Superseded per revision 2 to Pump & Valve Inservice Testing Program dtd 8/21/84
50-528/529

PUMP AND VALVE
INSERVICE TESTING PROGRAM
PALO VERDE NUCLEAR GENERATING STATION

REVISION 1

AUGUST 17, 1982

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INTRODUCTION

The Inservice Inspection Program for Palo Verde Nuclear Generating Station is developed in compliance with the rules and regulations of 10CFR50.55a and Section XI of the ASME Boiler and Pressure Vessel Code, 1980 Edition, Winter 1980 Addenda. Where these rules were determined to be impractical, specific relief was written.

Section 1.0 discusses the Inservice Testing Program for applicable Class 1, 2, and 3 pumps. Section 2.0 discusses the Inservice Testing Program for applicable Class 1, 2, and 3 valves.

1.0 INSERVICE TESTING OF PUMPS

1.1 General Information

The Inservice Testing Program for ASME Class 1, 2 and 3 pumps was developed in accordance with, and meets the requirements of ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWP, 1980 Edition, Winter 1980 Addenda.

The Inservice Testing Program for pumps will remain in effect through the next 10 year inservice inspection interval.

Section 3.1 lists all Class 1, 2 and 3 pumps which are to be tested, along with the applicable parameters to be measured.

1.2 Program Information

The following information is included in the Inservice Testing Program for pumps:

A. Pump Number lists the pump identification number as shown on the P&ID's.

B. Pump Name describes the pump's functional identification as it is related to system operation.

C. ISI Class is the Owner's classification of the pump per ISI requirements.

D. P&ID and Coordinates indicates the drawing and grid location where the pump appears.

E. Test Parameters indicates the required test quantities required per Table IWP-3100-1.*

F. Notes are general statements which can be referred to in the ISI Testing Program.

1.3 Test Frequency

An inservice test shall be run on each pump nominally every three months during plant operation. If this frequency can reasonably be accomplished during shutdown periods it will be, however, this is not mandatory. Where a pump is not tested on a three month frequency during plant shutdown, it will be tested prior to declaring the system operable, per Technical Specifications.

*These quantities will be either measured, observed, or calculated (denoted by "M", "O", or "C" in the ISI Testing Program). "PRR-(1) will denote a specific request for relief concerning that parameter.

1.4 Request for Relief

Where ASME Section XI requirements are determined to be impractical, a request for relief is written.

Where relief from an ASME Code requirement is granted within the provisions of 10CFR50.55a (g) (6) (i), it will be incorporated into the Palo Verde Inservice Testing Program.

Relief requests are shown in Appendix A.

1.5 Special Test

Where a pump is operated more frequently than every 3 months, it need not be stopped for a special test, provided the requirements of IWP-3400b are met.

2.0 INSERVICE TESTING OF VALVES

2.1 The Inservice Testing Program for ASME Class 1, 2 and 3 valves was developed in accordance with, and meets the requirements of ASME Boiler and Pressure Vessel Code, Section XI, Subsection IWV, 1980 Edition, Winter 1980 Addenda.

The Inservice Testing Program for valves will remain in effect throughout the next 10 year inservice inspection interval.

The Inservice Testing Program lists all ASME Class 1, 2 and 3 valves that have been assigned valve categories. Except for valves directly in the flow path (B passive), valves exempted per IWV-1200 are not listed. This listing is located in Section 3.2.

The tables are organized by system in order of the assigned P&ID number.

2.2 Program Information

The following information is included in the Inservice Testing Program for valves:

A. Valve Number lists the valve identification number as shown on the P&ID's.

B. Coordinates reference the grid on the P&ID where the valve appears.

C. ISI Class is the Owner's classification of the valve per ISI requirements.

D. Valve Category indicates the category assigned to the valve based on the definitions of IWV-2200.

E. Valve Size lists the nominal size of the valve in inches.

F. Valve Type lists the valve design.

G. Actuator Type lists the type of valve actuator.

H. Valve Position indicates the normal position of the valve during plant operation; either normally open (0), normally closed (C) or both (0/C).

I. Stroke Direction indicates the direction which an active valve must stroke to perform its safety function. Also, the direction in which the valve will be stroked to satisfy the exercising requirements of IWV-3410 and IWV-3520. This may be specified as open (O), closed (C) or both (O/C).

J. Test lists the test or tests that will be performed for each valve to fulfill the requirements of Subsection IWV.

Appendix J Leak Test (AJLT)

Valve will be leak tested in accordance with 10CFR50, Appendix J requirements.

Full Stroke Test (FST)

Valve will be full stroke exercised for operability in the direction necessary to fulfill its safety function.

