utilization Facilities,"
4. NUREG 0578, TMI-2 Lessons Learned Task Force: Status Report and Short-Term Recommendations; July, 1979
5. NUREG 0737, Clarification of TMI Action Plan Requirements; November, 1980
6. 10 CFR 20, Standards for Protection against Radiation
7. 10 CFR 50, Domestic Licensing of Production and Utilization Facilities
8. NUREG-0654 / FEMA-REP-1, Revision 1 "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants".
9. NUREG 0654, Supplement 3, Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, Guidance for Protective Action Strategies, November 2011."

10. EPA 400-R-92-001, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents; October, 1991

11. Reg. Guide 1.97, Revision 2, Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident; December, 1980

12. NUREG-0696, Functional Criteria for Emergency Response Facilities, 1981

13. NEI 99-01, "Methodology for Development of Emergency Action Levels" Rev. 6

14. NUREG/CR 7002, Criteria for Development of Evacuation Time Estimate Studies, published in November 2011.

15. NUREG 1394, Emergency Response Data System (ERDS) Implementation, Revision 1, June 1991 and the related Generic Letter 93 01, Emergency Response Data System Test Program, March 3, 1993

16. NRC Regulatory Issue Summary 2005 02 Clarifying the Process for Making Emergency Plan Changes, February 14, 2005

17. Regulatory Guide 1.219, Guidance on Making Changes to Emergency Plans for Nuclear Power Reactors.

18. NSIR/DPR-ISG-01, "Interim Staff Guidance – Emergency Planning for Nuclear Power Plants,"

19. NRC Information Bulletin 2005-02, Emergency Preparedness and Response for Security Based Events

20. Nuclear Energy Institute (NEI) 99-01, Revision 6, Methodology for Development of Emergency Action Levels, endorsed by the U.S. Nuclear Regulatory Commission (NRC or the Commission) by letter dated March 28, 2013 (Thaggard, M., U.S. Nuclear Regulatory Commission, letter to Susan Perkins-Grew, Nuclear Energy Institute, "U.S. Nuclear Regulatory Commission Review and Endorsement of NEI 99-01, Revision 6, dated November, 2012 (TAC No. D92368)," dated March 28, 2013. [ADAMS Accession No. ML12346A463].

21. NRC letter dated September 8, 2017, Palo Verde Nuclear Generating Station, Units 1, 2, and 3 Issuance of Amendments to Revise Emergency Action Levels to a Scheme Based on Nuclear Energy institute NEI 99-01, Revision 6 (CAC NOS. MF6803, MF6804 and MF6805. This letter provided Amendment No. 198 to renewed Facility Operating License No. NPF-41, Amendment No. 198 to Renewed Facility Operating License No. NPF-51 and Amendment No. 198 to Renewed Facility Operating License No. NPF-74 for the Palo Verde Nuclear Generating Station, Units 1, 2, and 3, respectively. The amendments consist of changes to the emergency action level (EAL) scheme including the NRC approved Safety Evaluation.

Appendix A

Classification Guidance and EAL Technical Basis

APPENDIX A CLASSIFICATION GUIDANCE AND EAL TECHNICAL BASIS

TABLE OF CONTENTS

PURPOSE

This document provides an explanation and rationale for each Emergency Action Level (EAL) included in the EAL Upgrade Project for Palo Verde Nuclear Generating Station (PVNGS). Decision-makers responsible for implementation of EP-0901, *Classifications*, may use this document as a technical reference in support of EAL interpretation. This information may assist the Emergency Coordinator in making classifications, particularly those involving judgment or multiple events. The basis information may also be useful in training and for explaining event classifications to off-site officials.

The expectation is that emergency classifications are to be made as soon as conditions are present and recognizable for the classification, but within 15 minutes or less in all cases of conditions present. Use of this document for assistance is not intended to delay the emergency classification.

Because the information in a basis document can affect emergency classification decision-making (e.g., the Emergency Coordinator refers to it during an event), the NRC staff expects that changes to the basis document will be evaluated in accordance with the provisions of 10 CFR 50.54(q).

2.0 DISCUSSION

2.1 Background

EALs are the plant-specific indications, conditions or instrument readings that are utilized to classify emergency conditions defined in the PVNGS Emergency Plan.

In 1992, the NRC endorsed NUMARC/NESP-007, Methodology for Development of Emergency Action Levels, as an alternative to NUREG-0654 EAL guidance.

NEI 99-01 (NUMARC/NESP-007), Revisions 4 and 5, were subsequently issued for industry implementation. Enhancements over earlier revisions included:

- Consolidating the system malfunction initiating conditions and example emergency action levels which address conditions that may be postulated to occur during plant shutdown conditions.
- Initiating conditions and example emergency action levels that fully address conditions that may be postulated to occur at permanently Defueled Stations and Independent Spent Fuel Storage Installations (ISFSIs).
- Simplifying the fission product barrier EAL threshold for a Site Area Emergency.

Subsequently, Revision 6 of NEI 99-01 incorporated resolutions to numerous implementation issues including the NRC EAL Frequently Asked Questions (FAQs). Using NEI 99-01, Revision 6, Methodology for the Development of Emergency Action Levels for Non-Passive Reactors, November 2012 (ref. 4.1.1), PVNGS conducted an EAL implementation upgrade project that produced the EALs discussed herein.

2.2 Fission Product Barriers

Fission product barrier thresholds represent threats to the defense in depth design concept that precludes the release of radioactive fission products to the environment. This concept relies on multiple physical barriers, any one of which, if maintained intact, precludes the release of significant amounts of radioactive fission products to the environment.

Many of the EALs derived from the NEI methodology are fission product barrier threshold based. That is, the conditions that define the EALs are based upon thresholds that represent the loss or potential loss of one or more of the three fission product barriers. “Loss” and “Potential Loss” signify the relative damage and threat of damage to the barrier. A “Loss” threshold means the barrier no longer assures containment of radioactive materials. A “Potential Loss” threshold implies an increased probability of barrier loss and decreased certainty of maintaining the barrier.

The primary fission product barriers are:

A. Fuel Clad (FC): The FC Barrier consists of the cladding material that contains the fuel pellets.

B. Reactor Coolant System (RCS): The RCS Barrier includes the RCS primary side and its connections up to and including the pressurizer safety and relief valves and other connections up to and including the primary isolation valves.

C. Containment (CTMT): The CTMT Barrier includes the containment building and connections up to and including the outermost containment isolation valves. This barrier also includes the main steam, feedwater and blowdown line extensions outside the containment building up to and including the outermost secondary side isolation valve. Containment Barrier thresholds are used as criteria for escalation of the emergency classification level (ECL) from Alert to a Site Area Emergency or a General Emergency

2.3 Fission Product Barrier Classification Criteria

The following criteria are the bases for event classification related to fission product barrier loss or potential loss:

Alert:

Any loss or any potential loss of either Fuel Clad or RCS barrier

Site Area Emergency:

Loss or potential loss of any two barriers

General Emergency:

Loss of any two barriers and loss or potential loss of the third barrier

2.4 EAL Organization

The PVNGS EAL scheme includes the following features:

- Division of the EAL set into three broad groups:
    - EALs applicable under any plant operating modes – This group would be reviewed by the EAL-user any time emergency classification is considered.
    - EALs applicable only under hot operating modes – This group would only be reviewed by the EAL-user when the plant is in 1 - Power Operation, 2 - Startup, 3 - Hot Standby or 4 - Hot Shutdown mode.
    - EALs applicable only under cold operating modes – This group would only be reviewed by the EAL-user when the plant is in 5 - Cold Shutdown, 6 - Refueling or Defueled mode.

The purpose of the groups is to avoid review of hot condition EALs when the plant is in a cold condition and avoid review of cold condition EALs when the plant is in a hot condition. This approach significantly minimizes the total number of EALs that must be reviewed by the user for a given plant condition, reduces user reading burden and, thereby, facilitates timely identification of the EAL that applies to the emergency.

- Within each group, assignment of EALs to categories and subcategories:

Category and subcategory titles are selected to represent conditions that are operationally significant to the EAL-user. The PVNGS EAL categories are aligned to and represent the NEI 99-01 ”Recognition Categories.” Subcategories are used in the PVNGS scheme as necessary to further divide the EALs of a category into logical sets of possible emergency classification thresholds. The PVNGS EAL categories and subcategories are listed below.

EAL Groups, Categories and Subcategories

EAL Group/Category	EAL Subcategory
Any Operating Mode:	
R – Abnormal Rad Levels/Rad Effluent	1 – Radiological Effluent 2 – Irradiated Fuel Event 3 – Area Radiation Levels
H – Hazards and Other Conditions Affecting Plant Safety	1 – Security 2 – Seismic Event 3 – Natural or Technological Hazard 4 – Fire 5 – Hazardous Gas 6 – Control Room Evacuation 7 – Emergency Coordinator Judgment
E - ISFSI	1 – Confinement Boundary
Hot Conditions:	
S – System Malfunction	1 – Loss of Emergency AC Power 2 – Loss of Vital DC Power 3 – Loss of Control Room Indications 4 – RCS Activity 5 – RCS Leakage 6 – RPS Failure 7 – Loss of Communications 8 – Containment Failure 9 – Hazardous Event Affecting Safety Systems
F – Fission Product Barrier Degradation	None
Cold Conditions:	
C – Cold Shutdown/Refueling System Malfunction	1 – RCS Level 2 – Loss of Emergency AC Power 3 – RCS Temperature 4 – Loss of Vital DC Power 5 – Loss of Communications 6 – Hazardous Event Affecting Safety Systems

The primary tool for determining the emergency classification level is the EAL Classification Matrix. The user of the EAL Classification Matrix may (but is not required to) consult the EAL Technical Bases Document in order to obtain additional information concerning the EALs under classification consideration. The user should consult Section 3.0 and Attachments 1 & 2 of this document for such information.

2.5 Technical Bases Information

EAL technical bases are provided in Attachment 1 for each EAL according to EAL group (Any, Hot, Cold), EAL category (R, C, H, S, E and F) and EAL subcategory. A summary explanation of each category and subcategory is given at the beginning of the technical bases discussions of the EALs included in the category. For each EAL, the following information is provided:

Category Letter & Title

Subcategory Number & Title

Initiating Condition (IC)

Site-specific description of the generic IC given in NEI 99-01, Rev. 6.

EAL Identifier (enclosed in rectangle)

Each EAL is assigned a unique identifier to support accurate communication of the emergency classification to onsite and offsite personnel. Four characters define each EAL identifier:

1. First character (letter): Corresponds to the EAL category as described above (R, C, H, S, E or F)
2. Second character (letter): The emergency classification (G, S, A or U)

   G = General Emergency

   S = Site Area Emergency

   A = Alert

   U = Unusual Event
3. Third character (number): Subcategory number within the given category. Subcategories are sequentially numbered beginning with the number one (1). If a category does not have a subcategory, this character is assigned the number one (1).
4. Fourth character (number): The numerical sequence of the EAL within the EAL subcategory. If the subcategory has only one EAL, it is given the number one (1).

Classification (enclosed in rectangle):

Unusual Event (U), Alert (A), Site Area Emergency (S) or General Emergency (G)

EAL (enclosed in rectangle)

Exact wording of the EAL as it appears in the EAL Classification Matrix

Mode Applicability

One or more of the following plant operating conditions comprise the mode to which each EAL is applicable: 1 - Power Operation, 2 - Startup, 3 – Hot Standby, 4 - Hot Shutdown, 5 - Cold Shutdown, 6 - Refueling, DEF - Defueled, or Any. (See Section 2.6 for operating mode definitions)

Definitions:

If the EAL wording contains a defined term, the definition of the term is included in this section. These definitions can also be found in Section 5.1.

Basis:

A basis section that provides PVNGS-relevant information concerning the EAL as well as a description of the rationale for the EAL as provided in NEI 99-01, Rev. 6.

PVNGS Basis Reference(s):

Site-specific source documentation from which the EAL is derived

2.6 Operating Mode Applicability (ref. 4.1.6)

1. Power Operation

Keff > 0.99 and reactor thermal power > 5%

2. Startup

Keff > 0.99 and reactor thermal power < 5%

3. Hot Standby

Keff < 0.99 and average coolant temperature > 350ºF

4. Hot Shutdown

Keff < 0.99 and average coolant temperature 350ºF > Tavg > 210 ºF and all reactor vessel head closure bolts fully tensioned

5. Cold Shutdown

Keff < 0.99 and average coolant temperature < 210ºF and all reactor vessel head closure bolts fully tensioned

6. Refueling

One or more reactor vessel head closure bolts less than fully tensioned.

7. Defueled

All fuel assemblies have been removed from Containment and placed in the spent fuel pit and the SFP transfer canal gate valve is closed.

The mode in effect at the time that an event or condition occurred, and prior to any plant or operator response, is the mode that determines whether or not an IC is applicable. If an event or condition occurs, and results in a mode change before the emergency is declared, the emergency classification level is still based on the mode that existed at the time that the event or condition was initiated (and not when it was declared). Once a different mode is reached, any new event or condition, not related to the original event or condition, requiring emergency classification should be evaluated against the ICs and EALs applicable to the operating mode at the time of the new event or condition. For events that occur in Cold Shutdown or Refueling, escalation is via EALs that are applicable in the Cold Shutdown or Refueling modes, even if Hot Shutdown (or a higher mode) is entered during the subsequent plant response. In particular, the fission product barrier EALs are applicable only to events that initiate in the Hot Shutdown mode or higher.

3.0 GUIDANCE ON MAKING EMERGENCY CLASSIFICATIONS

3.1 General Considerations

When making an emergency classification, the Emergency Coordinator must consider all information having a bearing on the proper assessment of an Initiating Condition (IC). This includes the Emergency Action Level (EAL) plus the associated Operating Mode Applicability, Notes and the informing basis information. In the Recognition Category F matrices, EALs are based on loss or potential loss of Fission Product Barrier Thresholds.

3.1.1 Classification Timeliness

NRC regulations require the licensee to establish and maintain the capability to assess, classify and declare an emergency condition within 15 minutes after the availability of indications to plant operators that an emergency action level has been exceeded and to promptly declare the emergency condition as soon as possible following identification of the appropriate emergency classification level. The NRC staff has provided guidance on implementing this requirement in NSIR/DPR-ISG-01, Interim Staff Guidance, Emergency Planning for Nuclear Power Plants (ref. 4.1.9).

When assessing an EAL that specifies a time duration for the off-normal condition, the “clock” for the EAL time duration runs concurrently with the emergency classification process “clock.”

3.1.2 Valid Indications

All emergency classification assessments shall be based upon valid indications, reports or conditions. A valid indication, report, or condition, is one that has been verified through appropriate means such that there is no doubt regarding the indicator's operability, the condition's existence, or the report's accuracy. For example, verification could be accomplished through an instrument channel check, response on related or redundant indicators, or direct observation by plant personnel. The validation of indications should be completed in a manner that supports timely emergency declaration.

3.1.3 Imminent Conditions

For ICs and EALs that have a stipulated time duration (e.g., 15 minutes, 30 minutes, etc.), the Emergency Coordinator should not wait until the applicable time has elapsed, but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. If an ongoing radiological release is detected and the release start time is unknown, it should be assumed that the release duration specified in the IC/EAL has been exceeded, absent data to the contrary.

3.1.4 Planned vs. Unplanned Events

A planned work activity that results in an expected event or condition which meets or exceeds an EAL does not warrant an emergency declaration provided that: 1) the activity proceeds as planned and 2) the plant remains within the limits imposed by the operating license. Such activities include planned work to test, manipulate, repair, maintain or modify a system or component. In these cases, the controls associated with the planning, preparation and execution of the work will ensure that compliance is maintained with all aspects of the operating license provided that the activity proceeds and concludes as expected. Events or conditions of this type may be subject to the reporting requirements of 10 CFR 50.72 (ref. 4.1.4).

3.1.5 Classification Based on Analysis

The assessment of some EALs is based on the results of analyses that are necessary to ascertain whether a specific EAL threshold has been exceeded (e.g., dose assessments, chemistry sampling, RCS leak rate calculation, etc.). For these EALs, the EAL wording or the associated basis discussion will identify the necessary analysis. In these cases, the 15-minute declaration period starts with the availability of the analysis results that show the threshold to be exceeded (i.e., this is the time that the EAL information is first available). The NRC expects licensees to establish the capability to initiate and complete EAL-related analyses within a reasonable period of time (e.g., maintain the necessary expertise on-shift).

3.1.6 Emergency Coordinator Judgment

While the EALs have been developed to address a full spectrum of possible events and conditions which may warrant emergency classification, a provision for classification based on operator/management experience and judgment is still necessary. The NEI 99-01 EAL scheme provides the Emergency Coordinator with the ability to classify events and conditions based upon judgment using EALs that are consistent with the Emergency Classification Level (ECL) definitions (refer to Category H). The Emergency Coordinator will need to determine if the effects or consequences of the event or condition reasonably meet or exceed a particular ECL definition. A similar provision is incorporated in the Fission Product Barrier Tables; judgment may be used to determine the status of a fission product barrier.

3.2 Classification Methodology

To make an emergency classification, the user will compare an event or condition (i.e., the relevant plant indications and reports) to an EAL(s) and determine if the EAL has been met or exceeded. The evaluation of an EAL must be consistent with the related Operating Mode Applicability and Notes. If an EAL has been met or exceeded, the associated IC is likewise met, the emergency classification process "clock" starts and the ECL must be declared in accordance with plant procedures no later than fifteen minutes after the process "clock" started.

When assessing an EAL that specifies a time duration for the off-normal condition, the "clock" for the EAL time duration runs concurrently with the emergency classification process "clock." For a full discussion of this timing requirement, refer to NSIR/DPR-ISG-01 (ref. 4.1.9).

3.2.1 Classification of Multiple Events and Conditions

When multiple emergency events or conditions are present, the user will identify all met or exceeded EALs. The highest applicable ECL identified is declared. For example:

- If an Alert EAL and a Site Area Emergency EAL are met, whether at one unit or at two different units, a Site Area Emergency should be declared.

There is no "additive" effect from multiple EALs meeting the same ECL. For example:

- If two Alert EALs are met, whether at one unit or at two different units, an Alert should be declared.

Related guidance concerning classification of rapidly escalating events or conditions is provided in Regulatory Issue Summary (RIS) 2007-02, *Clarification of NRC Guidance for Emergency Notifications During Quickly Changing Events* (ref. 4.1.2).

3.2.2 Consideration of Mode Changes During Classification

The mode in effect at the time that an event or condition occurred and prior to any plant or operator response, is the mode that determines whether or not an IC is applicable. If an event or condition occurs and results in a mode change before the emergency is declared, the emergency classification level is still based on the mode that existed at the time that the event or condition was initiated (and not when it was declared). Once a different mode is reached, any new event or condition, not related to the original event or condition, requiring emergency classification should be evaluated against the ICs and EALs applicable to the operating mode at the time of the new event or condition.

For events that occur in Cold Shutdown or Refueling, escalation is via EALs that are applicable in the Cold Shutdown or Refueling modes, even if Hot Shutdown (or a higher mode) is entered during the subsequent plant response. In particular, the fission product barrier EALs are applicable only to events that initiate in the Hot Shutdown mode or higher.

3.2.3 Classification of Imminent Conditions

Although EALs provide specific thresholds, the Emergency Coordinator must remain alert to events or conditions that could lead to meeting or exceeding an EAL within a relatively short period of time (i.e., a change in the ECL is IMMINENT). If, in the judgment of the Emergency Coordinator, meeting an EAL is IMMINENT, the emergency classification should be made as if the EAL has been met. While applicable to all ECLs, this approach is particularly important at the higher emergency classification levels since it provides additional time for implementation of protective measures.

3.2.4 Emergency Classification Level Upgrading and Downgrading

An ECL may be downgraded when the event or condition that meets the highest IC and EAL no longer exists and other site-specific downgrading requirements are met. If downgrading the ECL is deemed appropriate, the new ECL would then be based on a lower applicable IC(s) and EAL(s). The ECL may also simply be terminated.

As noted above, guidance concerning classification of rapidly escalating events or conditions is provided in RIS 2007-02 (ref. 4.1.2).

3.2.5 Classification of Short-Lived Events

Event-based ICs and EALs define a variety of specific occurrences that have potential or actual safety significance. By their nature, some of these events may be short-lived and, thus, over before the emergency classification assessment can be completed. If an event occurs that meets or exceeds an EAL, the associated ECL must be declared regardless of its continued presence at the time of declaration. Examples of such events include an earthquake or a failure of the reactor protection system to automatically trip the reactor followed by a successful manual trip.

3.2.6 Classification of Transient Conditions

Many of the ICs and/or EALs employ time-based criteria. These criteria will require that the IC/EAL conditions be present for a defined period of time before an emergency declaration is warranted. In cases where no time-based criterion is specified, it is recognized that some transient conditions may cause an EAL to be met for a brief period of time (e.g., a few seconds to a few minutes). The following guidance should be applied to the classification of these conditions.

EAL momentarily met during expected plant response - In instances where an EAL is briefly met during an expected (normal) plant response, an emergency declaration is not warranted provided that associated systems and components are operating as expected and operator actions are performed in accordance with procedures.

EAL momentarily met but the condition is corrected prior to an emergency declaration – If an operator takes prompt manual action to address a condition and the action is successful in correcting the condition prior to the emergency declaration, then the applicable EAL is not considered met and the associated emergency declaration is not required. For illustrative purposes, consider the following example:

> An ATWS occurs and the high pressure ECCS systems fail to automatically start. Reactor vessel level rapidly decreases and the plant enters an inadequate core cooling condition (a potential loss of both the fuel clad and RCS barriers). If an operator manually starts a high pressure ECCS system in accordance with an EOP step and clears the inadequate core cooling condition prior to an emergency declaration, then the classification should be based on the ATWS only.

It is important to stress that the 15-minute emergency classification assessment period (process clock) is not a "grace period" during which a classification may be delayed to allow the performance of a corrective action that would obviate the need to classify the event. Emergency classification assessments must be deliberate and timely, with no undue delays. The provision discussed above addresses only those rapidly evolving situations when an operator is able to take a successful corrective action prior to the Emergency Coordinator completing the review and steps necessary to make the emergency declaration. This provision is included to ensure that any public protective actions resulting from the emergency classification are truly warranted by the plant conditions.

3.2.7 After-the-Fact Discovery of an Emergency Event or Condition

In some cases, an EAL may be met but the emergency classification was not made at the time of the event or condition. This situation can occur when personnel discover that an event or condition existed which met an EAL, but no emergency was declared and the event or condition no longer exists at the time of discovery. This may be due to the event or condition not being recognized at the time or an error that was made in the emergency classification process.

In these cases, no emergency declaration is warranted; however, the guidance contained in NUREG-1022 (ref. 4.1.3) is applicable. Specifically, the event should be reported to the NRC in accordance with 10 CFR 50.72 (ref. 4.1.4) within one hour of the discovery of the undeclared event or condition. The licensee should also notify appropriate State and local agencies in accordance with the agreed upon arrangements.

3.2.8 Retraction of an Emergency Declaration

Guidance on the retraction of an emergency declaration reported to the NRC is discussed in NUREG-1022 (ref. 4.1.3).

4.0 REFERENCES

4.1 Developmental

4.1.1 NEI 99-01, Revision 6, *Methodology for the Development of Emergency Action Levels for Non-Passive Reactors*, ADAMS Accession Number ML12326A805.

4.1.2 RIS 2007-02, *Clarification of NRC Guidance for Emergency Notifications during Quickly Changing Events*, February 2, 2007.

4.1.3 NUREG-1022, *Event Reporting Guidelines: 10 CFR 50.72 and 50.73*

4.1.4 10 CFR 50.72, *Immediate Notification Requirements for Operating Nuclear Power Reactors*

4.1.5 10 CFR 50.73, *License Event Report System*

4.1.6 Technical Specifications Table 1.1-1, *Modes*

4.1.7 Procedure 40EP-9EO10, *LM-Containment Evacuation and Closure, Appendix 249*

4.1.8 Procedure Writers Manual PVNGS Plant Procedure Writers Manual

4.1.9 NSIR/DPR-ISG-01, *Interim Staff Guidance, Emergency Planning for Nuclear Power Plants*

4.1.10 *PVNGS Emergency Plan*

4.1.11 Procedure 40DP-9ZZ30, *Reduced Inventory Operations*

4.1.12 Procedure 20DP-0SK49, *Security Integrated Response Plan (Proprietary Information)*

4.2 Implementing

4.2.1 Procedure, EP-0901, *Classifications*

4.2.2 PVNGS-TO-NEI 99-01, Rev. 6, EAL CROSS-REFERENCE

4.2.3 PVNGS EAL Matrix

5.0 DEFINITIONS, ABBREVIATIONS & ACRONYMS

5.1 Definitions (ref. 4.1.1 except as noted)

Selected terms used in Initiating Condition and Emergency Action Level statements are set in all capital letters (e.g., ALL CAPS). These words are defined terms that have specific meanings as used in this document. The definitions of these terms are provided below.

Alert

Events are in progress, or have occurred, which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of hostile action. Any releases are expected to be small fractions of the EPA Protective Action Guideline exposure levels.

Confinement Boundary

The barrier(s) between spent fuel and the environment once the spent fuel is processed for dry storage. As related to the PVNGS ISFSI, Confinement Boundary is defined as the Transportable Storage Canister (TSC) for the NAC-UMS.

Containment Closure

The procedurally defined actions taken to secure containment and its associated structures, systems and components as a functional barrier to fission product release under shutdown conditions.

As applied to PVNGS, Containment Closure is established when the requirements of procedure 40EP-9EO10, LM-Containment Evacuation and Closure, Appendix 249, for containment closure are met (ref. 4.1.7).

Emergency Action Level

A pre-determined, site-specific, observable threshold for an Initiating Condition that, when met or exceeded, places the plant in a given emergency classification level.

Emergency Classification Level

One of a set of names or titles established by the US Nuclear Regulatory Commission (NRC) for grouping off-normal events or conditions according to (1) potential or actual effects or consequences, and (2) resulting onsite and offsite response actions. The emergency classification levels, in ascending order of severity, are: Unusual Event (UE), Alert, Site Area Emergency (SAE) and General Emergency (GE).

EPA PAGs

Environment Protection Agency Protective Action Guidelines. The EPA PAGs are expressed in terms of dose commitment: 1 Rem TEDE or 5 Rem CDE Thyroid. Actual or projected offsite exposures in excess of the EPA PAGs requires PVNGS to recommend protective actions for the general public to offsite planning agencies.

Explosion

A rapid, violent and catastrophic failure of a piece of equipment due to combustion, chemical reaction or overpressurization. A release of steam (from high energy lines or components) or an electrical component failure (caused by short circuits, grounding, arcing, etc.) should not automatically be considered an explosion. Such events require a post-event inspection to determine if the attributes of an explosion are present.

Faulted

The term applied to a steam generator that has a steam or feedwater leak on the secondary side of sufficient size to cause an uncontrolled drop in steam generator pressure or the steam generator to become completely depressurized.

Fire

Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute fires. Observation of flame is preferred but is NOT required if large quantities of smoke and heat are observed.

Fission Product Barrier Threshold

A pre-determined, site-specific, observable threshold indicating the loss or potential loss of a fission product barrier.

Flooding

A condition where water is entering a room or area faster than installed equipment is capable of removal, resulting in a rise of water level within the room or area.

General Emergency

Events are in progress or have occurred which involve actual or imminent substantial core degradation or melting with potential for loss of containment integrity or hostile actions that result in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA Protective Action Guideline exposure levels offsite for more than the immediate site area.

Hostage

A person(s) held as leverage against the station to ensure that demands will be met by the station.

Hostile Action

An act toward PVNGS or its personnel that includes the use of violent force to destroy equipment, take hostages and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, projectiles, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. Hostile action should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on PVNGS. Non-terrorism-based EALs should be used to address such activities (i.e., this may include violent acts between individuals in the owner controlled area).

Hostile Force

One or more individuals who are engaged in a determined assault, overtly or by stealth and deception, equipped with suitable weapons capable of killing, maiming, or causing destruction.

Imminent

The trajectory of events or conditions is such that an EAL will be met within a relatively short period of time regardless of mitigation or corrective actions.

Impede(d)

Personnel access to a room or area is hindered to an extent that extraordinary measures are necessary to facilitate entry of personnel into the affected room/area (e.g., requiring use of protective equipment, such as SCBAs, that is not routinely employed).

Independent Spent Fuel Storage Installation (ISFSI)

A complex that is designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage.

Initiating Condition (IC)

An event or condition that aligns with the definition of one of the four emergency classification levels by virtue of the potential or actual effects or consequences.

Intrusion

The act of entering without authorization. Discovery of a bomb in a specified area is indication of intrusion into that area by a hostile force.

Maintain

Take appropriate action to hold the value of an identified parameter within specified limits.

Projectile

An object directed toward a Nuclear Power Plant that could cause concern for its continued operability, reliability, or personnel safety.

Plant or ISFSI Protected Area

An area, located within the PVNGS Exclusion Area Boundary, encompassed by physical barriers and to which access is controlled per 10 CFR 73.55. The PVNGS Power Plant Protected Area and the ISFSI Protected Area are two Protected Areas located within the PVNGS OWNER CONTROLLED AREA (ref 4.1.10)

RCS Intact

The RCS should be considered intact when the RCS pressure boundary is in its normal condition for the cold shutdown mode of operation (e.g., no freeze seals or nozzle dams, pressurizer manway and safeties installed).

Reduced Inventory

Plant condition when fuel is in the reactor vessel and Reactor Coolant System level is less than or equal to the 111 foot elevation (ref. 4.1.11).

Refueling Pathway

The reactor refueling pool, fuel storage pool and fuel transfer canal comprise the refueling pathway.

Ruptured

The condition of a steam generator in which primary-to-secondary leakage is of sufficient magnitude to require a safety injection.

Restore

Take the appropriate action required to return the value of an identified parameter to the applicable limits.

Safety System

A system required for safe plant operation, cooling down the plant and/or placing it in the cold shutdown condition, including the ECCS. These are typically systems classified as safety related (as defined in 10 CFR 50.2).

Those structures, systems and components that are relied upon to remain functional during and following design basis events to assure:

1) The integrity of the reactor coolant pressure boundary;

2) The capability to shut down the reactor and maintain it in a safe shutdown condition;

3) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures.

Security Owner Controlled Area (SOCA)

An area encompassed by physical barriers to which access is controlled. (ref 4.1.12).

Security Condition

Any security event as listed in the approved security contingency plan that constitutes a threat/compromise to site security, threat/risk to site personnel, or a potential degradation to the level of safety of the plant. A security condition does not involve a hostile action.

Site Area Emergency

Events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or hostile actions that result in intentional damage or malicious acts; (1) toward site personnel or equipment that could lead to the likely failure of or; (2) that prevent effective access to equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA Protective Action Guidelines exposure levels beyond the site boundary.

Site Boundary

The boundary of a reactor site beyond which the land or property is not owned, leased, or otherwise controlled by the licensee (ref. 4.1.10).

Unisolable

An open or breached system line that cannot be isolated, remotely or locally.

Unplanned

A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

Unusual Event

Events are in progress or have occurred which indicate a potential degradation in the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs.

Valid

An indication, report, or condition, is considered to be valid when it is verified by (1) an instrument channel check, or (2) indications on related or redundant indicators, or (3) by direct observation by plant personnel, such that doubt related to the indicator's operability, the condition's existence, or the report's accuracy is removed. Implicit in this definition is the need for timely assessment.

Visible Damage

Damage to a component or structure that is readily observable without measurements, testing, or analysis. The visual impact of the damage is sufficient to cause concern regarding the operability or reliability of the affected component or structure.

5.2 Abbreviations/Acronyms

°F .... Degrees Fahrenheit

° .... Degrees

AC .... Alternating Current

AOP .... Abnormal Operating Procedure

ATWS .... Anticipated Transient Without Scram

CET .... Core Exit Thermocouple

CDE .... Committed Dose Equivalent

CFR .... Code of Federal Regulations

CR .... Control Room

CSFST .... Critical Safety Function Status Tree

CTMT .... Containment

DBA .... Design Basis Accident

DC .... Direct Current

DEF .... Defueled

DG .... Diesel Generator

EAL .... Emergency Action Level

ECCS .... Emergency Core Cooling System

ECL .... Emergency Classification Level

EOC .... Emergency Operations Center

EOF .... Emergency Operations Facility

EOP	Emergency Operating Procedure
EPA	Environmental Protection Agency
EPABX	Electronic Private Automatic Branch Exchange
ERG	Emergency Response Guideline
EPIP	Emergency Plan Implementing Procedure
ESF	Engineered Safety Feature
ESW	Emergency Service Water
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
GE	General Emergency
IC	Initiating Condition
IPEEE	Individual Plant Examination of External Events (Generic Letter 88-20)
Keff	Effective Neutron Multiplication Factor
LCO	Limiting Condition of Operation
LER	Licensee Event Report
LOCA	Loss of Coolant Accident
LWR	Light Water Reactor
MPC	Maximum Permissible Concentration/Multi-Purpose Canister
mR, mRem, mrem, mREM	milli-Roentgen Equivalent Man
MSL	Main Steam Line
MW	Megawatt
NEI	Nuclear Energy Institute
NESP	National Environmental Studies Project
NPP	Nuclear Power Plant
NRC	Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
NORAD	North American Aerospace Defense Command
(NO)UE	Notification of Unusual Event
OBE	Operating Basis Earthquake

OCA .... Owner Controlled Area

ODCM .... Off-site Dose Calculation Manual

ORO .... Offsite Response Organization

OSC .... Operations Support Center

PA .... Protected Area

PAG .... Protective Action Guideline

PPS .... Plant Protection System

PRA/PSA .... Probabilistic Risk Assessment / Probabilistic Safety Assessment

PWR .... Pressurized Water Reactor

PSIG .... Pounds per Square Inch Gauge

R .... Roentgen

RCC .... Reactor Control Console

RCS .... Reactor Coolant System

Rem, rem, REM .... Roentgen Equivalent Man

Rep CET .... Representative Core Exit Thermocouple

RETS .... Radiological Effluent Technical Specifications

RFAT .... Radiological Field Assessment Team

R(P)V .... Reactor (Pressure) Vessel

RVLIS .... Reactor Vessel Level Indicating System

RVLMS .... Reactor Vessel Level Monitoring System

RWLIS .... Refueling Water Level Indicating System

RWT .... Refueling Water Storage Tank

SAR .... Safety Analysis Report

SBO .... Station Blackout

SBOG .... Station Blackout Generator

SCBA .... Self-Contained Breathing Apparatus

SG .... Steam Generator

SI .... Safety Injection

SIAS .... Safety Injection Actuation System

SOCA .... Security Owner Controlled Area

SPDS .... Safety Parameter Display System

SRO .... Senior Reactor Operator

STSC .... Satellite Technical Support Center

SUT .... Startup Transformer

TEDE .... Total Effective Dose Equivalent

TOAF .... Top of Active Fuel

TSC .... Technical Support Center

UFSAR .... Updated Final Safety Analysis Report

WOG .... Westinghouse Owners Group

6.0 PVNGS-TO-NEI-99-01, Rev. 6, EAL CROSS-REFERENCE

This cross-reference is provided to facilitate association and location of a PVNGS EAL within the NEI 99-01 IC/EAL identification scheme. Further information regarding the development of the PVNGS EALs based on the NEI guidance can be found in the EAL Comparison Matrix.

PVNGS	NEI 99-01, Rev. 6	
EAL	IC	Example EAL
RU1.1	AU1	1, 2
RU1.2	AU1	3
RU2.1	AU2	1
RA1.1	AA1	1
RA1.2	AA1	2
RA1.3	AA1	2
RA1.3	AA1	3
RA2.1	AA2	1
RA2.2	AA2	2
RA2.3	AA2	3
RA3.1	AA3	1
RA3.2	AA3	2
RS1.1	AS1	1
RS1.2	AS1	2

PVNGS	NEI 99-01, Rev. 6	
EAL	**IC**	**Example EAL**
RS1.3	AS1	3
RS2.1	AS2	1
RG1.1	AG1	1
RG1.2	AG1	2
RG1.3	AG1	3
RG2.1	AG2	1
CU1.1	CU1	1
CU1.2	CU1	2
CU2.1	CU2	1
CU3.1	CU3	1
CU3.2	CU3	2
CU4.1	CU4	1
CU5.1	CU5	1, 2, 3
CA1.1	CA1	1
CA1.2	CA1	2
CA2.1	CA2	1
CA3.1	CA3	1, 2
CA6.1	CA6	1
CS1.1	CS1	3
CG1.1	CG1	2
FA1.1	FA1	1
FS1.1	FS1	1
FG1.1	FG1	1
HU1.1	HU1	1, 2, 3
HU2.1	HU2	1
HU3.1	HU3	1
HU3.2	HU3	2

PVNGS	NEI 99-01, Rev. 6	
EAL	**IC**	**Example EAL**
HU3.3	HU3	3
HU3.4	HU3	4
HU4.1	HU4	1
HU4.2	HU4	2
HU4.3	HU4	3
HU4.4	HU4	4
HU7.1	HU7	1
HA1.1	HA1	1, 2
HA5.1	HA5	1
HA6.1	HA6	1
HA7.1	HA7	1
HS1.1	HS1	1
HS6.1	HS6	1
HS7.1	HS7	1
HG7.1	HG7	1
SU1.1	SU1	1
SU3.1	SU2	1
SU4.1	SU3	1
SU4.2	SU3	2
SU5.1	SU4	1, 2, 3
SU6.1	SU5	1
SU6.2	SU5	2
SU7.1	SU6	1, 2, 3
SU8.1	SU7	1, 2
SA1.1	SA1	1
SA3.1	SA2	1
SA6.1	SA5	1

PVNGS	NEI 99-01, Rev. 6	
EAL	**IC**	**Example EAL**
SA9.1	SA9	1
SS1.1	SS1	1
SS2.1	SS8	1
SS6.1	SS5	1
SG1.1	SG1	1
SG1.2	SG8	1
EU1.1	EU1	1

7.0 ATTACHMENTS

Attachment 1 - Emergency Action Level Technical Bases

Attachment 2 - Fission Product Barrier Loss/Potential Loss Matrix and Basis

Attachment 3 - Safe Operation & Shutdown Rooms Tables R-2 & H-2 Bases

Attachment 4 - Palo Verde Safety System List

ATTACHMENT 1
EAL Technical Bases

Category R – Abnormal Rad Release/Rad Effluent

EAL Group: ANY (EALs in this category are applicable to any plant condition, hot or cold.)

Many EALs are based on actual or potential degradation of fission product barriers because of the elevated potential for offsite radioactivity release. Radioactivity release through degradation of fission product barriers is not always apparent via non-radiological symptoms. Therefore, direct indication of elevated radiological effluents or area radiation levels are appropriate symptoms for emergency classification.

At lower levels, abnormal radioactivity releases may be indicative of a failure of containment systems or precursors to more significant releases. At higher release rates, offsite radiological conditions may result which require offsite protective actions. Elevated area radiation levels in plant may also be indicative of the failure of containment systems or preclude access to plant vital equipment necessary to ensure plant safety.

Events of this category pertain to the following subcategories:

1. Radiological Effluent

Direct indication of effluent radiation monitoring systems provides a rapid assessment mechanism to determine releases in excess of classifiable limits. Projected offsite doses, actual offsite field measurements or measured release rates via sampling indicate doses or dose rates above classifiable limits.

2. Irradiated Fuel Event

Conditions indicative of a loss of adequate shielding or damage to irradiated fuel may preclude access to vital plant areas or result in radiological releases that warrant emergency classification.

3. Area Radiation Levels

Sustained general area radiation levels which may preclude access to areas requiring continuous occupancy also warrant emergency classification.

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 1 – Radiological Effluent

Initiating Condition: Release of gaseous radioactivity > 2 times the ODCM limits for 60 minutes or longer

EAL:

RU1.1 Unusual Event

Reading on any Table R-1 effluent radiation monitor > column "UE" for ≥ 60 minutes (Notes 1, 2, 3)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Note 2: If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded the specified time limit.