Partial Stroke Test (PST)

Valve will be partial stroke exercised when full stroke exercising is impractical.

Fail-Safe Test (FT)

All valves with fail-safe actuators will be tested to verify proper fail-safe operation upon loss of actuator power.

Verify Position Indicator (VPI)

Automatically accuated valves with remote indication will be verified in accordance with IWV-3300.

Pressure Safety Valve Testing (PSVT)

Relief and safety valve set points will be verified in accordance with IWV-3510.

K. Test Mode indicated the frequency at which the preceeding mentioned tests will be performed. The following abbreviations are used:

Cold Shutdown (CS)

Valve testing at cold shutdown is valve testing which commences not later than seventy-two (72) hours after cold shutdown and continues until

required testing is completed or plant startup, whichever occurs first. Completion of all required valve testing is not a requisite to plant startup. Valve testing which is not completed during a cold shutdown will be performed during subsequent cold shutdowns to meet the Code specified testing requirements. No valve is required to be tested more often than once every 90 days.

Note: Completion of all valve testing during cold shutdown is not required if plant operating conditions will not permit the testing of specific valves.

Normal Operation (OP)

Valve tests with this designation will be performed once every three months.

Reactor Refueling (RF)

Valve tests with this designation will be conducted at reactor refueling outages only.

L. Max Stroke Time lists the maximum allowed full stroke time measured in seconds from signal initiation until stroke completion is indicated. Testing is to be completed for all stroke times listed whenever the valve is full stroke tested (ref. IWV-3413).

M. Relief Request references the relief request contained in Appendix B that applies to the particular valve.

N. Remarks lists clarification remarks.

2.3 Request for Relief

Where ASME Section XI requirements were determined to be impractical, a request for relief was written.

2.4 Explanation of Abbreviations and Notes

See the following pages.

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
EXPLANATION OF ABBREVIATIONS		

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
					BA								BALL
					BTF								BUTTERFLY
					CK								CHECK
					DIA								DIAPHRAGM
					GA								GATE
					GL								GLOBE
					PCV								PRESSURE CONTROL VALVE
					PSV								PRESSURE SAFETY VALVE

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SYSTEM	P & ID	PAGE
EXPLANATION OF ABBREVIATIONS		

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
					TW								THREE WAY
						AO							AIR OPERATOR
						HY							HYDRAULIC
						MAN							MANUAL
						MO							MOTOR OPERATOR
						SA							SELF ACTUATED
						SOL							SOLENOID
							O						OPEN

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SYSTEM	P & ID	PAGE
EXPLANATION OF ABBREVIATIONS		

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
							C						CLOSED
									AJLT				APPENDIX J LEAK TEST
									FST				FULL STROKE TEST
									PST				PARTIAL STROKE TEST
									FT				FAIL TEST
									VPI				VERIFY POSITION INDICATOR
									PSVT				PRESSURE SAFETY VALVE TEST
										OP			NORMAL OPERATION

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ISI CLASS 1, 2 & 3 VALVES

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SYSTEM: EXPLANATION OF ABBREVIATIONS | P & ID: | PAGE:

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
										CS			COLD SHUTDOWN
										RF			REACTOR REFUELING
												VRR	VALVE RELIEF REQUEST

EXPLANATION OF NOTES

NOTES:

1. This valve is within a non-safety related system, however, it is used for containment isolation and therefore will be tested in accordance with 10CFR50 Appendix J requirements.

2. This valve is a pressure relief valve and will be tested at the frequency stated in IWV-3511.

3. This valve is a passive valve and does not require testing.

4. This valve cannot be full stroke exercised.

5. This valve cannot be partially stroke exercised during plant operation.

6. All motor operated valves fail-as-is and therefore do not require a fail safe test per IWV-3415.

7. Position of valve is determined to be non-safety related and therefore requires no testing.

8. This valve is A passive and will only be tested in accordance with 10CFR50 Appendix J rules.

9. This valve will be tested in accordance with 10CFR50 Appendix J requirements.

10. This valve operates during normal operation and therefore requires no special testing (IWV-3414).

11. Operability of this valve shall be noted when the Diesel Generator System is tested for operability.

SECTION 3.1

INSERVICE TESTING PROGRAM - PUMPS

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INSERVICE TESTING PROGRAM
ISI CLASS 1,2 & 3 PUMPS
PALO VERDE NUCLEAR GENERATING STATION

PUMP NUMBER	PUMP NAME	ISI CLASS	P & ID AND COORDINATES	TEST PARAMETERS						NOTES
				SPEED	INLET PRES.	DIFF. PRES.	FLOW RATE	VIBRATION	BEARING TEMP.	
AFA-P01	Auxiliary Feedwater Pump (Turbine Driven)	3	AFP-001 E5	O	O	C	O	M	PRR-1	
AFB-P01	Auxiliary Feedwater Pumb (Motor Driven)	3	AFP-001 C6	NA	O	C	O	M	PRR-1	
CHA-P01	Charging Pump No.1.	2	CHP-002 B3	NA	M	C	O	M	PRR-1	
CHB-P01	Charging Pump No.2	2	CHP-002 D3	NA	M	C	O	M	PRR-1	
CHE-P01	Charging Pump No. 3	2	CHP-002 F3	NA	M	C	O	M	PRR-1	
CTA-P01	Condensate Transfer Pump	3	CTP-001 C5	NA	M	C	O	M	PRR-1	
CTB-P01	Condensate Transfer Pump	3	CTP-001 A5	NA	M	C	O	M	PRR-1	
DFA-P01	Diesel Generator Fuel Oil Transfer Pump	3	DFP-001 B6	NA	C	C	O	PRR-2	PRR-1	
DFB-P01	Diesel Generator Fuel Oil Transfer Pump	3	DFP-001 B2	NA	C	C	O	PRR-2	PRR-1	
DGA-P02	Diesel Generator Jacket Water Cooling Pump	3	M018-106	-	-	-	-	-	-	PRR-3
DGB-P02	Diesel Generator Jacket Water Cooling Pump	3	M018-106	-	-	-	-	-	-	PRR-3
DGA-P03	Diesel Generator Lube Oil Pump	3	M018-105	-	-	-	-	-	-	PRR-3
DGB-P03	Diesel Generator Lube Oil Pump	3	M018-105	-	-	-	-	-	-	PRR-3
DGA-P05	Diesel Generator Fuel Oil Booster Pump	3	M018-103	-	-	-	-	-	-	PRR-3
DGA-P05	Diesel Generator Fuel Oil Booster Pump	3	M018-103	-	-	-	-	-	-	PRR-3

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PUMP NUMBER	PUMP NAME	ISI CLASS	P & ID AND COORDINATES	TEST PARAMETERS						NOTES
				SPEED	INLET PRES.	DIFF. PRES.	FLOW RATE	VIBRATION	BEARING TEMP.	
ECA-P01	Essential Chilled Water Circulation Pump	3	ECP-001 B8	NA	M	C	O	M	PRR-1	
ECB-P01	Essential Chilled Water Circulation Pump	3	ECP-001 B3	NA	M	C	O	M	PRR-1	
EWA-P01	Essential Cooling Water Pump	3	EWP-001 D5	NA	M	C	O	M	PRR-1	
EWB-P01	Essential Cooling Water Pump	3	EWP-001 D2	NA	M	C	O	M	PRR-1	
PCA-P01	Fuel Pool Cooling Pump #1	3	PCP-001 D14	NA	M	C	O	M	PRR-1	
PCB-P01	Fuel Pool Cooling Pump #2	3	PCP-001 C14	NA	M	C	O	M	PRR-1	
SIA-P01	LPSI Pump #1	2	S1P-001 F11	NA	M	C	O	M	PRR-1	
SIB-P01	LPSI Pump #2	2	S1P-001 B11	NA	M	C	O	M	PRR-1	
S1A-P02	HPSI Pump #1	2	S1P-001 F11	NA	M	C	O	M	PRR-1	
S1B-P02	SPSI Pump #2	2	S1P-001 A11	NA	M	C	O	M	PRR-1	
SIA-P03	Containment Spray Pump #1	2	SIP-001 H11	NA	M	C	O	M	PRR-1	
S1B-P03	Containment Spray Pump #2	2	SIP-001 C11	NA	M	C	O	M	PRR-1	
S1A-P05	Spray Chemical Addition Pump #1	2	SIP-001 D14	NA	M	C	O	M	PRR-1	
S1B-P05	Spray Chemical Addition Pump #2	2	S1P-001 C14	NA	M	C	O	M	PRR-1	
SPA-P01	Essential Spray Pond Pump #1	3	SPP-001 D4	NA	M	C	O	M	PRR-1	
SPB-P01	Essential Spray Pond Pump #2	3	SPP-001 D7	NA	M	C	O	M	PRR-1	

SECTION 3.2

INSERVICE TESTING PROGRAM - VALVES

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ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V002	G7	3	B	6"	GA	MAN	O	O	NA				NOTE 3
V005	E7	3	C	8"	CK	SA	C	C	NA				NOTE 3
V006	E7	3	B	8"	GA	MAN	O	O	NA				NOTE 3
V007	E7	3	C	8"	CK	SA	O	O	FST	OP			
V009	C7	3	C	8"	CK	SA	C	C	NA				NOTE 3
V015	E5	3	C	6"	CK	SA	C	O	FST	CS		VRR-11	NOTE 5
V016	E5	3	B	6"	GA	MAN	O	O	NA				NOTE 3
V017	D7	3	B	3"	GA	MAN	O	O	NA				NOTE 3