Note 3: If the effluent flow past an effluent monitor is known to have stopped, indicating that the release path is isolated, the effluent monitor reading is no longer VALID for classification purposes.

Table R-1 Effluent Monitoring Classification Thresholds

Release Point		Monitor	GE	SAE	Alert	UE
	Plant Vent Low	RU-143 Ch 1	---	---	1.04E-02 µCi/cc	1.22E-03 µCi/cc
	Plant Vent High	RU-144 Ch 1	1.04E+00 µCi/cc	1.04E-01 µCi/cc	---	---
	Fuel Building Low	RU-145 Ch1	---	---	---	1.13E-02 µCi/cc
	Fuel Building High	RU-146 Ch 1	---	3.50E+00 µCi/cc	3.50E-01 µCi/cc	---
		RU-146 Ch 2	3.50E+01 µCi/cc	---	---	---

Mode Applicability:

All

Definition(s):

None

Basis:

The column "UE" gaseous release values in Table R-1 represent two times the appropriate ODCM release rate limits associated with the specified monitors (ref. 1, 2).

This IC addresses a potential decrease in the level of safety of the plant as indicated by a low level radiological release that exceeds regulatory commitments for an extended period of time (e.g., an uncontrolled release). It includes any gaseous radiological release, monitored or unmonitored.

Nuclear power plants incorporate design features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases and to control and monitor intentional releases. The occurrence of an extended, uncontrolled radioactive release to the environment is indicative of degradation in these features and/or controls.

Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of plant conditions alone. The inclusion of both plant condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions.

Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes.

Releases should not be prorated or averaged. For example, a release exceeding 4 times release limits for 30 minutes does not meet the EAL.

This EAL addresses normally occurring continuous radioactivity releases from monitored gaseous effluent pathways.

Escalation of the emergency classification level would be via IC RA1.

PVNGS Basis Reference(s):

1. Offsite Dose Calculation Manual Palo Verde Nuclear Generating Station Units 1, 2 and 3
2. Letter 102-05894-DCM/CJS, Dated 9/15/08, PVNGS Units 1, 2, 3, and ISFSI Docket Nos. 50-528, 50-529, 50-530, and 72-44 Proposed PVNGS Emergency Plan Change to Implement NEI 99-01, Revision 5, Emergency Action Levels (EALs) Attachment 1 Radiological Calculations
3. NEI 99-01, AU1

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 1 – Radiological Effluent

Initiating Condition: Release of gaseous radioactivity greater than 2 times the ODCM limits for 60 minutes or longer.

EAL:

RU1.2 **Unusual Event**

Sample analysis for a gaseous release indicates a concentration or release rate > 2 x ODCM limits for ≥ 60 minutes (Notes 1, 2)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Note 2: If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded the specified time limit.

Mode Applicability:

All

Definition(s):

None

Basis:

This IC addresses a potential decrease in the level of safety of the plant as indicated by a lowlevel radiological release that exceeds regulatory commitments for an extended period of time (e.g., an uncontrolled release). It includes any gaseous radiological release, monitored or unmonitored, including those for which a radioactivity discharge permit is normally prepared.

Nuclear power plants incorporate design features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases and to control and monitor intentional releases. The occurrence of an extended, uncontrolled radioactive release to the environment is indicative of degradation in these features and/or controls.

Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of plant conditions alone. The inclusion of both plant condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions.

ATTACHMENT 1
EAL Technical Bases

Releases should not be prorated or averaged. For example, a release exceeding 4 times release limits for 30 minutes does not meet the EAL.

This EAL addresses uncontrolled gaseous releases that are detected by sample analyses or environmental surveys, particularly on unmonitored pathways.

Escalation of the emergency classification level would be via IC RA1.

PVNGS Basis Reference(s):

1. *Offsite Dose Calculation Manual Palo Verde Nuclear Generating Station Units 1, 2 and 3*
2. NEI 99-01, AU1

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 1 – Radiological Effluent

Initiating Condition: Release of gaseous radioactivity resulting in offsite dose greater than 10 mrem TEDE or 50 mrem thyroid CDE

EAL:

RA1.1 Alert

Reading on any Table R-1 effluent radiation monitor > column "ALERT" for ≥ 15 minutes (Notes 1, 2, 3, 4)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Note 2: If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded the specified time limit.

Note 3: If the effluent flow past an effluent monitor is known to have stopped, indicating that the release path is isolated, the effluent monitor reading is no longer VALID for classification purposes.

Note 4: The pre-calculated effluent monitor values presented in EALs RA1.1, RS1.1 and RG1.1 should be used for emergency classification assessments until the results from a dose assessment using actual meteorology are available.

Table R-1 Effluent Monitor Classification Thresholds

Release Point	Monitor	GE	SAE	Alert	UE
Plant Vent Low	RU-143 Ch 1	---	---	1.04E-02 µCi/cc	1.22E-03 µCi/cc
Plant Vent High	RU-144 Ch 1	1.04E+00 µCi/cc	1.04E-01 µCi/cc	---	---
Fuel Building Low	RU-145 Ch1	---	---	---	1.13E-02 µCi/cc
Fuel Building High	RU-146 Ch 1	---	3.50E+00 µCi/cc	3.50E-01 µCi/cc	---
	RU-146 Ch 2	3.50E+01 µCi/cc	---	---	---

Mode Applicability:

All

Definition(s):

None

Basis:

This EAL address gaseous radioactivity releases, that for whatever reason, cause effluent radiation monitor readings corresponding to site boundary doses that exceed either:

- 10 mRem TEDE
- 50 mRem CDE Thyroid

The column "ALERT" gaseous effluent release values in Table R-1 correspond to calculated doses of 1% (10% of the SAE thresholds) of the EPA Protective Action Guidelines (TEDE or CDE Thyroid) (ref. 1).

This IC addresses a release of gaseous radioactivity that results in projected or actual offsite doses greater than or equal to 1% of the EPA Protective Action Guides (PAGs). It includes both monitored and un-monitored releases. Releases of this magnitude represent an actual or potential substantial degradation of the level of safety of the plant as indicated by a radiological release that significantly exceeds regulatory limits (e.g., a significant uncontrolled release).

Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of plant conditions alone. The inclusion of both plant condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions.

The TEDE dose is set at 1% of the EPA PAG of 1,000 mrem while the 50 mrem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.

Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes.

Escalation of the emergency classification level would be via IC RS1.

PVNGS Basis Reference(s):

1. Letter 102-05894-DCM/CJS, Dated 9/15/08, *PVNGS Units 1, 2, 3, and ISFSI Docket Nos. 50-528, 50-529, 50-530, and 72-44, Proposed PVNGS Emergency Plan Change to Implement NEI 99-01, Revision 5, Emergency Action Levels (EALs) Attachment 1 Radiological Calculations*
2. NEI 99-01, AA1

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 1 – Radiological Effluent

Initiating Condition: Release of gaseous radioactivity resulting in offsite dose greater than 10 mrem TEDE or 50 mrem thyroid CDE

EAL:

RA1.2 Alert

Dose assessment using actual meteorology indicates doses > 10 mrem TEDE or 50 mrem thyroid CDE at or beyond the SITE BOUNDARY (Note 4)

Note 4: The pre-calculated effluent monitor values presented in EALs RA1.1, RS1.1 and RG1.1 should be used for emergency classification assessments until the results from a dose assessment using actual meteorology are available.

Mode Applicability:

All

Definition(s):

SITE BOUNDARY - The boundary of a reactor site beyond which the land or property is not owned, leased, or otherwise controlled by the licensee.

Basis:

This IC addresses a release of gaseous radioactivity that results in projected or actual offsite doses greater than or equal to 1% of the EPA Protective Action Guides (PAGs). It includes both monitored and un-monitored releases. Releases of this magnitude represent an actual or potential substantial degradation of the level of safety of the plant as indicated by a radiological release that significantly exceeds regulatory limits (e.g., a significant uncontrolled release).

Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of plant conditions alone. The inclusion of both plant condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions.

The TEDE dose is set at 1% of the EPA PAG of 1,000 mrem while the 50 mrem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.

Escalation of the emergency classification level would be via IC RS1.

ATTACHMENT 1
EAL Technical Bases

PVNGS Basis Reference(s):

1. Procedure EP-0903, Accident Assessment
2. NEI 99-01, AA1

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 1 – Radiological Effluent

Initiating Condition: Release of gaseous radioactivity resulting in offsite dose greater than 10 mrem TEDE or 50 mrem thyroid CDE

EAL:

RA1.3 **Alert**

Field survey results indicate EITHER of the following at or beyond the SITE BOUNDARY:

- Closed window dose rates > 10 mR/hr expected to continue for $\geq$ 60 minutes
- Analyses of field survey samples indicate thyroid CDE > 50 mrem for 60 minutes of inhalation.

(Notes 1, 2)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Note 2: If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded the specified time limit.

Mode Applicability:

All

Definition(s):

SITE BOUNDARY - The boundary of a reactor site beyond which the land or property is not owned, leased, or otherwise controlled by the licensee.

Basis:

Procedure EP-0904, *ERO/ERF Activation and Operation*, provides guidance for emergency or post-accident radiological environmental monitoring (ref. 1).

This IC addresses a release of gaseous or radioactivity that results in projected or actual offsite doses greater than or equal to 1% of the EPA Protective Action Guides (PAGs). It includes both monitored and un-monitored releases. Releases of this magnitude represent an actual or potential substantial degradation of the level of safety of the plant as indicated by a radiological release that significantly exceeds regulatory limits (e.g., a significant uncontrolled release).

Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of plant conditions alone.

ATTACHMENT 1
EAL Technical Bases

The inclusion of both plant condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions.

The TEDE dose is set at 1% of the EPA PAG of 1,000 mrem while the 50 mrem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.

Escalation of the emergency classification level would be via IC RS1.

PVNGS Basis Reference(s):

1. Procedure EP-0904, ERO/ERF Activation and Operation
2. NEI 99-01, AA1

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 1 – Radiological Effluent

Initiating Condition: Release of gaseous radioactivity resulting in offsite dose greater than 100 mrem TEDE or 500 mrem thyroid CDE

EAL:

RS1.1 Site Area Emergency

Reading on any Table R-1 effluent radiation monitor > column "SAE" for ≥ 15 minutes (Notes 1, 2, 3, 4)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Note 2: If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded the specified time limit.

Note 3: If the effluent flow past an effluent monitor is known to have stopped, indicating that the release path is isolated, the effluent monitor reading is no longer VALID for classification purposes.

Note 4: The pre-calculated effluent monitor values presented in EALs RA1.1, RS1.1 and RG1.1 should be used for emergency classification assessments until the results from a dose assessment using actual meteorology are available.

Table R-1 Effluent Monitor Classification Thresholds

Release Point	Monitor	GE	SAE	Alert	UE
Plant Vent Low	RU-143 Ch 1	---	---	1.04E-02 µCi/cc	1.22E-03 µCi/cc
Plant Vent High	RU-144 Ch 1	1.04E+00 µCi/cc	1.04E-01 µCi/cc	---	---
Fuel Building Low	RU-145 Ch1	---	---	---	1.13E-02 µCi/cc
Fuel Building High	RU-146 Ch 1	---	3.50E+00 µCi/cc	3.50E-01 µCi/cc	---
	RU-146 Ch 2	3.50E+01 µCi/cc	---	---	---

Mode Applicability:

All

Definition(s):

None

Basis:

This EAL address gaseous radioactivity releases, that for whatever reason, cause effluent radiation monitor readings corresponding to site boundary doses that exceed either:

- 100 mRem TEDE
- 500 mRem CDE Thyroid

The column "SAE" gaseous effluent release value in Table R-1 corresponds to calculated doses of 10% of the EPA Protective Action Guidelines (TEDE or CDE Thyroid) (ref. 1).

This IC addresses a release of gaseous radioactivity that results in projected or actual offsite doses greater than or equal to 10% of the EPA Protective Action Guides (PAGs). It includes both monitored and un-monitored releases. Releases of this magnitude are associated with the failure of plant systems needed for the protection of the public.

Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of plant conditions alone. The inclusion of both plant condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions.

The TEDE dose is set at 10% of the EPA PAG of 1,000 mrem while the 500 mrem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.

Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes.

Escalation of the emergency classification level would be via IC RG1.

PVNGS Basis Reference(s):

1. Letter 102-05894-DCM/CJS, Dated 9/15/08, *PVNGS Units 1, 2, 3, and ISFSI Docket Nos. 50-528, 50-529, 50-530, and 72-44 Proposed PVNGS Emergency Plan Change to Implement NEI 99-01, Revision 5, Emergency Action Levels (EALs) Attachment 1 Radiological Calculations*
2. NEI 99-01, AS1

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 1 – Radiological Effluent

Initiating Condition: Release of gaseous radioactivity resulting in offsite dose greater than 100 mrem TEDE or 500 mrem thyroid CDE

EAL:

RS1.2 Site Area Emergency

Dose assessment using actual meteorology indicates doses > 100 mrem TEDE or 500 mrem thyroid CDE at or beyond the SITE BOUNDARY (Note 4)

Note 4: The pre-calculated effluent monitor values presented in EALs RA1.1, RS1.1 and RG1.1 should be used for emergency classification assessments until the results from a dose assessment using actual meteorology are available.

Mode Applicability:

All

Definition(s):

SITE BOUNDARY - The boundary of a reactor site beyond which the land or property is not owned, leased, or otherwise controlled by the licensee.

Basis:

This IC addresses a release of gaseous radioactivity that results in projected or actual offsite doses greater than or equal to 10% of the EPA Protective Action Guides (PAGs). It includes both monitored and un-monitored releases. Releases of this magnitude are associated with the failure of plant systems needed for the protection of the public.

Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of plant conditions alone. The inclusion of both plant condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions.

The TEDE dose is set at 10% of the EPA PAG of 1,000 mrem while the 500 mrem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.

Escalation of the emergency classification level would be via IC RG1.

PVNGS Basis Reference(s):

1. Procedure EP-0903, Accident Assessment
2. NEI 99-01, AS1

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 1 – Radiological Effluent

Initiating Condition: Release of gaseous radioactivity resulting in offsite dose greater than 100 mrem TEDE or 500 mrem thyroid CDE

EAL:

RS1.3 Site Area Emergency

Field survey results indicate EITHER of the following at or beyond the SITE BOUNDARY:

- Closed window dose rates > 100 mR/hr expected to continue for ≥ 60 minutes
- Analyses of field survey samples indicate thyroid CDE > 500 mrem for 60 minutes of inhalation.

(Notes 1, 2)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Note 2: If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded the specified time limit.

Mode Applicability:

All

Definition(s):

SITE BOUNDARY - The boundary of a reactor site beyond which the land or property is not owned, leased, or otherwise controlled by the licensee.

Basis:

Procedure EP-0904, *ERO/ERF Activation and Operation*, provides guidance for emergency or post-accident radiological environmental monitoring (ref. 1).

This IC addresses a release of gaseous radioactivity that results in projected or actual offsite doses greater than or equal to 10% of the EPA Protective Action Guides (PAGs). It includes both monitored and un-monitored releases. Releases of this magnitude are associated with the failure of plant systems needed for the protection of the public.

Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of plant conditions alone.

The inclusion of both plant condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions.

The TEDE dose is set at 10% of the EPA PAG of 1,000 mrem while the 500 mrem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.

Escalation of the emergency classification level would be via IC RG1.

PVNGS Basis Reference(s):

1. Procedure EP-0904, ERO/ERF Activation and Operation
2. NEI 99-01, AS1

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 1 – Radiological Effluent

Initiating Condition: Release of gaseous radioactivity resulting in offsite dose greater than 1,000 mrem TEDE or 5,000 mrem thyroid CDE

EAL:

RG1.1 General Emergency

Reading on any Table R-1 effluent radiation monitor > column "GE" for ≥ 15 minutes (Notes 1, 2, 3, 4)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Note 2: If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded the specified time limit.

Note 3: If the effluent flow past an effluent monitor is known to have stopped, indicating that the release path is isolated, the effluent monitor reading is no longer VALID for classification purposes.

Note 4: The pre-calculated effluent monitor values presented in EALs RA1.1, RS1.1 and RG1.1 should be used for emergency classification assessments until the results from a dose assessment using actual meteorology are available.

Table R-1 Effluent Monitor Classification Thresholds

Release Point		Monitor	GE	SAE	Alert	UE
	Plant Vent Low	RU-143 Ch 1	---	---	1.04E-02 µCi/cc	1.22E-03 µCi/cc
	Plant Vent High	RU-144 Ch 1	1.04E+00 µCi/cc	1.04E-01 µCi/cc	---	---
	Fuel Building Low	RU-145 Ch1	---	---	---	1.13E-02 µCi/cc
	Fuel Building High	RU-146 Ch 1	---	3.50E+00 µCi/cc	3.50E-01 µCi/cc	---
		RU-146 Ch 2	3.50E+01 µCi/cc	---	---	---

Mode Applicability:

All

Definition(s):

None

Basis:

This EAL address gaseous radioactivity releases, that for whatever reason, cause effluent radiation monitor readings corresponding to site boundary doses that exceed either:

- 1000 mRem TEDE
- 5000 mRem CDE Thyroid

The column "GE" gaseous effluent release values in Table R-1 correspond to calculated doses of 100% of the EPA Protective Action Guidelines (TEDE or CDE Thyroid) (ref. 1).

This IC addresses a release of gaseous radioactivity that results in projected or actual offsite doses greater than or equal to the EPA Protective Action Guides (PAGs). It includes both monitored and un-monitored releases. Releases of this magnitude will require implementation of protective actions for the public.

Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of plant conditions alone. The inclusion of both plant condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions.

The TEDE dose is set at the EPA PAG of 1,000 mrem while the 5,000 mrem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.

Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes.

PVNGS Basis Reference(s):

1. Letter 102-05894-DCM/CJS, Dated 9/15/08, *PVNGS Units 1, 2, 3, and ISFSI Docket Nos. 50-528, 50-529, 50-530, and 72-44 Proposed PVNGS Emergency Plan Change to Implement NEI 99-01, Revision 5, Emergency Action Levels (EALs) Attachment 1 Radiological Calculations*
2. NEI 99-01, AG1

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 1 – Radiological Effluent

Initiating Condition: Release of gaseous radioactivity resulting in offsite dose greater than 1,000 mrem TEDE or 5,000 mrem thyroid CDE

EAL:

RG1.2	**General Emergency**
Dose assessment using actual meteorology indicates doses > 1,000 mrem TEDE or 5,000 mrem thyroid CDE at or beyond the SITE BOUNDARY (Note 4)	

Note 4: The pre-calculated effluent monitor values presented in EALs RA1.1, RS1.1 and RG1.1 should be used for emergency classification assessments until the results from a dose assessment using actual meteorology are available.

Mode Applicability:

All

Definition(s):

SITE BOUNDARY - The boundary of a reactor site beyond which the land or property is not owned, leased, or otherwise controlled by the licensee.

Basis:

This IC addresses a release of gaseous radioactivity that results in projected or actual offsite doses greater than or equal to the EPA Protective Action Guides (PAGs). It includes both monitored and un-monitored releases. Releases of this magnitude will require implementation of protective actions for the public.

Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of plant conditions alone. The inclusion of both plant condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions.

The TEDE dose is set at the EPA PAG of 1,000 mrem while the 5,000 mrem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.

ATTACHMENT 1
EAL Technical Bases

PVNGS Basis Reference(s):

1. Procedure EP-0903, Accident Assessment
2. NEI 99-01, AG1

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 1 – Radiological Effluent

Initiating Condition: Release of gaseous radioactivity resulting in offsite dose greater than 1,000 mrem TEDE or 5,000 mrem thyroid CDE

EAL:

RG1.3 General Emergency

Field survey results indicate EITHER of the following at or beyond the SITE BOUNDARY:

- Closed window dose rates > 1,000 mR/hr expected to continue for ≥ 60 minutes
- Analyses of field survey samples indicate thyroid CDE > 5,000 mrem for 60 minutes of inhalation.

(Notes 1, 2)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Note 2: If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded the specified time limit.

Mode Applicability:

All

Definition(s):

SITE BOUNDARY - The boundary of a reactor site beyond which the land or property is not owned, leased, or otherwise controlled by the licensee.

Basis:

Procedure EP-0904, ERO/ERF Activation and Operation, provides guidance for emergency or post-accident radiological environmental monitoring (ref. 1).

This IC addresses a release of gaseous radioactivity that results in projected or actual offsite doses greater than or equal to the EPA Protective Action Guides (PAGs). It includes both monitored and un-monitored releases. Releases of this magnitude will require implementation of protective actions for the public.

Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of plant conditions alone.

ATTACHMENT 1
EAL Technical Bases

The inclusion of both plant condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions.

The TEDE dose is set at the EPA PAG of 1,000 mrem while the 5,000 mrem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.

PVNGS Basis Reference(s):

1. Procedure EP-0904, *ERO/ERF Activation and Operation*
2. NEI 99-01, AG1

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 2 – Irradiated Fuel Event

Initiating Condition: UNPLANNED loss of water level above irradiated fuel

EAL:

RU2.1 Unusual Event

UNPLANNED water level drop in the REFUELING PATHWAY as indicated by low water level alarm (PCN-E02) or level indication (installed plant indicator/camera or RWLIS)

AND

UNPLANNED alert alarm on any of the following corresponding radiation monitors:

- RU-16 Containment Operating Level Area
- RU-17 Incore Instrument Area (when installed)
- RU-19 New Fuel Area
- RU-31 Spent Fuel Pool Area
- RU-33 Refueling Machine Area (when installed)

Mode Applicability:

All

Definition(s):

UNPLANNED - A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

REFUELING PATHWAY- The reactor refueling pool, fuel storage pool and fuel transfer canal comprise the refueling pathway.

Basis:

The low water level alarm in this EAL refers to the Fuel Pool low level alarm (procedure 40AL-9PC01, Fuel Pool Cooling and Cleanup Local Alarm Panel PCN-E02 Responses) (ref. 1). During the fuel transfer phase of refueling operations, the fuel transfer canal is normally in communication with the fuel storage pool and the refueling pool in the Containment is in communication with the fuel transfer canal when the fuel transfer tube is open. A lowering in water level in the SFP, fuel transfer canal or refueling pool is therefore sensed by the SFP low level alarm. (ref. 1, 2).

The SFP is locally monitored in the Fuel Building by Level indicators PCN-LIT-3/5 on PCNE02. These level indicating transmitters also initiate local panel alarms via level switches PCN-LSHL-3/PCN-LSL-5 on low and low low SFP level respectively. The alarms are also located on PCNE02 and annunciate a general Control Room alarm on window “FUEL POOL CLG SYS TRBL” indicating an alarm is in on the local panel.

Level is also indicated in the Control Room visually via digital camera feed and in the back panel area on panel PCN-E015 by a digital level indicator. This Control Room indication does not have associated annunciation.

Technical Specification LCO 3.7.14 (ref. 3) requires at least 23 ft of water above the Fuel Storage Pool storage racks. Technical Specification LCO 3.9.6 (ref. 4) requires at least 23 ft of water above the Reactor Vessel flange in the refueling pool. During refueling, this maintains sufficient water level in the fuel transfer canal, refueling pool and SFP to retain iodine fission product activity in the water in the event of a fuel handling accident.

The listed radiation monitors are those expected to see increased area radiation levels as a result of a loss of REFUELING PATHWAY inventory (ref. 2). Increasing radiation indications on these monitors in the absence of indications of decreasing REFUELING PATHWAY level are not classifiable under this EAL. The Alert alarms are set very low (3 X normal background) and would promptly alert operators of any increase in area radiation (ref. 5).

When the spent fuel pool and reactor cavity are connected, there could exist the possibility of uncovering irradiated fuel. Therefore, this EAL is applicable for conditions in which irradiated fuel is being transferred to and from the reactor vessel and spent fuel pool.

This IC addresses a decrease in water level above irradiated fuel sufficient to cause elevated radiation levels. This condition could be a precursor to a more serious event and is also indicative of a minor loss in the ability to control radiation levels within the plant. It is therefore a potential degradation in the level of safety of the plant.

A water level decrease will be primarily determined by indications from available level instrumentation. Other sources of level indications may include reports from plant personnel (e.g., from a refueling crew) or video camera observations (if available). A significant drop in the water level may also cause an increase in the radiation levels of adjacent areas that can be detected by monitors in those locations.

The effects of planned evolutions should be considered. For example, a refueling bridge area radiation monitor reading may increase due to planned evolutions such as lifting of the reactor vessel head or movement of a fuel assembly. Note that this EAL is applicable only in cases where the elevated reading is due to an unplanned loss of water level.

A drop in water level above irradiated fuel within the reactor vessel may be classified in accordance with Recognition Category C during the Cold Shutdown and Refueling modes.

Escalation of the emergency classification level would be via IC RA2.

PVNGS Basis Reference(s):

1. Procedure 40AL-9PC01, *Fuel Pool Cooling and Cleanup Local Alarm Panel PCN-E02 Responses*
2. Procedure 40AO-9ZZ23, *Loss of SFP Level or Cooling*
3. Technical Specification LCO 3.7.14, *Fuel Storage Pool Water Level*
4. Technical Specification LCO 3.9.6, *Refueling Water Level – Fuel Assemblies*
5. Design Basis Manual – Radiation Monitoring System
6. NEI 99-01, AU2

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 2 – Irradiated Fuel Event

Initiating Condition: Significant lowering of water level above, or damage to, irradiated fuel

EAL:

RA2.1	**Alert**
Uncovery of irradiated fuel in the REFUELING PATHWAY	

Mode Applicability:

All

Definition(s):

REFUELING PATHWAY - The reactor refueling pool, fuel storage pool and fuel transfer canal comprise the refueling pathway.

Basis:

This IC addresses events that have caused imminent or actual damage to an irradiated fuel assembly, or a significant lowering of water level within the spent fuel pool. These events present radiological safety challenges to plant personnel and are precursors to a release of radioactivity to the environment. As such, they represent an actual or potential substantial degradation of the level of safety of the plant.

This EAL applies to irradiated fuel that is licensed for dry storage up to the point that the loaded storage cask is sealed. Once sealed, damage to a loaded cask causing loss of the CONFINEMENT BOUNDARY is classified in accordance with IC EU1.1.

Escalation of the emergency would be based on either Recognition Category R or C ICs.

This EAL escalates from RU2.1 in that the loss of level, in the affected portion of the REFUELING PATHWAY, is of sufficient magnitude to have resulted in uncovery of irradiated fuel. Indications of irradiated fuel uncovery may include direct or indirect visual observation (e.g., reports from personnel or camera images), as well as significant changes in water and radiation levels, or other plant parameters. Computational aids may also be used (e.g., a boil-off curve). Classification of an event using this EAL should be based on the totality of available indications, reports and observations.

While an area radiation monitor could detect an increase in a dose rate due to a lowering of water level in some portion of the REFUELING PATHWAY, the reading may not be a reliable indication of whether or not the fuel is actually uncovered. To the degree possible, readings should be considered in combination with other available indications of inventory loss.

A drop in water level above irradiated fuel within the reactor vessel may be classified in accordance Recognition Category C during the Cold Shutdown and Refueling modes.

Escalation of the emergency classification level would be via IC RS1.

PVNGS Basis Reference(s):

1. Procedure 40AO-9ZZ23, *Loss of SFP Level or Cooling*
2. NEI 99-01, AA2

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 2 – Irradiated Fuel Event

Initiating Condition: Significant lowering of water level above, or damage to, irradiated fuel

EAL:

RA2.2 Alert

Damage to irradiated fuel resulting in a release of radioactivity from the fuel as indicated by high alarm on any of the following:

- RU-16 Containment Operating Level Area
- RU-17 Incore Instrument Area (when installed)
- RU-19 New Fuel Area
- RU-31 Spent Fuel Pool Area
- RU-33 Refueling Machine Area (when installed)
- RU-37/38 Containment Purge Exhaust Area
- RU-143 Plant Vent
- RU-145 Fuel Building Vent

Mode Applicability:

All

Definition(s):

None

Basis:

The specified radiation monitors are those expected to see increase area radiation levels as a result of damage to irradiated fuel (ref. 1, 2).

This IC addresses events that have caused actual damage to an irradiated fuel assembly, or a significant lowering of water level within the spent fuel pool. These events present radiological safety challenges to plant personnel and are precursors to a release of radioactivity to the environment. As such, they represent an actual or potential substantial degradation of the level of safety of the plant.

This EAL applies to irradiated fuel that is licensed for dry storage up to the point that the loaded storage cask is sealed. Once sealed, damage to a loaded cask causing loss of the CONFINEMENT BOUNDARY is classified in accordance with EU1.1.

Escalation of the emergency would be based on either Recognition Category R or C ICs.

This EAL addresses a release of radioactive material caused by mechanical damage to irradiated fuel. Damaging events may include the dropping, bumping or binding of an assembly, or dropping a heavy load onto an assembly. A rise in readings on radiation monitors should be considered in conjunction with in-plant reports or observations of a potential fuel damaging event (e.g., a fuel handling accident).

Escalation of the emergency classification level would be via IC RS1.

PVNGS Basis Reference(s):

1. Design Basis Manual – Radiation Monitoring System
2. Procedure 40AO-9ZZ22, *Fuel Damage*
3. NEI 99-01, AA2

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 2 – Irradiated Fuel Event

Initiating Condition: Significant lowering of water level above, or damage to, irradiated fuel

EAL:

RA2.3	**Alert**
Spent fuel pool level $\leq$ 125 ft. (Level 2)	

Mode Applicability:

All

Definition(s):

None

Basis:

For PVNGS, Level 2, which corresponds to 10 ft. above the top of the fuel racks in the SFP (9 ft. based on instrument indication margin), is an indicated level of 125 ft. (ref. 2).

This IC addresses events that have caused imminent or actual damage to an irradiated fuel assembly, or a significant lowering of water level within the spent fuel pool. These events present radiological safety challenges to plant personnel and are precursors to a release of radioactivity to the environment. As such, they represent an actual or potential substantial degradation of the level of safety of the plant.

Escalation of the emergency would be based on either Recognition Category R or C ICs. Spent fuel pool water level at this value is within the lower end of the level range necessary to prevent significant dose consequences from direct gamma radiation to personnel performing operations in the vicinity of the spent fuel pool. This condition reflects a significant loss of spent fuel pool water inventory and thus it is also a precursor to a loss of the ability to adequately cool the irradiated fuel assembles stored in the pool.

PVNGS Basis Reference(s):

1. Letter 102-06728, dated July 11, 2013, and Adams Accession #13199A033, *Response to Request for Additional Information for the PVNGS Overall Integrated Plan in Response to March 12, 2012, Commission Order Modifying License with Regard to Reliable Spent Fuel Pool Level Instrumentation (Order Number EA-12-051)*
2. Evaluation 4512970
3. NEI 99-01, AA2

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 2 – Irradiated Fuel Event

Initiating Condition: Spent fuel pool level at the top of the fuel racks

EAL:

RS2.1	**Site Area Emergency**
Spent fuel pool level ≤ 116 ft. (Level 3)	

Mode Applicability:

All

Definition(s):

None

Basis:

For PVNGS, Level 3, which corresponds to 0 ft. above the top of the fuel racks in the SFP, is an indicated level of 116 ft. (includes a 1 ft.10 inches instrument indication error margin) (ref. 2).

This EAL addresses a significant loss of spent fuel pool inventory control and makeup capability leading to IMMINENT fuel damage. This condition entails major failures of plant functions needed for protection of the public and thus warrant a Site Area Emergency declaration.

It is recognized that this IC would likely not be met until well after another Site Area Emergency IC was met; however, it is included to provide classification diversity.

Escalation of the emergency classification level would be via IC RG1 or RG2.

PVNGS Basis Reference(s):

1. Letter 102-06728, dated July 11, 2013 and Adams Accession #13199A033, *Response to Request for Additional Information for the PVNGS Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying License with Regard to Reliable Spent Fuel Pool Level Instrumentation (Order Number EA-12-051)*
2. Evaluation 4512970
3. NEI 99-01, AS2

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 2 – Irradiated Fuel Event

Initiating Condition: Spent fuel pool level cannot be restored to at least the top of the fuel racks for 60 minutes or longer

EAL:

RG2.1	**General Emergency**
Spent fuel pool level cannot be restored to at least 116 ft. (Level 3) for ≥ 60 minutes (Note 1)	

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Mode Applicability:

All

Definition(s):

None

Basis:

For PVNGS, Level 3, which corresponds to 0 ft. above the top of the fuel racks in the SFP, is an indicated level of 116 ft. (includes a 1 ft.10 inches instrument indication error margin) (ref. 2).

This EAL addresses a significant loss of spent fuel pool inventory control and makeup capability leading to a prolonged uncovery of spent fuel. This condition will lead to fuel damage and a radiological release to the environment.

It is recognized that this IC would likely not be met until well after another General Emergency IC was met; however, it is included to provide classification diversity.

PVNGS Basis Reference(s):

1. Letter 102-06728, dated July 11, 2013 and Adams Accession #13199A033, *Response to Request for Additional Information for the PVNGS Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying License with Regard to Reliable Spent Fuel Pool Level Instrumentation (Order Number EA-12-051)*
2. Evaluation 4512970
3. NEI 99-01, AG2

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 3 – Area Radiation Levels

Initiating Condition: Radiation levels that IMPEDE access to equipment necessary for normal plant operations, cooldown or shutdown

EAL:

RA3.1 Alert

Dose rates > 15 mR/hr in EITHER of the following areas:

- Control Room
- Central Alarm Station (CAS) (by survey)

Mode Applicability:

All

Definition(s):

None

Basis:

Areas that meet this threshold include the Control Room and the Central Alarm Station (CAS). The Radiation Monitoring System monitors the Control Room for area radiation (ref. 1). If unavailable local radiation surveys can be performed. The CAS is included in this EAL because of its' importance to permitting access to areas required to assure safe plant operations.

There is no permanently installed CAS area radiation monitor that may be used to assess this EAL threshold. Therefore this threshold must be assessed via local radiation survey for the CAS (ref. 1).

This IC addresses elevated radiation levels in certain plant rooms/areas sufficient to preclude or impede personnel from performing actions necessary to maintain normal plant operation, or to perform a normal plant cooldown and shutdown. As such, it represents an actual or potential substantial degradation of the level of safety of the plant. The Emergency Coordinator should consider the cause of the increased radiation levels and determine if another IC may be applicable.

Escalation of the emergency classification level would be via Recognition Category R, C or F ICs.

PVNGS Basis Reference(s):

1. Design Basis Manual – *Radiation Monitoring System*
2. NEI 99-01, AA3

ATTACHMENT 1
EAL Technical Bases

Category: R – Abnormal Rad Levels/Rad Effluent

Subcategory: 3 – Area Radiation Levels

Initiating Condition: Radiation levels that IMPEDE access to equipment necessary for normal plant operations, cooldown or shutdown

EAL:

RA3.2 Alert

An UNPLANNED event results in radiation levels that prohibit or IMPEDE access to any Table R-2 rooms (Note 5)

Note 5: If the equipment in the listed room was already inoperable or out-of-service before the event occurred, then no emergency classification is warranted.

Table R-2 Safe Operation & Shutdown Rooms	
Room	**Mode Applicability**
Control Building 100 ft. Class DC Equipment Room C	4, 5
Control Building 100 ft. Class DC Equipment Room D	4, 5

Mode Applicability:

4 – Hot Shutdown, 5 – Cold Shutdown

Definition(s):

IMPEDE(D) - Personnel access to a room or area is hindered to an extent that extraordinary measures are necessary to facilitate entry of personnel into the affected room/area (e.g., requiring use of protective equipment, such as SCBAs, that is not routinely employed).

UNPLANNED - A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

Basis:

If the equipment in the listed room was already inoperable, or out-of-service, before the event occurred, then no emergency should be declared since the event will have no adverse impact beyond that already allowed by Technical Specifications at the time of the event.

The list of plant rooms with entry-related mode applicability identified specify those rooms that contain equipment which require a manual/local action as specified in operating procedures used for normal plant operation, cooldown and shutdown. Rooms or areas in which actions of a contingent or emergency nature would be performed (e.g., an action to address an off-normal or emergency condition such as emergency repairs, corrective measures or emergency operations) are not included. In addition, the list specifies the plant mode(s) during which entry would be required for each room (ref. 1).

This IC addresses elevated radiation levels in certain plant rooms/areas sufficient to preclude or impede personnel from performing actions necessary to maintain normal plant operation, or to perform a normal plant cooldown and shutdown. As such, it represents an actual or potential substantial degradation of the level of safety of the plant. The Emergency Coordinator should consider the cause of the increased radiation levels and determine if another IC may be applicable.

For RA3.2, an Alert declaration is warranted if entry into the affected room/area is, or may be, procedurally required during the plant operating mode in effect at the time of the elevated radiation levels. The emergency classification is not contingent upon whether entry is actually necessary at the time of the increased radiation levels. Access should be considered as impeded if extraordinary measures are necessary to facilitate entry of personnel into the affected room/area (e.g., installing temporary shielding, requiring use of non-routine protective equipment, requesting an extension in dose limits beyond normal administrative limits).

An emergency declaration is not warranted if any of the following conditions apply:

- The plant is in an operating mode different than the mode specified for the affected room/area (i.e., entry is not required during the operating mode in effect at the time of the elevated radiation levels). For example, the plant is in Mode 1 when the radiation increase occurs and the procedures used for normal operation, cooldown and shutdown do not require entry into the affected room until Mode 4.
- The increased radiation levels are a result of a planned activity that includes compensatory measures which address the temporary inaccessibility of a room or area (e.g., radiography, spent filter or resin transfer, etc.).
- The action for which room/area entry is required is of an administrative or record keeping nature (e.g., normal rounds or routine inspections).
- The access control measures are of a conservative or precautionary nature and would not actually prevent or impede a required action.

Escalation of the emergency classification level would be via Recognition Category R, C or F ICs.

ATTACHMENT 1
EAL Technical Bases

NOTE: EAL RA3.2 mode applicability has been limited to the applicable modes identified in Table R-2 Safe Operation & Shutdown Rooms/Areas. If due to plant operating procedure or plant configuration changes, the applicable plant modes specified in Table R-2 are changed, a corresponding change to Attachment 3 ‘Safe Operation & Shutdown Areas Tables R-2 & H-2 Bases’ and to EAL RA3.2 mode applicability is required.

PVNGS Basis Reference(s):

1. Attachment 3 - Safe Operation & Shutdown Areas Tables R-3 & H-2 Bases
2. NEI 99-01, AA3

Category E – Independent Spent Fuel Storage Installation (ISFSI)

EAL Group: ANY (EALs in this category are applicable to any plant condition, hot or cold.)

An independent spent fuel storage installation (ISFSI) is a complex that is designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage. A significant amount of the radioactive material contained within a canister must escape its packaging and enter the environment for there to be a significant environmental effect resulting from an accident involving the dry storage of spent nuclear fuel.

A Notification of Unusual Event is declared on the basis of the occurrence of an event of sufficient magnitude that a loaded cask confinement boundary is damaged or violated.

ATTACHMENT 1
EAL Technical Bases

Category: ISFSI

Subcategory: Confinement Boundary

Initiating Condition: Damage to a loaded cask CONFINEMENT BOUNDARY

EAL:

EU1.1 Unusual Event

Damage to a loaded canister CONFINEMENT BOUNDARY as indicated by an on-contact radiation reading on the surface of a loaded spent fuel cask greater than any of the following:

- 100 mrem/hr (neutron + gamma) on the side of the cask
- 100 mrem/hr (neutron + gamma) on the top of the cask
- 200 mrem/hr (neutron + gamma) at the air inlets or outlets

Mode Applicability:

All

Definition(s):

CONFINEMENT BOUNDARY - The barrier(s) between spent fuel and the environment once the spent fuel is processed for dry storage. As related to the PVNGS ISFSI, Confinement Boundary is defined as the Transportable Storage Canister (TSC) for the NAC-UMS.

INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI) - A complex that is designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage.

Basis:

The PVNGS ISFSI utilizes the NAC-UMS dry spent fuel storage system for dry spent fuel storage. The system consist of a Transportable Storage Canister (TSC) and concrete Vertical Concrete Cask (VCC). The TSC is the CONFINEMENT BOUNDARY. The TSC is welded and designed to provide confinement of all radionuclides under normal, off-normal and accident conditions (ref. 1, 2).

Confinement boundary is defined as the barrier(s) between areas containing radioactive substances and the environment. Therefore, damage to a confinement boundary must be a confirmed physical breach between the spent fuel and the environment for the TSC.

The values shown represent 2 times the limits specified in the ISFSI Certificate of Compliance (C of C) Technical Specification for radiation external to a loaded TSC for a NAC-UMS canister (ref. 1)

This IC addresses an event that results in damage to the CONFINEMENT BOUNDARY of a storage cask containing spent fuel. It applies to irradiated fuel that is licensed for dry storage beginning at the point that the loaded storage cask is sealed. The issues of concern are the creation of a potential or actual release path to the environment, degradation of one or more fuel assemblies due to environmental factors and configuration changes which could cause challenges in removing the cask or fuel from storage.

The existence of “damage” is determined by radiological survey. The ISFSI C of C technical specification multiple of “2 times,” which is also used in Recognition Category R IC RU1, is used here to distinguish between non-emergency and emergency conditions. The emphasis for this classification is the degradation in the level of safety of the spent fuel cask and not the magnitude of the associated dose or dose rate. It is recognized that in the case of extreme damage to a loaded cask, the fact that the “on-contact” dose rate limit is exceeded may be determined based on measurement of a dose rate at some distance from the cask.

Security-related events for ISFSIs are covered under ICs HU1 and HA1.

PVNGS Basis Reference(s):

1. *USNRC Certificate of Compliance for NAC International’s UMS Spent Fuel Storage Casks No. 1015, Amendment 5 ,Appendix A,Technical Specifications for the NAC-UMS System*
2. NEI 99-01, E-HU1

Category C – Cold Shutdown / Refueling System Malfunction

EAL Group: Cold Conditions (RCS temperature $\leq$ 210ºF); EALs in this category are applicable only in one or more cold operating modes.

Category C EALs are directly associated with cold shutdown or refueling system safety functions. Given the variability of plant configurations (e.g., systems out-of-service for maintenance, containment open, reduced AC power redundancy, time since shutdown) during these periods, the consequences of any given initiating event can vary greatly. For example, a loss of decay heat removal capability that occurs at the end of an extended outage has less significance than a similar loss occurring during the first week after shutdown. Compounding these events is the likelihood that instrumentation necessary for assessment may also be inoperable. The cold shutdown and refueling system malfunction EALs are based on performance capability to the extent possible with consideration given to RCS integrity, containment closure and fuel clad integrity for the applicable operating modes (5 - Cold Shutdown, 6 - Refueling, D – Defueled).

The events of this category pertain to the following subcategories:

1. <u>RCS Level</u>

RCS water level is directly related to the status of adequate core cooling and, therefore, fuel clad integrity.

2. <u>Loss of Emergency AC Power</u>

Loss of emergency plant electrical power can compromise plant safety system operability including decay heat removal and emergency core cooling systems which may be necessary to ensure fission product barrier integrity. This category includes loss of onsite and offsite power sources for 4.16KV AC emergency buses.

3. <u>RCS Temperature</u>

Uncontrolled or inadvertent temperature or pressure increases are indicative of a potential loss of safety functions.

4. <u>Loss of Vital DC Power</u>

Loss of emergency plant electrical power can compromise plant safety system operability including decay heat removal and emergency core cooling systems which may be necessary to ensure fission product barrier integrity. This category includes loss of power to or degraded voltage on the 125V DC vital buses.

5. Loss of Communications

Certain events that degrade plant operator ability to effectively communicate with essential personnel within or external to the plant warrant emergency classification.

6. Hazardous Event Affecting Safety Systems

Certain hazardous natural and technological events may result in visible damage to or degraded performance of safety systems warranting classification.

ATTACHMENT 1
EAL Technical Bases

Category: C – Cold Shutdown/Refueling System Malfunction

Subcategory: 1 – RCS Level

Initiating Condition: UNPLANNED loss of RCS inventory for 15 minutes or longer

EAL:

CU1.1 Unusual Event

UNPLANNED loss of reactor coolant results in RCS water level less than a required lower limit for ≥ 15 minutes (Notes 1, 10)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Note 10: Variations in RCS boron concentration, temperature and Containment Temperature from those used in RWLIS calibration will induce indication errors. Refer to *Operator Assistance Program RWLIS_Spreadsheet.xls.*

Mode Applicability:

5 - Cold Shutdown, 6 – Refueling

Definition(s):

UNPLANNED - A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

Basis:

With the plant in Cold Shutdown, RCS water level is normally maintained above the partial drain condition of 10% pressurizer level (117 ft. RWLIS W.R.) (ref. 1). However, if RCS level is being controlled below the pressurizer partial drain setpoint, or if level is being maintained in a designated band in the reactor vessel it is the inability to maintain level above the low end of the designated control band due to a loss of inventory resulting from a leak in the RCS that is the concern.

With the plant in Refueling mode, RCS water level is normally maintained at or above the reactor vessel flange (Technical Specification LCO 3.9.6 requires at least 23 ft. of water above the top of the reactor vessel flange in the refueling pool during refueling operations) (ref. 2).

Procedure 40OP-9ZZ16, RCS Drain Operations, provides direction regarding variations in RCS boron concentration, temperature and Containment Temperature from those used in RWLIS calibration will induce indication errors, which are addressed by a controlled program, Operator Assistance Program RWLIS_Spreadsheet.xls (ref. 1).

This IC addresses the inability to restore and maintain water level to a required minimum level (or the lower limit of a level band), or a loss of the ability to monitor RCS level concurrent with indications of coolant leakage. Either of these conditions is considered to be a potential degradation of the level of safety of the plant.

Refueling evolutions that decrease RCS water inventory are carefully planned and controlled. An UNPLANNED event that results in water level decreasing below a procedurally required limit warrants the declaration of an Unusual Event due to the reduced water inventory that is available to keep the core covered.

This EAL recognizes that the minimum required RCS level can change several times during the course of a refueling outage as different plant configurations and system lineups are implemented. This EAL is met if the minimum level, specified for the current plant conditions, cannot be maintained for 15 minutes or longer. The minimum level is typically specified in the applicable operating procedure but may be specified in another controlling document.

The 15-minute threshold duration allows sufficient time for prompt operator actions to restore and maintain the expected water level. This criterion excludes transient conditions causing a brief lowering of water level.

Continued loss of RCS inventory may result in escalation to the Alert emergency classification level via either IC CA1 or CA3.

PVNGS Basis Reference(s):

1. Procedure 40OP-9ZZ16, *RCS Drain Operations*
2. Technical Specification LCO 3.9.6, *Refueling Water Level – Fuel Assemblies*
3. NEI 99-01, CU1

ATTACHMENT 1
EAL Technical Bases

Category: C – Cold Shutdown/Refueling System Malfunction

Subcategory: 1 – RCS Level

Initiating Condition: UNPLANNED loss of RCS inventory for 15 minutes or longer

EAL:

CU1.2 Unusual Event

RCS level cannot be monitored

AND EITHER

- UNPLANNED increase in any Table C-1 sump/tank level due to loss of RCS inventory
- Visual observation of UNISOLABLE RCS leakage

Table C-1 Sumps/Tanks
• Containment Sumps • Reactor Cavity Sump • Auxiliary Building Sumps • CVCS Holdup Tank • Reactor Drain Tank • Refueling Water Tank • Equipment Drain Tank

Mode Applicability:

5 - Cold Shutdown, 6 – Refueling

Definition(s):

UNISOLABLE - An open or breached system line that cannot be isolated, remotely or locally.

UNPLANNED - A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

Basis:

In Cold Shutdown mode, the RCS will normally be intact and standard RCS level monitoring means are available.

In the Refuel mode, the RCS is not intact and reactor vessel level may be monitored by different means, including the ability to monitor level visually.

ATTACHMENT 1
EAL Technical Bases

In this EAL, all water level indication is unavailable and the RCS inventory loss must be detected by indirect leakage indications (Table C-1). Level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage. If the make-up rate to the RCS unexplainably rises above the preestablished rate, a loss of RCS inventory may be occurring even if the source of the leakage cannot be immediately identified. Visual observation of significant leakage from systems connected to the RCS that cannot be isolated could also be indicative of a loss of RCS inventory (ref. 1, 2).

This IC addresses the inability to restore and maintain water level to a required minimum level (or the lower limit of a level band), or a loss of the ability to monitor RCS level concurrent with indications of coolant leakage. Either of these conditions is considered to be a potential degradation of the level of safety of the plant.

Refueling evolutions that decrease RCS water inventory are carefully planned and controlled. An UNPLANNED event that results in water level decreasing below a procedurally required limit warrants the declaration of an Unusual Event due to the reduced water inventory that is available to keep the core covered.

This EAL addresses a condition where all means to determine level have been lost. In this condition, operators may determine that an inventory loss is occurring by observing changes in sump and/or tank levels (Table C-1). Sump and/or tank level changes must be evaluated against other potential sources of water flow to ensure they are indicative of leakage from the RCS.

Continued loss of RCS inventory may result in escalation to the Alert emergency classification level via either IC CA1 or CA3.

PVNGS Basis Reference(s):

1. Procedure 40AO-9ZZ02, *Excessive RCS Leakrate*
2. Procedure 40OP-9ZZ16, *RCS Drain Operations*
3. NEI 99-01, CU1

ATTACHMENT 1
EAL Technical Bases

Category: C – Cold Shutdown/Refueling System Malfunction

Subcategory: 1 – RCS Level

Initiating Condition: Loss of RCS inventory

EAL:

CA1.1 Alert

Loss of RCS inventory as indicated by RCS level < 101 ft. 6 in.
(RWLIS NR RCN-LI-752A/RCN-LR-752)

Mode Applicability:

5 - Cold Shutdown, 6 – Refueling

Definition(s):

None

Basis:

RCS water level, as indicated on RWLIS narrow range (RCN-LI-752A or RCN-LR-752), of 101 ft 6 in., corresponds to 2 inches above the RCS Hot Leg centerline and is the lowest level for continued operation of normal shutdown cooling (SDC) (ref. 1).

The inability to restore and maintain level after reaching this setpoint infers a failure of the RCS barrier.

This IC addresses conditions that are precursors to a loss of the ability to adequately cool irradiated fuel (i.e., a precursor to a challenge to the fuel clad barrier). This condition represents a potential substantial reduction in the level of plant safety.

For this EAL, a lowering of RCS water level below 101 ft. 6 in. indicates that operator actions have not been successful in restoring and maintaining RCS water level. The heat-up rate of the coolant will increase as the available water inventory is reduced. A continuing decrease in water level will lead to core uncovery.

Although related, this EAL is concerned with the loss of RCS inventory and not the potential concurrent effects on systems needed for decay heat removal (e.g., loss of a Decay Heat Removal suction point). An increase in RCS temperature caused by a loss of decay heat removal capability is evaluated under IC CA3.

If RCS water level continues to lower, then escalation to Site Area Emergency would be via IC CS1.

PVNGS Basis Reference(s):

1. Procedure 40OP-9ZZ16, *RCS Drain Operations*
2. NEI 99-01, CA1

ATTACHMENT 1
EAL Technical Bases

Category: C – Cold Shutdown/Refueling System Malfunction

Subcategory: 1 – RCS Level

Initiating Condition: Loss of RCS inventory

EAL:

CA1.2 **Alert**

RCS level cannot be monitored for ≥ 15 minutes (Note 1)

AND EITHER

- UNPLANNED increase in any Table C-1 Sump / Tank level due to a loss of RCS inventory
- Visual observation of UNISOLABLE RCS leakage

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Table C-1 Sumps/Tanks
• Containment Sumps • Reactor Cavity Sump • Auxiliary Building Sumps • CVCS Holdup Tank • Reactor Drain Tank • Refueling Water Tank • Equipment Drain Tank

Mode Applicability:

5 - Cold Shutdown, 6 – Refueling

Definition(s):

UNISOLABLE - An open or breached system line that cannot be isolated, remotely or locally.

UNPLANNED - A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

Basis:

In Cold Shutdown mode, the RCS will normally be intact and standard RCS level monitoring means are available.

In the Refuel mode, the RCS is not intact and RCS level may be monitored by different means, including the ability to monitor level visually.

In this EAL, all RCS water level indication would be unavailable for greater than 15 minutes and the RCS inventory loss must be detected by indirect leakage indications (Table C-1). Level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage. If the make-up rate to the RCS unexplainably rises above the pre-established rate, a loss of RCS inventory may be occurring even if the source of the leakage cannot be immediately identified. Visual observation of significant leakage from systems connected to the RCS that cannot be isolated could also be indicative of a loss of RCS inventory (ref. 1, 2).

This IC addresses conditions that are precursors to a loss of the ability to adequately cool irradiated fuel (i.e., a precursor to a challenge to the fuel clad barrier). This condition represents a potential substantial reduction in the level of plant safety.

For this EAL, the inability to monitor RCS level may be caused by instrumentation and/or power failures, or water level dropping below the range of available instrumentation. If water level cannot be monitored, operators may determine that an inventory loss is occurring by observing changes in sump and/or tank levels. Sump and/or tank level changes must be evaluated against other potential sources of water flow to ensure they are indicative of leakage from the RCS.

The 15-minute duration for the loss of level indication was chosen because it is half of the EAL duration specified in IC CS1.

If the RCS inventory level continues to lower, then escalation to Site Area Emergency would be via IC CS1.

PVNGS Basis Reference(s):

1. Procedure 40AO-9ZZ02, *Excessive RCS Leakrate*
2. Procedure 40OP-9ZZ16, *RCS Drain Operations*
3. NEI 99-01, CA1

ATTACHMENT 1
EAL Technical Bases

Category: C – Cold Shutdown/Refueling System Malfunction

Subcategory: 1 – RCS Level

Initiating Condition: Loss of RCS inventory affecting core decay heat removal capability

EAL:

CS1.1 Site Area Emergency

RCS level cannot be monitored for ≥ 30 minutes (Note 1)

AND

Core uncovery is indicated by any of the following:

- UNPLANNED increase in any Table C-1 sump/tank level of sufficient magnitude to indicate core uncovery
- RU-33 ≥ 9,000 mR/hr (when installed)
- Erratic Excore Monitor indication

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Table C-1 Sumps/Tanks
• Containment Sumps • Reactor Cavity Sump • Auxiliary Building Sumps • CVCS Holdup Tank • Reactor Drain Tank • Refueling Water Tank • Equipment Drain Tank

Mode Applicability:

5 - Cold Shutdown, 6 – Refueling

Definition(s):

UNPLANNED - A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

Basis:

In Cold Shutdown mode, the RCS will normally be intact and standard RCS level monitoring means are available.

In the Refueling mode, the RCS is not intact and RPV level may be monitored by different means, including the ability to monitor level visually.

The bottom of the RWLIS indication is 99’ 7”. If level lowers less than 99’ 7” then level would not be able to be monitored. If RWLIS is not in service then when RVLMS is < 21 % plenum level (Detector #8) level would not be able to be monitored.

In this EAL, all RCS water level indication would be unavailable for greater than 30 minutes and the RCS inventory loss must be detected by indirect leakage indications (Table C-1). Level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage. If the make-up rate to the RCS unexplainably rises above the pre-established rate, a loss of RCS inventory may be occurring even if the source of the leakage cannot be immediately identified. Visual observation of significant leakage from systems connected to the RCS that cannot be isolated could also be indicative of a loss of RCS inventory (ref. 1, 2).

Sump or tank level increases should be of a magnitude that correlates to a volume sufficient to indicate fuel has been uncovered or uncovery is imminent.

The Reactor Vessel inventory loss may be detected by the refueling machine area radiation monitor or erratic Excore Monitor indication.

As water level in the reactor vessel lowers, the dose rate above the core will rise. The dose rate due to this core shine should result in up-scaled (10,000 mR/hr) refueling machine area radiation monitor (RU-33) indication. A threshold value of 90% of scale has been selected as an on-scale indicator (ref. 3, 4).

Post-TMI accident studies indicated that the installed PWR nuclear instrumentation will operate erratically when the core is uncovered and that this should be used as a tool for making such determinations (ref. 5).

This IC addresses a significant and prolonged loss of reactor vessel/RCS inventory control and makeup capability leading to IMMINENT fuel damage. The lost inventory may be due to a RCS component failure, a loss of configuration control or prolonged boiling of reactor coolant. These conditions entail major failures of plant functions needed for protection of the public and thus warrant a Site Area Emergency declaration.

Following an extended loss of core decay heat removal and inventory makeup, decay heat will cause reactor coolant boiling and a further reduction in reactor vessel level. If RCS level cannot be restored, fuel damage is probable.

The 30-minute criterion is tied to a readily recognizable event start time (i.e., the total loss of ability to monitor level) and allows sufficient time to monitor, assess and correlate reactor and plant conditions to determine if core uncovery has actually occurred (i.e., to account for various accident progression and instrumentation uncertainties). It also allows sufficient time for performance of actions to terminate leakage, recover inventory control/makeup equipment and/or restore level monitoring.

The inability to monitor RCS level may be caused by instrumentation and/or power failures, or water level dropping below the range of available instrumentation. If water level cannot be monitored, operators may determine that an inventory loss is occurring by observing changes in sump and/or tank levels. Sump and/or tank level changes must be evaluated against other potential sources of water flow to ensure they are indicative of leakage from the RCS.

This EAL addresses concerns raised by Generic Letter 88-17, *Loss of Decay Heat Removal*, SECY 91-283, *Evaluation of Shutdown and Low Power Risk Issues*, NUREG-1449, *Shutdown and Low-Power Operation at Commercial Nuclear Power Plants in the United States*, and NUMARC 91-06, *Guidelines for Industry Actions to Assess Shutdown Management*.

Escalation of the emergency classification level would be via IC CG1 or RG1

PVNGS Basis Reference(s):

1. Procedure 40AO-9ZZ02, *Excessive RCS Leakrate*
2. Procedure 40OP-9ZZ16, *RCS Drain Operations*
3. UFSAR Table 11.5-1, Continuous Process and Effluent Radiation Monitoring
4. UFSAR Section 11.5.2.1.5.4, Refueling Area Monitor
5. Nuclear Safety Analysis Center (NSAC), 1980, *Analysis of Three Mile Island - Unit 2 Accident*, NSAC-1
6. NEI 99-01, CS1

ATTACHMENT 1
EAL Technical Bases

Category: C – Cold Shutdown/Refueling System Malfunction

Subcategory: 1 – RCS Level

Initiating Condition: Loss of RCS inventory affecting fuel clad integrity with containment challenged

EAL:

CG1.1 General Emergency

RCS level cannot be monitored for ≥ 30 minutes (Note 1)

AND

Core uncovery is indicated by any of the following:

- UNPLANNED increase in any Table C-1 sump/tank level of sufficient magnitude to indicate core uncovery
- RU-33 ≥ 9,000 mR/hr (when installed)
- Erratic Excore Monitor indication

AND

Any Containment Challenge indication, Table C-2

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Note 6: If CONTAINMENT CLOSURE is re-established prior to exceeding the 30-minute time limit, declaration of a General Emergency is not required.

Table C-1 Sumps/Tanks
• Containment Sumps • Reactor Cavity Sump • Auxiliary Building Sumps • CVCS Holdup Tank • Reactor Drain Tank • Refueling Water Tank • Equipment Drain Tank

Table C-2 Containment Challenge Indications
• CONTAINMENT CLOSURE not established (Note 6) • Containment hydrogen concentration ≥ 4.9% • Unplanned rise in containment pressure

Mode Applicability:

5 - Cold Shutdown, 6 – Refueling

Definition(s):

CONTAINMENT CLOSURE - The procedurally defined actions taken to secure containment and its associated structures, systems and components as a functional barrier to fission product release under shutdown conditions.

As applied to PVNGS, Containment Closure is established when the requirements of procedure 40EP-9EO10, LM-Containment Evacuation and Closure, Appendix 249, for containment closure are met.

UNPLANNED - A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

Basis:

In Cold Shutdown mode, the RCS will normally be intact and standard RCS level monitoring means are available.

In the Refueling mode, the RCS is not intact and RPV level may be monitored by different means, including the ability to monitor level visually.

The bottom of the RWLIS indication is 99' 7". If level lowers less than 99' 7" then level would not be able to be monitored. If RWLIS is not in service then when RVLMS is < 21 % plenum level (Detector #8) level would not be able to be monitored.

In this EAL, all RCS water level indication would be unavailable for greater than 30 minutes and the RCS inventory loss must be detected by indirect leakage indications (Table C-1). Level increases must be evaluated against other potential sources of leakage such as cooling water sources inside the containment to ensure they are indicative of RCS leakage. If the make-up rate to the RCS unexplainably rises above the pre-established rate, a loss of RCS inventory may be occurring even if the source of the leakage cannot be immediately identified. Visual observation of significant leakage from systems connected to the RCS that cannot be isolated could also be indicative of a loss of RCS inventory (ref. 1, 2).

Sump or tank level increases should be of a magnitude that correlates to a volume sufficient to indicate fuel has been uncovered or uncovery is imminent.

The Reactor Vessel inventory loss may be detected by the refueling machine area radiation monitor or erratic Excore Monitor indication.

As water level in the reactor vessel lowers, the dose rate above the core will rise. The dose rate due to this core shine should result in up-scaled (10,000 mR/hr) refueling machine area radiation monitor (RU-33) indication. A threshold value of 90% of scale has been selected as an on-scale indicator (ref. 3, 4).

Post-TMI accident studies indicate that the installed PWR nuclear instrumentation will operate erratically when the core is uncovered and that this should be used as a tool for making such determinations (ref. 5).

Three conditions are associated with a challenge to Containment integrity:

1. CONTAINMENT CLOSURE not established - The status of Containment closure is tracked if plant conditions change that could raise the risk of a fission product release as a result of a loss of decay heat removal (ref. 6). If containment closure is re-established prior to exceeding the 30 minute core uncovery time limit then escalation to GE would not occur.

2. Containment hydrogen ≥ 4.9% - The 4.9% hydrogen concentration threshold represents the Hydrogen Recombiners Function Failure Indication (ref. 11) and is the acceptance criteria for the PVNGS Safety Function Status Check for LOCA, Containment Combustible Gas Control (ref.7, 8, 10,). PVNGS is equipped with a Hydrogen Control System (HCS) which serves to limit or reduce combustible gas concentrations in the containment. The HCS is an engineered safety feature with redundant hydrogen recombiners, hydrogen mixing system, hydrogen monitoring subsystem and a backup hydrogen purge subsystem. The HCS is designed to maintain the containment hydrogen concentration below 4% by volume (ref. 8). Two containment hydrogen monitors have a range of 0% to 10% (ref. 8, 9). Since the hydrogen monitoring system may be out of service in Modes 5 and 6, alternative means of determining hydrogen concentration may be required if the Emergency Coordinator believes conditions exist that may cause hydrogen generation inside containment.

3. UNPLANNED rise in containment pressure - An unplanned pressure rise in containment while in cold shutdown or refueling modes can threaten Containment Closure capability and thus containment potentially cannot be relied upon as a barrier to fission product release.

This IC addresses the inability to restore and maintain reactor vessel level above the top of active fuel with containment challenged. This condition represents actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity. Releases can be reasonably expected to exceed EPA PAG exposure levels offsite for more than the immediate site area.

Following an extended loss of core decay heat removal and inventory makeup, decay heat will cause reactor coolant boiling and a further reduction in reactor vessel level. If RCS level cannot be restored, fuel damage is probable.

With CONTAINMENT CLOSURE not established, there is a high potential for a direct and unmonitored release of radioactivity to the environment. If CONTAINMENT CLOSURE is reestablished prior to exceeding the 30-minute time limit, then declaration of a General Emergency is not required.

The existence of an explosive mixture means, at a minimum, that the containment atmospheric hydrogen concentration is sufficient to support a hydrogen burn (i.e., at the lower deflagration limit). A hydrogen burn will raise containment pressure and could result in collateral equipment damage leading to a loss of containment integrity. It therefore represents a challenge to Containment integrity.

In the early stages of a core uncovery event, it is unlikely that hydrogen buildup due to a core uncovery could result in an explosive gas mixture in containment. If all installed hydrogen gas monitors are out-of-service during an event leading to fuel cladding damage, it may not be possible to obtain a containment hydrogen gas concentration reading as ambient conditions within the containment will preclude personnel access. During periods when installed containment hydrogen gas monitors are out-of-service, operators may use the other listed indications to assess whether or not containment is challenged.

The 30-minute criterion is tied to a readily recognizable event start time (i.e., the total loss of ability to monitor level) and allows sufficient time to monitor, assess and correlate reactor and plant conditions to determine if core uncovery has actually occurred (i.e., to account for various accident progression and instrumentation uncertainties). It also allows sufficient time for performance of actions to terminate leakage, recover inventory control/makeup equipment and/or restore level monitoring.

The inability to monitor RCS level may be caused by instrumentation and/or power failures, or water level dropping below the range of available instrumentation. If water level cannot be monitored, operators may determine that an inventory loss is occurring by observing changes in sump and/or tank levels. Sump and/or tank level changes must be evaluated against other potential sources of water flow to ensure they are indicative of leakage from the RCS.

This EAL addresses concerns raised by Generic Letter 88-17, *Loss of Decay Heat Removal*; SECY 91-283, *Evaluation of Shutdown and Low Power Risk Issues*; NUREG-1449, *Shutdown and Low-*

Power Operation at Commercial Nuclear Power Plants in the United States; and NUMARC 91-06, *Guidelines for Industry Actions to Assess Shutdown Management*.

PVNGS Basis Reference(s):

1. Procedure 40AO-9ZZ02, *Excessive RCS Leakrate*
2. Procedure 40OP-9ZZ16, *RCS Drain Operations*
3. UFSAR Table 11.5-1, Continuous Process and Effluent Radiation Monitoring
4. UFSAR Section 11.5.2.1.5.4, Refueling Area Monitor
5. Nuclear Safety Analysis Center (NSAC), 1980, *Analysis of Three Mile Island - Unit 2 Accident*, NSAC-1
6. Procedure 40EP-9EO10, *LM-Containment Evacuation and Closure*, Appendix 249
7. Procedure 40DP-9AP08, *Loss of Coolant Accident Technical Guideline*
8. UFSAR Section 1.2.4.2, Additional PVNGS Engineered Safety Features
9. UFSAR Table 6.2.5-1, Combustible Gas Control System Design Parameters
10. Procedure 40EP-9EO03, *Loss of Coolant Accident*
11. Nuclear Fuel Management Analysis Calculation TA-13-C00-2000-001, *EOP Setpoint Document*
12. NEI 99-01, CG1

ATTACHMENT 1
EAL Technical Bases

Category: C – Cold Shutdown/Refueling System Malfunction

Subcategory: 2 – Loss of Emergency AC Power

Initiating Condition: Loss of all but one AC power source to emergency buses for 15 minutes or longer

EAL:

CU2.1 Unusual Event

AC power capability, Table C-3, to emergency 4.16KV buses PBA-S03 and PBB-S04 reduced to a single power source for ≥ 15 minutes (Note 1)

AND

Any additional single power source failure will result in loss of all AC power to SAFETY SYSTEMS

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Table C-3 AC Power Sources

Offsite:

- • SUT (normal)
- • SUT (alternate)
- • SBOG #1 (if already aligned)
- • SBOG #2 (if already aligned)

Onsite:

- • DG A
- • DG B

Mode Applicability:

5 - Cold Shutdown, 6 – Refueling, D – Defueled

Definition(s):

SAFETY SYSTEM - A system required for safe plant operation, cooling down the plant and/or placing it in the cold shutdown condition, including the ECCS. These are typically systems classified as safety-related (as defined in 10 CFR 50.2):

Those structures, systems and components that are relied upon to remain functional during and following design basis events to assure:

1) The integrity of the reactor coolant pressure boundary;
2) The capability to shut down the reactor and maintain it in a safe shutdown condition;
3) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures.

Basis:

For emergency classification purposes, "capability" means that an AC power source is available to and capable of powering the emergency bus(es) within 15 min, whether or not the buses are currently powered from it.

The condition indicated by this EAL is the degradation of the offsite and onsite power sources such that any additional single failure would result in a loss of all AC power to the emergency buses.

4.16KV buses PBA-S03 and PBB-S04 are the emergency (essential) buses. PBA-S03 supplies power to Train A safety related loads and PBB-S04 supplies power to Train B safety related loads. Each bus has two normal sources of offsite power. Each source is from one of three 13.8 KV Startup Transformers (SUT) via its normal and alternative ESF Service Transformer NBN-X03 and the alternate supply to PBB-S04 or NBN-X04. Transformer NBN-X03 is the normal supply to bus PBA-S03 and the alternate supply to PBB-S04; Transformer NBN-X04 is the normal supply to bus PBB-S04 and the alternate supply to PBA-S03 (ref. 1).

In addition, PBA-S03 and PBB-S04 each have an emergency diesel generator (DG A & DG B) which supply electrical power to the bus automatically in the event that the preferred source becomes unavailable (ref. 1).

Additional alternate offsite AC power sources are the two redundant 13.8KV SBO gas turbine generators (SBOG #1 & SBOG #2). However, these sources can only be credited if already aligned, that is, capable of powering one or more emergency bus within 15 minutes. Each SBOG is rated at approximately 3.4 MW and can supply the shutdown SAFETY SYSTEM loads in Modes 5, 6 and Defueled.

This cold condition EAL is equivalent to the hot condition EAL SA1.1.

This IC describes a significant degradation of offsite and onsite AC power sources such that any additional single failure would result in a loss of all AC power to SAFETY SYSTEMS. In this condition, the sole AC power source may be powering one, or more than one, train of safety related equipment.

When in the cold shutdown, refueling, or defueled mode, this condition is not classified as an Alert because of the increased time available to restore another power source to service. Additional time is available due to the reduced core decay heat load and the lower temperatures and pressures in various plant systems. Thus, when in these modes, this condition is considered to be a potential degradation of the level of safety of the plant.

An “AC power source” is a source recognized in AOPs and EOP and capable of supplying required power to an essential bus. Some examples of this condition are presented below.

- A loss of all offsite power with a concurrent failure of all but one emergency power source (e.g., an onsite diesel generator).
- A loss of all offsite power and loss of all emergency power sources (e.g., onsite diesel generators) with a single train of emergency buses being fed from an SBOG.
- A loss of emergency power sources (e.g., onsite diesel generators) with a single train of emergency buses being fed from an offsite power source.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of power.

The subsequent loss of the remaining single power source would escalate the event to an Alert in accordance with IC CA2.

PVNGS Basis Reference(s):

1. Drawing 13-E-MAA-001, *Main Single Line Diagram*
2. UFSAR Section 8.3.1, AC Power Systems
3. Procedure 40AO-9ZZ12, *Degraded Electrical Power*
4. UFSAR Section 1.2.10.3.9, Alternate AC Power System
5. NEI 99-01, CU2

ATTACHMENT 1
EAL Technical Bases

Category: C – Cold Shutdown/Refueling System Malfunction

Subcategory: 2 – Loss of Emergency AC Power

Initiating Condition: Loss of **all** offsite and **all** onsite AC power to emergency buses for 15 minutes or longer

EAL:

CA2.1 **Alert**
Loss of all offsite and all onsite AC power capability to emergency 4.16KV buses PBA-S03 and PBB-S04 for ≥ 15 minutes (Note 1)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Mode Applicability:

5 - Cold Shutdown, 6 - Refueling, D – Defueled

Basis:

For emergency classification purposes, “capability” means that an AC power source is available to and capable of powering the emergency bus(es) within 15 min, whether or not the buses are currently powered from it.

4.16KV buses PBA-S03 and PBB-S04 are the emergency (essential) buses. PBA-S03 supplies power to Train A safety related loads and PBB-S04 supplies power to Train B safety related loads. Each bus has two normal sources of offsite power. Each source is from one of three 13.8 KV Startup Transformers (SUT) via its normal and alternative ESF Service Transformer NBN-X03 or NBN-X04. Transformer NBN-X03 is the normal supply to bus PBA-S03 and the alternate supply to PBB-S04; Transformer NBN-X04 is the normal supply to bus PBB-S04 and the alternate supply to PBA-S03 (ref. 1).

In addition, PBA-S03 and PBB-S04 each have an emergency diesel generator (DG A & DG B) which supply electrical power to the bus automatically in the event that the preferred source becomes unavailable (ref. 1).

Additional alternate offsite AC power sources include, but not limited to, the two redundant 13.8KV SBO gas turbine generators (SBOG #1 & SBOG #2). However, these sources can only be credited if already aligned, that is, capable of powering one or more emergency bus within 15 minutes. Each SBOG is rated at approximately 3.4 MW and can supply the shutdown SAFETY SYSTEM loads in Modes 5, 6 and Defueled.

This cold condition EAL is equivalent to the hot condition loss of all offsite AC power EAL SS1.1.

This IC addresses a total loss of AC power that compromises the performance of all SAFETY SYSTEMS requiring electric power including those necessary for emergency core cooling, containment heat removal/pressure control, spent fuel heat removal and the ultimate heat sink.

When in the cold shutdown, refueling, or defueled mode, this condition is not classified as a Site Area Emergency because of the increased time available to restore an emergency bus to service. Additional time is available due to the reduced core decay heat load and the lower temperatures and pressures in various plant systems. Thus, when in these modes, this condition represents an actual or potential substantial degradation of the level of safety of the plant.

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Escalation of the emergency classification level would be via IC CS1 or RS1.

PVNGS Basis Reference(s):

1. Drawing 13-E-MAA-001, *Main Single Line Diagram*
2. UFSAR Section 8.3.1, AC Power Systems
3. Procedure 40AO-9ZZ12, *Degraded Electrical Power*
4. UFSAR Section 1.2.10.3.9, Alternate AC Power System
5. NEI 99-01, CA2

Category: C – Cold Shutdown/Refueling System Malfunction

Subcategory: 3 – RCS Temperature

Initiating Condition: UNPLANNED increase in RCS temperature

EAL:

CU3.1	**Unusual Event**
UNPLANNED increase in RCS temperature to > 210°F	

Mode Applicability:

5 - Cold Shutdown, 6 – Refueling

Mode Applicability:

UNPLANNED - A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

Basis:

Several instruments are capable of providing indication of RCS temperature with respect to the Technical Specification cold shutdown temperature limit (210°F, ref. 1). These include cold leg (T_{cold}) temperature indications, hot leg (Thot) temperature indications with RCPs running, CETs and SDC Heat Exchanger inlet temperature indications (ref. 2, 3).

However, if Shutdown Cooling (SDC) flow is lost, then the normal temperature elements used to monitor RCS temperature are not accurate indicators of RCS temperature. The CETs are the design instruments for these conditions. For some periods of time the CETs may not be available. The current practices concerning determining time to boil can be used in the evaluation of these EALs. Without CET indication and with a loss of SDC flow the following guidance should be used (ref. 4):

- Use the predetermined “time to boil” data for evaluating these EALs. This approach reflects the relatively small numerical difference between the typical Technical Specification cold shutdown temperature limit of 210°F and the boiling temperature of RCS water with the plant in Mode 5 or 6.

- Alternately, the Control Room staff may use a procedure or user aid to determine when RCS temperature will likely exceed 210°F given the actual plant conditions (e.g., using a heat-up curve).

This IC addresses an UNPLANNED increase in RCS temperature above the Technical Specification cold shutdown temperature limit and represents a potential degradation of the level of safety of the plant. If the RCS is not intact and CONTAINMENT CLOSURE is not established during this event, the Emergency Coordinator should also refer to IC CA3.

A momentary UNPLANNED excursion above the Technical Specification cold shutdown temperature limit when the heat removal function is available does not warrant a classification.

This EAL involves a loss of decay heat removal capability, or an addition of heat to the RCS in excess of that which can currently be removed, such that reactor coolant temperature cannot be maintained below the cold shutdown temperature limit specified in Technical Specifications.

During this condition, there is no immediate threat of fuel damage because the core decay heat load has been reduced since the cessation of power operation.

During an outage, the level in the reactor vessel will normally be maintained at or above the reactor vessel flange. Refueling evolutions that lower water level below the reactor vessel flange are carefully planned and controlled. A loss of forced decay heat removal at reduced inventory may result in a rapid increase in reactor coolant temperature depending on the time after shutdown.

Escalation to Alert would be via IC CA1 based on an inventory loss or IC CA3 based on exceeding plant configuration-specific time criteria.

PVNGS Basis Reference(s):

1. Technical Specifications Table 1.1-1, Modes
2. Procedure 40OP-9ZZ03, *Reactor Startup*
3. Procedure 40ST-9RC01, *RCS and Pressurizer Heatup and Cooldown Rates*
4. Safety Analysis Operational Data Book
5. NEI 99-01, CU3

ATTACHMENT 1
EAL Technical Bases

Category: C – Cold Shutdown/Refueling System Malfunction

Subcategory: 3 – RCS Temperature

Initiating Condition: UNPLANNED increase in RCS temperature

EAL:

CU3.2	**Unusual Event**
Loss of all RCS temperature and RCS level indication for ≥ 15 minutes (Note 1)	

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Mode Applicability:

5 - Cold Shutdown, 6- Refueling

Definition(s):

None

Basis:

Several instruments are capable of providing indication of RCS temperature with respect to the Technical Specification cold shutdown temperature limit (210°F, ref. 1). These include cold leg (T_{cold}) temperature indications, hot leg (Thot) temperature indications with RCPs running, CETs and SDC Heat Exchanger inlet temperature indications (ref. 2, 3).

Several instruments are capable of providing indication of RCS level including pressurizer level, RWLIS, RVLMS and local monitor (gauge glass) (ref. 4).

This EAL addresses the inability to determine RCS temperature and level and represents a potential degradation of the level of safety of the plant. If the RCS is not intact and CONTAINMENT CLOSURE is not established during this event, the Emergency Coordinator should also refer to IC CA3.

This EAL reflects a condition where there has been a significant loss of instrumentation capability necessary to monitor RCS conditions and operators would be unable to monitor key parameters necessary to assure core decay heat removal. During this condition, there is no immediate threat of fuel damage because the core decay heat load has been reduced since the cessation of power operation.

ATTACHMENT 1
EAL Technical Bases

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of indication.

Escalation to Alert would be via IC CA1 based on an inventory loss or IC CA3 based on exceeding plant configuration-specific time criteria.

PVNGS Basis Reference(s):

1. Technical Specification Table 1.1-1, *Modes*
2. Procedure 40OP-9ZZ03, *Reactor Startup*
3. Procedure 40ST-9RC01, *RCS and Pressurizer Heatup and Cooldown Rates*
4. Procedure 40OP-9ZZ16, *RCS Drain Operations*
5. NEI 99-01, CU3

ATTACHMENT 1
EAL Technical Bases

Category: C – Cold Shutdown/Refueling System Malfunction

Subcategory: 3 – RCS Temperature

Initiating Condition: Inability to maintain plant in cold shutdown

EAL:

CA3.1 Alert
UNPLANNED increase in RCS temperature to > 210°F for > Table C-4 duration (Note 1)
OR
UNPLANNED RCS pressure increase > 10 psia (This criterion does not apply during water-solid plant conditions)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Table C-4: Heat-up Duration Thresholds

RCS Statues	CONTAINMENT CLOSURE Status	Heat-up Duration
Intact (but not REDUCED INVENTORY	N/A	60 minutes.*
Not intact **OR** REDUCED INVENTORY	Established	20 minutes.*
	Not Established	0 minutes.
* If an RCS heat removal system is in operation within this time frame and RCS temperature is being reduced, the EAL is not applicable.		

Mode Applicability:

5 - Cold Shutdown, 6- Refueling

Definition(s):

CONTAINMENT CLOSURE - The procedurally defined actions taken to secure containment and its associated structures, systems and components as a functional barrier to fission product release under shutdown conditions.

As applied to PVNGS, Containment Closure is established when the requirements of procedure 40EP-9EO10, LM-Containment Evacuation and Closure, Appendix 249, for containment closure are met.