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V018	D7	3	B	6"	GL	MAN	C	C	NA				NOTE 3
V021	C7	3	B	8"	GA	MAN	0	0	NA				NOTE 3
V022	C7	3	C	8"	CK	SA	C	0	FST	OP			
V024	C6	3	C	6"	CK	SA	C	0	FST	CS		VRR-11	NOTE 5
V025	C5	3	B	6"	GA	MAN	0	0	NA				NOTE 3
V026	B7	3	B	3"	GA	MAN	0	0	NA				NOTE 3
V027	A7	3	B	6"	GL	MAN	C	C	NA				NOTE 3
V047	F4	3	B	1"	GL	MAN	0	0	NA				NOTE 3

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V057	F7	3	B	1"	GL	MAN	O	O	NA				NOTE 3
V079	E1	2	C	6"	CK	SA	C	O	FST	CS		VRR-11	NOTE 5
V080	C1	2	C	6"	CK	SA	C	O	FST	CS		VRR-11	NOTE 5
V096	G7	3	C	4"	CK	SA	C	C	NA				NOTE 3
V115	F5	3	B	3/4"	GL	MAN	C	C	NA				NOTE 3
V119	F7	3	B	1"	GL	MAN	C	C	NA				NOTE 3
V122	F4	3	B	1"	GL	MAN	C	C	NA				NOTE 3
V137	E5	3	C	6"	CK	SA	C	O	FST	OP			

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V138	C6	3	C	6"	CK	SA	C	O	FST	OP			
V142	F3	3	B	1"	GL	MAN	O	O	NA				NOTE 3
V144	F3	3	B	1"	GL	MAN	C	C	NA				NOTE 3
HV30	B4	3	B	6"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
HV31	C4	3	B	6"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
HV32	E4	3	B	6"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
HV33	D4	3	B	6"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
HV54	F6	3	B	4"	GL	MO	O	O/C	FST VPI	OP RF			NOTE 6

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UV34	B3	2	A	6"	GA	MO	C	O	FST VPI AJLT	OP RF RF	10s		NOTES 6, 9
UV35	C3	2	A	6"	GA	MO	C	O	FST VPI AJLT	OP RF RF	10s		NOTES 6, 9
UV36	E3	2	A	6"	GA	MO	C	O	FST VPI AJLT	OP RF RF	10s		NOTES 6, 9
UV37	D3	2	A	6"	GA	MO	C	O	FST VPI AJLT	OP RF RF	10s		NOTES 6, 9

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V020	F15	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V022	F15	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V023	F15	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V024	F14	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V043	G12	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V393	G15	2	B	3/4"	GL	MAN	C	C	NA				NOTE 3
V429	D16	2	C	2"	CK	SA	O/C	O	FST	OP			NOTE 10
V431	G11	1	C	2"	CK	SA	C	O	FST	CS		VRR-12	NOTE 5

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V433	G9	1	C	2"	CK	SA	O/C	O	FST	RF		VRR-14	
V434	F9	1	B	2"	GA	MAN	O	O	NA				NOTE 3
V435	F10	1	C	2"	CK	SA	O/C	O	FST	RF		VRR-14	
V436	D15	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V613	G6	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V787	H1	1	C	1"	CK	SA	O	O/C	FST	RF		VRR-13	NOTE 5
V788	H1	1	B	1"	GL	MAN	O	O	NA				NOTE 3
V802	G2	1	C	1"	CK	SA	O	O/C	FST	RF		VRR-13	NOTE 5

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V803	G1	1	B	1"	GL	MAN	O	O	NA				NOTE 3
V807	F1	1	C	1"	CK	SA	O	O/C	FST	RF		VRR-13	NOTE 5
V808	F1	1	B	1"	GL	MAN	O	O	NA				NOTE 3
V812	E1	1	C	1"	CK	SA	O	O/C	FST	RF		VRR-13	NOTE 5
V813	E1	1	B	1"	GL	MAN	O	O	NA				NOTE 3
V816	G5	2	B	1½"	GL	MAN	O	O	NA				NOTE 3
V818	G4	2	B	1½"	GL	MAN	O	O	NA				NOTE 3
V819	F5	2	B	1½"	GL	MAN	O	O	NA				NOTE 3