UNPLANNED -. A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

REDUCED INVENTORY - Plant condition when fuel is in the reactor vessel and Reactor Coolant System level is less than or equal to the 111 foot elevation.

Basis:

Several instruments are capable of providing indication of RCS temperature with respect to the Technical Specification cold shutdown temperature limit (210°F, ref. 1). These include cold leg (T_{cold}) temperature indications, hot leg (T_{hot}) temperature indications with RCPs running, CETs and SDC Heat Exchanger inlet temperature indications (ref. 2, 3).

However, if Shutdown Cooling (SDC) flow is lost, then the normal temperature elements used to monitor RCS temperature are not accurate indicators of RCS temperature. The CETs are the design instruments for these conditions. For some periods of time the CETs may not be available. The current practices concerning determining time to boil can be used in the evaluation of these EALs. Without CET indication and with a loss of SDC flow the following guidance should be used (ref. 4):

- Use the predetermined "time to boil" data for evaluating these EALs. This approachreflects the relatively small numerical difference between the typical Technical Specification cold shutdown temperature limit of 210°F and the boiling temperature of RCS water with the plant in Mode 5 or 6.
- Alternately, the Control Room staff may use a procedure or user aid to determine when RCS temperature will likely exceed 210°F given the actual plant conditions (e.g., using a heat-up curve).

RCS pressure instruments RCA PI-103, RCC-PI-105, RCD-PI-106 and RCB-PI-104 are capable of measuring pressure to less than 10 psia (ref. 3).

This IC addresses conditions involving a loss of decay heat removal capability or an addition of heat to the RCS in excess of that which can currently be removed. Either condition represents an actual or potential substantial degradation of the level of safety of the plant.

A momentary UNPLANNED excursion above the Technical Specification cold shutdown temperature limit when the heat removal function is available does not warrant a classification.

ATTACHMENT 1
EAL Technical Bases

The RCS Heat-up Duration Thresholds table addresses an increase in RCS temperature when CONTAINMENT CLOSURE is established but the RCS is not intact, or RCS inventory is reduced (e.g., mid-loop operation). The 20-minute criterion was included to allow time for operator action to address the temperature increase.

The RCS Heat-up Duration Thresholds table also addresses an increase in RCS temperature with the RCS intact. The status of CONTAINMENT CLOSURE is not crucial in this condition since the intact RCS is providing a high pressure barrier to a fission product release. The 60- minute time frame should allow sufficient time to address the temperature increase without a substantial degradation in plant safety.

Finally, in the case where there is an increase in RCS temperature, the RCS is not intact or is at reduced inventory and CONTAINMENT CLOSURE is not established, no heat-up duration is allowed (i.e., 0 minutes). This is because 1) the evaporated reactor coolant may be released directly into the containment atmosphere and subsequently to the environment, and 2) there is reduced reactor coolant inventory above the top of irradiated fuel.

The RCS pressure increase threshold provides a pressure-based indication of RCS heat-up in the absence of RCS temperature monitoring capability.

Escalation of the emergency classification level would be via IC CS1 or RS1.

PVNGS Basis Reference(s):

1. Technical Specification Table 1.1-1, *Modes*
2. Procedure 40OP-9ZZ03, *Reactor Startup*
3. Procedure 40ST-9RC01, *RCS and Pressurizer Heatup and Cooldown Rates*
4. Safety Analysis Operational Data Book
5. NEI 99-01, CA3

ATTACHMENT 1
EAL Technical Bases

Category: C – Cold Shutdown/Refueling System Malfunction

Subcategory: 4 – Loss of Vital DC Power

Initiating Condition: Loss of Vital DC power for 15 minutes or longer

EAL:

CU4.1	**Unusual Event**
Indicated voltage is < 112VDC on vital DC buses required by Technical Specifications for $\geq$ 15 minutes (Note 1)	

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Mode Applicability:

5 - Cold Shutdown, 6- Refueling

Definition(s):

None

Basis:

The purpose of this EAL is to recognize a loss of DC power compromising the ability to monitor and control the removal of decay heat during cold shutdown or refueling operations. This EAL is intended to be anticipatory in as much as the operating crew may not have necessary indication and control of equipment needed to respond to the loss.

The vital DC buses are the following 125 VDC Class 1E buses (ref. 1):

Train A:
- PKA-M41
- PKC-M43

Train B:
- PKB-M42
- PKD-M44

There are four, 60 cell, lead-calcium storage batteries (PKA-F11, PKC-F13, PKB-F12 and PKDF14) that supplement the output of the battery chargers. They supply DC power to the distribution buses when AC power to the chargers is lost or when transient loads exceed the capacity of the battery chargers (ref. 1).

All four of the 125VDC buses supply inverters for 120VAC PN bus power as well as control power for various safety related systems. Each battery is designed to have sufficient stored energy to supply the required emergency loads for 120 minutes following a loss of AC power to the chargers (ref. 2).

Minimum DC bus voltage is 112 VDC (ref. 3).

This EAL is the cold condition equivalent of the hot condition loss of DC power EAL SS2.1. This IC addresses a loss of vital DC power which compromises the ability to monitor and control operable SAFETY SYSTEMS when the plant is in the cold shutdown or refueling mode. In these modes, the core decay heat load has been significantly reduced and coolant system temperatures and pressures are lower; these conditions increase the time available to restore a vital DC bus to service. Thus, this condition is considered to be a potential degradation of the level of safety of the plant.

As used in this EAL, “required” means the vital DC buses necessary to support operation of the in-service, or operable, train or trains of SAFETY SYSTEM equipment. For example, if Train A is out-of-service (inoperable) for scheduled outage maintenance work and Train B is in-service (operable), then a loss of Vital DC power affecting Train B would require the declaration of an Unusual Event. A loss of Vital DC power to Train A would not warrant an emergency classification.

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Depending upon the event, escalation of the emergency classification level would be via IC CA1 or CA3, or an IC in Recognition Category R.

PVNGS Basis Reference(s):

1. Drawing 01-E-PKA-001, *Main Single Line Diagram 125V DC Class 1E and 120VAC Vital Inst Power System*
2. UFSAR Section 8.3.2, DC Power Systems
3. Calculation 01-EC-PK-0207, *DC Battery Sizing and Minimum Voltage*
4. NEI 99-01, CU4

ATTACHMENT 1
EAL Technical Bases

Category: C – Cold Shutdown/Refueling System Malfunction

Subcategory: 5 – Loss of Communications

Initiating Condition: Loss of all onsite or offsite communications capabilities

EAL:

CU5.1 Unusual Event

Loss of **all** Table C-5 onsite communication methods

OR

Loss of **all** Table C-5 Offsite Response Organization (ORO) communication methods

OR

Loss of **all** Table C-5 NRC communication methods

Table C-5 Communication Methods			
System	**Onsite**	**ORO**	**NRC**
PBX	X	X	X
Plant Page	X		
Two-Way Radio	X		
FTS (ENS)			X
Telephone Ringdown Circuits (NAN)		X	
Cellular Phones		X	X

Mode Applicability:

5 - Cold Shutdown, 6- Refueling, D - Defueled

Definition(s):

None

Basis:

Onsite, offsite and NRC communications include one or more of the systems listed in Table C-5 (ref. 1, 2).

ATTACHMENT 1
EAL Technical Bases

1. PBX

Onsite emergency telephone lines are divided among three onsite EPABX switches. Each EPABX switch is provided with a backup battery for reliability.

This system will function during emergencies as it does during normal operations. Telephones have the capability of trunk access (via local provider) and the APS owned private communications system which provides direct dial capabilities to the entire APS voice system via the company owned private communications system. The PVNGS telephone EPABX Systems through which all PVNGS telephone calls pass, are equipped with uninterruptible power supplies (battery chargers and batteries) and dedicated priority switching to ensure the reliability of the telephone system. The PVNGS EPABXs are the primary links for PVNGS phones. There are also administratively dedicated lines for the CR, STSC, TSC, EOF and OSC.

2. Plant (Area) Paging

The area paging system provides a reliable means of notifying and providing instructions to onsite personnel. Access to this system is through the EPABX system telephones by use of dedicated numbers.

3. Two-Way Radios

PVNGS operates a trunked radio system, with separate talk groups available for departments such as Operations, Security, Fire Protection, Radiation Protection, Emergency Preparedness, the Water Reclamation Facility, etc. This system includes base station consoles at various locations and emergency facilities throughout the site. Some of the radios used during emergencies are portable radios at various site locations, mobile radios in the RFAT vehicles and base station consoles at the TSC, EOF, Unit OSCs, Unit STSCs and Unit Control Rooms. PVNGS Fire Protection also maintains radios that are used to contact the air ambulance service to provide landing instructions.

4. FTS (ENS)

The NRC Emergency Notification System (ENS) is an FTS telephone used for official communications with NRC Headquarters. The NRC Headquarters has the capability to patch into the NRC Regional offices. The primary purpose of this phone is to provide a reliable method for the initial notification of the NRC and to maintain continuous communications with the NRC after initial notification. ENS telephones are located in the Control Room, TSC and EOF.

ATTACHMENT 1
EAL Technical Bases

5. Telephone Ringdown Circuits (NAN)

These voice circuits serve as a primary communications link for providing technical information to offsite agencies, public information communications and the communication of protective action recommendations to offsite authorities.

6. Cellular Phones

Each STSC, the TSC and EOF have a cellular phone to provide additional independent lines of communication.

This EAL is the cold condition equivalent of the hot condition EAL SU7.1.

This IC addresses a significant loss of on-site or offsite communications capabilities. While not a direct challenge to plant or personnel safety, this event warrants prompt notifications to OROs and the NRC.

This IC should be assessed only when extraordinary means are being utilized to make communications possible (e.g., use of non-plant, privately owned equipment, relaying of on-site information via individuals or multiple radio transmission points, individuals being sent to offsite locations, etc.).

The first EAL condition addresses a total loss of the communications methods used in support of routine plant operations.

The second EAL condition addresses a total loss of the communications methods used to notify all OROs of an emergency declaration. The OROs referred to here are the State and Maricopa County EOCs.

The third condition addresses a total loss of the communications methods used to notify the NRC of an emergency declaration.

PVNGS Basis Reference(s):

1. PVNGS Emergency Plan, Section 7.2 Communications Systems
2. UFSAR Section 9.5.2, Communication Systems
3. NEI 99-01, CU5

ATTACHMENT 1
EAL Technical Bases

Category: C – Cold Shutdown/Refueling System Malfunction

Subcategory: 6 – Hazardous Event Affecting Safety Systems

Initiating Condition: Hazardous event affecting a SAFETY SYSTEM needed for the current operating mode

EAL:

CA6.1 Alert

The occurrence of **any** Table C-6 hazardous event

AND EITHER

- Event damage has caused indications of degraded performance in at least one train of a SAFETY SYSTEM needed for the current operating mode
- The event has caused VISIBLE DAMAGE to a SAFETY SYSTEM component or structure needed for the current operating mode

Table C-6 Hazardous Events
• Seismic event (earthquake) • Internal or external FLOODING event • High winds or tornado strike • FIRE • EXPLOSION • Other events with similar hazard characteristics as determined by the Shift Manager

Mode Applicability:

5 - Cold Shutdown, 6 – Refueling

Definition(s):

EXPLOSION - A rapid, violent and catastrophic failure of a piece of equipment due to combustion, chemical reaction or overpressurization. A release of steam (from high energy lines or components) or an electrical component failure (caused by short circuits, grounding, arcing, etc.) should not automatically be considered an explosion. Such events require a post-event inspection to determine if the attributes of an explosion are present.

FIRE - Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute fires. Observation of flame is preferred but is NOT required if large quantities of smoke and heat are observed.

FLOODING - A condition where water is entering a room or area faster than installed equipment is capable of removal, resulting in a rise of water level within the room or area.

SAFETY SYSTEM - A system required for safe plant operation, cooling down the plant and/or placing it in the cold shutdown condition, including the ECCS. These are typically systems classified as safety-related (as defined in 10 CFR 50.2):

Those structures, systems and components that are relied upon to remain functional during and following design basis events to assure:

(1) The integrity of the reactor coolant pressure boundary;

(2) The capability to shut down the reactor and maintain it in a safe shutdown condition;

(3) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures.

VISIBLE DAMAGE - Damage to a component or structure that is readily observable without measurements, testing, or analysis. The visual impact of the damage is sufficient to cause concern regarding the operability or reliability of the affected component or structure.

Basis:

Refer to Attachment 4 for a list of Palo Verde SAFETY SYTEMS (ref. 5).

This IC addresses a hazardous event that causes damage to a SAFETY SYSTEM, or a structure containing SAFETY SYSTEM components, needed for the current operating mode. This condition significantly reduces the margin to a loss or potential loss of a fission product barrier and therefore represents an actual or potential substantial degradation of the level of safety of the plant.

The first conditional addresses damage to a SAFETY SYSTEM train that is in service/operation since indications for it will be readily available. The indications of degraded performance should be significant enough to cause concern regarding the operability or reliability of the SAFETY SYSTEM train.

The second conditional addresses damage to a SAFETY SYSTEM component that is not in service/operation or readily apparent through indications alone, or to a structure containing

SAFETY SYSTEM components. Operators will make this determination based on the totality of available event and damage report information. This is intended to be a brief assessment not requiring lengthy analysis or quantification of the damage.

- The significance of seismic events are discussed under EAL HU2.1. Annunciator 7C14A, SEISMIC OCCURRENCE will illuminate if the seismic instrument detects ground motion in excess of the seismic EVENT trigger threshold (ref. 1).
- Internal FLOODING may be caused by events such as component failures, equipment misalignment, or outage activity mishaps.
- High winds in excess of design (105 mph) or tornado strikes can cause significant structural damage (ref. 4).
- Areas containing functions and systems required for safe shutdown of the plant are identified by fire area (ref. 2).
- An explosion that degrades the performance of a SAFETY SYSTEM train or visibly damages a SAFETY SYSTEM component or structure would be classified under this EAL.
- This cold condition EAL is equivalent to the hot condition EAL SA9.1.

Escalation of the emergency classification level would be via IC CS1 or RS1.

PVNGS Basis Reference(s):

1. Procedure 40AO-9ZZ21, *Acts of Nature*
2. UFSAR Table 3-2.1, Quality Classification of Structures, Systems and Components
3. UFSAR Section 2.4.2.2.1, Offsite Flood Design Considerations
4. UFSAR Section 2.3.1.2.3, Extreme Winds
5. Attachment 4 - Palo Verde Safety Systems
6. NEI 99-01, CA6

Category H – Hazards and Other Conditions Affecting Plant Safety

EAL Group: ANY (EALs in this category are applicable to any plant condition, hot or cold.).

Hazards are non-plant, system-related events that can directly or indirectly affect plant operation, reactor plant safety or personnel safety.

1. Security

Unauthorized entry attempts into the Plant Protected Area, bomb threats, sabotage attempts and actual security compromises threatening loss of physical control of the plant.

2. Seismic Event

Natural events such as earthquakes have potential to cause plant structure or equipment damage of sufficient magnitude to threaten personnel or plant safety.

3. Natural or Technology Hazard

Other natural and non-naturally occurring events that can cause damage to plant facilities include tornados, FLOODING, hazardous material releases and events restricting site access warranting classification.

4. Fire

Fires can pose significant hazards to personnel and reactor safety. Appropriate for classification are fires within the Plant Protected Area or which may affect operability of equipment needed for safe shutdown

5. Hazardous Gas

Toxic, corrosive, asphyxiant or flammable gas leaks can affect normal plant operations or preclude access to plant areas required to safely shutdown the plant.

6. Control Room Evacuation

Events that are indicative of loss of Control Room habitability. If the Control Room must be evacuated, additional support for monitoring and controlling plant functions is necessary through the emergency response facilities.

7. Emergency Coordinator Judgment

The EALs defined in other categories specify the predetermined symptoms or events that are indicative of emergency or potential emergency conditions and thus warrant classification. While these EALs have been developed to address the full spectrum of possible emergency conditions which may warrant classification and subsequent implementation of the Emergency Plan, a provision for classification of emergencies based on operator/management experience and judgment is still necessary. The EALs of this category provide the Emergency Coordinator the latitude to classify emergency conditions consistent with the established classification criteria based upon Emergency Coordinator judgment.

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards

Subcategory: 1 – Security

Initiating Condition: Confirmed SECURITY CONDITION or threat

EAL:

HU1.1 Unusual Event

A SECURITY CONDITION that does not involve a HOSTILE ACTION as reported by the Security Shift Supervision

OR

Notification of a credible security threat directed at the site

OR

A validated notification from the NRC providing information of an aircraft threat

Mode Applicability:

All

Definition(s):

SECURITY CONDITION - Any security event as listed in the approved security contingency plan that constitutes a threat/compromise to site security, threat/risk to site personnel, or a potential degradation to the level of safety of the plant. A security condition does not involve a hostile action.

HOSTILE ACTION - An act toward PVNGS or its personnel that includes the use of violent force to destroy equipment, take hostages and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, projectiles, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. Hostile action should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on PVNGS. Non-terrorism-based EALs should be used to address such activities (i.e., this may include violent acts between individuals in the owner controlled area).

Basis:

This EAL is based on the *PVNGS Security Plan, Training and Qualification Plan, Safeguards Contingency Plan and Independent Spent Fuel Storage Installation Security Program* (ref. 1).

This IC addresses events that pose a threat to plant personnel or SAFETY SYSTEM equipment and thus represent a potential degradation in the level of plant safety. Security events which do not meet one of these EALs are adequately addressed by the requirements of 10 CFR 73.71 or 10 CFR 50.72. Security events assessed as HOSTILE ACTIONS are classifiable under ICs HA1 and HS1.

Timely and accurate communications between the Security Shift Supervision and the Control Room is essential for proper classification of a security-related event. Classification of these events will initiate appropriate threat-related notifications to plant personnel and Offsite Response Organizations.

Security plans and terminology are based on the guidance provided by NEI 03-12, *Template for the Security Plan, Training and Qualification Plan, Safeguards Contingency Plan and Independent Spent Fuel Storage Installation Security Program*.

The first threshold references the Security Shift Supervision because these are the individuals trained to confirm that a security event is occurring or has occurred. Training on security event confirmation and classification is controlled due to the nature of Safeguards and 10 CFR 2.39 information.

The second threshold addresses the receipt of a credible security threat. The credibility of the threat is assessed in accordance with the PVNGS Security Plan.

The third threshold addresses the threat from the impact of an aircraft on the plant. The NRC Headquarters Operations Officer (HOO) will communicate to the licensee if the threat involves an aircraft. The status and size of the plane may also be provided by NORAD through the NRC. Validation of the threat is performed in accordance with the PVNGS Security Plan (ref. 1).

Emergency plans and implementing procedures are public documents; therefore, EALs should not incorporate Security-sensitive information. This includes information that may be advantageous to a potential adversary, such as the particulars concerning a specific threat or threat location. Security-sensitive information should be contained in non-public documents such as the PVNGS Security Plan (ref. 1).

Escalation of the emergency classification level would be via IC HA1.

PVNGS Basis Reference(s):

1. *PVNGS Security Plan, Training and Qualification Plan, Safeguards Contingency Plan and Independent Spent Fuel Storage Installation Security Program (Safeguards)*
2. NEI 99-01, HU1

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards

Subcategory: 1 – Security

Initiating Condition: Hostile action within the SECURITY OWNER CONTROLLED AREA or airborne attack threat within 30 minutes

EAL:

HA1.1 Alert

A HOSTILE ACTION is occurring or has occurred within the SECURITY OWNER CONTROLLED AREA as reported by the Security Shift Supervision

OR

A validated notification from NRC of an aircraft attack threat within 30 minutes of the site

Mode Applicability:

All

Definition(s):

HOSTILE ACTION - An act toward PVNGS or its personnel that includes the use of violent force to destroy equipment, take hostages and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, projectiles, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. Hostile action should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on PVNGS. Non-terrorism-based EALs should be used to address such activities (i.e., this may include violent acts between individuals in the owner controlled area).

SECURITY OWNER CONTROLLED AREA - An area encompassed by physical barriers to which access is controlled.

Basis:

This IC addresses the occurrence of a HOSTILE ACTION within the SECURITY OWNER CONTROLLED AREA or notification of an aircraft attack threat. This event will require rapid response and assistance due to the possibility of the attack progressing to the PLANT PROTECTED AREA, or the need to prepare the plant and staff for a potential aircraft impact.

Timely and accurate communications between the Security Shift Supervision and the Control Room is essential for proper classification of a security-related event (ref. 1).

ATTACHMENT 1
EAL Technical Bases

Security plans and terminology are based on the guidance provided by NEI 03-12, Template for the Security Plan, Training and Qualification Plan, Safeguards Contingency Plan and Independent Spent Fuel Storage Installation Security Program.

As time and conditions allow, these events require a heightened state of readiness by the plant staff and implementation of onsite protective measures (e.g., evacuation, dispersal or sheltering). The Alert declaration will also heighten the awareness of Offsite Response Organizations (OROs), allowing them to be better prepared should it be necessary to consider further actions.

This IC does not apply to incidents that are accidental events, acts of civil disobedience, or otherwise are not a HOSTILE ACTION perpetrated by a HOSTILE FORCE. Examples include the crash of a small aircraft, shots from hunters, physical disputes between employees, etc. Reporting of these types of events is adequately addressed by other EALs, or the requirements of 10 CFR 73.71 or 10 CFR 50.72.

The first threshold is applicable for any HOSTILE ACTION occurring, or that has occurred, in the SECURITY OWNER CONTROLLED AREA. This includes any action directed against an ISFSI that is located outside the PLANT PROTECTED AREA.

The second threshold addresses the threat from the impact of an aircraft on the plant and the anticipated arrival time is within 30 minutes. The intent of this EAL is to ensure that threat-related notifications are made in a timely manner so that plant personnel and OROs are in a heightened state of readiness. This EAL is met when the threat-related information has been validated in accordance with security procedures.

The NRC Headquarters Operations Officer (HOO) will communicate to the licensee if the threat involves an aircraft. The status and size of the plane may be provided by NORAD through the NRC.

In some cases, it may not be readily apparent if an aircraft impact within the SECURITY OWNER CONTROLLED AREA was intentional (i.e., a HOSTILE ACTION). It is expected, although not certain, that notification by an appropriate Federal agency to the site would clarify this point. In this case, the appropriate federal agency is intended to be NORAD, FBI, FAA or NRC. The emergency declaration, including one based on other ICs/EALs, should not be unduly delayed while awaiting notification by a Federal agency.

Emergency plans and implementing procedures are public documents; therefore, EALs should not incorporate Security-sensitive information. This includes information that may be advantageous to a potential adversary, such as the particulars concerning a specific threat or threat location. Security-sensitive information should be contained in non-public documents such as the PVNGS Security Plan (ref. 1).

Escalation of the emergency classification level would be via IC HS1.

PVNGS Basis Reference(s):

1. *PVNGS Security Plan, Training and Qualification Plan, Safeguards Contingency Plan and Independent Spent Fuel Storage Installation Security Program (Safeguards)*
2. NEI 99-01, HA1

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards

Subcategory: 1 – Security

Initiating Condition: Hostile Action within the PLANT PROTECTED AREA

EAL:

HS1.1	**Site Area Emergency**
A HOSTILE ACTION is occurring or has occurred within the PLANT PROTECTED AREA as reported by the Security Shift Supervision	

Mode Applicability:

All

Definition(s):

HOSTILE ACTION - An act toward PVNGS or its personnel that includes the use of violent force to destroy equipment, take hostages and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, projectiles, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. Hostile action should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on PVNGS. Non-terrorism-based EALs should be used to address such activities (i.e., this may include violent acts between individuals in the owner controlled area).

PLANT PROTECTED AREA - An area, located within the PVNGS Exclusion Area Boundary, encompassed by physical barriers and to which access is controlled per 10 CFR 73.55. The PVNGS Plant Protected Area and the ISFSI Protected Area are two Protected Areas located within the PVNGS OWNER CONTROLLED AREA.

Basis:

This IC addresses the occurrence of a HOSTILE ACTION within the PROTECTED AREA. This event will require rapid response and assistance due to the possibility for damage to plant equipment.

Timely and accurate communications between the Security Shift Supervision and the Control Room is essential for proper classification of a security-related event (ref. 1).

Security plans and terminology are based on the guidance provided by NEI 03-12, *Template for the Security Plan, Training and Qualification Plan, Safeguards Contingency Plan and Independent Spent Fuel Storage Installation Security Program*.

As time and conditions allow, these events require a heightened state of readiness by the plant staff and implementation of onsite protective measures (e.g., evacuation, dispersal or sheltering). The Site Area Emergency declaration will mobilize Offsite Response Organization (ORO) resources and have them available to develop and implement public protective actions in the unlikely event that the attack is successful in impairing multiple safety functions.

This IC does not apply to a HOSTILE ACTION directed at an ISFSI PROTECTED AREA located outside the PLANT PROTECTED AREA; such an attack should be assessed using IC HA1. It also does not apply to incidents that are accidental events, acts of civil disobedience, or otherwise are not a HOSTILE ACTION perpetrated by a HOSTILE FORCE. Examples include the crash of a small aircraft, shots from hunters, physical disputes between employees, etc. Reporting of these types of events is adequately addressed by other EALs, or the requirements of 10 CFR 73.71 or 10 CFR 50.72.

Emergency plans and implementing procedures are public documents; therefore, EALs should not incorporate Security-sensitive information. This includes information that may be advantageous to a potential adversary, such as the particulars concerning a specific threat or threat location. Security-sensitive information should be contained in non-public documents such as the PVNGS Security Plan (ref. 1).

PVNGS Basis Reference(s):

1. *PVNGS Security Plan, Training and Qualification Plan, Safeguards Contingency Plan and Independent Spent Fuel Storage Installation Security Program (Safeguards)*
2. NEI 99-01, HS1

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards

Subcategory: 2 – Seismic Event

Initiating Condition: Seismic event greater than OBE levels

EAL:

HU2.1	**Unusual Event**
Seismic event > OBE as indicated on Control Panel A-J-SMN-C01	

Mode Applicability:

All

Definition(s):

None

Basis:

Five Force Balance Accelerometer units are installed within Unit 1 structures and one is installed in the Free Field area south of Unit 1.

Peak ground motion acceleration of 0.10g horizontal or vertical is the Operating Basis Earthquake for PVNGS (ref. 1). OBE is detected and analyzed by Free Field Accelerometer Sensor #6 (AJSMNXT0006) only.

Annunciator 7C14A, SEISMIC OCCURRENCE, will illuminate if the seismic instrument detects ground motion in excess of the seismic EVENT trigger threshold (ref. 1, 2).

Unit 1 Control Panel A-J-SMN-C01 provides both red EVENT and yellow “OBE” LED indications (ref. 1, 2). Peak acceleration levels can also be determined using the graphic user interface display screen (ref. 4).

Procedure 40AO-9ZZ21, Acts of Nature, provides the guidance should the OBE earthquake threshold be exceeded and any required response actions (ref. 3, 4).

To avoid inappropriate emergency classification resulting from spurious actuation of the seismic instrumentation or felt motion not attributable to seismic activity, an offsite agency (USGS, National Earthquake Information Center) can confirm that an earthquake has occurred in the area of the plant. Such confirmation should not, however, preclude a timely emergency declaration based on receipt of the OBE alarm. The NEIC can be contacted by calling the number listed in procedure

40AO-9ZZ21. Select option #1 and inform the analyst you wish to confirm recent seismic activity in the vicinity of PVNGS. If requested, provide the analyst with the following PVNGS Unit 1 coordinates: 33º 23' 23" north latitude, 112º 51' 43" west longitude (ref. 5). Alternatively, near real-time seismic activity can be accessed via the NEIC website:
http://earthquake.usgs.gov/earthquakes/dyfi/archives.php

This IC addresses a seismic event that results in accelerations at the plant site greater than those specified for an Operating Basis Earthquake (OBE). An earthquake greater than an OBE but less than a Safe Shutdown Earthquake (SSE) should have no significant impact on safety-related systems, structures and components; however, some time may be required for the plant staff to ascertain the actual post-event condition of the plant (e.g., performs walk-downs and post-event inspections). Given the time necessary to perform walk-downs and inspections and fully understand any impacts, this event represents a potential degradation of the level of safety of the plant.

Event verification with external sources should not be necessary during or following an OBE. Earthquakes of this magnitude should be readily felt by on-site personnel and recognized as a seismic event (e.g., lateral accelerations in excess of 0.10g). The Shift Manager or Emergency Coordinator may seek external verification if deemed appropriate (e.g., a call to the USGS, check internet news sources, etc.); however, the verification action must not preclude a timely emergency declaration.

Depending upon the plant mode at the time of the event, escalation of the emergency classification level would be via IC CA6 or SA9.

PVNGS Basis Reference(s):

1. UFSAR Section 2.5.2.7, Operating Basis Earthquakes
2. Procedure 40AL-9RK7C, *Panel C07C Alarm Response 7C14A Seismic Occurrence*
3. Procedure 40AO-9ZZ21, *Acts of Nature*
4. Procedure 79IS-9SM01, *Analysis of Seismic Event*
5. UFSAR Table 2.1-1, Containment Building Centerlines
6. NEI 99-01, HU2

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards

Subcategory: 3 – Natural or Technology Hazard

Initiating Condition: Hazardous event

EAL:

HU3.1	**Unusual Event**
A tornado strike within the PLANT PROTECTED AREA	

Mode Applicability:

All

Definition(s):

PLANT PROTECTED AREA - An area, located within the PVNGS Exclusion Area Boundary, encompassed by physical barriers and to which access is controlled per 10 CFR 73.55. The PVNGS Plant Protected Area and the ISFSI Protected Area are two Protected Areas located within the PVNGS OWNER CONTROLLED AREA.

Basis:

Response actions associated with a tornado onsite is provided in procedure 40AO-9ZZ21, *Acts of Nature* (ref. 1).

If damage is confirmed visually or by other in-plant indications, the event may be escalated to an Alert under EAL CA6.1 or SA9.1.

A tornado striking (touching down) within the PLANT PROTECTED AREA warrants declaration of an Unusual Event regardless of the measured wind speed at the meteorological tower. A tornado is defined as a violently rotating column of air in contact with the ground and extending from the base of a thunderstorm.

This IC addresses hazardous events that are considered to represent a potential degradation of the level of safety of the plant.

EAL HU3.1 addresses a tornado striking (touching down) within the PLANT PROTECTED AREA.

Escalation of the emergency classification level would be based on ICs in Recognition Categories R, F, S or C.

PVNGS Basis Reference(s):

1. Procedure 40AO-9ZZ21, *Acts of Nature*
2. UFSAR Section 2.3.1.2.3, Extreme Winds
3. NEI 99-01, HU3

Category: H – Hazards and Other Conditions Affecting Plant Safety

Subcategory: 3 – Natural or Technology Hazard

Initiating Condition: Hazardous event

EAL:

HU3.2	**Unusual Event**
Internal room or area FLOODING of a magnitude sufficient to require manual or automatic electrical isolation of a SAFETY SYSTEM component needed for the current operating mode	

Mode Applicability:

All

Definition(s):

FLOODING - A condition where water is entering a room or area faster than installed equipment is capable of removal, resulting in a rise of water level within the room or area.

SAFETY SYSTEM - A system required for safe plant operation, cooling down the plant and/or placing it in the cold shutdown condition, including the ECCS. These are typically systems classified as safety-related (as defined in 10 CFR 50.2):

Those structures, systems and components that are relied upon to remain functional during and following design basis events to assure:

(1) The integrity of the reactor coolant pressure boundary;

(2) The capability to shut down the reactor and maintain it in a safe shutdown condition;

(3) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures.

Basis:

This IC addresses hazardous events that are considered to represent a potential degradation of the level of safety of the plant.

This EAL addresses FLOODING of a building room or area that results in operators isolating power to a SAFETY SYSTEM component due to water level or other wetting concerns. Classification is also required if the water level or related wetting causes an automatic isolation of a SAFETY SYSTEM component from its power source (e.g., a breaker or relay trip). To warrant classification, operability of the affected component must be required by Technical Specifications for the current operating mode.

Escalation of the emergency classification level would be based on ICs in Recognition Categories R, F, S or C.

PVNGS Basis Reference(s):

1. NEI 99-01, HU3

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards and Other Conditions Affecting Plant Safety

Subcategory: 3 – Natural or Technology Hazard

Initiating Condition: Hazardous event

EAL:

HU3.3 Unusual Event

Movement of personnel within the PLANT PROTECTED AREA is IMPEDED due to an offsite event involving hazardous materials (e.g., an offsite chemical spill or toxic gas release)

Mode Applicability:

All

Definition(s):

IMPEDE(D) - Personnel access to a room or area is hindered to an extent that extraordinary measures are necessary to facilitate entry of personnel into the affected room/area (e.g., requiring use of protective equipment, such as SCBAs, that is not routinely employed).

PLANT PROTECTED AREA - An area, located within the PVNGS Exclusion Area Boundary, encompassed by physical barriers and to which access is controlled per 10 CFR 73.55. The PVNGS Plant Protected Area and the ISFSI Protected Area are two Protected Areas located within the PVNGS OWNER CONTROLLED AREA.

Basis:

As used here, the term "offsite" is meant to be areas external to the PVNGS PLANT PROTECTED AREA.

This IC addresses hazardous events that are considered to represent a potential degradation of the level of safety of the plant.

This EAL addresses a hazardous materials event originating at an offsite location and of sufficient magnitude to impede the movement of personnel within the PLANT PROTECTED AREA.

Escalation of the emergency classification level would be based on ICs in Recognition Categories R, F, S or C.

PVNGS Basis Reference(s):

1. NEI 99-01, HU3

Category: H – Hazards and Other Conditions Affecting Plant Safety

Subcategory: 3 – Natural or Technology Hazard

Initiating Condition: Hazardous event

EAL:

HU3.4	**Unusual Event**
A hazardous event that results in on-site conditions sufficient to prohibit the plant staff from accessing the site via personal vehicles (Note 7)	

Note 7: This EAL does not apply to routine traffic impediments such as fog, snow, ice, or vehicle breakdowns or accidents.

Mode Applicability:

All

Definition(s):

None

Basis:

This IC addresses hazardous events that are considered to represent a potential degradation of the level of safety of the plant.

This EAL addresses a hazardous event that causes an on-site impediment to vehicle movement and significant enough to prohibit the plant staff from accessing the site using personal vehicles. Examples of such an event include site FLOODING caused by a hurricane, heavy rains, up-river water releases, dam failure, etc., or an on-site train derailment blocking the access road.

This EAL is not intended apply to routine impediments such as fog, snow, ice, or vehicle breakdowns or accidents, but rather to more significant conditions such as the Hurricane Andrew strike on Turkey Point in 1992, the flooding around the Cooper Station during the Midwest floods of 1993, or the flooding around Ft. Calhoun Station in 2011.

Escalation of the emergency classification level would be based on ICs in Recognition Categories R, F, S or C.

PVNGS Basis Reference(s):

1. NEI 99-01, HU3

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards and Other Conditions Affecting Plant Safety

Subcategory: 4 – Fire

Initiating Condition: FIRE potentially degrading the level of safety of the plant

EAL:

HU4.1 Unusual Event

A FIRE is not extinguished within 15 minutes of any of the following FIRE detection indications (Note 1):

- Report from the field (i.e., visual observation)
- Receipt of multiple (more than 1) fire alarms or indications
- Field verification of a single fire alarm

AND EITHER

The FIRE is located within **any** Table H-1 area

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Table H-1 Fire Areas
• Containment • Auxiliary Building • Control Building • Diesel Generator Building • Diesel Generator Fuel Oil Storage Tanks • Fuel Building • Main Steam Support Structure • Refueling Water Tank • Essential Spray Pond System • Condensate Storage Tank

Mode Applicability:

All

Definition(s):

FIRE - Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute fires. Observation of flame is preferred but is NOT required if large quantities of smoke and heat are observed.

Basis:

The 15 minute requirement begins with a credible notification that a fire is occurring, or receipt of multiple valid fire detection system alarms or field validation of a single fire alarm. The alarm is to be validated using available Control Room indications or alarms to prove that it is not spurious, or by reports from the field. Actual field reports must be made within the 15 minute time limit or a classification must be made.

Table H-1 Fire Areas are based on UFSAR Table 3.2-1 Quality Classification of Structures, Systems and Components. Table H-1 Fire Areas include those structures containing functions and systems required for safe shutdown of the plant (SAFETY SYSTEMS) (ref. 1).

This IC addresses the magnitude and extent of FIRES that may be indicative of a potential degradation of the level of safety of the plant.

For EAL HU4.1 the intent of the 15-minute duration is to size the FIRE and to discriminate against small FIRES that are readily extinguished (e.g., smoldering waste paper basket). In addition to alarms, other indications of a FIRE could be a drop in fire main pressure, automatic activation of a suppression system, etc.

Upon receipt, operators will take prompt actions to confirm the validity of an initial fire alarm, indication, or report. For EAL assessment purposes, the emergency declaration clock starts at the time that the initial multiple alarms, indication, or report was received and not the time that a subsequent verification action was performed. If only a single indication is available to the Control Room staff, the emergency declaration clock starts at the time a field report is given that validates the existence. Similarly, the fire duration clock also starts at the time of receipt of the initial multiple alarms, indication or report.

Depending upon the plant mode at the time of the event, escalation of the emergency classification level would be via IC CA6 or SA9.

PVNGS Basis Reference(s):

1. UFSAR Table 3.2-1, Quality Classification of Structures, Systems and Components
2. NEI 99-01, HU4

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards and Other Conditions Affecting Plant Safety

Subcategory: 4 – Fire

Initiating Condition: FIRE potentially degrading the level of safety of the plant

EAL:

HU4.2 Unusual Event

Receipt of a single fire alarm (i.e., no other indications of a FIRE)

AND

The fire alarm is indicating a FIRE within any Table H-1 area

AND

The existence of a FIRE is not verified within 30 minutes of alarm receipt (Note 1)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Table H-1 Fire Areas
• Containment • Auxiliary Building • Control Building • Diesel Generator Building • Diesel Generator Fuel Oil Storage Tanks • Fuel Building • Main Steam Support Structure • Refueling Water Tank • Essential Spray Pond System • Condensate Storage Tank

Mode Applicability:

All

Definition(s):

FIRE - Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute fires. Observation of flame is preferred but is NOT required if large quantities of smoke and heat are observed.

Basis:

The 30 minute requirement begins upon receipt of a single valid fire detection system alarm. The alarm is to be validated using available Control Room indications or alarms to prove that it is not spurious, or by reports from the field. Actual field reports must be made within the 30 minute time limit or a classification must be made. If a fire is verified to be occurring by field report, classification shall be made based on EAL HU4.1.

Table H-1 Fire Areas are based on UFSAR Table 3.2-1 Quality Classification of Structures, Systems and Components. Table H-1 Fire Areas include those structures containing functions and systems required for safe shutdown of the plant (SAFETY SYSTEMS) (ref. 1).

This IC addresses the magnitude and extent of FIRES that may be indicative of a potential degradation of the level of safety of the plant.

This EAL addresses receipt of a single fire alarm and the existence of a FIRE is not verified (i.e., proved or disproved) within 30-minutes of the alarm. Upon receipt, operators will take prompt actions to confirm the validity of a single fire alarm. For EAL assessment purposes, the 30-minute clock starts at the time that the initial alarm was received and not the time that a subsequent verification action was performed.

A single fire alarm, absent other indication(s) of a FIRE, may be indicative of equipment failure or a spurious activation and not an actual FIRE. For this reason, additional time is allowed to verify the validity of the alarm. The 30-minute period is a reasonable amount of time to determine if an actual FIRE exists; however, after that time and absent information to the contrary, it is assumed that an actual FIRE is in progress.

If an actual FIRE is verified by a report from the field, then HU4.1 is immediately applicable and the emergency must be declared if the FIRE is not extinguished within 15-minutes of the report. If the alarm is verified to be due to an equipment failure or a spurious activation and this verification occurs within 30-minutes of the receipt of the alarm, then this EAL is not applicable and no emergency declaration is warranted.

<u>Basis-Related Requirements from Appendix R</u>

Appendix R to 10 CFR 50, states in part:

> *Criterion 3 of Appendix A to this part specifies that 'Structures, systems and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.'*

When considering the effects of fire, those systems associated with achieving and maintaining safe shutdown conditions assume major importance to safety because damage to them can lead to core damage resulting from loss of coolant through boil-off.

Because fire may affect safe shutdown systems and because the loss of function of systems used to mitigate the consequences of design basis accidents under post-fire conditions does not per se impact public safety, the need to limit fire damage to systems required to achieve and maintain safe shutdown conditions is greater than the need to limit fire damage to those systems required to mitigate the consequences of design basis accidents.

In addition, Appendix R to 10 CFR 50, requires, among other considerations, the use of 1-hour fire barriers for the enclosure of cable and equipment and associated non-safety circuits of one redundant train (G.2.c). As used in HU4.2, the 30-minutes to verify a single alarm is well within this worst-case 1-hour time period.

Depending upon the plant mode at the time of the event, escalation of the emergency classification level would be via IC CA6 or SA9.

PVNGS Basis Reference(s):

1. UFSAR Table 3.2-1, Quality Classification of Structures, Systems and Components
2. NEI 99-01, HU4

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards and Other Conditions Affecting Plant Safety

Subcategory: 4– Fire

Initiating Condition: FIRE potentially degrading the level of safety of the plant

EAL:

HU4.3 Unusual Event

A FIRE within the PLANT PROTECTED AREA or ISFSI PROTECTED AREA not extinguished within 60 minutes of the initial report, alarm or indication (Note 1)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Mode Applicability:

All

Definition(s):

FIRE - Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute fires. Observation of flame is preferred but is NOT required if large quantities of smoke and heat are observed.

INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI) - A complex that is designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage.

PLANT or ISFSI PROTECTED AREA - An area, located within the PVNGS Exclusion Area Boundary, encompassed by physical barriers and to which access is controlled per 10 CFR 73.55. The PVNGS Plant Protected Area and the ISFSI Protected Area are two Protected Areas located within the PVNGS OWNER CONTROLLED AREA.

Basis:

This IC addresses the magnitude and extent of FIRES that may be indicative of a potential degradation of the level of safety of the plant.

In addition to a FIRE addressed by EAL HU4.1 or HU4.2, a FIRE within the PLANT PROTECTED AREA not extinguished within 60-minutes may also potentially degrade the level of plant safety. This basis extends to a FIRE occurring within the ISFSI PROTECTED AREA.

Depending upon the plant mode at the time of the event, escalation of the emergency classification level would be via IC CA6 or SA9.

PVNGS Basis Reference(s):

1. NEI 99-01, HU4

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards and Other Conditions Affecting Plant Safety

Subcategory: 4 – Fire

Initiating Condition: FIRE potentially degrading the level of safety of the plant

EAL:

HU4.4	**Unusual Event**
A FIRE within the PLANT PROTECTED AREA or ISFSI PROTECTED AREA that requires firefighting support by an offsite fire response agency to extinguish	

Mode Applicability:

All

Definition(s):

FIRE - Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute fires. Observation of flame is preferred but is NOT required if large quantities of smoke and heat are observed.

INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI): A complex that is designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage.

PLANT or ISFSI PROTECTED AREA - An area, located within the PVNGS Exclusion Area Boundary, encompassed by physical barriers and to which access is controlled per 10 CFR 73.55. The PVNGS Plant Protected Area and the ISFSI Protected Area are two Protected Areas located within the PVNGS OWNER CONTROLLED AREA.

Basis:

This IC addresses the magnitude and extent of FIRES that may be indicative of a potential degradation of the level of safety of the plant.

If a FIRE within the PLANT or ISFSI PROTECTED AREA is of sufficient size to require a response by an offsite firefighting agency (e.g., a local town Fire Department), then the level of plant safety is potentially degraded. The dispatch of an offsite firefighting agency to the site requires an emergency declaration only if it is needed to actively support firefighting efforts because the fire is beyond the capability of the Onsite Fire Department to extinguish. Declaration is not necessary if the agency resources are placed on stand-by, or supporting postextinguishment recovery or investigation actions.

Depending upon the plant mode at the time of the event, escalation of the emergency classification level would be via IC CA6 or SA9.

PVNGS Basis Reference(s):

1. NEI 99-01, HU4

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards and Other Conditions Affecting Plant Safety

Subcategory: 5– Hazardous Gases

Initiating Condition: Gaseous release IMPEDING access to equipment necessary for normal plant operations, cooldown or shutdown

EAL:

HA5.1 Alert

Release of a toxic, corrosive, asphyxiant or flammable gas into any Table H-2 rooms

AND

Entry into the room is prohibited or IMPEDED (Note 5)

Note 5: If the equipment in the listed room was already inoperable or out-of-service before the event occurred, then no emergency classification is warranted.

Mode Applicability:

All

Definition(s):

IMPEDE(D) - Personnel access to a room or area is hindered to an extent that extraordinary measures are necessary to facilitate entry of personnel into the affected room/area (e.g., requiring use of protective equipment, such as SCBAs, that is not routinely employed).

Basis:

If the equipment in the listed room was already inoperable, or out-of-service, before the event occurred, then no emergency should be declared since the event will have no adverse impact beyond that already allowed by Technical Specifications at the time of the event.

The list of plant rooms with entry-related mode applicability identified specify those rooms that contain equipment which require a manual/local action as specified in operating procedures used for normal plant operation, cooldown and shutdown. Rooms or areas in which actions of a contingent or emergency nature would be performed (e.g., an action to address an off-normal or emergency condition such as emergency repairs, corrective measures or emergency operations) are not included. In addition, the list specifies the plant mode(s) during which entry would be required for each room or area (ref. 1).

This IC addresses an event involving a release of a hazardous gas that precludes or impedes access to equipment necessary to maintain normal plant operation, or required for a normal plant cooldown and shutdown. This condition represents an actual or potential substantial degradation of the level of safety of the plant.

An Alert declaration is warranted if entry into the affected room/area is, or may be, procedurally required during the plant operating mode in effect at the time of the gaseous release. The emergency classification is not contingent upon whether entry is actually necessary at the time of the release.

Evaluation of the IC and EAL do not require atmospheric sampling; it only requires the Emergency Coordinator's judgment that the gas concentration in the affected room/area is sufficient to preclude or significantly impede procedurally required access. This judgment may be based on a variety of factors including an existing job hazard analysis, report of ill effects on personnel, advice from a subject matter expert or operating experience with the same or similar hazards. Access should be considered as impeded if extraordinary measures are necessary to facilitate entry of personnel into the affected room/area (e.g., requiring use of protective equipment, such as SCBAs, that is not routinely employed).

An emergency declaration is not warranted if any of the following conditions apply:

- The plant is in an operating mode different than the mode specified for the affected room/area (i.e., entry is not required during the operating mode in effect at the time of the gaseous release). For example, the plant is in Mode 1 when the gaseous release occurs and the procedures used for normal operation, cooldown and shutdown do not require entry into the affected room until Mode 4.
- The gas release is a planned activity that includes compensatory measures which address the temporary inaccessibility of a room or area (e.g., fire suppression system testing).
- The action for which room/area entry is required is of an administrative or record keeping nature (e.g., normal rounds or routine inspections).
- The access control measures are of a conservative or precautionary nature and would not actually prevent or impede a required action.

An asphyxiant is a gas capable of reducing the level of oxygen in the body to dangerous levels. Most commonly, asphyxiants work by merely displacing air in an enclosed environment. This reduces the concentration of oxygen below the normal level of around 19%, which can lead to breathing difficulties, unconsciousness or even death.

This EAL does not apply to firefighting activities that automatically or manually activate a fire suppression system in an area.

Escalation of the emergency classification level would be via Recognition Category R, C or F ICs.

NOTE: EAL HA5.1 mode applicability has been limited to the applicable modes identified in Table H-2 Safe Operation & Shutdown Rooms/Areas. If due to plant operating procedure or plant configuration changes, the applicable plant modes specified in Table H-2 are changed, a corresponding change to Attachment 3 'Safe Operation & Shutdown Areas Tables R-2 & H-2 Bases' and to EAL HA5 mode applicability is required.

PVNGS Basis Reference(s):

1. Attachment 3 - Safe Operation & Shutdown Areas Tables R-3 & H-2 Bases
2. NEI 99-01, HA5

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards and Other Conditions Affecting Plant Safety

Subcategory: 6 – Control Room Evacuation

Initiating Condition: Control Room evacuation resulting in transfer of plant control to alternate locations

EAL:

HA6.1 Alert

An event has resulted in plant control being transferred from the Control Room to the Remote Shutdown Panel (RSP)

Mode Applicability:

All

Definition(s):

None

Basis:

The Control Room Supervisor (CRS) determines if the Control Room is uninhabitable and requires evacuation. Control Room inhabitability may be caused by fire, dense smoke, noxious fumes, bomb threat in or adjacent to the Control Room, or other life threatening conditions.

Procedure 40AO-9ZZ18, *Shutdown Outside the Control Room*, provides the instructions for bringing the unit to Mode 5, Cold Shutdown, if the Control Room has been determined to be uninhabitable for any reason other than fire (Ref. 1).

Procedure 40AO-9ZZ19, *Control Room Fire*, provides the instructions for bringing the unit to Mode 5, Cold Shutdown, if the Control Room has been determined to be uninhabitable due to a fire (Ref. 2).

Inability to establish plant control from outside the Control Room escalates this event to a Site Area Emergency per EAL HS6.1.

This IC addresses an evacuation of the Control Room that results in transfer of plant control to alternate locations outside the Control Room. The loss of the ability to control the plant from the Control Room is considered to be a potential substantial degradation in the level of plant safety.

Following a Control Room evacuation, control of the plant will be transferred to alternate shutdown locations. The necessity to control a plant shutdown from outside the Control Room, in addition to responding to the event that required the evacuation of the Control Room, will present challenges to plant operators and other on-shift personnel. Activation of the ERO and emergency response facilities will assist in responding to these challenges.

Escalation of the emergency classification level would be via IC HS6.

PVNGS Basis Reference(s):

1. Procedure 40AO-9ZZ18, *Shutdown Outside the Control Room*
2. Procedure 40AO-9ZZ19, *Control Room Fire*
3. NEI 99-01, HA6

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards and Other Conditions Affecting Plant Safety

Subcategory: 6– Control Room Evacuation

Initiating Condition: Inability to control a key safety function from outside the Control Room

EAL:

HS6.1 Site Area Emergency

An event has resulted in plant control being transferred from the Control Room to the Remote Shutdown Panel (RSP)

AND

Control of **any** of the following key safety functions is not re-established within 15 minutes (Note 1):

- Reactivity Control (Modes 1, 2 and 3 only)
- Core Heat Removal
- RCS Heat Removal

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 – Hot Shutdown, 5 - Cold Shutdown, 6 - Refueling

Definition(s):

None

Basis:

The Control Room Supervisor (CRS) determines if the Control Room is uninhabitable and requires evacuation. Control Room inhabitability may be caused by fire, dense smoke, noxious fumes, bomb threat in or adjacent to the Control Room, or other life threatening conditions.

Procedure 40AO-9ZZ18, *Shutdown Outside the Control Room*, provides the instructions for tripping the unit and maintaining RCS inventory and Hot Shutdown conditions from outside the Control Room due to reasons other than fire (Ref. 1).

Procedure 40AO-9ZZ19, *Control Room Fire*, provides the instructions for tripping the unit and maintaining RCS inventory and Hot Shutdown conditions from outside the Control Room due to a fire (Ref. 2).

The intent of this EAL is to capture events in which control of the plant cannot be reestablished in a timely manner. The 15 minute time for transfer starts when the Control Room is evacuated (when CRS leaves the Control Room, not when procedures 40AO-9ZZ18 or 40AO-9ZZ19 are entered). The time interval is based on how quickly control must be reestablished without core uncovery and/or core damage. The determination of whether or not control is established from outside the Control Room is based on Emergency Coordinator judgment. The Emergency Coordinator is expected to make a reasonable, informed judgment that control of the plant from outside the Control Room cannot be established within the 15 minute interval.

Once the Control Room is evacuated, the objective is to establish control of important plant equipment and maintain knowledge of important plant parameters in a timely manner. Primary emphasis should be placed on components and instruments that supply protection for and information about safety functions. Typically, these safety functions are reactivity control (ability to shutdown the reactor and maintain it shutdown), RCS inventory (ability to cool the core) and secondary heat removal (ability to maintain a heat sink).

This IC addresses an evacuation of the Control Room that results in transfer of plant control to alternate locations and the control of a key safety function cannot be reestablished in a timely manner. The failure to gain control of a key safety function following a transfer of plant control to alternate locations is a precursor to a challenge to one or more fission product barriers within a relatively short period of time.

The determination of whether or not "control" is established at the remote safe shutdown location(s) is based on Emergency Coordinator judgment. The Emergency Coordinator is expected to make a reasonable, informed judgment within 15 minutes whether or not the operating staff has control of key safety functions from the remote safe shutdown location(s).

Escalation of the emergency classification level would be via IC FG1 or CG1

PVNGS Basis Reference(s):

1. Procedure 40AO-9ZZ18, *Shutdown Outside the Control Room*
2. Procedure 40AO-9ZZ19, *Control Room Fire*
3. NEI 99-01, HS6

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards and Other Conditions Affecting Plant Safety

Subcategory: 7– Emergency Coordinator Judgment

Initiating Condition: Other conditions exist that in the judgment of the Emergency Coordinator warrant declaration of a UE

EAL:

HU7.1 Unusual Event

Other conditions exist which in the judgment of the Emergency Coordinator indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs.

Mode Applicability:

All

Definition(s):

None

Basis:

The Emergency Coordinator is the designated onsite individual having the responsibility and authority for implementing the *PVNGS Emergency Plan* (ref. 1). The Operations Shift Manager (SM) initially acts in the capacity of the Emergency Coordinator and takes actions as outlined in the Emergency Plan implementing procedures (ref. 2). If required by the emergency classification or if deemed appropriate by the Emergency Coordinator, emergency response personnel are notified and instructed to report to their emergency response locations. In this manner, the individual usually in charge of activities in the Control Room is responsible for initiating the necessary emergency response, but Plant Management is expected to manage the emergency response as soon as available to do so in anticipation of the possible wide-ranging responsibilities associated with managing a major emergency.

This IC addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the Emergency Coordinator to fall under the emergency classification level description for an Unusual Event.

ATTACHMENT 1
EAL Technical Bases

PVNGS Basis Reference(s):

1. *PVNGS Emergency Plan*, Section 4.2.1.1, Emergency Coordinator
2. *PVNGS Emergency Plan*, Section 4.2.1.12, Shift Manager
3. NEI 99-01, HU7

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards and Other Conditions Affecting Plant Safety

Subcategory: 7– Emergency Coordinator Judgment

Initiating Condition: Other conditions exist that in the judgment of the Emergency Coordinator warrant declaration of an Alert

EAL:

HA7.1 Alert

Other conditions exist which in the judgment of the Emergency Coordinator, indicate that events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA Protective Action Guideline exposure levels.

Mode Applicability:

All

Definition(s):

HOSTILE ACTION - An act toward PVNGS or its personnel that includes the use of violent force to destroy equipment, take hostages and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, projectiles, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. Hostile action should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on PVNGS. Non-terrorism-based EALs should be used to address such activities (i.e., this may include violent acts between individuals in the owner controlled area).

Basis:

The Emergency Coordinator is the designated onsite individual having the responsibility and authority for implementing the *PVNGS Emergency Plan* (ref. 1). The Operations Shift Manager (SM) initially acts in the capacity of the Emergency Coordinator and takes actions as outlined in the Emergency Plan implementing procedures (ref. 2). If required by the emergency classification or if deemed appropriate by the Emergency Coordinator, emergency response personnel are notified and instructed to report to their emergency response locations. In this manner, the individual usually in charge of activities in the Control Room is responsible for initiating the necessary emergency response, but Plant Management is expected to manage the emergency response as soon as available to do so in anticipation of the possible wide-ranging responsibilities associated with managing a major emergency.

This IC addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the Emergency Coordinator to fall under the emergency classification level description for an Alert.

PVNGS Basis Reference(s):

1. *PVNGS Emergency Plan*, Section 4.2.1.1, Emergency Coordinator
2. *PVNGS Emergency Plan*, Section 4.2.1.12, Shift Manager
3. NEI 99-01, HA7

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards and Other Conditions Affecting Plant Safety

Subcategory: 7– Emergency Coordinator Judgment

Initiating Condition: Other conditions exist that in the judgment of the Emergency Coordinator warrant declaration of an Alert

EAL:

HS7.1 **Site Area Emergency**
Other conditions exist which in the judgment of the Emergency Coordinator indicate that events are in progress or have occurred which involve actual or likely major failures of plant functions needed for protection of the public or HOSTILE ACTION that results in intentional damage or malicious acts, (1) toward site personnel or equipment that could lead to the likely failure of or, (2) that prevent effective access to equipment needed for the protection of the public. Any releases are not expected to result in exposure levels which exceed EPA Protective Action Guideline exposure levels beyond the site boundary

Mode Applicability:

All

Definition(s):

HOSTILE ACTION - An act toward PVNGS or its personnel that includes the use of violent force to destroy equipment, take hostages and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, projectiles, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. Hostile action should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on PVNGS. Non-terrorism-based EALs should be used to address such activities (i.e., this may include violent acts between individuals in the owner controlled area).

Basis:

The Emergency Coordinator is the designated onsite individual having the responsibility and authority for implementing the PVNGS Emergency Plan (ref. 1). The Operations Shift Manager (SM) initially acts in the capacity of the Emergency Coordinator and takes actions as outlined in the Emergency Plan implementing procedures (ref. 2). If required by the emergency classification or if deemed appropriate by the Emergency Coordinator, emergency response personnel are notified and instructed to report to their emergency response locations. In this manner, the individual usually in charge of activities in the Control Room is responsible for initiating the necessary emergency response, but Plant Management is expected to manage the emergency response as soon as available to do so in anticipation of the possible wide-ranging responsibilities associated with managing a major emergency.

This IC addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the Emergency Coordinator to fall under the emergency classification level description for a Site Area Emergency.

PVNGS Basis Reference(s):

1. *PVNGS Emergency Plan*, Section 4.2.1.1 Emergency Coordinator
2. *PVNGS Emergency Plan*, Section 4.2.1.12 Shift Manager
3. NEI 99-01, HA7

ATTACHMENT 1
EAL Technical Bases

Category: H – Hazards and Other Conditions Affecting Plant Safety

Subcategory: 7– Emergency Coordinator Judgment

Initiating Condition: Other conditions exist which in the judgment of the Emergency Coordinator warrant declaration of a General Emergency

EAL:

HG7.1	**General Emergency**

Other conditions exist which in the judgment of the Emergency Coordinator indicate that events are in progress or have occurred which involve actual or IMMINENT substantial core degradation or melting with potential for loss of containment integrity or HOSTILE ACTION that results in an actual loss of physical control of the facility. Releases can be reasonably expected to exceed EPA Protective Action Guideline exposure levels offsite for more than the immediate site area

Mode Applicability:

All

Definition(s):

HOSTILE ACTION - An act toward PVNGS or its personnel that includes the use of violent force to destroy equipment, take hostages and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, projectiles, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. Hostile action should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on PVNGS. Non-terrorism-based EALs should be used to address such activities (i.e., this may include violent acts between individuals in the owner controlled area).

IMMINENT - The trajectory of events or conditions is such that an EAL will be met within a relatively short period of time regardless of mitigation or corrective actions.

Basis:

The Emergency Coordinator is the designated onsite individual having the responsibility and authority for implementing the *PVNGS Emergency Plan* (ref. 1). The Operations Shift Manager (SM) initially acts in the capacity of the Emergency Coordinator and takes actions as outlined in the Emergency Plan implementing procedures (ref. 2). If required by the emergency classification or if deemed appropriate by the Emergency Coordinator, emergency response personnel are notified and instructed to report to their emergency response locations. In this manner, the individual usually in charge of activities in the Control Room is responsible for initiating the necessary emergency response, but Plant Management is expected to manage the emergency response as soon as available to do so in anticipation of the possible wide-ranging responsibilities associated with managing a major emergency.

Releases can reasonably be expected to exceed EPA PAG plume exposure levels outside the Site Boundary.

This IC addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the Emergency Coordinator to fall under the emergency classification level description for a General Emergency.

PVNGS Basis Reference(s):

1. *PVNGS Emergency Plan*, Section 4.2.1.1 Emergency Coordinator
2. *PVNGS Emergency Plan*, Section 4.2.1.12 Shift Manager
3. NEI 99-01, HA7

ATTACHMENT 1
EAL Technical Bases

Category S – Systems Malfunction

EAL Group: Hot Conditions (RCS temperature > 210ºF); EALs in this category are applicable only in one or more hot operating modes.

Numerous system-related equipment failure events that warrant emergency classification have been identified in this category. They may pose actual or potential threats to plant safety.

The events of this category pertain to the following subcategories:

1. Loss of Emergency AC Power

Loss of emergency electrical power can compromise plant safety system operability including decay heat removal and emergency core cooling systems which may be necessary to ensure fission product barrier integrity. This category includes loss of onsite and offsite sources for 4.16KV AC emergency buses.

2. Loss of Vital DC Power

Loss of emergency electrical power can compromise plant safety system operability including decay heat removal and emergency core cooling systems which may be necessary to ensure fission product barrier integrity. This category includes loss of vital plant 125 VDC power sources.

3. Loss of Control Room Indications

Certain events that degrade plant operator ability to effectively assess plant conditions within the plant warrant emergency classification. Losses of indicators are in this subcategory.

4. RCS Activity

During normal operation, reactor coolant fission product activity is very low. Small concentrations of fission products in the coolant are primarily from the fission of tramp uranium in the fuel clad or minor perforations in the clad itself. Any significant increase from these base-line levels (2% - 5% clad failures) is indicative of fuel failures and is covered under the Fission Product Barrier Degradation category. However, lesser amounts of clad damage may result in coolant activity exceeding Technical Specification limits. These fission products will be circulated with the reactor coolant and can be detected by coolant sampling.

5. RCS Leakage

The reactor vessel provides a volume for the coolant that covers the reactor core. The reactor pressure vessel and associated pressure piping (reactor coolant system) together provide a barrier to limit the release of radioactive material should the reactor fuel clad integrity fail. Excessive RCS leakage greater than Technical Specification limits indicates potential pipe cracks that may propagate to an extent threatening fuel clad, RCS and containment integrity.

6. RPS Failure

This subcategory includes events related to failure of the Reactor Protection System (RPS) to initiate and complete reactor trips. In the plant licensing basis, postulated failures of the RPS to complete a reactor trip comprise a specific set of analyzed events referred to as Anticipated Transient Without Scram (ATWS) events. For EAL classification, however, ATWS is intended to mean any trip failure event that does not achieve reactor shutdown. If RPS actuation fails to assure reactor shutdown, positive control of reactivity is at risk and could cause a threat to fuel clad, RCS and containment integrity.

7. Loss of Communications

Certain events that degrade plant operator ability to effectively communicate with essential personnel within or external to the plant warrant emergency classification.

8. Containment Failure

Failure of containment isolation capability (under conditions in which the containment is not currently challenged) warrants emergency classification. Failure of containment pressure control capability also warrants emergency classification.

9. Hazardous Event Affecting Safety Systems

Various natural and technological events that result in degraded plant safety system performance or significant visible damage warrant emergency classification under this subcategory.

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 1 – Loss of Emergency AC Power

Initiating Condition: Loss of **all** offsite AC power capability to emergency buses for 15 minutes or longer

EAL:

SU1.1	**Unusual Event**
Loss of all offsite AC power capability, Table S-1, to emergency 4.16KV buses PBA-S03 and PBB-S04 for ≥ 15 minutes (Note 1)	

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Table S-1 AC Power Sources
Offsite: • SUT (normal) • SUT (alternate) • SBOG #1 **AND** SBOG #2 (if already aligned)
Onsite: • DG A • DG B

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 – Hot Shutdown

Definition(s):

None

Basis:

The 4.16KV AC System provides the power requirements for operation and safe shutdown of the plant. The essential switchgear are buses PBA-S03 and PBB-S04 (ref. 1).

The condition indicated by this EAL is the degradation of all offsite AC power sources such that any only onsite AC power capability exists for 15 minutes or longer.

4.16KV buses PBA-S03 and PBB-S04 are the emergency (essential) buses. PBA-S03 supplies power to Train A safety related loads and PBB-S04 supplies power to Train B safety related loads.

ATTACHMENT 1
EAL Technical Bases

Each bus has two normal sources of offsite power. Each source is from one of three 13.8 KV Startup Transformers (SUT) via its normal and alternative ESF Service Transformer NBN-X03 or NBN-X04. Transformer NBN-X03 is the normal supply to bus PBA-S03 and the alternate supply to PBB-S04; Transformer NBN-X04 is the normal supply to bus PBB-S04 and the alternate supply to PBA-S03 (ref. 1).

Additional alternate offsite AC power sources are the two redundant 13.8KV SBO gas turbine generators (SBOG #1 & SBOG #2). However, these sources can only be credited if already aligned, that is, capable of powering one or more emergency bus within 15 minutes. The SBOGs can only be credited if they are running in parallel since they are not rated to supply all the SAFETY SYSTEM loads.

PBA-S03 and PBB-S04 each have an onsite emergency diesel generator (DG A & DG B) which supply electrical power to the bus automatically in the event that the preferred source becomes unavailable (ref. 1).

This IC addresses a prolonged loss of offsite power. The loss of offsite power sources renders the plant more vulnerable to a complete loss of power to AC emergency buses. This condition represents a potential reduction in the level of safety of the plant.

For emergency classification purposes, “capability” means that an offsite AC power source(s) is available to the emergency buses, whether or not the buses are powered from it.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of offsite power.

Escalation of the emergency classification level would be via IC SA1.

PVNGS Basis Reference(s):

1. Drawing 13-E-MAA-001, *Main Single Line Diagram*
2. UFSAR Section 8.3.1, AC Power Systems
3. Procedure 40AO-9ZZ12, *Degraded Electrical Power*
4. UFSAR Section 1.2.10.3.9, Alternate AC Power System
5. NEI 99-01, SU1

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 1 – Loss of Emergency AC Power

Initiating Condition: Loss of **all but one** AC power source to emergency buses for 15 minutes or longer

EAL:

SA1.1 Alert

AC power capability, Table S-1, to emergency 4.16KV buses PBA-S03 and PBB-S04 reduced to a single power source for $\geq$ 15 minutes (Note 1)

AND

Any additional single power source failure will result in loss of all AC power to SAFETY SYSTEMS

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Table S-1 AC Power Sources
Offsite: • SUT (normal) • SUT (alternate) • SBOG #1 **AND** SBOG #2 (if already aligned)
Onsite: • DG A • DG B

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 3 - Hot Shutdown

Definition(s):

SAFETY SYSTEM - A system required for safe plant operation, cooling down the plant and/or placing it in the cold shutdown condition, including the ECCS. These are typically systems classified as safety-related (as defined in 10 CFR 50.2):

> Those structures, systems and components that are relied upon to remain functional during and following design basis events to assure:
>
> 1) The integrity of the reactor coolant pressure boundary;

2) The capability to shut down the reactor and maintain it in a safe shutdown condition;
3) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures.

Basis:

For emergency classification purposes, “capability” means that an AC power source is available to and capable of powering the emergency bus(es) within 15 min, whether or not the buses are currently powered from it.

The 4.16KV AC System provides the power requirements for operation and safe shutdown of the plant. The essential switchgear are buses PBA-S03 and PBB-S04 (ref. 1).

The condition indicated by this EAL is the degradation of the offsite and onsite power sources such that any additional single failure would result in a loss of all AC power to the emergency buses.

4.16KV buses PBA-S03 and PBB-S04 are the emergency (essential) buses. PBA-S03 supplies power to Train A safety related loads and PBB-S04 supplies power to Train B safety related loads. Each bus has two normal sources of offsite power. Each source is from one of three 13.8 KV Startup Transformers (SUT) via its normal and alternative ESF Service Transformer NBN-X03 or NBN-X04. Transformer NBN-X03 is the normal supply to bus PBA-S03 and the alternate supply to PBB-S04; Transformer NBN-X04 is the normal supply to bus PBB-S04 and the alternate supply to PBA-S03 (ref. 1).

In addition, PBA-S03 and PBB-S04 each have an emergency diesel generator (DG A & DG B) which supply electrical power to the bus automatically in the event that the preferred source becomes unavailable (ref. 1).

Additional alternate offsite AC power sources are the two redundant 13.8KV SBO gas turbine generators (SBOG #1 & SBOG #2). However, these sources can only be credited if already aligned, that is, capable of powering one or more emergency bus within 15 minutes. The SBOGs can only be credited if they are running in parallel since they are not rated to supply all the SAFETY SYSTEM loads.

If the capability of a second source of emergency bus power is not restored within 15 minutes, an Alert is declared under this EAL.

This IC describes a significant degradation of offsite and onsite AC power sources such that any additional single failure would result in a loss of all AC power to SAFETY SYSTEMS. In this condition, the sole AC power source may be powering one, or more than one, train of safety related equipment. This IC provides an escalation path from IC SU1.

An "AC power source" is a source recognized in AOPs and EOPs and capable of supplying required power to an emergency bus. Some examples of this condition are presented below.

- A loss of all offsite power with a concurrent failure of all but one emergency power source (e.g., an onsite diesel generator).
- A loss of all offsite power and loss of all emergency power sources (e.g., onsite diesel generators) with a single train of emergency buses being back-fed from the unit main generator.
- A loss of emergency power sources (e.g., onsite diesel generators) with a single train of emergency buses being fed from an offsite power source.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of power.

Escalation of the emergency classification level would be via IC SS1.

PVNGS Basis Reference(s):

1. Drawing 13-E-MAA-001, *Main Single Line Diagram*
2. UFSAR Section 8.3.1, AC Power Systems
3. Procedure 40AO-9ZZ12, *Degraded Electrical Power*
4. UFSAR Section 1.2.10.3.9, Alternate AC Power System
5. NEI 99-01, SA1

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 1– Loss of Emergency AC Power

Initiating Condition: Loss of **all** offsite power and all onsite AC power to emergency buses for 15 minutes or longer

EAL:

SS1.1	**Site Area Emergency**
Loss of all offsite and all onsite AC power capability to emergency 4.16KV buses PBA-S03 and PBB-S04 for ≥ 15 minutes (Note 1)	

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

None

Basis:

For emergency classification purposes, "capability" means that an AC power source is available to and capable of powering the emergency bus(es) within 15 min, whether or not the buses are currently powered from it.

The 4.16KV AC System provides the power requirements for operation and safe shutdown of the plant. The essential switchgear are buses PBA-S03 and PBB-S04 (ref. 1).

4.16KV buses PBA-S03 and PBB-S04 are the emergency (essential) buses. PBA-S03 supplies power to Train A safety related loads and PBB-S04 supplies power to Train B safety related loads. Each bus has two normal sources of offsite power. Each source is from one of three 13.8 KV Startup Transformers (SUT) via its normal and alternative ESF Service Transformer NBN-X03 or NBN-X04. Transformer NBN-X03 is the normal supply to bus PBA-S03 and the alternate supply to PBB-S04; Transformer NBN-X04 is the normal supply to bus PBB-S04 and the alternate supply to PBA-S03 (ref. 1).

In addition, PBA-S03 and PBB-S04 each have an emergency diesel generator (DG A & DG B) which supply electrical power to the bus automatically in the event that the preferred source becomes unavailable (ref. 1).

Additional alternate offsite AC power sources include, but not limited to, the two redundant 13.8KV SBO gas turbine generators (SBOG #1 & SBOG #2). However, these sources can only be credited if already aligned, that is, capable of powering one or more emergency bus within 15 minutes. The SBOGs can only be credited if they are running in parallel since they are not rated to supply all the SAFETY SYSTEM loads

The interval begins when both offsite and onsite AC power capability are lost.

This IC addresses a total loss of AC power that compromises the performance of all SAFETY SYSTEMS requiring electric power including those necessary for emergency core cooling, containment heat removal/pressure control, spent fuel heat removal and the ultimate heat sink. In addition, fission product barrier monitoring capabilities may be degraded under these conditions. This IC represents a condition that involves actual or likely major failures of plant functions needed for the protection of the public.

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Escalation of the emergency classification level would be via ICs RG1, FG1 or SG1.

PVNGS Basis Reference(s):

1. Drawing 13-E-MAA-001, *Main Single Line Diagram*
2. UFSAR Section 8.3.1, AC Power Systems
3. Procedure 40AO-9ZZ12, *Degraded Electrical Power*
4. UFSAR Section 1.2.10.3.9, Alternate AC Power System
5. Procedure 40EP-9EO08, *Blackout*
6. NEI 99-01, SS1

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 1 – Loss of Emergency AC Power

Initiating Condition: Prolonged loss of **all** offsite and **all** onsite AC power to emergency buses

EAL:

SG1.1 General Emergency

Loss of all offsite and all onsite AC power capability to emergency 4.16KV buses PBA-S03 and PBB-S04

AND EITHER

- Restoration of at least one emergency bus in < 4 hour is not likely (Note 1)
- Rep CET reading > 1200ºF

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

None

Basis:

This EAL is indicated by the extended loss of all offsite and onsite AC power capability to 4.16KV emergency buses PBA-S03 and PBB-S04 either for greater then the PVNGS Station Blackout (SBO) coping analysis time (4 hrs.) (ref. 8) or that has resulted in indications of an actual loss of adequate core cooling (Rep CET > 1200 ºF) (ref. 6, 7).

For emergency classification purposes, "capability" means that an AC power source is available to and capable of powering the emergency bus(es), whether or not the buses are currently powered from it.

The 4.16KV AC System provides the power requirements for operation and safe shutdown of the plant. The essential switchgear are buses PBA-S03 and PBB-S04 (ref. 1).

4.16KV buses PBA-S03 and PBB-S04 are the emergency (essential) buses. PBA-S03 supplies power to Train A safety related loads and PBB-S04 supplies power to Train B safety related loads. Each bus has two normal sources of offsite power. Each source is from one of three 13.8 KV

Startup Transformers (SUT) via its normal and alternative ESF Service Transformer NBN-X03 or NBN-X04. Transformer NBN-X03 is the normal supply to bus PBA-S03 and the alternate supply to PBB-S04; Transformer NBN-X04 is the normal supply to bus PBB-S04 and the alternate supply to PBA-S03 (ref. 1).

In addition, PBA-S03 and PBB-S04 each have an emergency diesel generator (DG A & DG B) which supply electrical power to the bus automatically in the event that the preferred source becomes unavailable (ref. 1).

Additional alternate offsite AC power sources include, but no limited to, the two redundant 13.8KV SBO gas turbine generators (SBOG #1 & SBOG #2). The SBOGs can only be credited if they are running in parallel since they are not rated to supply all the SAFETY SYSTEM loads.

Rep CET (Representative Core Exit Temperature) is a calculated temperature value generated by the Qualified Safety Parameter Display System (QSPDS). The QSPDS CET processing function generates a representative temperature based on a statistical analysis of thermocouples monitoring the reactor coolant temperature at the top of selected fuel assemblies.

This IC addresses a prolonged loss of all power sources to AC emergency buses. A loss of all AC power compromises the performance of all SAFETY SYSTEMS requiring electric power including those necessary for emergency core cooling, containment heat removal/pressure control, spent fuel heat removal and the ultimate heat sink. A prolonged loss of these buses will lead to a loss of one or more fission product barriers. In addition, fission product barrier monitoring capabilities may be degraded under these conditions.

The EAL should require declaration of a General Emergency prior to meeting the thresholds for IC FG1. This will allow additional time for implementation of offsite protective actions.

Escalation of the emergency classification from Site Area Emergency will occur if it is projected that power cannot be restored to at least one AC emergency bus by the end of the analyzed station blackout coping period. Beyond this time, plant responses and event trajectory are subject to greater uncertainty and there is an increased likelihood of challenges to multiple fission product barriers.

The estimate for restoring at least one emergency bus should be based on a realistic appraisal of the situation. Mitigation actions with a low probability of success should not be used as a basis for delaying a classification upgrade. The goal is to maximize the time available to prepare for and implement, protective actions for the public.

The EAL will also require a General Emergency declaration if the loss of AC power results in parameters that indicate an inability to adequately remove decay heat from the core.

PVNGS Basis Reference(s):

1. Drawing13-E-MAA-001, *Main Single Line Diagram*
2. UFSAR Section 8.3.1, AC Power Systems
3. EOP Setpoint Document TA-13-C00-2000-001
4. 40AO-9ZZ12, *Degraded Electrical Power*
5. UFSAR Section 1.2.10.3.9 Alternate AC Power System
6. Procedure 40DP-9AP13, *Blackout Technical Guideline*
7. Procedure 40EP-9EO09, *Functional Recovery*
8. Core Damage Assessment User Manual
9. Evaluation 4578373, *Station Blackout Coping Analysis for Margin to Core Covery*
10. NEI 99-01, SG1

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 1 – Loss of Emergency AC Power

Initiating Condition: Loss of **all** emergency AC and vital DC power sources for 15 minutes or longer

EAL:

SG1.2 General Emergency

Loss of all offsite and all onsite AC power capability to emergency 4.16KV buses PBA-S03 and PBB-S04 for ≥ 15 minutes

AND

Loss of 125 VDC power based on battery bus voltage indications < 112 VDC on **both** vital DC buses PKA-M41and PKB-M42 for ≥ 15 minutes (Note 1)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

None

Basis:

This EAL is indicated by the loss of all offsite and onsite emergency AC power capability to 4.16KV emergency buses PBA-S03 and PBB-S04 for greater than 15 minutes in combination with degraded vital DC power voltage. This EAL addresses operating experience from the March 2011 accident at Fukushima Daiichi.

For emergency classification purposes, “capability” means that an AC power source is available to and capable of powering the emergency bus(es) within 15 min, whether or not the buses are currently powered from it.

The 4.16KV AC System provides the power requirements for operation and safe shutdown of the plant. The essential switchgear are buses PBA-S03 and PBB-S04 (ref. 1).

ATTACHMENT 1
EAL Technical Bases

The 4.16KV buses PBA-S03 and PBB-S04 are the emergency (essential) buses. PBA-S03 supplies power to Train A safety related loads and PBB-S04 supplies power to Train B safety related loads. Each bus has two normal sources of offsite power. Each source is from one of three 13.8 KV Startup Transformers (SUT) via its normal and alternative ESF Service Transformer NBN-X03 or NBN-X04. Transformer NBN-X03 is the normal supply to bus PBA-S03 and the alternate supply to PBB-S04; Transformer NBN-X04 is the normal supply to bus PBBS04 and the alternate supply to PBA-S03 (ref. 1).

In addition, PBA-S03 and PBB-S04 each have an emergency diesel generator (DG A & DG B) which supply electrical power to the bus automatically in the event that the preferred source becomes unavailable (ref. 1). However, these sources can only be credited if already aligned, that is, power one or more emergency bus within 15 minutes.

Additional alternate offsite AC power sources include, but not limited to, the two redundant 13.8KV SBO gas turbine generators (SBOG #1 & SBOG #2). However, these sources can only be credited if already aligned, that is, capable of powering one or more emergency bus within 15 minutes. The SBOGs can only be credited if they are running in parallel since they are not rated to supply all the SAFETY SYSTEM loads.

The vital DC buses are the following 125 VDC Class 1E buses (ref. 6):

Train A:
- PKA-M41
- PKC-M43

Train B:
- PKB-M42
- PKD-M44

For this EAL credit is only taken for buses PKA-M41 and PKB-M42 as these are the Train A and Train B buses that provide safety system control power.

There are four, 60 cell, lead-calcium storage batteries (PKA-F11, PKC-F13, PKB-F12 and PKDF14) that supplement the output of the battery chargers. They supply DC power to the distribution buses when AC power to the chargers is lost or when transient loads exceed the capacity of the battery chargers (ref. 6).