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V821	F4	2	B	1½"	GL	MAN	C	C	NA				NOTE 3
V822	G4	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V823	F4	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V835	G3	2	AC	1½"	CK	SA	O	O/C	FST AJLT	CS RF		VRR-13	NOTE 5, 9
V836	G6	2	B	1½"	GL	MAN	O	O	NA				NOTE 3
V839	G7	2	B	1½"	GL	MAN	O	O	NA				NOTE 3
V844	H5	2	B	3/4"	GL	MAN	C	C	NA				NOTE 3
V854	E15	2	A	3/4"	GL	MAN	C	C	AJLT	RF			NOTE 8

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V866	H1	1	C	1:	CK	SA	O	O/C	FST	RF		VRR-13	NOTE 5
V867	G1	1	C	1"	CK	SA	O	O/C	FST	RF		VRR-13	NOTE 5
V868	F1	1	C	1"	CK	SA	O	O/C	FST	RF		VRR-13	NOTE 5
V869	E1	1	C	1"	CK	SA	O	O/C	FST	RF		VRR-13	NOTE 5
V993	D15	2	B	1"	GL	MAN	C	C	NA				NOTE 3
FV241	H2	2	B	1"	GL	AO	O	O	NA				NOTE 3
FV242	G2	2	B	1"	GL	AO	O	O	NA				NOTE 3
FV243	F2	2	B	1"	GL	AO	O	O	NA				NOTE 3

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
CHEMICAL AND VOLUME CONTROL	13-M-CHP-001	

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
FV244	E2	2	B	1"	GL	AO	O	O	NA				NOTE 3
HV203	H12	2	B	2"	GL	SOL	C	O/C	FST FT VPI	CS CS RF		VRR-12	NOTE 5
HV205	G12	1	B	2"	GL	SOL	C	O/C	FST FT VPI	CS CS RF		VRR-12	NOTE 5
HV255	G4	2	A	1½"	GL	MO	O	O/C	FST VPI AJLT	CS RF RF	5s	VRR-13	NOTES 6, 9
HV524	D16	2	A	2"	GL	MO	O	O/C	FST VPI AJLT	CS RF RF	5s	VRR-14	NOTES 5, 6, 9
UV231P	G8	2	B	1½"	GL	AO	O	O	NA				NOTE 3
UV515	H15	1	B	2"	GL	AO	O	C	FST FT VPI	OP OP RF			
UV516	H15	1	A	2"	GL	AO	O	C	FST FT VPI AJLT	OP OP RF RF	5s		NOTE 9

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: CHEMICAL AND VOLUME CONTROL | P & ID: 13-M-CHP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV523	F13	2	A	2"	GL	AO	O	C	FST FT VPI AJLT	OP OP RF RF	5s		NOTE 9
UV924	E14	2	A	½"	GA	SOL	C	C	AJLT	RF			NOTE 8
VM70	F15	2	AC	3"	CK	SA	O	O/C	FST AJLT	CS RF		VRR-14	NOTES 5,9
PDV240	G11	1	B	2"	GL	SOL	O	O/C	FST FT VPI	OP OP RF			
PSV865	H6	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: CHEMICAL AND VOLUME CONTROL

P & ID: 13-M-CHP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V118	C6	2	C	4"	CK	SA	O/C	O	FST	OP			
V124	E14	2	B	3"	DIA	MAN	C	C	NA				NOTE 3
V130	C12	3	B	1"	DIA	MAN	O	O	NA				NOTE 3
V134	B11	3	B	1"	DIA	MAN	O	O	NA				NOTE 3
V143	B14	3	B	3"	DIA	MAN	O	O	NA				NOTE 3
V144	B14	3	B	3"	DIA	MAN	O	O	NA				NOTE 3
V145	B14	3	B	3"	DIA	MAN	O	O	NA				NOTE 3
V152	B12	3	B	3"	DIA	MAN	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: CHEMICAL AND VOLUME CONTROL

P & ID: 13-M-CHP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V153	B12	3	B	3"	DIA	MAN	O	O	NA				NOTE 3
V154	B12	3	C	3"	CK	SA	C	NA	NA				NOTE 7
V155	B12	3	C	3"	CK	SA	C	NA	NA				NOTE 7
V161	B12	3	B	3"	DIA	MAN	O	O	NA				NOTE 3
V166	B11	3	B	3"	DIA	MAN	O	O	NA				NOTE 3
V174	B9	3	B	2"	DIA	MAN	C	C	NA				NOTE 3
V177	B6	2	C	3"	CK	SA	C	C	NA				NOTE 3
V179	C7	2	C	3"	CK	SA	C	C	NA				NOTE 3

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INSERVICE TESTING PROGRAM

ISI CLASS 1,2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: CHEMICAL AND VOLUME CONTROL