All four of the 125VDC buses supply inverters for 120VAC PN bus power as well as control power for various safety related systems. Each battery is designed to have sufficient stored energy to supply the required emergency loads for 120 minutes following a loss of AC power to the chargers (ref. 7).

Minimum DC bus voltage is 112 VDC (ref. 8).

ATTACHMENT 1
EAL Technical Bases

This IC addresses a concurrent and prolonged loss of both emergency AC and Vital DC power. A loss of all emergency AC power compromises the performance of all SAFETY SYSTEMS requiring electric power including those necessary for emergency core cooling, containment heat removal/pressure control, spent fuel heat removal and the ultimate heat sink. A loss of vital DC power compromises the ability to monitor and control SAFETY SYSTEMS. A sustained loss of both emergency AC and vital DC power will lead to multiple challenges to fission product barriers.

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses. The 15-minute emergency declaration clock begins at the point when both EAL thresholds are met.

PVNGS Basis Reference(s):

1. Drawing 13-E-MAA-001, *Main Single Line Diagram*
2. UFSAR Section 8.3.1 AC Power Systems
3. Procedure 40AO-9ZZ12, *Degraded Electrical Power*
4. UFSAR Section 1.2.10.3.9, Alternate AC Power System
5. Procedure 40DP-9AP13, *Blackout Technical Guideline*
6. Drawing 01-E-PKA-001, *Main Single Line Diagram 125V DC Class 1E and 120VAC Vital Inst Power System*
7. UFSAR Section 8.3.2, DC Power Systems
8. Calculation 01-EC-PK-0207 DC, *Battery Sizing and Minimum Voltage*
9. NEI 99-01, SG8

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 2– Loss of Vital DC Power

Initiating Condition: Loss of all vital DC power for 15 minutes or longer

EAL:

SS2.1 Site Area Emergency

Loss of 125 VDC power based on battery bus voltage indications < 112 VDC on both vital DC buses PKA-M41and PKB-M42 for ≥ 15 minutes (Note 1)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

None

Basis:

The vital DC buses are the following 125 VDC Class 1E buses (ref. 1):

Train A:
- PKA-M41
- PKC-M43

Train B:
- PKB-M42
- PKD-M44

For this EAL credit is only taken for buses PKA-M41 and PKB-M42 as these are the Train A and Train B buses that provide safety system control power.

There are four, 60 cell, lead-calcium storage batteries (PKA-F11, PKC-F13, PKB-F12 and PKDF14) that supplement the output of the battery chargers. They supply DC power to the distribution buses when AC power to the chargers is lost or when transient loads exceed the capacity of the battery chargers (ref. 1).

All four of the 125VDC buses supply inverters for 120VAC PN bus power as well as control power for various safety related systems. Each battery is designed to have sufficient stored energy to supply the required emergency loads for 120 minutes following a loss of AC power to the chargers (ref. 2).

Minimum DC bus voltage is 112 VDC (ref. 3).

This IC addresses a loss of vital DC power which compromises the ability to monitor and control SAFETY SYSTEMS. In modes above Cold Shutdown, this condition involves a major failure of plant functions needed for the protection of the public.

Fifteen minutes was selected as a threshold to exclude transient or momentary power losses.

Escalation of the emergency classification level would be via ICs RG1, FG1 or SG1.

PVNGS Basis Reference(s):

1. Drawing 01-E-PKA-001, *Main Single Line Diagram 125V DC Class 1E and 120VAC Vital Inst Power System*
2. UFSAR Section 8.3.2, DC Power Systems
3. Calculation 01-EC-PK-0207, *DC Battery Sizing and Minimum Voltage*
4. NEI 99-01, SS8

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 3– Loss of Control Room Indications

Initiating Condition: UNPLANNED loss of Control Room indications for 15 minutes or longer

EAL:

SU3.1	**Unusual Event**
An UNPLANNED event results in the inability to monitor one or more Table S-2 parameters from within the Control Room for $\geq$ 15 minutes (Note 1)	

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Note 11: Downcomer flow instruments are also credited for auxiliary feed flow indication.

Table S-2 Safety System Parameters
• Reactor power • RCS level • RCS pressure • CET temperature • Level in at least one S/G • Auxiliary feed flow to at least one S/G (Note 11)

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

UNPLANNED - A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

Basis:

SAFETY SYSTEM parameters listed in Table S-2 are monitored in the Control Room through a combination of hard control panel indicators as well as computer based information systems. The Plant Computer serves as a redundant compensatory indicator which may be utilized in lieu of normal Control Room indicators (ref. 1, 2).

Downcomer flow instruments are also credited for auxiliary feed flow indication.

ATTACHMENT 1
EAL Technical Bases

This IC addresses the difficulty associated with monitoring normal plant conditions without the ability to obtain SAFETY SYSTEM parameters from within the Control Room. This condition is a precursor to a more significant event and represents a potential degradation in the level of safety of the plant.

As used in this EAL, an “inability to monitor” means that values for one or more of the listed parameters cannot be determined from within the Control Room. This situation would require a loss of all of the Control Room sources for the given parameter(s). For example, the reactor power level cannot be determined from any analog, digital and recorder source within the Control Room.

An event involving a loss of plant indications, annunciators and/or display systems is evaluated in accordance with 10 CFR 50.72 (and associated guidance in NUREG-1022) to determine if an NRC event report is required. The event would be reported if it significantly impaired the capability to perform emergency assessments. In particular, emergency assessments necessary to implement abnormal operating procedures, emergency operating procedures and emergency plan implementing procedures addressing emergency classification, accident assessment, or protective action decision-making.

This EAL is focused on a selected subset of plant parameters associated with the key safety functions of reactivity control, core cooling and RCS heat removal. The loss of the ability to determine one or more of these parameters from within the Control Room is considered to be more significant than simply a reportable condition. In addition, if all indication sources for one or more of the listed parameters are lost, then the ability to determine the values of other SAFETY SYSTEM parameters may be impacted as well. For example, if the value for reactor vessel level cannot be determined from the indications and recorders on a main control board, the SPDS or the plant computer, the availability of other parameter values may be compromised as well.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of indication.

Escalation of the emergency classification level would be via IC SA3.

PVNGS Basis Reference(s):

1. UFSAR Section 7.5, Safety-Related Display Instrumentation
2. UFSAR Section 18.I.D.2, Plant Safety Parameter Display System
3. NEI 99-01, SU2

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 3– Loss of Control Room Indications

Initiating Condition: UNPLANNED loss of Control Room indications for 15 minutes or longer with a significant transient in progress

EAL:

SA3.1 Alert

An UNPLANNED event results in the inability to monitor one or more Table S-2 parameters from within the Control Room for ≥ 15 minutes (Note 1)

AND

Any significant transient is in progress, Table S-3

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Note 11: Downcomer flow instruments are also credited for auxiliary feed flow indication.

Table S-2 Safety System Parameters
• Reactor power • RCS level • RCS pressure • CET temperature • Level in at least one S/G • Auxiliary feed flow to at least one S/G (Note 11)

Table S-3 Significant Transients
• Reactor trip • Runback > 25% thermal power • Electrical load rejection > 25% electrical load • Reactor power cutback • ECCS actuation

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

UNPLANNED - A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

Basis:

SAFETY SYSTEM parameters listed in Table S-2 are monitored in the Control Room through a combination of hard control panel indicators as well as computer based information systems. The Plant Computer serves as a redundant compensatory indicator which may be utilized in lieu of normal Control Room indicators (ref. 1, 2).

Downcomer flow instruments are also credited for auxiliary feed flow indication.

Significant transients are listed in Table S-3 and include response to automatic or manually initiated functions such as reactor trips, runbacks involving greater than 25% thermal power change, electrical load rejections of greater than 25% full electrical load, reactor power cutbacks or ECCS (SI) injection actuations.

This IC addresses the difficulty associated with monitoring rapidly changing plant conditions during a transient without the ability to obtain SAFETY SYSTEM parameters from within the Control Room. During this condition, the margin to a potential fission product barrier challenge is reduced. It thus represents a potential substantial degradation in the level of safety of the plant.

As used in this EAL, an "inability to monitor" means that values for one or more of the listed parameters cannot be determined from within the Control Room. This situation would require a loss of all of the Control Room sources for the given parameter(s). For example, the reactor power level cannot be determined from any analog, digital and recorder source within the Control Room.

An event involving a loss of plant indications, annunciators and/or display systems is evaluated in accordance with 10 CFR 50.72 (and associated guidance in NUREG-1022) to determine if an NRC event report is required. The event would be reported if it significantly impaired the capability to perform emergency assessments. In particular, emergency assessments necessary to implement abnormal operating procedures, emergency operating procedures and emergency plan implementing procedures addressing emergency classification, accident assessment, or protective action decision-making.

This EAL is focused on a selected subset of plant parameters associated with the key safety functions of reactivity control, core heat removal and RCS heat removal. The loss of the ability to determine one or more of these parameters from within the Control Room is considered to be more significant than simply a reportable condition. In addition, if all indication sources for one or more of the listed parameters are lost, then the ability to determine the values of other SAFETY SYSTEM parameters may be impacted as well. For example, if the value for reactor vessel level cannot be determined from the indications and recorders on a main control board, the SPDS or the plant computer, the availability of other parameter values may be compromised as well.

Fifteen minutes was selected as a threshold to exclude transient or momentary losses of indication. Escalation of the emergency classification level would be via ICs FS1 or IC RS1.

PVNGS Basis Reference(s):

1. UFSAR Section 7.5, Safety-Related Display Instrumentation
2. UFSAR Section 18.I.D.2, Plant Safety Parameter Display System
3. NEI 99-01, SA2

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 4– RCS Activity

Initiating Condition: Reactor coolant activity greater than Technical Specification allowable limits

EAL:

SU4.1	**Unusual Event**
Letdown Monitor RU-155D reading > high alarm	

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

None

Basis:

A reading on the Letdown Monitor RU-155D > high alarm is indicative of coolant activity in excess of the Technical Specification RCS activity limits (ref 1, 2).

This IC addresses a reactor coolant activity value that exceeds an allowable limit specified in Technical Specifications. This condition is a precursor to a more significant event and represents a potential degradation of the level of safety of the plant.

Escalation of the emergency classification level would be via ICs FA1 or the Recognition Category R ICs.

PVNGS Basis Reference(s):

1. Technical Specification 3.4.17, *RCS Specific Activity*
2. Calculation 13-NC-CH-311, *Letdown Line PRM Dose Rates*
3. NEI 99-01, SU3

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 4– RCS Activity

Initiating Condition: Reactor coolant activity greater than Technical Specification allowable limits

EAL:

SU4.2	**Unusual Event**
Sample analysis indicates RCS activity > Technical Specification LCO 3.4.17 limits	

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

None

Basis:

The specific iodine activity is limited to either ≤ 60 μCi/gm Dose Equivalent I-131 or ≤ 1.0 μCi/gm Dose Equivalent I-131 for > 48 hr continuous period. The specific Xe-133 activity is limited to ≤ 550 μCi/gm Dose Equivalent XE-133 for > 48 hr continuous period. Entry into Condition C of LCO 3.4.17 meets the intent of this EAL (ref 1, 2).

This IC addresses a reactor coolant activity value that exceeds an allowable limit specified in Technical Specifications. This condition is a precursor to a more significant event and represents a potential degradation of the level of safety of the plant.

Escalation of the emergency classification level would be via ICs FA1 or the Recognition Category R ICs.

PVNGS Basis Reference(s):

1. Technical Specification 3.4.17, *RCS Specific Activity*
2. Procedure 40AO-9ZZ22, *Fuel Damage*
3. NEI 99-01, SU3

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 5– RCS Leakage

Initiating Condition: RCS leakage for 15 minutes or longer

EAL:

SU5.1 Unusual Event

RCS unidentified or pressure boundary leakage > 10 gpm for ≥ 15 minutes

OR

RCS identified leakage > 25 gpm for ≥ 15 minutes

OR

Reactor coolant leakage to a location outside containment > 25 gpm for ≥ 15 minutes (Note 1)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

None

Basis:

Manual or computer-based methods of performing an RCS inventory balance are normally used to determine RCS leakage. ERFDADS is the preferred method of calculating RCS leak rate. When ERFDADS software is not available, procedural guidance is available to perform the backup and manual RCS inventory balance (ref. 1, 4, 5, 6).

Identified leakage includes:

- Leakage such as that from pump seals or valve packing (except reactor coolant pump (RCP) seal water injection or leakoff), that is captured and conducted to collection systems or a sump or collecting tank (leakage into an intact Reactor Drain Tank is also considered identified leakage), or

- Leakage into the containment atmosphere from sources that are both specifically located and known either not to interfere with the operation of leakage detection systems or not to be pressure boundary leakage, or

- RCS leakage through a steam generator to the secondary system (ref. 2).

Unidentified leakage is all leakage (except RCP seal water injection or leakoff) that is not identified leakage (ref. 2).

Pressure Boundary leakage is leakage (except SG leakage) through a nonisolable fault in an RCS component body, pipe wall, or vessel wall (ref. 2)

Reactor coolant leakage outside of the containment that is not considered identified or unidentified leakage per Technical Specifications. For example: leakage via interfacing systems such as RCS to the Nuclear Cooling Water System, Essential Cooling Water System, Safety Injection System, or systems that directly see RCS pressure outside containment such as Chemical & Volume Control System, Nuclear Sampling system and Residual Heat Removal system (when in the shutdown cooling mode) (ref. 3, 4).

Palo Verde specific operating experience is that a High Pressure Seal Cooler (HPSC) leak to the Nuclear Cooling Water (NC) System must be isolated to containment within 15 minutes of discovery due to the location of the NC system expansion tank and potential dose concerns on the Auxiliary Building roof.

This IC addresses RCS leakage which may be a precursor to a more significant event. In this case, RCS leakage has been detected and operators, following applicable procedures, have been unable to promptly isolate the leak. This condition is considered to be a potential degradation of the level of safety of the plant.

The first and second EAL conditions are focused on a loss of mass from the RCS due to “unidentified leakage," "pressure boundary leakage" or "identified leakage” (as these leakage types are defined in the plant Technical Specifications). The third condition addresses an RCS mass loss caused by an UNISOLABLE leak through an interfacing system. These conditions thus apply to leakage into the containment, a secondary-side system (e.g., steam generator tube leakage) or a location outside of containment.

The leak rate values for each condition were selected because they are usually observable with normal Control Room indications. Lesser values typically require time-consuming calculations to determine (e.g., a mass balance calculation). The first condition uses a lower value that reflects the greater significance of unidentified or pressure boundary leakage.

The release of mass from the RCS due to the as-designed/expected operation of a relief valve does not warrant an emergency classification. An emergency classification would be required if a mass loss is caused by a relief valve that is not functioning as designed/expected (e.g., a relief valve sticks open and the line flow cannot be isolated).

The 15-minute threshold duration allows sufficient time for prompt operator actions to isolate the leakage, if possible.

Escalation of the emergency classification level would be via ICs of Recognition Category R or F.

PVNGS Basis Reference(s):

1. Procedure 40ST-9RC02, *ERFDADS (Preferred) Calculation of RCS Water Inventory*
2. Technical Specification, 1.1, *Definitions*
3. UFSAR Section 5.2.5.4, Intersystem Leakage
4. Procedure 40AO-9ZZ02, *Excessive RCS Leakrate*
5. Procedure 40ST-9RC05, *Manual Calculation of RCS Water Inventory*
6. Procedure 40ST-9RC08, *OAP (Backup) Calculation of RCS Water Inventory*
7. NEI 99-01, SU4

Category: S – System Malfunction

Subcategory: 6– RPS Failure

Initiating Condition: Automatic or manual trip fails to shut down the reactor

EAL:

SU6.1 Unusual Event

An automatic trip did not shut down the reactor as indicated by reactor power > 5% after any RPS setpoint is exceeded

AND

A subsequent automatic trip or manual trip action taken at the reactor control consoles (B05 or B01) is successful in shutting down the reactor as indicated by reactor power ≤ 5% (Note 8)

Note 8: A manual trip action is any operator action, or set of actions, which causes the control rods to be rapidly inserted into the core and does not include manually driving in control rods or implementation of boron injection strategies.

Mode Applicability:

1 - Power Operation

Definition(s):

None

Basis:

The first condition of this EAL identifies the need to cease critical reactor operations by actuation of the automatic Reactor Protection System (RPS) trip function. A reactor trip is automatically initiated by the RPS when certain continuously monitored parameters exceed predetermined setpoints (ref. 1, 4).

Following a successful reactor trip, rapid insertion of the control rods occurs. Nuclear power promptly drops to a fraction of the original power level and then decays to a level several decades less with a negative startup rate. The reactor power drop continues until reactor power reaches the point at which the influence of source neutrons on reactor power starts to be observable. A predictable post-trip response from an automatic reactor trip signal should therefore consist of a prompt drop in reactor power as sensed by the nuclear instrumentation and a lowering of power into the source range. For the purpose of emergency classification a successful trip has occurred when there is sufficient rod insertion from the trip of RPS to bring the reactor power to or below the Power Operation Mode threshold of 5% (ref. 2).

5% rated power is the Power Operation mode threshold. Below 5%, plant response will be similar to that observed during a normal shutdown. Nuclear instrumentation can be used to determine if reactor power is greater than 5 % power (ref. 1, 2).

For the purposes of emergency classification, successful manual trip actions are those which can be quickly performed from the reactor control consoles (B05 or B01). Reactor shutdown achieved by use of other trip actions do not constitute a successful manual trip (ref. 3).

Following any automatic RPS trip signal, procedure 40EP-9EO01, Standard Post Trip Actions (ref. 3) prescribes insertion of redundant manual trip signals to back up the automatic RPS trip function and ensure reactor shutdown is achieved if Reactivity Control acceptance criteria are not met. Even if the first subsequent manual trip signal inserts all control rods to the full-in position immediately after the initial failure of the automatic trip, the lowest level of classification that must be declared is an Unusual Event.

In the event that the operator identifies a reactor trip is imminent and initiates a successful manual reactor trip before the automatic RPS trip setpoint is reached, no declaration is required. The successful manual trip of the reactor before it reaches its automatic trip setpoint or reactor trip signals caused by instrumentation channel failures (without exceeding an RPS trip setpoint) do not lead to a potential fission product barrier loss and are thus not classifiable under this EAL. However, if subsequent manual reactor trip actions fail to reduce reactor power to or below 5%, the event escalates to the Alert under EAL SA6.1.

If by procedure, operator actions include the initiation of an immediate manual trip following receipt of an automatic trip signal and there are no clear indications that the automatic trip failed (such as a time delay following indications that a trip setpoint was exceeded), it may be difficult to determine if the reactor was shut down because of automatic trip or manual actions. If a subsequent review of the trip actuation indications reveals that the automatic trip did not cause the reactor to be shut down, then consideration should be given to evaluating the fuel for potential damage and the reporting requirements of 50.72 should be considered for the transient event.

This IC addresses a failure of the RPS to initiate or complete an automatic or manual reactor trip that results in a reactor shutdown and either a subsequent operator manual action taken at the reactor control consoles or an automatic trip is successful in shutting down the reactor. This event is a precursor to a more significant condition and thus represents a potential degradation of the level of safety of the plant.

Following the failure on an automatic reactor trip, operators will promptly initiate manual actions at the reactor control consoles to shutdown the reactor (e.g., initiate a manual reactor trip). If these manual actions are successful in shutting down the reactor, core heat generation will quickly fall to a level within the capabilities of the plant's decay heat removal systems.

If an initial manual reactor trip is unsuccessful, operators will promptly take manual action at another location(s) on the reactor control consoles to shutdown the reactor (e.g., initiate a manual reactor trip) using a different switch). Depending upon several factors, the initial or subsequent effort to manually trip the reactor, or a concurrent plant condition, may lead to the generation of an automatic reactor trip signal. If a subsequent manual or automatic trip is successful in shutting down the reactor, core heat generation will quickly fall to a level within the capabilities of the plant's decay heat removal systems.

A manual action at the reactor control consoles is any operator action, or set of actions, which causes the control rods to be rapidly inserted into the core (e.g., initiating a manual reactor trip). This action does not include manually driving in control rods or implementation of boron injection strategies. Actions taken at back-panels or other locations within the Control Room, or any location outside the Control Room, are not considered to be "at the reactor control consoles."

The plant response to the failure of an automatic or manual reactor trip will vary based upon several factors including the reactor power level prior to the event, availability of the condenser, performance of mitigation equipment and actions, other concurrent plant conditions, etc. If subsequent operator manual actions taken at the reactor control consoles are also unsuccessful in shutting down the reactor, then the emergency classification level will escalate to an Alert via IC SA6. Depending upon the plant response, escalation is also possible via IC FA1. Absent the plant conditions needed to meet either IC SA6 or FA1, an Unusual Event declaration is appropriate for this event.

Should a reactor trip signal be generated as a result of plant work (e.g., RPS setpoint testing), or instrument failure the following classification guidance should be applied.

- If the signal causes a plant transient that should have included an automatic reactor trip and the RPS fails to automatically shutdown the reactor, then this IC and the EALs are applicable and should be evaluated.
- If the signal does not cause a plant transient and the trip failure is determined through other means (e.g., assessment of test results), then this IC and the EALs are not applicable and no classification is warranted.

PVNGS Basis Reference(s):

1. Technical Specification 3.3.1, *Reactor Protection System (RPS) Instrumentation – Operating*
2. Technical Specification Table 1.1-1, *Modes*
3. Procedure 40EP-9EO01, *Standard Post Trip Actions*
4. UFSAR Section, 7.2.2.2 Trip Bases
5. NEI 99-01, SU5

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 6– RPS Failure

Initiating Condition: Automatic or manual trip fails to shut down the reactor

EAL:

SU6.2 Unusual Event

A manual trip did not shut down the reactor as indicated by reactor power > 5% after **any** manual trip action was initiated

AND

A subsequent automatic trip or manual trip action taken at the reactor control consoles (B05 or B01) is successful in shutting down the reactor as indicated by reactor power ≤ 5% (Note 8)

Note 8: A manual trip action is any operator action, or set of actions, which causes the control rods to be rapidly inserted into the core and does not include manually driving in control rods or implementation of boron injection strategies.

Mode Applicability:

1 - Power Operation

Definition(s):

None

Basis:

This EAL addresses a failure of a manually initiated trip in the absence of having exceeded an automatic RPS trip setpoint and a subsequent automatic or manual trip is successful in shutting down the reactor (ref. 1).

Following a successful reactor trip, rapid insertion of the control rods occurs. Nuclear power promptly drops to a fraction of the original power level and then decays to a level several decades less with a negative startup rate. The reactor power drop continues until reactor power reaches the point at which the influence of source neutrons on reactor power starts to be observable. A predictable post-trip response from an automatic reactor trip signal should therefore consist of a prompt drop in reactor power as sensed by the nuclear instrumentation and a lowering of power into the source range. For the purpose of emergency classification a successful trip has occurred when there is sufficient rod insertion from the manual trip to bring the reactor power to or below the Power Operation Mode threshold level of 5% (ref. 2).

5% rated power is the Power Operation mode threshold. Below 5%, plant response will be similar to that observed during a normal shutdown. Nuclear instrumentation can be used to determine if reactor power is greater than 5 % power (ref. 1, 2).

For the purposes of emergency classification, successful manual trip actions are those which can be quickly performed from the reactor control consoles (B05 or B01). Reactor shutdown achieved by use of other trip actions do not constitute a successful manual trip (ref. 3).

Following the failure of any manual trip signal, procedure 40EP-9EO01, Standard Post Trip Actions (ref. 3), prescribes insertion of redundant manual trip signals to back up the RPS trip function and ensure reactor shutdown is achieved if Reactivity Control acceptance criteria are not met. Even if a subsequent automatic trip signal or the first subsequent manual trip signal inserts all control rods to the full-in position immediately after the initial failure of the manual trip, the lowest level of classification that must be declared is an Unusual Event (ref. 3).

If both subsequent automatic and subsequent manual reactor trip actions in the Control Room fail to reduce reactor power below ≤ 5% following a failure of an initial manual trip, the event escalates to an Alert under EAL SA6.1.

This IC addresses a failure of the RPS to initiate or complete an automatic or manual reactor trip that results in a reactor shutdown and either a subsequent operator manual action taken at the reactor control consoles or an automatic trip is successful in shutting down the reactor. This event is a precursor to a more significant condition and thus represents a potential degradation of the level of safety of the plant.

Following the failure on an automatic reactor trip, operators will promptly initiate manual actions at the reactor control consoles to shutdown the reactor (e.g., initiate a manual reactor trip). If these manual actions are successful in shutting down the reactor, core heat generation will quickly fall to a level within the capabilities of the plant's decay heat removal systems.

If an initial manual reactor trip is unsuccessful, operators will promptly take manual action at another location(s) on the reactor control consoles to shutdown the reactor (e.g., initiate a manual reactor trip) using a different switch). Depending upon several factors, the initial or subsequent effort to manually the reactor, or a concurrent plant condition, may lead to the generation of an automatic reactor trip signal. If a subsequent manual or automatic trip is successful in shutting down the reactor, core heat generation will quickly fall to a level within the capabilities of the plant's decay heat removal systems.

A manual action at the reactor control consoles is any operator action, or set of actions, which causes the control rods to be rapidly inserted into the core (e.g., initiating a manual reactor trip).

This action does not include manually driving in control rods or implementation of boron injection strategies. Actions taken at back-panels or other locations within the Control Room, or any location outside the Control Room, are not considered to be “at the reactor control consoles.”

The plant response to the failure of an automatic or manual reactor trip will vary based upon several factors including the reactor power level prior to the event, availability of the condenser, performance of mitigation equipment and actions, other concurrent plant conditions, etc. If subsequent operator manual actions taken at the reactor control consoles are also unsuccessful in shutting down the reactor, then the emergency classification level will escalate to an Alert via IC SA6. Depending upon the plant response, escalation is also possible via IC FA1. Absent the plant conditions needed to meet either IC SA6 or FA1, an Unusual Event declaration is appropriate for this event.

Should a reactor trip signal be generated as a result of plant work (e.g., RPS setpoint testing) or instrument failure, the following classification guidance should be applied.

If the signal causes a plant transient that should have included an automatic reactor trip and the RPS fails to automatically shutdown the reactor, then this IC and the EALs are applicable and should be evaluated.

If the signal does not cause a plant transient and the trip failure is determined through other means (e.g., assessment of test results), then this IC and the EALs are not applicable and no classification is warranted.

PVNGS Basis Reference(s):

1. Technical Specification 3.3.1, *Reactor Protection System (RPS) Instrumentation – Operating*
2. Technical Specification Table 1.1-1, *Modes*
3. Procedure 40EP-9EO01, *Standard Post Trip Actions*
4. UFSAR Section 7.2.2.2, Trip Bases
5. NEI 99-01, SU5

Category: S – System Malfunction

Subcategory: 2– RPS Failure

Initiating Condition: Automatic or manual trip fails to shut down the reactor and subsequent manual actions taken at the reactor control consoles are not successful in shutting down the reactor

EAL:

SA6.1 **Alert**

An automatic or manual trip fails to shut down the reactor as indicated by reactor power > 5%

AND

Manual trip actions taken at the reactor control consoles (B05 or B01) are **not** successful in shutting down the reactor as indicated by reactor power > 5% (Note 8)

Note 8: A manual trip action is any operator action, or set of actions, which causes the control rods to be rapidly inserted into the core and does not include manually driving in control rods or implementation of boron injection strategies.

Mode Applicability:

1 - Power Operation

Definition(s):

None

Basis:

This EAL addresses any automatic or manual reactor trip signal that fails to shut down the reactor followed by a subsequent manual trip that fails to shut down the reactor to an extent the reactor is producing significant power (ref. 1, 4).

Following a successful reactor trip, rapid insertion of the control rods occurs. Nuclear power promptly drops to a fraction of the original power level and then decays to a level several decades less with a negative startup rate. The reactor power drop continues until reactor power reaches the point at which the influence of source neutrons on reactor power starts to be observable. A predictable post-trip response from an automatic reactor trip signal should therefore consist of a prompt drop in reactor power as sensed by the nuclear instrumentation and a lowering of power into the source range. For the purpose of emergency classification a successful trip has occurred when there is sufficient rod insertion from the manual trip to bring the reactor power to or below 5% (ref. 2).

5% rated power is the Power Operation mode threshold. Below 5%, plant response will be similar to that observed during a normal shutdown. Nuclear instrumentation can be used to determine if reactor power is greater than 5 % power (1, 2).

For the purposes of emergency classification, successful manual trip actions are those which can be quickly performed from the reactor control consoles (B05 or B01). Reactor shutdown achieved by use of other trip actions do not constitute a successful manual trip (ref. 3).

Escalation of this event to a Site Area Emergency would be under EAL SS6.1 or Emergency Coordinator judgment.

This IC addresses a failure of the RPS to initiate or complete an automatic or manual reactor trip that results in a reactor shutdown and subsequent operator manual actions taken at the reactor control consoles to shutdown the reactor are also unsuccessful. This condition represents an actual or potential substantial degradation of the level of safety of the plant. An emergency declaration is required even if the reactor is subsequently shutdown by an action taken away from the reactor control consoles since this event entails a significant failure of the RPS.

A manual action at the reactor control console is any operator action, or set of actions, which causes the control rods to be rapidly inserted into the core (e.g., initiating a manual reactor trip). This action does not include manually driving in control rods or implementation of boron injection strategies. If this action(s) is unsuccessful, operators would immediately pursue additional manual actions at locations away from the reactor control console (e.g., locally opening breakers). Actions taken at back panels or other locations within the Control Room, or any location outside the Control Room, are not considered to be “at the reactor control console.”

The plant response to the failure of an automatic or manual reactor trip will vary based upon several factors including the reactor power level prior to the event, availability of the condenser, performance of mitigation equipment and actions, other concurrent plant conditions, etc. If the failure to shut down the reactor is prolonged enough to cause a challenge to the core cooling or RCS heat removal safety functions, the emergency classification level will escalate to a Site Area Emergency via IC SS6. Depending upon plant responses and symptoms, escalation is also possible via IC FS1. Absent the plant conditions needed to meet either IC SS6 or FS1, an Alert declaration is appropriate for this event.

It is recognized that plant responses or symptoms may also require an Alert declaration in accordance with the Recognition Category F ICs; however, this IC and EAL are included to ensure a timely emergency declaration.

PVNGS Basis Reference(s):

1. Technical Specification 3.3.1, *Reactor Trip System (RTS) Instrumentation*
2. Technical Specification Table 1.1-1, *Modes*
3. Procedure 40EP-9EO01, *Standard Post Trip Actions*
4. UFSAR Section 7.2.2.2, Trip Bases
5. NEI 99-01, SA5

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 2– RPS Failure

Initiating Condition: Inability to shut down the reactor causing a challenge to core cooling or RCS heat removal

EAL:

SS6.1 Site Area Emergency

An automatic or manual trip fails to shut down the reactor as indicated by reactor power > 5%

AND

All actions to shut down the reactor are not successful as indicated by reactor power > 5%

AND EITHER

- Rep CET > 1200ºF
- RCS subcooling < 24 ºF

Mode Applicability:

1 - Power Operation

Definition(s):

None

Basis:

This EAL addresses the following:

- Any automatic reactor trip signal (ref. 1) followed by a manual trip that fails to shut down the reactor to an extent the reactor is producing energy in excess of the heat load for which the safety systems were designed (EAL SA6.1) and

- Indications that either core cooling is extremely challenged or heat removal is extremely challenged.

The combination of failures of both front line and backup protection systems to function in response to a plant transient, along with the continued production of heat, poses a direct threat to the Fuel Clad and RCS barriers.

Reactor shutdown achieved by use of other trip actions specified in procedure 40EP-9EO01, *Standard Post Trip Actions*, (such as opening NGN-L03B2 and NGN-L10B2 supply breakers, emergency boration or manually driving control rods) are also credited as a successful manual trip provided reactor power can be reduced to or below 5% before indications of an extreme challenge to either core cooling or heat removal exist (ref. 2, 3).

5% rated power is the Power Operation mode threshold. Below 5%, plant response will be similar to that observed during a normal shutdown. Nuclear instrumentation can be used to determine if reactor power is greater than 5 % power.

Indication of continuing core cooling degradation is manifested by CETs are reading greater than 1200ºF.

Rep CET (Representative Core Exit Temperature) is a calculated temperature value generated by the Qualified Safety Parameter Display System (QSPDS). The QSPDS CET processing function generates a representative temperature based on a statistical analysis of thermocouples monitoring the reactor coolant temperature at the top of selected fuel assemblies.

Indication of inability to adequately remove heat from the RCS is manifested by RCS subcooling < 24 ºF. (ref. 4).

This IC addresses a failure of the RPS to initiate or complete an automatic or manual reactor trip that results in a reactor shutdown, all subsequent operator actions to manually shutdown the reactor are unsuccessful and continued power generation is challenging the capability to adequately remove heat from the core and/or the RCS. This condition will lead to fuel damage if additional mitigation actions are unsuccessful and thus warrants the declaration of a Site Area Emergency.

In some instances, the emergency classification resulting from this IC/EAL may be higher than that resulting from an assessment of the plant responses and symptoms against the Recognition Category F ICs/EALs. This is appropriate in that the Recognition Category F ICs/EALs do not address the additional threat posed by a failure to shut down the reactor. The inclusion of this IC and EAL ensures the timely declaration of a Site Area Emergency in response to prolonged failure to shutdown the reactor.

Escalation of the emergency classification level would be via IC RG1 or FG1.

PVNGS Basis Reference(s):

1. Technical Specification 3.3.1, Reactor Trip System (RTS) Instrumentation
2. Technical Specification Table 1.1-1, Modes
3. Procedure 40EP-9EO01, Standard Post Trip Actions
4. Procedure 40EP-9EO09, Functional Recovery
5. NEI 99-01, SS5

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 7– Loss of Communications

Initiating Condition: Loss of **all** onsite or offsite communications capabilities

EAL:

SU7.1 **Unusual Event**

Loss of **all** Table S-4 onsite communication methods

OR

Loss of **all** Table S-4 Offsite Response Organization (ORO) communication methods

OR

Loss of **all** Table S-4 NRC communication methods

Table S-4 Communication Methods			
System	**Onsite**	**ORO**	**NRC**
PBX	X	X	X
Plant Page	X		
Two-Way Radio	X		
FTS (ENS)			X
Telephone Ringdown Circuits (NAN)		X	
Cellular Phones		X	X

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

None

Basis:

Onsite, offsite and NRC communications include one or more of the systems listed in Table S-4 (ref. 1, 2).

ATTACHMENT 1
EAL Technical Bases

1. PBX

Onsite emergency telephone lines are divided among three onsite EPABX switches. Each EPABX switch is provided with a backup battery for reliability.

This system will function during emergencies as it does during normal operations. Telephones have the capability of trunk access (via local provider) and the APS owned private communications system which provides direct dial capabilities to the entire APS voice system via the company owned private communications system. The PVNGS telephone EPABX Systems through which all PVNGS telephone calls pass, are equipped with uninterruptible power supplies (battery chargers and batteries) and dedicated priority switching to ensure the reliability of the telephone system. The PVNGS EPABXs are the primary links for PVNGS phones. There are also administratively dedicated lines for the CR, STSC, TSC, EOF and OSC.

2. Plant (Area) Paging

The area paging system provides a reliable means of notifying and providing instructions to onsite personnel. Access to this system is through the EPABX system telephones by use of dedicated numbers.

3. Two-Way Radios

PVNGS operates a trunked radio system, with separate talk groups available for departments such as Operations, Security, Fire Protection, Radiation Protection, Emergency Preparedness, the Water Reclamation Facility, etc. This system includes base station consoles at various locations and emergency facilities throughout the site. Some of the radios used during emergencies are portable radios at various site locations, mobile radios in the RFAT vehicles and base station consoles at the TSC, EOF, Unit OSCs, Unit STSCs and Unit Control Rooms. PVNGS Fire Protection also maintains radios that are used to contact the air ambulance service to provide landing instructions.

4. FTS (ENS)

The NRC Emergency Notification System (ENS) is an FTS telephone used for official communications with NRC Headquarters. The NRC Headquarters has the capability to patch into the NRC Regional offices. The primary purpose of this phone is to provide a reliable method for the initial notification of the NRC and to maintain continuous communications with the NRC after initial notification. ENS telephones are located in the Control Room, TSC and EOF.

5. Telephone Ringdown Circuits (NAN)

   These voice circuits serve as a primary communications link for providing technical information to offsite agencies, public information communications and the communication of protective action recommendations to offsite authorities.

6. Cellular Phones

   Each STSC, the TSC and EOF have a cellular phone to provide additional independent lines of communication.

This EAL is the hot condition equivalent of the cold condition EAL CU5.1.

This IC addresses a significant loss of on-site or offsite communications capabilities. While not a direct challenge to plant or personnel safety, this event warrants prompt notifications to OROs and the NRC.

This IC should be assessed only when extraordinary means are being utilized to make communications possible (e.g., use of non-plant, privately owned equipment, relaying of on-site information via individuals or multiple radio transmission points, individuals being sent to offsite locations, etc.).

The first EAL condition addresses a total loss of the communications methods used in support of routine plant operations.

The second EAL condition addresses a total loss of the communications methods used to notify all OROs of an emergency declaration. The OROs referred to here are the State and Maricopa County EOCs.

The third condition addresses a total loss of the communications methods used to notify the NRC of an emergency declaration.

PVNGS Basis Reference(s):

1. *PVNGS Plant Radiological Emergency Response Plan (RERP)*, Section 7.2
2. UFSAR Section 9.5.2, Communication Systems
3. NEI 99-01, SU6

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 8– Containment Failure

Initiating Condition: Failure to isolate containment or loss of containment pressure control.

EAL:

SU8.1 **Unusual Event**

EITHER:

- Any penetration is not closed when required within 15 minutes of a VALID isolation signal (Note 1)
- Containment pressure > 8.5 psig with < 4350 gpm Containment Spray flow for ≥ 15 minutes (Note 1)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

VALID - An indication, report, or condition, is considered to be valid when it is verified by (1) an instrument channel check, or (2) indications on related or redundant indicators, or (3) by direct observation by plant personnel, such that doubt related to the indicator's operability, the condition's existence, or the report's accuracy is removed. Implicit in this definition is the need for timely assessment.

Basis:

Containment isolations are initiated by the Containment Isolation Actuation System (CIAS), Safety Injection Actuation Signal (SIAS), Main Steam Isolation Signal (MSIS) and Containment Spray Actuation Signal (CSAS) (ref. 1, 2).

The Containment Spray System consists of two separate trains of equal capacity, each capable of meeting the design bases requirement. Each train includes a containment spray pump, spray headers, nozzles, valves and piping. The refueling water storage tank (RWT) supplies borated water to the Containment Spray System during the injection phase of operation. In the recirculation mode of operation, Containment Spray pump suction is transferred from the RWT to the Containment sumps (ref. 3).

ATTACHMENT 1
EAL Technical Bases

The Containment pressure high-high setpoint (8.5 psig) is the pressure at which the Containment Spray equipment should actuate and begin performing its function (ref. 4). Consistent with the design requirement, “one full train of depressurization equipment” is therefore defined to be the availability of one train of Containment Spray providing a minimum of 4350 gpm spray flow (ref. 5). LPSI cross-tie can be credited provided the alignment can be made within the 15 minute threshold. If less than this equipment is operating and Containment pressure is above the actuation setpoint, the threshold is met.

This EAL addresses a failure of one or more containment penetrations to automatically isolate (close) when required by an actuation signal. It also addresses an event that results in high containment pressure with a concurrent failure of containment pressure control systems. Absent challenges to another fission product barrier, either condition represents potential degradation of the level of safety of the plant.

For the first condition, the containment isolation signal must be generated as the result on an offnormal/ accident condition (e.g., a safety injection or high containment pressure); a failure resulting from testing or maintenance does not warrant classification. The determination of containment and penetration status – isolated or not isolated – should be made in accordance with the appropriate criteria contained in the plant AOPs and EOPs. The 15-minute criterion is included to allow operators time to manually isolate the required penetrations, if possible. The second condition addresses a condition where containment pressure is greater than the setpoint at which containment energy (heat) removal systems are designed to automatically actuate and less than one full train of equipment is capable of operating per design. The 15- minute criterion is included to allow operators time to manually start equipment that may not have automatically started, if possible. The inability to start the required equipment indicates that containment heat removal/depressurization systems (e.g., containment sprays) are either lost or performing in a degraded manner.

This event would escalate to a Site Area Emergency in accordance with IC FS1 if there were a concurrent loss or potential loss of either the Fuel Clad or RCS fission product barriers.

PVNGS Basis Reference(s):

1. UFSAR Section 6.2.1.5.3.8, Containment Purge System
2. UFSAR Section 6.2.4, Containment Isolation System
3. UFSAR Section 6.2.2, Containment Heat Removal System
4. UFSAR Table 7.3-11A, ESFAS Setpoints and Margins to Actuation
5. Procedure 40EP-9EO01, *Standard Post Trip Actions*
6. NEI 99-01, SU7

ATTACHMENT 1
EAL Technical Bases

Category: S – System Malfunction

Subcategory: 9– Hazardous Event Affecting Safety Systems

Initiating Condition: Hazardous event affecting a SAFETY SYSTEM needed for the current operating mode

EAL:

SA9.1 Alert

The occurrence of any Table S-5 hazardous event

AND EITHER:

- Event damage has caused indications of degraded performance in at least one train of a SAFETY SYSTEM needed for the current operating mode
- The event has caused VISIBLE DAMAGE to a SAFETY SYSTEM component or structure needed for the current operating mode

Table S-5 Hazardous Events
• Seismic event (earthquake) • Internal or external FLOODING event • High winds or tornado strike • FIRE • EXPLOSION • Other events with similar hazard characteristics as determined by the Shift Manager

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

EXPLOSION - A rapid, violent and catastrophic failure of a piece of equipment due to combustion, chemical reaction or overpressurization. A release of steam (from high energy lines or components) or an electrical component failure (caused by short circuits, grounding, arcing, etc.) should not automatically be considered an explosion. Such events require a post-event inspection to determine if the attributes of an explosion are present.

ATTACHMENT 1
EAL Technical Bases

FIRE - Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute fires. Observation of flame is preferred but is NOT required if large quantities of smoke and heat are observed.

FLOODING - A condition where water is entering a room or area faster than installed equipment is capable of removal, resulting in a rise of water level within the room or area.

SAFETY SYSTEM - A system required for safe plant operation, cooling down the plant and/or placing it in the cold shutdown condition, including the ECCS. These are typically systems classified as safety-related (as defined in 10 CFR 50.2):

Those structures, systems and components that are relied upon to remain functional during and following design basis events to assure:

(1) The integrity of the reactor coolant pressure boundary;

(2) The capability to shut down the reactor and maintain it in a safe shutdown condition;

(3) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures.

VISIBLE DAMAGE - Damage to a component or structure that is readily observable without measurements, testing, or analysis. The visual impact of the damage is sufficient to cause concern regarding the operability or reliability of the affected component or structure.

Basis:

Refer to Attachment 4 for a list of Palo Verde SAFETY SYSTEMS (ref. 5)

This IC addresses a hazardous event that causes damage to a SAFETY SYSTEM, or a structure containing SAFETY SYSTEM components, needed for the current operating mode. This condition significantly reduces the margin to a loss or potential loss of a fission product barrier and therefore represents an actual or potential substantial degradation of the level of safety of the plant.

The first condition addresses damage to a SAFETY SYSTEM train that is in service/operation since indications for it will be readily available. The indications of degraded performance should be significant enough to cause concern regarding the operability or reliability of the SAFETY SYSTEM train.

The second condition addresses damage to a SAFETY SYSTEM component that is not in service/operation or readily apparent through indications alone, or to a structure containing

SAFETY SYSTEM components. Operators will make this determination based on the totality of available event and damage report information. This is intended to be a brief assessment not requiring lengthy analysis or quantification of the damage.

- The significance of seismic events are discussed under EAL HU2.1. Annunciator 7C14A, SEISMIC OCCURRENCE will illuminate if the seismic instrument detects ground motion in excess of the seismic EVENT trigger threshold (ref. 1).

- Internal FLOODING may be caused by events such as component failures, equipment misalignment, or outage activity mishaps.

- High winds in excess of design (105 mph) or tornado strikes can cause significant structural damage (ref. 4).

- Areas containing functions and systems required for safe shutdown of the plant are identified by fire area (ref. 2).

- An explosion that degrades the performance of a SAFETY SYSTEM train or visibly damages a SAFETY SYSTEM component or structure would be classified under this EAL.

Escalation of the emergency classification level would be via IC FS1 or RS1.

PVNGS Basis Reference(s):

1. Procedure 40AO-9ZZ21, *Acts of Nature*
2. UFSAR Table 3-2.1, Quality Classification of Structures, Systems and Components
3. UFSAR Section 2.4.2.2.1, Offsite Flood Design Considerations
4. UFSAR Section 2.3.1.2.3, Extreme Winds
5. Attachment 4 - Palo Verde Safety Systems
6. NEI 99-01, SA9

Category F – Fission Product Barrier Degradation

EAL Group: Hot Conditions (RCS temperature > 210ºF); EALs in this category are applicable only in one or more hot operating modes.

EALs in this category represent threats to the defense in depth design concept that precludes the release of highly radioactive fission products to the environment. This concept relies on multiple physical barriers any one of which, if maintained intact, precludes the release of significant amounts of radioactive fission products to the environment. The primary fission product barriers are:

A. Fuel Clad (FC): The Fuel Clad Barrier consists of the cladding material that contains the fuel pellets.

B. Reactor Coolant System (RCS): The RCS Barrier includes the RCS primary side and its connections up to and including the pressurizer safety and relief valves and other connections up to and including the primary isolation valves.

C. Containment (CTMT): The Containment Barrier includes the containment building and connections up to and including the outermost containment isolation valves. This barrier also includes the main steam, feedwater and blowdown line extensions outside the containment building up to and including the outermost secondary side isolation valve. Containment Barrier thresholds are used as criteria for escalation of the ECL from Alert to a Site Area Emergency or a General Emergency.

The EALs in this category require evaluation of the loss and potential loss thresholds listed in the fission product barrier matrix of Table F-1 (Attachment 2). “Loss” and “Potential Loss” signify the relative damage and threat of damage to the barrier. “Loss” means the barrier no longer assures containment of radioactive materials. “Potential Loss” means integrity of the barrier is threatened and could be lost if conditions continue to degrade. The number of barriers that are lost or potentially lost and the following criteria determine the appropriate emergency classification level:

Alert:

Any loss or any potential loss of either Fuel Clad or RCS

Site Area Emergency:

Loss or potential loss of any two barriers

General Emergency:

Loss of any two barriers and loss or potential loss of third barrier

ATTACHMENT 1
EAL Technical Bases

The logic used for emergency classification based on fission product barrier monitoring should reflect the following considerations:

- The Fuel Clad Barrier and the RCS Barrier are weighted more heavily than the Containment Barrier.

- Unusual Event ICs associated with RCS and Fuel Clad Barriers are addressed under System Malfunction ICs.

- For accident conditions involving a radiological release, evaluation of the fission product barrier thresholds will need to be performed in conjunction with dose assessments to ensure correct and timely escalation of the emergency classification. For example, an evaluation of the fission product barrier thresholds may result in a Site Area Emergency classification while a dose assessment may indicate that an EAL for General Emergency IC RG1 has been exceeded.

- The fission product barrier thresholds specified within a scheme reflect plant-specific PVNGS design and operating characteristics.

- As used in this category, the term RCS leakage encompasses not just those types defined in Technical Specifications but also includes the loss of RCS mass to any location– inside the containment, an interfacing system, or outside of the containment. The release of liquid or steam mass from the RCS due to the as-designed/expected operation of a relief valve is not considered to be RCS leakage.

- At the Site Area Emergency level, EAL users should maintain cognizance of how far present conditions are from meeting a threshold that would require a General Emergency declaration. For example, if the Fuel Clad and RCS fission product barriers were both lost, then there should be frequent assessments of containment radioactive inventory and integrity. Alternatively, if both the Fuel Clad and RCS fission product barriers were potentially lost, the Emergency Coordinator would have more assurance that there was no immediate need to escalate to a General Emergency.

Category: Fission Product Barrier Degradation

Subcategory: N/A

Initiating Condition: **Any** loss or **any** potential loss of either Fuel Clad or RCS

EAL:

FA1.1	**Alert**
Any loss or **any** potential loss of either Fuel Clad or RCS (Table F-1)	

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

None

Basis:

Fuel Clad, RCS and Containment comprise the fission product barriers. Table F-1 (Attachment 2) lists the fission product barrier thresholds, bases and references.

At the Alert classification level, Fuel Clad and RCS barriers are weighted more heavily than the Containment barrier. Unlike the Containment barrier, loss or potential loss of either the Fuel Clad or RCS barrier may result in the relocation of radioactive materials or degradation of core cooling capability. Note that the loss or potential loss of Containment barrier in combination with loss or potential loss of either Fuel Clad or RCS barrier results in declaration of a Site Area Emergency under EAL FS1.1

PVNGS Basis Reference(s):

1. NEI 99-01, FA1

ATTACHMENT 1
EAL Technical Bases

Category: Fission Product Barrier Degradation

Subcategory: N/A

Initiating Condition: Loss or potential loss of any two barriers

EAL:

FS1.1	**Site Area Emergency**
Loss or potential loss of **any** two barriers (Table F-1)	

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

None

Basis:

Fuel Clad, RCS and Containment comprise the fission product barriers. Table F-1 (Attachment 2) lists the fission product barrier thresholds, bases and references.

At the Site Area Emergency classification level, each barrier is weighted equally. A Site Area Emergency is therefore appropriate for any combination of the following conditions:

- One barrier loss and a second barrier loss (i.e., loss - loss)
- One barrier loss and a second barrier potential loss (i.e., loss - potential loss)
- One barrier potential loss and a second barrier potential loss (i.e., potential loss – potential loss)

At the Site Area Emergency classification level, the ability to dynamically assess the proximity of present conditions with respect to the threshold for a General Emergency is important. For example, the existence of Fuel Clad and RCS Barrier loss thresholds in addition to offsite dose assessments would require continual assessments of radioactive inventory and Containment integrity in anticipation of reaching a General Emergency classification. Alternatively, if both Fuel Clad and RCS potential loss thresholds existed, the Emergency Coordinator would have greater assurance that escalation to a General Emergency is less imminent.

PVNGS Basis Reference(s):

1. NEI 99-01, FS1

ATTACHMENT 1
EAL Technical Bases

Category: Fission Product Barrier Degradation

Subcategory: N/A

Initiating Condition: Loss of **any** two barriers and loss or potential loss of third barrier

EAL:

FG1.1	**General Emergency**
Loss of **any** two barriers **AND** Loss or potential loss of third barrier (Table F-1)	

Mode Applicability:

1 - Power Operation, 2 - Startup, 3 - Hot Standby, 4 - Hot Shutdown

Definition(s):

None

Basis:

Fuel Clad, RCS and Containment comprise the fission product barriers. Table F-1 (Attachment 2) lists the fission product barrier thresholds, bases and references.

At the General Emergency classification level each barrier is weighted equally. A General Emergency is therefore appropriate for any combination of the following conditions:

- Loss of Fuel Clad, RCS and Containment barriers
- Loss of Fuel Clad and RCS barriers with potential loss of Containment barrier
- Loss of RCS and Containment barriers with potential loss of Fuel Clad barrier
- Loss of Fuel Clad and Containment barriers with potential loss of RCS barrier

PVNGS Basis Reference(s):

1. NEI 99-01, FS1

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Introduction

Table F-1 lists the threshold conditions that define the Loss and Potential Loss of the three fission product barriers (Fuel Clad, Reactor Coolant System and Containment). The table is structured so that each of the three barriers occupies adjacent columns. Each fission product barrier column is further divided into two columns; one for Loss thresholds and one for Potential Loss thresholds.

The first column of the table (to the left of the Fuel Clad Loss column) lists the categories (types) of fission product barrier thresholds. The fission product barrier categories are:

A. RCS or SG Tube Leakage
B. Inadequate Heat Removal
C. CTMT Radiation / RCS Activity
D. CTMT Integrity or Bypass
E. Emergency Coordinator Judgment

Each category occupies a row in Table F-1 thus forming a matrix defined by the categories. The intersection of each row with each Loss/Potential Loss column forms a cell in which one or more fission product barrier thresholds appear. If NEI 99-01 does not define a threshold for a barrier Loss/Potential Loss, the cell is left blank, shaded or otherwise indicated as not having a threshold associated with it.

Thresholds are assigned sequential numbers within each Loss and Potential Loss column beginning with number one. In this manner, a threshold can be identified by its category title and number. For example, the first Fuel Clad barrier Loss in Category C would be assigned "FC Loss C.1," the third Containment barrier Potential Loss in Category D would be assigned "CTMT P-Loss D.3," etc.

If a cell in Table F-1 contains more than one numbered threshold, each of the numbered thresholds, if exceeded, signifies a Loss or Potential Loss of the barrier. It is not necessary to exceed all of the thresholds in a category before declaring a barrier Loss/Potential Loss.

Subdivision of Table F-1 by category facilitates association of plant conditions to the applicable fission product barrier Loss and Potential Loss thresholds. This structure promotes a systematic approach to assessing the classification status of the fission product barriers.

When equipped with knowledge of plant conditions related to the fission product barriers, the EAL-user first scans down the category column of Table F-1, locates the likely category and then reads across the fission product barrier Loss and Potential Loss thresholds in that category to determine if a threshold has been exceeded. If a threshold has not been exceeded, the EAL-user proceeds to the next likely category and continues review of the thresholds in the new category.

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

If the EAL-user determines that any threshold has been exceeded, by definition, the barrier is lost or potentially lost – even if multiple thresholds in the same barrier column are exceeded, only that one barrier is lost or potentially lost. The EAL-user must examine each of the three fission product barriers to determine if other barrier thresholds in the category are lost or potentially lost. For example, if containment radiation is sufficiently high, a Loss of the Fuel Clad and RCS barriers and a Potential Loss of the Containment barrier can occur. Barrier Losses and Potential Losses are then applied to the criterion given in EALs FG1.1, FS1.1 and FA1.1 to determine the appropriate emergency classification.

In the remainder of this Attachment, the Fuel Clad barrier threshold bases appear first, followed by the RCS barrier and finally the Containment barrier threshold bases. In each barrier, the bases are given according category Loss followed by category Potential Loss beginning with Category A, then B,…, E.

ATTACHMENT 2

Fission Product Barrier Loss/Potential Loss Matrix and Bases

Table F-1 Fission Product Barrier Threshold Matrix

	Fuel Clad (FC) Barrier		**Reactor Coolant System (RCS) Barrier**		**Containment (CTMT) Barrier**	
Category	**Loss**	**Potential Loss**	**Loss**	**Potential Loss**	**Loss**	**Potential Loss**
A RCS or SG Tube Leakage	None	1. RVLMS < 21% plenum (Detector #8)	1. An automatic or manual ECCS (SIAS) actuation required by **EITHER:** • UNISOLABLE RCS leakage • SG tube RUPTURE	1. With letdown isolated, operation of the standby charging pump is required by EITHER: • UNISOLABLE RCS leakage • SG tube leakage 2. Pressurized thermal shock transient in excess of the upper (200ºF) subcooling P/T limit (Note 9) **AND** RCS pressure is rising	1. A leaking or RUPTURED SG is FAULTED outside of containment	None
B Inadequate Heat Removal	1. Rep CETs > 1200ºF	1. Rep CETs > 700ºF 2. RCS heat removal cannot be established **AND** RCS subcooling < 24ºF	None	1. RCS heat removal cannot be established **AND** RCS subcooling <24ºF	None	1. Rep CETs > 1200ºF **AND** Functional recovery procedures not effective within 15 min. (Note 1)
C CTMT Radiation/RCS Activity	1. Containment radiation RU-148 > 2.1E+05 mR/hr **OR** RU-149 > 2.4E+05 mR/hr 2. Dose equivalent I-131 coolant activity > 300 µCi/gm	None	1. Containment radiation RU-148 > 5.0E+04 mR/hr **OR** RU-149 > 5.6E+04 mR/hr	None	None	1. Containment radiation RU-148 > 6.8E+06 mR/hr **OR** RU-149 > 7.8E+06 mR/hr
D CTMT Integrity or Bypass	None	None	None	None	1. Containment isolation is required **AND EITHER:** • Containment integrity has been lost based on Emergency Coordinator judgment • UNISOLABLE pathway from Containment to the environment exists 2. Indications of RCS leakage outside of Containment	1. Containment pressure > 60 psig 2. Containment hydrogen concentration ≥ 4.9% 3. Containment pressure > 8.5 psig with < 4350 gpm Containment Spray flow for ≥ 15 min. (Note 1)
E EC Judgment	1. **Any** condition in the opinion of the Emergency Coordinator that indicates loss of the fuel clad barrier	1. **Any** condition in the opinion of the Emergency Coordinator that indicates potential loss of the fuel clad barrier	1. **Any** condition in the opinion of the Emergency Coordinator that indicates loss of the RCS barrier	1. **Any** condition in the opinion of the Emergency Coordinator that indicates potential loss of the RCS barrier	1. **Any** condition in the opinion of the Emergency Coordinator that indicates loss of the Containment barrier	1. **Any** condition in the opinion of the Emergency Coordinator that indicates potential loss of the Containment barrier

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Fuel Clad

Category: A. RCS or SG Tube Leakage

Degradation Threat: Loss

Threshold:

None

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Fuel Clad

Category: A. RCS or SG Tube Leakage

Degradation Threat: Potential Loss

Threshold:

1. RVLMS < 21% plenum (Detector #8)

Definition(s):

None

Basis:

21% plenum on RVLMS (Detector #8) is the minimum RVLMS indication above Top of Active Fuel (TOAF) which corresponds to 4 in. above the fuel alignment plate and is the last indication of inventory control (ref. 1, 2).

This reading indicates a reduction in reactor vessel water level sufficient to allow the onset of heat-induced cladding damage.

PVNGS Basis Reference(s):

1. Procedure 40OP-9ZZ16, *RCS Drain Operations*, Appendix M
2. Nuclear Fuel Management Analysis Calculation *TA-13-C00-2000-001, EOP Setpoint Document*
3. NEI 99-01, RCS or SG Tube Leakage Fuel Clad Potential Loss 1.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Fuel Clad

Category: B. Inadequate Heat Removal

Degradation Threat: Loss

Threshold:

1. Rep CETs > 1200 ºF

Definition(s):

None

Basis:

Core Exit Thermocouples (CETs) are a component of Inadequate Core Cooling Instrumentation and provide an indirect indication of fuel clad temperature by measuring the temperature of the reactor coolant that leaves the core region. Although clad rupture due to high temperature is not expected for CET readings less than the threshold, temperatures of this magnitude signal significant superheating of the reactor coolant and core uncovery (ref. 1).

This reading indicates temperatures within the core are sufficient to cause significant superheating of reactor coolant.

Rep CET (Representative Core Exit Temperature) is a calculated temperature value generated by the Qualified Safety Parameter Display System (QSPDS). The QSPDS CET processing function generates a representative temperature based on a statistical analysis of thermocouples monitoring the reactor coolant temperature at the top of selected fuel assemblies.

PVNGS Basis Reference(s):

1. UFSAR Appendix 18B, System 80 Generic Inadequate Core Cooling Instrumentation
2. NEI 99-01, Inadequate Heat Removal Fuel Clad Loss 2.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Fuel Clad

Category: B. Inadequate Heat Removal

Degradation Threat: Loss

Threshold:

1. Rep CETs > 700 ºF

Definition(s):

None

Basis:

Core Exit Thermocouples (CETs) are a component of Inadequate Core Cooling Instrumentation and provide an indirect indication of fuel clad temperature by measuring the temperature of the reactor coolant that leaves the core region. If Rep CETs indicate > 700°F, subcooling has been lost for at least some regions of the core (ref. 1). 700°F qualifies as a condition representing a potential loss of the fuel clad barrier.

This reading indicates a reduction in reactor vessel water level sufficient to allow the onset of heat-induced cladding damage.

Rep CET (Representative Core Exit Temperature) is a calculated temperature value generated by the Qualified Safety Parameter Display System (QSPDS). The QSPDS CET processing function generates a representative temperature based on a statistical analysis of thermocouples monitoring the reactor coolant temperature at the top of selected fuel assemblies.

PVNGS Basis Reference(s):

1. UFSAR Appendix 18B, System 80 Generic Inadequate Core Cooling Instrumentation
2. NEI 99-01, Inadequate Heat Removal Fuel Clad Potential Loss 2.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Fuel Clad

Category: B. Inadequate Heat Removal

Degradation Threat: Potential Loss

Threshold:

2. RCS heat removal cannot be established

   AND

   RCS subcooling < 24ºF

Definition(s):

None

Basis:

In combination with RCS Potential Loss B.1, meeting this threshold results in a Site Area Emergency.

The steam generators (SGs) provide the normal means of heat transfer from the RCS to the main condenser and ultimate heat sink. Procedure 40EP-9EO03, *Loss of Coolant Accident*, requires maintenance of RCS heat removal at all times during a LOCA. Once RCS pressure and temperature are reduced, RCS heat removal can be provided by Shutdown Cooling (SDC) system. Once the SDC system is placed in service, the SG heat sink capability is no longer necessary (ref. 1).

If RCS subcooling approaches 24°F, the margin to superheated conditions is being reduced. Following an uncomplicated reactor trip, subcooling margin should be in excess of 50°F. Subcooling margin greater than 24°F ensures the fluid surrounding the core is sufficiently cooled and provides margin for reestablishing SI flow should subcooling deteriorate when SI flow is secured. Voids may exist in some parts of the RCS (e.g., Reactor Vessel head) but are permissible as long as core heat removal is maintained (ref. 2). RCS subcooling is determined using appropriate CET (natural circulation) or T_{hot} (forced circulation) temperature indications. Upper head subcooling indication should not be used.

The combination of the threshold conditions indicates that RCS heat removal is under extreme challenge. This threshold addresses loss of functions required for hot shutdown with the reactor at pressure and temperature and thus a potential loss of the Fuel Clad barrier. This is also a potential loss of the RCS barrier and therefore results in at least a Site Area Emergency.

This condition indicates an extreme challenge to the ability to remove RCS heat using the steam generators (i.e., loss of an effective secondary-side heat sink). This condition represents a potential loss of the Fuel Clad Barrier. In accordance with EOPs, there may be unusual accident conditions during which operators intentionally reduce the heat removal capability of the steam generators; during these conditions, classification using threshold is not warranted.

PVNGS Basis Reference(s):

1. Procedure 40EP-9EO03, *Loss of Coolant Accident*
2. Procedure 40EP-9EO09, *Functional Recovery*
3. NEI 99-01, Inadequate Heat Removal Fuel Clad Loss 2.B

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Fuel Clad

Category: C. CTMT Radiation/RCS Activity

Degradation Threat: Loss

Threshold:

1. Containment radiation RU-148 > 2.1E+05 mR/hr OR RU-149 > 2.4E+05 mR/hr

Definition(s):

None

Basis:

The specified containment radiation monitor readings (ref. 1) indicate the release of reactor coolant, with elevated activity indicative of fuel damage, into the Containment. The reading is derived assuming the instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory associated with a concentration of 300 μCi/cc dose equivalent I-131 into the Containment atmosphere with containment sprays operating. The values are based on calculated readings fifteen minutes after shutdown. Reactor coolant concentrations of this magnitude are several times larger than the maximum concentrations (including iodine spiking) allowed within Technical Specifications and are therefore indicative of fuel damage (approximately 2-5% clad failure depending on core inventory and RCS volume).

Monitors used for this fission product barrier loss threshold are the Containment High Range Radiation Monitors RU-148 and RU-149 (ref. 1).

The radiation monitor reading corresponds to an instantaneous release of all reactor coolant mass into the containment, assuming that reactor coolant activity equals 300 μCi/gm dose equivalent I-131. Reactor coolant activity above this level is greater than that expected for iodine spikes and corresponds to an approximate range of 2% to 5% fuel clad damage. Since this condition indicates that a significant amount of fuel clad damage has occurred, it represents a loss of the Fuel Clad Barrier.

The radiation monitor reading in this threshold is higher than that specified for RCS Barrier Loss threshold C.1 since it indicates a loss of both the Fuel Clad Barrier and the RCS Barrier. Note that a combination of the two monitor readings appropriately escalates the ECL to a Site Area Emergency.

PVNGS Basis Reference(s):

1. Calculation 13-NC-ZY-216, *Determination of Containment Activities from High Radiation Monitors*
2. NEI 99-01, CTMT Radiation / RCS Activity Fuel Clad Loss 3.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Fuel Clad

Category: C. CTMT Radiation/RCS Activity

Degradation Threat: Loss

Threshold:

2. Dose equivalent I-131 coolant activity > 300 μCi/gm

Definition(s):

None

Basis:

Dose Equivalent Iodine (DEI) is determined by procedure 74ST-9RC02, *Reactor Coolant System Specific Activity Surveillance Test* (ref. 1).

Elevated reactor coolant activity represents a potential degradation in the level of safety of the plant and a potential precursor of more serious problems. The threshold dose equivalent I-131 concentration is well above that expected for iodine spikes and corresponds to about 2% to 5% fuel clad damage. Since this condition indicates that a significant amount of fuel clad damage has occurred, it represents a loss of the Fuel Clad Barrier (ref. 2).

This threshold indicates that RCS radioactivity concentration is greater than 300 μCi/gm dose equivalent I-131. Reactor coolant activity above this level is greater than that expected for iodine spikes and corresponds to an approximate range of 2% to 5% fuel clad damage. Since this condition indicates that a significant amount of fuel clad damage has occurred, it represents a loss of the Fuel Clad Barrier.

It is recognized that sample collection and analysis of reactor coolant with highly elevated activity levels could require several hours to complete. Nonetheless, a sample-related threshold is included as a backup to other indications.

There is no Potential Loss threshold associated with RCS Activity/Containment Radiation.

PVNGS Basis Reference(s):

1. Procedure 74ST-9RC02, Reactor Coolant System Specific Activity Surveillance Test
2. NEI 99-01, CTMT Radiation / RCS Activity Fuel Clad Loss 3.B

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Fuel Clad

Category: C. CTMT Radiation/RCS Activity

Degradation Threat: Potential Loss

Threshold:

None

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Fuel Clad

Category: C. CTMT Integrity or Bypass

Degradation Threat: Loss

Threshold:

None

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Fuel Clad

Category: C. CTMT Integrity or Bypass

Degradation Threat: Potential Loss

Threshold:

None

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Fuel Clad

Category: E. Emergency Coordinator Judgment

Degradation Threat: Loss

Threshold:

1. **Any** condition in the opinion of the Emergency Coordinator that indicates loss of the Fuel Clad barrier

Definition(s):

None

Basis:

Emergency Coordinator judgment threshold addresses any other factors relevant to determining if the Fuel Clad barrier is lost. Such a determination should include imminent barrier degradation, barrier monitoring capability and dominant accident sequences.

- Imminent barrier degradation exists if the degradation will likely occur within relatively short period of time based on a projection of current safety system performance. The term "imminent" refers to recognition of the inability to reach safety function acceptance criteria before completion of all checks.
- Barrier monitoring capability is decreased if there is a loss or lack of reliable indicators. This assessment should include instrumentation operability concerns, readings from portable instrumentation and consideration of offsite monitoring results.
- Dominant accident sequences lead to degradation of all fission product barriers and likely entry to the EOPs. The Emergency Coordinator should be mindful of the Loss of AC power (Station Blackout) and ATWS EALs to assure timely emergency classification declarations.

This threshold addresses any other factors that are to be used by the Emergency Coordinator in determining whether the Fuel Clad barrier is lost.

PVNGS Basis Reference(s):

1. NEI 99-01, Emergency Director Judgment Fuel Clad Loss 6.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Fuel Clad

Category: E. Emergency Coordinator Judgment

Degradation Threat: Potential Loss

Threshold:

1. **Any** condition in the opinion of the Emergency Coordinator that indicates potential loss of the Fuel Clad barrier

Definition(s):

None

Basis:

The Emergency Coordinator judgment threshold addresses any other factors relevant to determining if the Fuel Clad barrier is potentially lost. Such a determination should include imminent barrier degradation, barrier monitoring capability and dominant accident sequences.

- Imminent barrier degradation exists if the degradation will likely occur within relatively short period of time based on a projection of current safety system performance. The term "imminent" refers to recognition of the inability to reach safety function acceptance criteria before completion of all checks.

- Barrier monitoring capability is decreased if there is a loss or lack of reliable indicators. This assessment should include instrumentation operability concerns, readings from portable instrumentation and consideration of offsite monitoring results.

- Dominant accident sequences lead to degradation of all fission product barriers and likely entry to the EOPs. The Emergency Coordinator should be mindful of the Loss of AC power (Station Blackout) and ATWS EALs to assure timely emergency classification declarations.

This threshold addresses any other factors that are to be used by the Emergency Coordinator in determining whether the Fuel Clad barrier is potentially lost. The Emergency Coordinator should also consider whether or not to declare the barrier potentially lost in the event that barrier status cannot be monitored.

PVNGS Basis Reference(s):

1. NEI 99-01, Emergency Director Judgment Potential Fuel Clad Loss 6.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Fuel Clad

Category: A. RCS or SG Tube Leakage

Degradation Threat: Loss

Threshold:

1. An automatic or manual ECCS (SIAS) actuation required by **EITHER:**
   - UNISOLABLE RCS leakage
   - SG tube RUPTURE

Definition(s):

UNISOLABLE - An open or breached system line that cannot be isolated, remotely or locally.

RUPTURE - The condition of a steam generator in which primary-to-secondary leakage is of sufficient magnitude to require a safety injection.

Basis:

This threshold is based on an UNISOLABLE RCS leak of sufficient size to require an automatic or manual actuation of the Emergency Core Cooling System (ECCS). This condition clearly represents a loss of the RCS Barrier.

This threshold is applicable to unidentified and pressure boundary leakage, as well as identified leakage. It is also applicable to UNISOLABLE RCS leakage through an interfacing system. The mass loss may be into any location – inside containment, to the secondary-side (i.e., steam generator tube leakage) or outside of containment.

A steam generator with primary-to-secondary leakage of sufficient magnitude to require a safety injection is considered to be RUPTURED. If a RUPTURED steam generator is also FAULTED outside of containment, the declaration escalates to a Site Area Emergency since the Containment Barrier Loss threshold 1.A will also be met.

PVNGS Basis Reference(s):

1. Procedure 40EP-9EO01, *Reactor Trip*
2. Procedure 40EP-9EO03, *Loss of Coolant Accident*
3. Procedure 40EP-9EO04, *Steam Generator Tube Rupture*
4. NEI 99-01, RCS or SG Tube Leakage Reactor Coolant System Loss 1.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Reactor Coolant System

Category: A. RCS or SG Tube Leakage

Degradation Threat: Potential Loss

Threshold:

2. With letdown isolated, operation of the standby charging pump is required by **EITHER:**
   - UNISOLABLE RCS leakage
   - SG tube RUPTURE

Definition(s):

UNISOLABLE - An open or breached system line that cannot be isolated, remotely or locally.

Basis:

This threshold is based on the inability to maintain liquid inventory within the RCS by normal operation of the Chemical and Volume Control System (CVCS). The CVCS includes three charging pumps: two charging pumps are normally operating with a flow capacity of ~44 gpm each or a total of 88 gpm (ref. 1). Approximately 10 gpm of charging flow bypasses the RCS due to leakage through the RCP seals; thus, the normal charging lineup delivers 88 gpm – 10 gpm = 78 gpm (ref. 1). A third charging pump being required with letdown isolated is indicative of a substantial RCS leak.

If the standby charging pump is started in response to decreasing pressurizer level and following isolation of letdown and/or the leak pressurizer level can be subsequently maintained with just two charging pumps, this threshold is not exceeded.

This threshold is based on an UNISOLABLE RCS leak that results in the inability to maintain pressurizer level within specified limits by operation of a normally used charging (makeup) pump, but an ECCS (SI) actuation has not occurred. The threshold is met when an operating procedure, or operating crew supervision, directs that a standby charging (makeup) pump be placed in service to restore and maintain pressurizer level following appropriate system isolation.

This threshold is applicable to unidentified and pressure boundary leakage, as well as identified leakage. It is also applicable to UNISOLABLE RCS leakage through an interfacing system. The mass loss may be into any location – inside containment, to the secondary-side (i.e., steam generator tube leakage) or outside of containment.

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

If a leaking steam generator is also FAULTED outside of containment, the declaration escalates to a Site Area Emergency since the Containment Barrier Loss threshold 1.A will also be met.

PVNGS Basis Reference(s):

1. UFSAR Section 9.3.4, Chemical and Volume Control System
2. Procedure 40EP-9EO01, *Reactor Trip*
3. Procedure 40EP-9EO01, *Standard Post Trip Actions*
4. Procedure 40EP-9EO03, *Loss of Coolant Accident*
5. Procedure 40EP-9EO04, *Steam Generator Tube Rupture*
6. NEI 99-01, RCS or SG Tube Leakage Reactor Coolant System Potential Loss 1.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Fuel Clad

Category: E. Emergency Coordinator Judgment

Degradation Threat: Potential Loss

Threshold:

2. Pressurized thermal shock transient in excess of the upper (200ºF) subcooling P/T limit (Note 9)

   AND

   RCS pressure is rising

Note 9: A pressurized thermal shock transient is defined as an UNPLANNED overcooling transient which causes RCS temperature to go below 500°F

Definition(s):

UNPLANNED - A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

Basis:

The "Potential Loss" threshold is defined by the upper subcooling P/T limit in combination with increasing RCS pressure which indicates an extreme challenge to the RCS barrier due to pressurized thermal shock transient. (ref. 1, 2, 3).

A pressurized thermal shock transient is defined as an unplanned overcooling transient which causes RCS temperature to go below 500°F (ref. 4).

This condition indicates an extreme challenge to the integrity of the RCS pressure boundary due to pressurized thermal shock – a transient that causes rapid RCS cooldown while the RCS is in Mode 3 or higher (i.e., hot and pressurized).

PVNGS Basis Reference(s):

1. Procedure 40EP-9EO05, *Excess Steam Demand*
2. Procedure 40EP-9EO09, *Functional Recovery*
3. Procedure 40EP-9EO10, *Standard Appendices Attachment 2 Figures*
4. Procedure 40DP-9AP17, *Standard Appendices Technical Guideline*
5. NEI 99-01, RCS or SG Tube Leakage Reactor Coolant System Potential Loss 1.B

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Reactor Coolant System

Category: B. Inadequate Heat Removal

Degradation Threat: Loss

Threshold:

None

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Reactor Coolant System

Category: B. Inadequate Heat Removal

Degradation Threat: Potential Loss

Threshold:

1. RCS heat removal cannot be established

   AND

   RCS subcooling < 24ºF

Definition(s):

None

Basis:

In combination with FC Potential Loss B.1, meeting this threshold results in a Site Area Emergency.

The steam generators (SGs) provide the normal means of heat transfer from the RCS to the main condenser and ultimate heat sink. Procedure 40EP-9EO03, *Loss of Coolant Accident*, requires maintenance of RCS heat removal at all times during a LOCA. Once RCS pressure and temperature are reduced, RCS heat removal can be provided by Shutdown Cooling (SDC). Once the SDC is placed in service, the SG heat sink capability is no longer necessary (ref. 1).

If RCS subcooling approaches 24°F, the margin to superheated conditions is being reduced. Following an uncomplicated reactor trip, subcooling margin should be in excess of 50°F. Subcooling margin greater than 24°F ensures the fluid surrounding the core is sufficiently cooled and provides margin for reestablishing SI flow should subcooling deteriorate when SI flow is secured. Voids may exist in some parts of the RCS (e.g., Reactor Vessel head) but are permissible as long as core heat removal is maintained (ref. 2). RCS subcooling is determined using appropriate CET or T_{hot} temperature indications. Upper head subcooling indication should not be used.

The combination of these conditions indicates the ultimate heat sink function is under extreme challenge. This threshold addresses loss of functions required for hot shutdown with the reactor at pressure and temperature and thus a potential loss of the Fuel Clad barrier. This is also a potential loss of the RCS barrier and therefore results in at least a Site Area Emergency.

This condition indicates an extreme challenge to the ability to remove RCS heat using the steam generators (i.e., loss of an effective secondary-side heat sink). This condition represents a potential loss of the RCS Barrier. In accordance with EOPs, there may be unusual accident conditions during which operators intentionally reduce the heat removal capability of the steam generators; during these conditions, classification using threshold is not warranted.

Meeting this threshold results in a Site Area Emergency because this threshold is identical to Fuel Clad Barrier Potential Loss threshold B.2; both will be met. This condition warrants a Site Area Emergency declaration because inadequate RCS heat removal may result in fuel heat-up sufficient to damage the cladding and increase RCS pressure to the point where mass will be lost from the system.

PVNGS Basis Reference(s):

1. Procedure 40EP-9EO03, *Loss of Coolant Accident*
2. Procedure 40EP-9EO09, *Functional Recovery*
3. NEI 99-01, Inadequate Heat Removal RCS Loss 2.B

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Reactor Coolant System

Category: C. CTMT Radiation/RCS Activity

Degradation Threat: Loss

Threshold:

1. Containment radiation RU-148 > 5.0E+04 mR/hr OR RU-149 > 5.6E+04 mR/hr

Definition(s):

None

Basis:

Containment radiation monitor readings greater than the specified values (ref. 1) indicate the release of reactor coolant to the Containment. The readings assume the instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory associated with normal operating concentrations (i.e., within Technical Specifications) into the Containment atmosphere. Because of the very high fuel clad integrity, only small amounts of noble gases would be dissolved in the primary coolant.

The readings are derived assuming the instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory associated with a concentration of 60 μCi/gm dose equivalent I-131 into the Containment atmosphere with containment sprays operating. The values are based on calculated readings fifteen minutes after shutdown.

Monitors used for this fission product barrier loss threshold are the Containment High Range Radiation Monitors RU-148 and RU-149 (ref. 1).

The radiation monitor reading corresponds to an instantaneous release of all reactor coolant mass into the containment, assuming that reactor coolant activity equals Technical Specification allowable limits. This value is lower than that specified for Fuel Clad Barrier Loss threshold C.1 since it indicates a loss of the RCS Barrier only.

There is no Potential Loss threshold associated with RCS Activity / Containment Radiation.

PVNGS Basis Reference(s):

1. Calculation 13-NC-ZY-216, *Determination of Containment Activities from High Radiation Monitors*
2. NEI 99-01, CTMT Radiation / RCS Activity RCS Loss 3.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Reactor Coolant System

Category: C. CTMT Radiation/RCS Activity

Degradation Threat: Potential Loss

Threshold:

None

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Reactor Coolant System

Category: D. CTMT Integrity or Bypass

Degradation Threat: Loss

Threshold:

None

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Reactor Coolant System

Category: D. CTMT Integrity or Bypass

Degradation Threat: Potential Loss

Threshold:

None

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Reactor Coolant System

Category: E. Emergency Coordinator Judgment

Degradation Threat: Loss

Threshold:

1. **Any** condition in the opinion of the Emergency Coordinator that indicates loss of the RCS barrier

Definition(s):

None

Basis:

Emergency Coordinator judgment threshold addresses any other factors relevant to determining if the RCS barrier is lost. Such a determination should include imminent barrier degradation, barrier monitoring capability and dominant accident sequences.

- Imminent barrier degradation exists if the degradation will likely occur within relatively short period of time based on a projection of current safety system performance. The term "imminent" refers to recognition of the inability to reach safety function acceptance criteria before completion of all checks.

- Barrier monitoring capability is decreased if there is a loss or lack of reliable indicators. This assessment should include instrumentation operability concerns, readings from portable instrumentation and consideration of offsite monitoring results.