P & ID: 13-M-CHP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V184	D8	3	C	3"	CK	SA	C	C	NA				NOTE 3
V190	B5	2	C	3"	CK	SA	C	O	FST	CS		VRR-18	NOTE 5
PCV215	A11	3	B	3"	DIA	MAN	C	C	NA				NOTE 3
V305	B15	2	C	20"	CK	SA	C	O	PST FST	OP RF		VRR-1	
V306	C13	2	C	20"	CK	SA	C	O	PST FST	OP RF		VRR-1	
V316	B4	2	B	4"	DIA	MAN	O	O	NA				NOTE 3
V317	B3	2	B	3/4"	DIA	MAN	C	C	NA				NOTE 3
V319	D4	2	B	4"	DIA	MAN	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
CHEMICAL AND VOLUME CONTROL	13-M-CHP-002	

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V320	D3	2	B	3/4"	GL	MAN	C	C	NA				NOTE 3
V322	F4	2	B	4"	DIA	MAN	O	O	NA				NOTE 3
V323	F3	2	B	3/4"	GL	MAN	C	C	NA				NOTE 3
V328	B2	2	C	2"	CK	SA	O/C	C	FST	OP			
V329	B2	2	B	3/4"	GL	MAN	C	C	NA				NOTE 3
V331	D2	2	C	2"	CK	SA	O/C	C	FST	OP			
V332	D2	2	B	3/4"	GL	MAN	C	C	NA				NOTE 3
V334	G2	2	C	2"	CK	SA	O/[illegible]	C	FST	OP			

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: CHEMICAL AND VOLUME CONTROL | P & ID: 13-M-CHP-002 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V335	G1	2	B	2"	GA	MAN	O	O	NA				NOTE 3
V336	F2	2	B	3/4"	GL	MAN	C	C	NA				NOTE 3
V337	D1	2	B	2"	GA	MAN	O	O	NA				NOTE 3
V339	B1	2	B	2"	GA	MAN	O	O	NA				NOTE 3
V440	C2	2	C	2"	CK	SA	C	C	NA				NOTE 3
V647	E14	2	C	3"	CK	SA	C	C	NA				NOTE 3
V649	D10	3	B	3"	DIA	MAN	C	C	NA				NOTE 3
V653	B10	3	B	3"	DIA	MAN	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: CHEMICAL AND VOLUME CONTROL | P & ID: 13-M-CHP-002 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V668	C8	3	C	2"	CK	SA	C	NA	NA				NOTE 7
V753	A12	3	B	3"	DIA	MAN	C	C	NA				NOTE 3
V755	C4	2	B	3"	DIA	MAN	C	C	NA				NOTE 3
V756	E4	2	B	3"	DIA	MAN	C	C	NA				NOTE 3
V757	F4	2	B	3"	DIA	MAN	C	C	NA				NOTE 3
V796	C2	2	B	2"	GA	MAN	C	C	NA				NOTE 3
V797	E2	2	B	2"	GA	MAN	C	C	NA				NOTE 3
V798	F2	2	B	2"	GA	MAN	C	C	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: CHEMICAL AND VOLUME CONTROL | P & ID: 13-M-CHP-002 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V946	C12	3	B	1"	GL	MAN	C	C	NA				NOTE 3
VM43	F15	2	B	1"	GL	MAN	O	O	NA				NOTE 3
VX47	C15	2	B	3"	GL	MAN	C	C	NA				NOTE 3
FV210Y	B9	3	B	1½"	PL	AO	O	NA	NA				NOTE 7
HV507	H15	2	B	3/4"	GL	AO	O	O	NA				NOTE 3
HV530	B15	2	B	20"	GA	MO	O	O	NA				NOTE 3
HV531	C14	2	B	20"	GA	MO	O	O	NA				NOTE 3
HV532	D15	2	B	3"	GL	AO	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
CHEMICAL AND VOLUME CONTROL	13-M-CHP-002	

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HV536	B14	3	B	3"	GL	MO	C	O	FST	OP			
UV501	C6	2	B	4"	GA	MO	O	C	FST	OP			
UV505	F14	2	A	1"	GL	AO	O	C	FST FT VPI AJLT	CS CS RF RF	5s	VRR-18	NOTE 9
UV506	F15	2	A	1"	GL	AO	O	C	FST FT VPI AJLT	CS CS RF RF	5s	VRR-18	NOTE 9
UV510	D12	3	B	3"	DIA	AO	C	C					NOTE 3
UV512	D7	3	B	3"	DIA	AO	C	NA					NOTE 7
UV514	B10	3	B	3"	GL	MO	C	NA					NOTE 7
UV527	C7	3	B	3"	GA	AO	[illegible]	NA					NOTE [illegible]

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: CHEMICAL AND VOLUME CONTROL

P & ID: 13-M-CHP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV199	H15	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV315	C3	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV318	F3	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV321	H3	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV324	E2	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV325	G2	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV326	C2	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: CHEMICAL AND VOLUME CONTROL | P & ID: 13-M-CHP-003 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V494	E14	2	A,C	1½"	CK	SA	O/C	C	FST AJLT	OP RF			NOTES 1,10
UV560	B15	2	A	3"	GA	AO	O/C	C	FST FT VPI AJLT	OP OP RF RF	5s		NOTES 1, 10
UV561	B15	2	A	3"	GA	AO	O/C	C	FST FT VPI AJLT	OP OP RF RF	5s		NOTES 1,10
UV580	E14	2	A	1½"	GA	AO	O/C	C	FST FT VPI AJLT	OP OP RF RF	5s		NOTES 1, 10
UV715	E13	2	A	½"	GL	SO	O/C	C	FST FT VPI AJLT	OP OP RF RF	5s		NOTES 1,10

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ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: CONTAINMENT PURGE

P & ID: 13-M-CPP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV2A	D6	2	A	42"	BTF	MO	C	C	AJLT	RF			NOTES 1,8
UV2B	E3	2	A	42"	BTF	MO	C	C	AJLT	RF			NOTES 1,8
UV3A	D5	2	A	42"	BTF	MO	C	C	AJLT	RF			NOTES 1,8
UV3B	E2	2	A	42"	BTF	MO	C	C	AJLT	RF			NOTES 1, 8
UV4A	D6	2	A	8"	BTF	MO	C	C	AJLT	RF			NOTES 1, 8
UV4B	D3	2	A	8"	BTF	MO	C	C	AJLT	RF			NOTES 1,8
UV5A	D5	2	A	8"	BTF	MO	C	C	AJLT	RF			NOTES 1, 8
UV5B	D2	2	A	8"	BTF	MO	C	C	AJLT	RF			NOTES 1,8

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: CONDENSATE STORAGE AND TRANSFER

P & ID: 13-M-CTP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V009	D7	3	B	6"	GA	MAN	C	C	NA				NOTE 3
V014	D4	3	B	8"	GA	MAN	O	O	NA				NOTE 3
V015	D4	3	B	8"	GA	MAN	O	O	NA				NOTE 3
V016	C4	3	C	3"	CK	SA	C	O	FST	OP			
V017	C4	3	B	3"	GA	MAN	O	O	NA				NOTE 3
V018	C3	3	B	3"	GA	MAN	C	C	NA				NOTE 3
V019	B3	3	B	3"	GA	MAN	C	C	NA				NOTE 3
V020	A4	3	C	3"	CK	SA	C	O	FST	OP			

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
CONDENSATE STORAGE AND TRANSFER	13-M-CTP-001	

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V021	A4	3	B	3"	GA	MAN	O	O	NA				NOTE 3
V022	A6	3	B	3"	GA	MAN	O	O	NA				NOTE 3
V023	C6	3	B	3"	GA	MAN	O	O	NA				NOTE 3
V028	C3	3	B	1"	GA	MAN	O	O	NA				NOTE 3
V029	B4	3	B	1"	GA	MAN	O	O	NA				NOTE 3
V033	C4	3	B	3"	GL	MAN	C	C	NA				NOTE 3
V037	C4	3	C	3"	CK	SA	C	C	NA				NOTE 3
V038	B4	3	C	3"	CK	SA	C	C	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: CONDENSATE STORAGE AND TRANSFER

P & ID: 13-M-CTP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V042	B4	3	B	3"	GL	MAN	C	C	NA				NOTE 3
V055	D7	3	B	6"	GA	MAN	C	C	NA				NOTE 3
(AF) V077	F3	3	B	6"	GA	MAN	O	O	NA				NOTE 3
(AF) V078	F3	3	B	6"	GA	MAN	O	O	NA				NOTE 3
HV4	D3	3	B	10"	BTF	MO	C	C	NA				NOTE 3
PSV8	G6	3	C	10"	PSV	SA	C	O	PSVT				NOTE. 2
PSV23	G5	3	C	10"	PSV	SA	C	O	PSVT				NOTE 2

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: DIESEL FUEL OIL AND TRANSFER

P & ID: 13-M-DFP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V003	H6	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V007	G7	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V008	G7	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V009	G8	3	B	2"	GA	MAN	C	C	NA				NOTE 3
V012	D6	3	C	2"	CK	SA	C	O	FST	OP			
V013	D6	3	B	2"	GL	MAN	O	O	NA				NOTE 3
V014	D6	3	B	2"	GA	MAN	C	C	NA				NOTE 3
V015	D5	3	B	2"	GA	MAN	C	C	NA				NOTE 3