- Dominant accident sequences lead to degradation of all fission product barriers and likely entry to the EOPs. The Emergency Coordinator should be mindful of the Loss of AC power (Station Blackout) and ATWS EALs to assure timely emergency classification declarations.

This threshold addresses any other factors that may be used by the Emergency Coordinator in determining whether the RCS Barrier is lost.

PVNGS Basis Reference(s):

1. NEI 99-01, Emergency Director Judgment RCS Loss 6.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Reactor Coolant System

Category: E. Emergency Coordinator Judgment

Degradation Threat: Potential Loss

Threshold:

1. **Any** condition in the opinion of the Emergency Coordinator that indicates potential loss of the RCS barrier

Definition(s):

None

Basis:

Emergency Coordinator judgment threshold addresses any other factors relevant to determining if the RCS barrier is potentially lost. Such a determination should include imminent barrier degradation, barrier monitoring capability and dominant accident sequences.

- Imminent barrier degradation exists if the degradation will likely occur within relatively short period of time based on a projection of current safety system performance. The term “imminent” refers to recognition of the inability to reach safety function acceptance criteria before completion of all checks.
- Barrier monitoring capability is decreased if there is a loss or lack of reliable indicators. This assessment should include instrumentation operability concerns, readings from portable instrumentation and consideration of offsite monitoring results.
- Dominant accident sequences lead to degradation of all fission product barriers and likely entry to the EOPs. The Emergency Coordinator should be mindful of the Loss of AC power (Station Blackout) and ATWS EALs to assure timely emergency classification declarations.

This threshold addresses any other factors that may be used by the Emergency Coordinator in determining whether the RCS Barrier is potentially lost. The Emergency Coordinator should also consider whether or not to declare the barrier potentially lost in the event that barrier status cannot be monitored.

PVNGS Basis Reference(s):

1. NEI 99-01, Emergency Director Judgment RCS Loss 6.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Containment

Category: A. RCS or SG Tube Leakage

Degradation Threat: Loss

Threshold:

1. A leaking or RUPTURED SG is FAULTED outside of containment

Definition(s):

FAULTED - The term applied to a steam generator that has a steam or feedwater leak on the secondary side of sufficient size to cause an uncontrolled drop in steam generator pressure or the steam generator to become completely depressurized.

RUPTURED - The condition of a steam generator in which primary-to-secondary leakage is of sufficient magnitude to require a safety injection.

Basis:

This threshold addresses a leaking or RUPTURED Steam Generator (SG) that is also FAULTED outside of containment. The condition of the SG, whether leaking or RUPTURED, is determined in accordance with the thresholds for RCS Barrier Potential Loss A.1 and Loss A.1, respectively. This condition represents a bypass of the containment barrier.

FAULTED is a defined term within the NEI 99-01 methodology; this determination is not necessarily dependent upon entry into, or diagnostic steps within, an EOP. For example, if the pressure in a steam generator is decreasing uncontrollably (part of the FAULTED definition) and the FAULTED steam generator isolation procedure is not entered because EOP user rules are dictating implementation of another procedure to address a higher priority condition, the steam generator is still considered FAULTED for emergency classification purposes.

The FAULTED criterion establishes an appropriate lower bound on the size of a steam release that may require an emergency classification. Steam releases of this size are readily observable with normal Control Room indications. The lower bound for this aspect of the containment barrier is analogous to the lower bound criteria specified in IC SU4 for the fuel clad barrier (i.e., RCS activity values) and IC SU5 for the RCS barrier (i.e., RCS leak rate values).

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

This threshold also applies to prolonged steam releases necessitated by operational considerations such as the forced steaming of a leaking or RUPTURED steam generator directly to atmosphere to cooldown the plant. These type of condition will result in a significant and sustained release of radioactive steam to the environment (and are thus similar to a FAULTED condition). The inability to isolate the steam flow without an adverse effect on plant cooldown meets the intent of a loss of containment.

Steam releases associated with the expected operation of a SG Atmospheric Dump Valve(s) do not meet the intent of this threshold. Such releases may occur intermittently for a short period of time following a reactor trip as operators process through emergency operating procedures to bring the plant to a stable condition and prepare to initiate a plant cooldown. This includes the initial cooldown to 540ºF to isolate the ruptured SG using Atmospheric Dump Valves directed in the SGTR EOP. Steam releases associated with the unexpected operation of a valve (e.g., a stuck-open safety valve) do meet this threshold.

Following an SG tube leak or rupture, there may be minor radiological releases through a secondary-side system component (e.g., air ejectors, glad seal exhausters, valve packing, steam traps, terry turbine exhaust, etc.). These types of releases do not constitute a loss or potential loss of containment but should be evaluated using the Recognition Category R ICs.

The ECLs resulting from primary-to-secondary (P-to-S) leakage, with or without a steam release from the FAULTED SG, are summarized below.

	Affected SG is FAULTED Outside of Containment?	
P-to-S Leak Rate	**Yes**	**No**
Less than or equal to 25 gpm	No classification	No classification
Greater than 25 gpm	Unusual Event per SU5.1	Unusual Event per SU5.1
Requires operation of the standby charging (makeup) pump (*RCS Barrier Potential Loss*)	Site Area Emergency per FS1.1	Alert per FA1.1
Requires an automatic or manual ECCS (SIAS) actuation (*RCS Barrier Loss*)	Site Area Emergency per FS1.1	Alert per FA1.1

There is no Potential Loss threshold associated with RCS or SG Tube Leakage.

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

PVNGS Basis Reference(s):

1. Procedure 40EP-9EO01, *Reactor Trip*
2. Procedure 40EP-9EO01, *Standard Post Trip Actions*
3. Procedure 40EP-9EO03, *Loss of Coolant Accident*
4. Procedure 40EP-9EO10, *Excess Steam Demand*
5. Procedure 40EP-9EO04, *Steam Generator Tube Rupture*
6. NEI 99-01, RCS or SG Tube Leakage Containment Loss 1.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Containment

Category: A. RCS or SG Tube Leakage

Degradation Threat: Potential Loss

Threshold:

None

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Containment

Category: B. Inadequate Heat Removal

Degradation Threat: Loss

Threshold:

None

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Containment

Category: B. Inadequate Heat Removal

Degradation Threat: Potential Loss

Threshold:

1. Rep CETs > 1200ºF

   AND

   Functional recovery procedure not effective within 15 minutes (Note 1)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Definition(s):

None

Basis:

Core Exit Thermocouples (CETs) are a component of Inadequate Core Cooling Instrumentation and provide an indirect indication of fuel clad temperature by measuring the temperature of the reactor coolant that leaves the core region. Although clad rupture due to high temperature is not expected for CET readings less than the threshold, temperatures of this magnitude signal significant superheating of the reactor coolant and core uncovery (ref. 1).

The 15 minute threshold starts when operators begin taking procedurally directed functional recovery actions.

If CET readings are greater than 1,200°F (ref. 1), the Fuel Clad barrier is also lost.

Rep CET (Representative Core Exit Temperature) is a calculated temperature value generated by the Qualified Safety Parameter Display System (QSPDS). The QSPDS CET processing function generates a representative temperature based on a statistical analysis of thermocouples monitoring the reactor coolant temperature at the top of selected fuel assemblies.

This condition represents an IMMINENT core melt sequence which, if not corrected, could lead to vessel failure and an increased potential for containment failure. For this condition to occur, there must already have been a loss of the RCS Barrier and the Fuel Clad Barrier. If implementation of a procedure(s) to restore adequate core cooling is not effective (successful) within 15 minutes, it is assumed that the event trajectory will likely lead to core melting and a subsequent challenge of the Containment Barrier.

The restoration procedure is considered “effective” if core exit thermocouple readings ar decreasing and/or if reactor vessel level is increasing. Whether or not the procedure(s) will be effective should be apparent within 15 minutes. The Emergency Coordinator should escalate the emergency classification level as soon as it is determined that the procedure(s) will not be effective.

Severe accident analyses (e.g., NUREG-1150) have concluded that function restoration procedures can arrest core degradation in a significant fraction of core damage scenarios, and that the likelihood of containment failure is very small in these events. Given this, it is appropriate to provide 15 minutes beyond the required entry point to determine if procedural actions can reverse the core melt sequence.

PVNGS Basis Reference(s):

1. UFSAR Appendix 18B, System 80 Generic Inadequate Core Cooling Instrumentation
2. Procedure 40EP-9EO09, *Functional Recovery*
3. NEI 99-01, Inadequate Heat Removal Containment Potential Loss 2.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Containment

Category: C. CTMT Radiation/RCS Activity

Degradation Threat: Loss

Threshold:

None

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Containment

Category: C. CTMT Radiation/RCS Activity

Degradation Threat: Potential Loss

Threshold:

1. Containment radiation RU-148 > 6.8E+06 mR/hr **OR** RU-149 > 7.8E+06 mR/hr

Definition(s):

None

Basis:

Containment radiation monitor readings greater than the values shown (ref. 1) indicate significant fuel damage well in excess of that required for loss of the RCS barrier and the Fuel Clad barrier.

The reading is derived assuming the instantaneous release and dispersal of the reactor coolant noble gas and iodine inventory associated with 20% clad failure into the Containment atmosphere with containment sprays operating. The values are based on calculated readings fifteen minutes after shutdown.

The readings are higher than that specified for Fuel Clad barrier Loss C.1 and RCS barrier Loss C.1. Containment radiation readings at or above the Containment barrier Potential Loss threshold, therefore, signify a loss of two fission product barriers and Potential Loss of a third, indicating the need to upgrade the emergency classification to a General Emergency.

Monitors used for this fission product barrier loss threshold are the Containment High Range Radiation Monitors RU-148 and RU-149 (ref. 1).

The radiation monitor reading corresponds to an instantaneous release of all reactor coolant mass into the containment, assuming that 20% of the fuel cladding has failed. This level of fuel clad failure is well above that used to determine the related Fuel Clad Barrier Loss and RCS Barrier Loss thresholds.

NUREG-1228, *Source Estimations During Incident Response to Severe Nuclear Power Plant Accidents*, indicates the fuel clad failure must be greater than approximately 20% in order for there to be a major release of radioactivity requiring offsite protective actions. For this condition to exist, there must already have been a loss of the RCS Barrier and the Fuel Clad Barrier. It is therefore prudent to treat this condition as a potential loss of containment which would then escalate the ECL to a General Emergency.

PVNGS Basis Reference(s):

1. Calculation 13-NC-ZY-216, *Determination of Containment Activities from High Radiation Monitors*
2. NEI 99-01, CTMT Radiation / RCS Activity Containment Potential Loss 3.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Containment

Category: D. CTMT Integrity or Bypass

Degradation Threat: Loss

Threshold:

1. Containment isolation is required

   AND

   - Containment integrity has been lost based on Emergency Coordinator judgment
   - UNISOLABLE pathway from Containment to the environment exists

Definition(s):

UNISOLABLE - An open or breached system line that cannot be isolated, remotely or locally.

Basis:

Containment isolations are initiated by the Containment Isolation Actuation System (CIAS) in response to a high containment pressure signal or low pressurizer pressure below the SIAS setpoint (ref. 1, 2).

A penetration is considered isolated with at least one containment isolation valve closed. This may include a check valve if there is no indication that it has failed to close.

These thresholds address a situation where containment isolation is required and one of two conditions exists as discussed below. Users are reminded that there may be accident and release conditions that simultaneously meet both bulleted thresholds.

First Threshold – Containment integrity has been lost, i.e., the actual containment atmospheric leak rate likely exceeds that associated with allowable leakage (or sometimes referred to as design leakage). Following the release of RCS mass into containment, containment pressure will fluctuate based on a variety of factors; a loss of containment integrity condition may (or may not) be accompanied by a noticeable drop in containment pressure. Recognizing the inherent difficulties in determining a containment leak rate during accident conditions, it is expected that the Emergency Coordinator will assess this threshold using judgment and with due consideration given to current plant conditions and available operational and radiological data (e.g., containment pressure, readings on radiation monitors outside containment, operating status of containment pressure control equipment, etc.).

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Refer to the middle piping run of Figure 1. Two simplified examples are provided. One is leakage from a penetration and the other is leakage from an in-service system valve. Depending upon radiation monitor locations and sensitivities, the leakage could be detected by any of the four monitors depicted in the figure.

Another example would be a loss or potential loss of the RCS barrier and the simultaneous occurrence of two FAULTED locations on a steam generator where one fault is located inside containment (e.g., on a steam or feedwater line) and the other outside of containment. In this case, the associated steam line provides a pathway for the containment atmosphere to escape to an area outside the containment.

Following the leakage of RCS mass into containment and a rise in containment pressure, there may be minor radiological releases associated with allowable (design) containment leakage through various penetrations or system components. These releases do not constitute a loss or potential loss of containment but should be evaluated using the Recognition Category R ICs.

Second Threshold – Conditions are such that there is an UNISOLABLE pathway for the migration of radioactive material from the containment atmosphere to the environment. As used here, the term “environment” includes the atmosphere of a room or area, outside the containment, that may, in turn, communicate with the outside-the-plant atmosphere (e.g., through discharge of a ventilation system or atmospheric leakage). Depending upon a variety of factors, this condition may or may not be accompanied by a noticeable drop in containment pressure.

Refer to the top piping run of Figure 1. In this simplified example, the inboard and outboard isolation valves remained open after a containment isolation was required (i.e., containment isolation was not successful). There is now an UNISOLABLE pathway from the containment to the environment.

The existence of a filter is not considered in the threshold assessment. Filters do not remove fission product noble gases. In addition, a filter could become ineffective due to iodine and/or particulate loading beyond design limits (i.e., retention ability has been exceeded) or water saturation from steam/high humidity in the release stream.

Leakage between two interfacing liquid systems, by itself, does not meet this threshold. There must be a release involved to atmosphere or into another plant structure outside of Containment.

Refer to the bottom piping run of Figure 1. In this simplified example, leakage in an RCP seal cooler is allowing radioactive material to enter the Auxiliary Building. The radioactivity would be detected by the Process Monitor. If there is no leakage from the closed water cooling system to the Auxiliary Building or atmosphere, then no threshold has been met.

Following the leakage of RCS mass into containment and a rise in containment pressure, there may be minor radiological releases associated with allowable containment leakage through various penetrations or system components. Minor releases may also occur if a containment isolation valve(s) fails to close but the containment atmosphere escapes to an enclosed system. These releases do not constitute a loss or potential loss of containment but should be evaluated using the Recognition Category R ICs.

The status of the containment barrier during an event involving steam generator tube leakage is assessed using Loss Threshold A.1.

PVNGS Basis Reference(s):

1. UFSAR Section 6.2.1.5.3.8, Containment Purge System
2. UFSAR Section 6.2.4, Containment Isolation System
3. NEI 99-01, CTMT Integrity or Bypass Containment Loss 4.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Containment

Category: D. CTMT Integrity or Bypass

Degradation Threat: Loss

Threshold:

2. Indications of RCS leakage outside of Containment

Definition(s):

None

Basis:

Procedure 40AO-9ZZ02, Excessive RCS Leakrate, (ref. 1) provides instructions to identify and isolate a LOCA outside of the containment. Potential RCS leak pathways outside containment include (ref. 1, 2):

- Nuclear Cooling System (such as RCP high pressure seal cooler to NC system)
- Safety Injection
- Chemical & Volume Control
- RCS sample lines

Palo Verde specific operating experience is that a High Pressure Seal Cooler (HPSC) leak to the Nuclear Cooling Water (NC) System must be isolated to containment within 15 minutes of discovery due to the location of the NC system expansion tank and potential dose concerns on the Auxiliary Building roof.

RCS Leakage Outside of Containment		
RCS Leak Rate	**Yes**	**No**
Less than or equal to 25 gpm	No classification	No classification
Greater than 25 gpm	Unusual Event per SU5.1	Unusual Event per SU5.1
Requires operation of the standby charging (makeup) pump (*RCS Barrier Potential Loss*)	Site Area Emergency per FS1.1	Alert per FA1.1
Requires an automatic or manual ECCS (SIAS) actuation (*RCS Barrier Loss*)	Site Area Emergency per FS1.1	Alert per FA1.1

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Containment sump, temperature, pressure and/or radiation levels will increase if reactor coolant mass is leaking into the containment. If these parameters have not increased, then the reactor coolant mass may be leaking outside of containment (i.e., a containment bypass sequence). Increases in sump, temperature, pressure, flow and/or radiation level readings outside of the containment may indicate that the RCS mass is being lost outside of containment.

Unexpected elevated readings and alarms on radiation monitors with detectors outside containment should be corroborated with other available indications to confirm that the source is a loss of RCS mass outside of containment. If the fuel clad barrier has not been lost, radiation monitor readings outside of containment may not increase significantly; however, other unexpected changes in sump levels, area temperatures or pressures, flow rates, etc. should be sufficient to determine if RCS mass is being lost outside of the containment.

Refer to the middle piping run of Figure 1. In this simplified example, a leak has occurred at a reducer on a pipe carrying reactor coolant in the Auxiliary Building. Depending upon radiation monitor locations and sensitivities, the leakage could be detected by any of the four monitors depicted in the figure and cause threshold D.1 to be met as well.

Refer to the bottom piping run of Figure 1. In this simplified example, leakage in an RCP seal cooler is allowing radioactive material to enter the Auxiliary Building and then atmosphere. The radioactivity would be detected by the Process Monitor. If the Nuclear Cooling System (NC) pump developed a leak that allowed steam/water to leak to atmosphere, then this threshold is met.

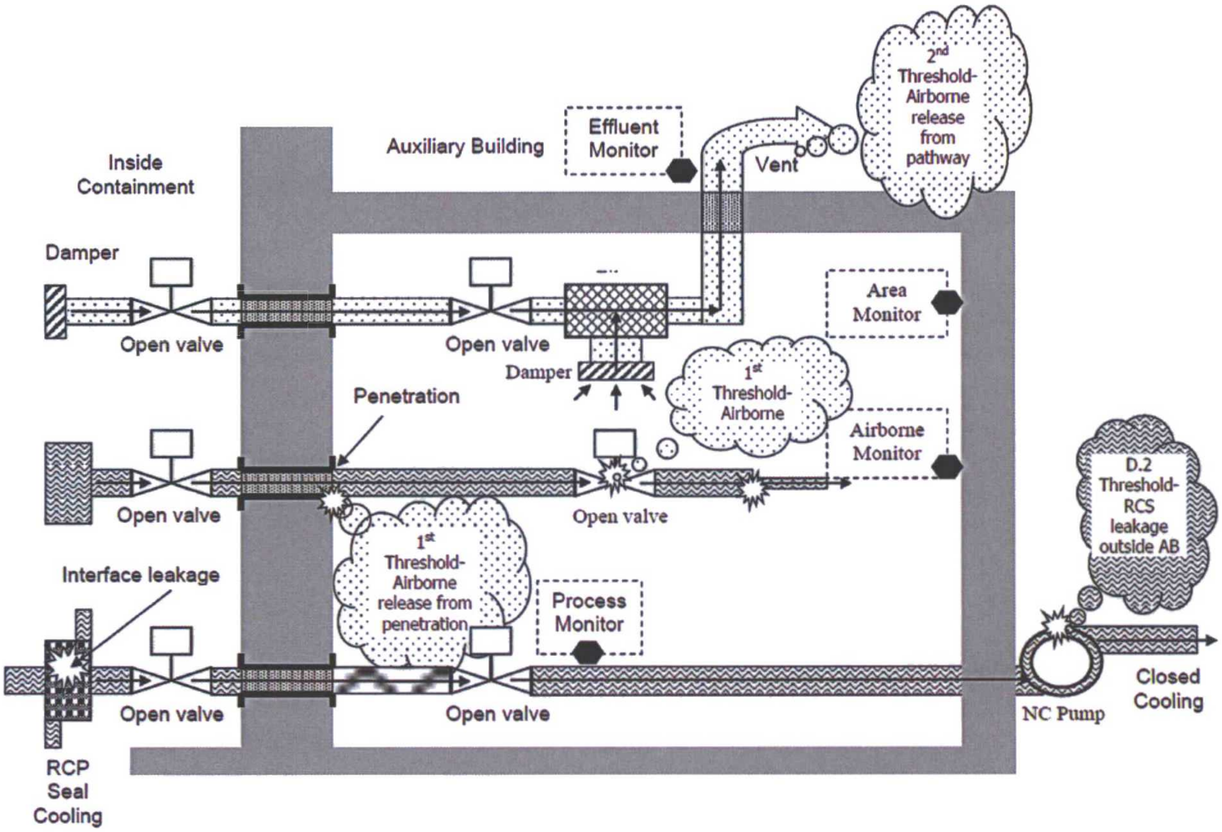
To ensure proper escalation of the emergency classification, the RCS leakage outside of containment must be related to the mass loss that is causing the RCS Loss and/or Potential Loss threshold A.1 to be met.

PVNGS Basis Reference(s):

1. Procedure 40AO-9ZZ02, *Excessive RCS Leakrate*
2. Procedure 40EP-9EO03, *Loss of Coolant Accident*
3. NEI 99-01, CTMT Integrity or Bypass Containment Loss

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Figure 1: Containment Integrity or Bypass Examples



ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Containment

Category: D. CTMT Integrity or Bypass

Degradation Threat: Potential Loss

Threshold:

1. Containment pressure > 60 psig

Definition(s):

None

Basis:

60 psig is the containment design pressure (ref. 1).

If containment pressure exceeds the design pressure, there exists a potential to lose the Containment Barrier. To reach this level, there must be an inadequate core cooling condition for an extended period of time; therefore, the RCS and Fuel Clad barriers would already be lost. Thus, this threshold is a discriminator between a Site Area Emergency and General Emergency since there is now a potential to lose the third barrier.

PVNGS Basis Reference(s):

1. UFSAR Section 1.2.12.1, Containment Building
2. NEI 99-01, CTMT Integrity or Bypass Containment Potential Loss 4.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Containment

Category: D. CTMT Integrity or Bypass

Degradation Threat: Potential Loss

Threshold:

2. Containment hydrogen concentration $\geq$ 4.9%

Definition(s):

None

Basis:

Following a design basis accident, hydrogen gas may be generated inside the containment by reactions such as zirconium metal with water, corrosion of materials of construction and radiolysis of aqueous solution in the core and sump. (ref. 1, 3).

PVNGS is equipped with a Containment Hydrogen Control (HP) system which serves to limit or reduce combustible gas concentrations in the Containment. The HP system is an engineered safety feature with redundant hydrogen recombiners, hydrogen mixing system, hydrogen monitoring subsystem and a backup hydrogen purge subsystem. The HP system is designed to maintain the Containment hydrogen concentration below 4% by volume (ref. 1, 2). HP system operation is prescribed by EOPs if Containment hydrogen concentration should reach 0.7% by volume (minimum detectable) (ref. 3).

The PVNGS Safety Function Status Check for LOCA, Containment Combustible Gas Control (procedure 40EP-9EO03, *Loss of Coolant Accident*), uses 4.9% as an acceptance criterion, which represents the Hydrogen Recombiner Function Failure Indication. This value should not be exceeded if the hydrogen recombiners are operating as desired.

If the Potential Loss threshold is reached or exceeded, the primary means of controlling Containment hydrogen concentration must have failed to perform its design function or has otherwise been inadequate in mitigating the hydrogen generation rate. For either case, continued hydrogen production may yield a flammable hydrogen concentration and a consequent threat to Containment integrity.

To generate such levels of combustible gas, loss of the Fuel Clad and RCS barriers must have occurred. With the Potential Loss of the containment barrier, the threshold hydrogen concentration, therefore, will likely warrant declaration of a General Emergency.

Two Containment hydrogen monitor indicators (HPA-AI-9 and HPB-AI-10) with a range of 0% to 10% provide indication on Control Room Panel B02 (ref. 2).

The existence of an explosive mixture means, at a minimum, that the containment atmospheric hydrogen concentration is sufficient to support a hydrogen burn (e.g., at the lower deflagration limit). A hydrogen burn will raise containment pressure and could result in collateral equipment damage leading to a loss of containment integrity. It therefore represents a potential loss of the Containment Barrier.

PVNGS Basis Reference(s):

1. UFSAR Section 6.2.5, Combustible Gas Control in Containment
2. Design Basis Manual – HP Containment Hydrogen Control System
3. Procedure 40DP-9AP14, *Functional Recovery Technical Guideline*, Section 15.0 Containment Combustible Gas Control
4. NEI 99-01, CTMT Integrity or Bypass Containment Potential Loss 4.B

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Containment

Category: D. CTMT Integrity or Bypass

Degradation Threat: Potential Loss

Threshold:

3. Containment pressure > 8.5 psig with < 4350 gpm Containment Spray flow for ≥ 15 minutes (Note 1)

Note 1: The Emergency Coordinator should declare the event promptly upon determining that time limit has been exceeded, or will likely be exceeded.

Definition(s):

None

Basis:

The Containment Spray System consists of two separate trains of equal capacity, each capable of meeting the design bases requirement. Each train includes a containment spray pump, spray headers, nozzles, valves and piping. The refueling water storage tank (RWT) supplies borated water to the Containment Spray System during the injection phase of operation. In the recirculation mode of operation, Containment Spray pump suction is transferred from the RWT to the Containment sumps (ref. 1).

The Containment pressure high-high setpoint (8.5 psig) is the pressure at which the Containment Spray equipment should actuate and begin performing its function (ref. 2). Consistent with the design requirement, "one full train of depressurization equipment" is therefore defined to be the availability of one train of Containment Spray providing a minimum of 4350 gpm spray flow (ref. 3). If less than this equipment is operating and Containment pressure is above the actuation setpoint, the threshold is met.

This threshold describes a condition where containment pressure is greater than the setpoint at which containment energy (heat) removal systems are designed to automatically actuate and less than one full train of equipment is capable of operating per design. The 15-minute criterion is included to allow operators time to manually start equipment that may not have automatically started, if possible. This threshold represents a potential loss of containment in that containment heat removal/depressurization systems (e.g., containment sprays but not including containment venting strategies) are either lost or performing in a degraded manner.

ATTACHMENT 2

Fission Product Barrier Loss/Potential Loss Matrix and Bases

PVNGS Basis Reference(s):

1. UFSAR Section 6.2.2, Containment Heat Removal System
2. UFSAR Table 7.3-11A, ESFAS Setpoints and Margins to Actuation
3. Procedure 40EP-9EO01, *Standard Post Trip Actions*
4. NEI 99-01, CTMT Integrity or Bypass Containment Potential Loss 4.C

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Containment

Category: E. Emergency Coordinator Judgment

Degradation Threat: Loss

Threshold:

1. **Any** condition in the opinion of the Emergency Coordinator that indicates loss of the Containment barrier

Definition(s):

None

Basis:

The Emergency Coordinator judgment threshold addresses any other factors relevant to determining if the Primary Containment barrier is lost. Such a determination should include imminent barrier degradation, barrier monitoring capability and dominant accident sequences.

- Imminent barrier degradation exists if the degradation will likely occur within relatively short period of time based on a projection of current safety system performance. The term "imminent" refers to recognition of the inability to reach safety function acceptance criteria before completion of all checks.
- Barrier monitoring capability is decreased if there is a loss or lack of reliable indicators. This assessment should include instrumentation operability concerns, readings from portable instrumentation and consideration of offsite monitoring results.
- Dominant accident sequences lead to degradation of all fission product barriers and likely entry to the EOPs. The Emergency Coordinator should be mindful of the Loss of AC power (Station Blackout) and ATWS EALs to assure timely emergency classification declarations.

This threshold addresses any other factors that may be used by the Emergency Coordinator in determining whether the Containment Barrier is lost.

PVNGS Basis Reference(s):

1. NEI 99-01, Emergency Director Judgment PC Loss 6.A

ATTACHMENT 2
Fission Product Barrier Loss/Potential Loss Matrix and Bases

Barrier: Containment

Category: E. Emergency Coordinator Judgment

Degradation Threat: Potential Loss

Threshold:

1. **Any** condition in the opinion of the Emergency Coordinator that indicates potential loss of the Containment barrier

Definition(s):

None

Basis:

The Emergency Coordinator judgment threshold addresses any other factors relevant to determining if the Primary Containment barrier is potentially lost. Such a determination should include imminent barrier degradation, barrier monitoring capability and dominant accident sequences.

- Imminent barrier degradation exists if the degradation will likely occur within relatively short period of time based on a projection of current safety system performance. The term "imminent" refers to recognition of the inability to reach safety function acceptance criteria before completion of all checks.

- Barrier monitoring capability is decreased if there is a loss or lack of reliable indicators. This assessment should include instrumentation operability concerns, readings from portable instrumentation and consideration of offsite monitoring results.

- Dominant accident sequences lead to degradation of all fission product barriers and likely entry to the EOPs. The Emergency Coordinator should be mindful of the Loss of AC power (Station Blackout) and ATWS EALs to assure timely emergency classification declarations.

This threshold addresses any other factors that may be used by the Emergency Coordinator in determining whether the Containment Barrier is potentially lost. The Emergency Coordinator should also consider whether or not to declare the barrier potentially lost in the event that barrier status cannot be monitored.

PVNGS Basis Reference(s):

1. NEI 99-01, Emergency Director Judgment PC Potential Loss 6.A

ATTACHMENT 3
Safe Operation & Shutdown Rooms Tables R-2 & H-2 Bases

Background

NEI 99-01, Revision 6 ICs AA3 and HA5 prescribe declaration of an Alert based on impeded access to rooms or areas (due to either area radiation levels or hazardous gas concentrations) where equipment necessary for normal plant operations, cooldown or shutdown is located. These areas are intended to be plant operating mode dependent. Specifically the Developers Notes For AA3 and HA5 states:

> *The 'site-specific list of plant rooms or areas with entry-related mode applicability identified' should specify those rooms or areas that contain equipment which require a manual/local action as specified in operating procedures used for normal plant operation, cooldown and shutdown. Do not include rooms or areas in which actions of a contingent or emergency nature would be performed (e.g., an action to address an off-normal or emergency condition such as emergency repairs, corrective measures or emergency operations). In addition, the list should specify the plant mode(s) during which entry would be required for each room or area.*
>
> *The list should not include rooms or areas for which entry is required solely to perform actions of an administrative or record keeping nature (e.g., normal rounds or routine inspections).*

Further, as specified in IC HA5:

> *The list need not include the Control Room if adequate engineered safety/design features are in place to preclude a Control Room evacuation due to the release of a hazardous gas. Such features may include, but are not limited to, capability to draw air from multiple air intakes at different and separate locations, inner and outer atmospheric boundaries, or the capability to acquire and maintain positive pressure within the Control Room envelope.*

ATTACHMENT 3
Safe Operation & Shutdown Rooms Tables R-2 & H-2 Bases

PVNGS Table R-2 and H-2 Bases

A review of station operating procedures identified the following mode dependent in-plant actions and associated areas that are required for normal plant operation, cooldown or shutdown:

Location - Safe Shutdown Area/Room	**Modes - 1,2**	**Modes - 3, 4 or 5**
LPSI Pumps A and B	SDC Equipment. *- No entry required* Inventory Control Equipment	Shut Down Cooling (SDC) *- No entry required* Inventory Control Equipment *- No entry required* Reactivity Control. *- No entry required*
Containment Spray Pumps A and B	Containment Pressure Control *- No entry required*	Shut Down Cooling (SDC) *- No entry required* Inventory Control Equipment *- No entry required* Reactivity Control. *- No entry required*
HPSI Pumps A and B	Inventory Control Equipment. - No entry required Reactivity Control. *- No entry required*	Inventory Control Equipment. *- No entry required* Reactivity Control. *- No entry required*
Aux. Bldg 120 West Electrical Penetration Room	Electrical Power. *- No entry required*	Electrical Power. *- No entry required*
Aux. Bldg 100 East Electrical Penetration Room	Electrical Power. *- No entry required*	Electrical Power. *- No entry required*
Essential Cooling Water Pumps	Support Equipment for Habitability Control, Containment Temperature, Control and Shutdown Cooling *- No entry required*	Support Equipment for Habitability Control, Containment Temperature, Control and Shutdown Cooling *- No entry required*
Control Building 100 foot 4160 Class Switchgear Room A & B	Electrical Power. *- No entry required*	Electrical Power. *- Entry required to access the DC equipment Rooms C and D - Modes 4 and 5*

ATTACHMENT 3
Safe Operation & Shutdown Rooms Tables R-2 & H-2 Bases

Location - Safe Shutdown Area/Room	**Modes - 1,2**	**Modes - 3, 4 or 5**
Control Building 100 foot Class DC Equipment Rooms A & B	Electrical Power. *- No entry required*	Electrical Power. *- No entry required*
Control Building 100 foot Class DC Equipment Rooms C & D	Electrical Power. *- No entry required*	Electrical Power. - Energize LTOP Isolation Valves for SDC. Procedure 40OP-9ZZ23, *Modes 4 and 5*
Emergency Diesel Generators A & B	Electrical Power. *- No entry required*	Electrical Power. *- No entry required*
Emergency Diesel Generators Day Tank Rooms	Electrical Power. *- No entry required*	Electrical Power. *- No entry required*
EDG Building HVAC Room	*- No entry required*	*- No entry required*
Control Building 160 ft Electrical Cable Spreading	*- No entry required*	*- No entry required*
Control Building 120 ft Electrical Cable Spreading	*- No entry required*	*- No entry required*
Control Building 80 ft Essential Chiller Rooms	*- No entry required*	*- No entry required*
Control Building Battery Rooms A, B, C and D	*- No entry required*	*- No entry required*
Turbine Building Elevations	*- No entry required*	*- No entry required*
Main Steam Support Structure 140, 120 and 100 foot elevations	*- No entry required*	*- No entry required*
Aux. Feedwater Pump Room A and B	Steam Generator Heat Removal *- No entry required*	Steam Generator Heat Removal *- No entry required*
Spray Pond Pump Rooms A and B	Support Equipment for Habitability Control, Containment Temperature, Control and Shutdown Cooling *No entry required*	Support Equipment for Habitability Control, Containment Temperature, Control and Shutdown Cooling *No entry required*

ATTACHMENT 3
Safe Operation & Shutdown Rooms Tables R-2 & H-2 Bases

Table R-2 & H-2 Results

Table R-2 & H-2 Safe Operating & Shutdown Rooms	
Room	**Mode Applicability**
Control Building 100 ft. Class DC Equipment Room C	4, 5
Control Building 100 ft. Class DC Equipment Room D	4, 5

Plant Operating Procedures Reviewed

1. Procedure 40OP-9ZZ05, *Power Operations*
2. Procedure 40OP-9ZZ23, *Outage GOP*
3. Procedure 40OP-9ZZ10, *Mode 3 to Mode 5 Operations*
4. Procedure 40OP-9SI01, *Shutdown Cooling Initiation*

ATTACHMENT 4
Palo Verde Safety System List

Safety System

A system required for safe plant operation, cooling down the plant and/or placing it in the cold shutdown condition, including the ECCS. These are typically systems classified as safety related (as defined in 10 CFR 50.2):

Those structures, systems and components that are relied upon to remain functional during and following design basis events to assure:

1) The integrity of the reactor coolant pressure boundary;

2) The capability to shut down the reactor and maintain it in a safe shutdown condition;

3) The capability to prevent or mitigate the consequences of accidents which could result in potential offsite exposures.

The SAFETY SYSTEMS included in this definition are those included to satisfy Criteria 1, 2 or 3 of 10 CFR 50.36(c)(2)(ii). Systems included by this definition are:

Structures - All Modes (except as noted)

- Containment Building
- Auxiliary Building
- Diesel Building
- Fuel Building
- Spray Pond
- Control Building
- Main Steam Support Structure Mode 1-4 and Mode 5 when steam generators are required per Technical Specifications

Modes 1-4

- Reactor Coolant System (RC)
- Safety Injection (SI)
- Refueling Water Tank
- Containment Air Locks
- Containment Isolation Valves- except when the penetration is isolated and out of service.
- Containment Spray System (SI) Modes 1-3 and Mode 4 $\geq$ 385 psia
- Main Steam Safety Valves (SG) Modes 1-3

ATTACHMENT 4
Palo Verde Safety System List

- Main Steam Isolation Valves (SG) Mode 1 and Modes 2-4 except when closed and deactivated
- Main Feedwater Isolation Valves (SG) Mode 1-4 except when closed and deactivated or isolated by another valve
- Atmospheric Dump Valves (SG) Modes 1-3, Mode 4 when Steam Generators are relied on for heat removal
- Auxiliary Feedwater System (AF) Modes 1-3, Mode 4 when Steam Generators are relied on for heat removal
- Condensate Storage Tank (CT) Modes 1-3, Mode 4 when Steam Generators are relied on for heat removal
- Essential Cooling Water System (EW)
- Essential Chill Water System (EC)
- Essential Spray Pond System (SP)
- Ultimate Heat Sink (SP)
- Control Room Essential Filtration and Ventilation (HJ)
- Engineered Safety Features Pump Room Exhaust Cleanup (HF)
- Diesel Generators (DG)
- Diesel Fuel Oil System (DF)
- DC Sources (PK)
- Class Battery Chargers (PK)
- Class Instrument Invertors (PN)
- Distribution Systems (PB, PG, PH, PK and PN)
- Shutdown Cooling System (SI) Mode 4
- Reactor Protection System (RPS)
- Engineered Safety Features Actuation System (ESFAS)
- Balance of Plant Engineered Safety Features Actuation System (BOP-ESFAS)

Modes 5 and 6

- Reactor Coolant System (RC)
- Shutdown Cooling System (SI)
- Diesel Generators (DG) Normally only one train required by TS
- Diesel Fuel Oil System (DF) Normally only one train required by TS
- DC Sources (PK) Normally only one train required by TS
- Class Battery Chargers (PK) Normally only one train required by TS
- Class Instrument Invertors (PN) Normally only one train required by TS
- Distribution Systems (PB, PG, PH, PK and PN) Normally only one train required by TS

ATTACHMENT 4
Palo Verde Safety System List

- Control Room Essential Filtration and Ventilation (HJ)
- Essential Cooling Water System (EW) Train(s) supporting Shutdown Cooling
- Essential Spray Pond System (SP) Train(s) supporting Shutdown Cooling and/or DG
- Ultimate Heat Sink (SP) Train(s) supporting Shutdown Cooling and/or DG

Enclosure 2

Summary of the 10 CFR 50.54(q) Analysis of Emergency Plan Revision 63

Summary of Analysis

The changes in the Palo Verde Nuclear Generating Station (PVNGS) Emergency Plan, Revision 63, are to correct header revision numbers and footer pagination issues. These changes are minor administrative corrections and continue to comply with the requirements of the PVNGS emergency plan, 10 CFR 50.47(b), and 10 CFR 50 Appendix E. The changes do not constitute a reduction in effectiveness. Therefore, these changes were made without prior NRC approval.

Change 1	
Summary of Change in the Emergency Plan:	Appendix A, Pages 124 through 385 – Corrected revision number in header
Current Revision	Revision 61
Change	Revision 63
Emergency Preparedness Function	Editorial change
Effectiveness Review/Conclusion	This is an administrative correction to the revision number in the document header. Functions and responsibilities did not change. This change is not a reduction in effectiveness of the PVNGS Emergency Plan.
Change 2	
Summary of Change in the Emergency Plan:	Appendix A, Pages 125 through 385 – Corrected pagination error in footer
Current Revision	2, 3, 4…of 265
Change	2, 3, 4…of 261
Emergency Preparedness Function	Editorial change
Effectiveness Review/Conclusion	This is an administrative correction of the pagination in the document footer. Functions and responsibilities did not change. This change is not a reduction in effectiveness of the PVNGS Emergency Plan.

<u>Overall Conclusion</u>

The changes in Revision 63 of the PVNGS Emergency Plan (described above) do not make a reduction in effectiveness or adversely affect any function or program element. These changes continue to comply with the requirements of PVNGS Emergency Plan, the NRC approved PVNGS Emergency Plan safety evaluation, current emergency planning licensing basis, 10CFR 50.47(b) and Appendix E to 10 CFR 50. These activities do not constitute a reduction in effectiveness. These changes were made without prior NRC approval.