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ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
DIESEL FUEL OIL AND TRANSFER	13-M-DFP-001	

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V018	D2	3	B	2"	GL	MAN	O	O	NA				NOTE 3
V019	D2	3	C	2"	CK	SA	C	O	FST	OP			
V020	D2	3	B	2"	GA	MAN	C	C	NA				NOTE 3
V021	D2	3	B	2"	GA	MAN	C	C	NA				NOTE 3
V028	G4	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V029	G5	3	B	2"	GA	MAN	C	C	NA				NOTE 3
V030	G4	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V032	H3	3	B	2"	GA	MAN	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: DIESEL FUEL OIL AND TRANSFER | P & ID: 13-M-DFP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V078	C5	3	B	2½"	GA	MAN	O	O	NA				NOTE 3
V079	C1	3	B	2½"	GA	MAN	O	O	NA				NOTE 3
V081	G8	3	B	2"	GA	MAN	C	O	FST	OP			
V082	G8	3	B	2"	GA	MAN	C	O	FST	OP			
V085	G4	3	B	2"	GA	MAN	C	O	FST	OP			
V086	G4	3	B	2"	GA	MAN	C	O	FST	OP			

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: DIESEL GENERATOR | P & ID: 13-M-DGP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V001	F6	3	B	1"	GA	MAN	O	O	NA				NOTE 3
V003	F7	3	C	2"	CK	SA	C	C	NA				NOTE 3
V004	F7	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V006	E7	3	C	2"	CK	SA	C	O	FST	OP			
V007	F8	3	B	2"	GA	MAN	C	C	NA				NOTE 3
V010	F3	3	B	1"	GA	MAN	O	O	NA				NOTE 3
V012	F3	3	C	2"	CK	SA	C	C	NA				NOTE 3
V013	F3	3	B	2"	GA	SA	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
DIESEL GENERATOR	13-M-DGP-001	

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V015	E3	3	C	2"	CK	SA	C	O	FST	OP			
V016	F4	3	B	2"	GA	MAN	C	C	NA				NOTE 3
V024	E7	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V025	E4	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V046	F7	3	B	1½"	GA	MAN	C	C	NA				NOTE 3
V047	F4	3	B	1½"	GA	MAN	C	C	NA				NOTE 3
V048	F7	3	B	1½"	GA	MAN	C	C	NA				NOTE 3
V049	F3	3	B	1½"	GA	MAN	C	C	NA				NOTE 3

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ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: DIESEL GENERATOR | P & ID: 13-M-DGP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V054	F8	3	B	1½"	GA	MAN	C	C	NA				NOTE 3
V055	F4	3	B	1½"	GA	MAN	C	C	NA				NOTE 3
V063	E6	3	B	1"	GL	MAN	C	C	NA				NOTE 3
V064	E2	3	B	1"	GL	MAN	C	C	NA				NOTE 3
V066	B7	3	C	1"	CK	SA	C	C	NA				NOTE 3
V067	B7	3	C	1"	CK	SA	C	C	NA				NOTE 3
V068	B3	3	C	1"	CK	SA	C	C	NA				NOTE 3
V069	B3	3	C	1"	CK	SA	C	C	NA				NOTE 3

Arizona
Public
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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: DIESEL GENERATOR

P & ID: 13-M-DGP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V384	B7	3	B	1"	GA	MAN	O	O	NA				NOTE 3
V394	B7	3	B	1"	GA	MAN	O	O	NA				NOTE 3
V484	B3	3	B	1"	GA	MAN	O	O	NA				NOTE 3
V494	B3	3	B	1"	GA	MAN	O	O	NA				NOTE 3
HCV9	B6	3	B	3"	BTF	MAN	O	O	NA				NOTE 3
HCV10	B2	3	B	3"	BTF	MAN	O	O	NA				NOTE 3
HCV11	B6	3	B	3"	BTF	MAN	O	O	NA				NOTE 3
HCV12	B2	3	B	3"	BTF	MAN	O	O	NA				NOTE 3

Arizona Public Service

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
DIESEL GENERATOR	13-M-DGP-001	34 of 139

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV1	F6	3	B	2"	GA	SOL	C	O	FST FT	OP OP			
UV2	F2	3	B	2"	GA	SOL	C	O	FST FT	OP OP			
PSV5	C6	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV6	C3	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV7	B6	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV8	B3	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2

INSERVICE TESTING PROGRAM

Arizona Public Service

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM DIESEL GENERATOR (STARTING AIR)

P & ID: M018-102

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V396	G4	3	C	3"	CK	SA	C	O					NOTE 11
V397	G5	3	C	3"	CK	SA	C	O					NOTE 11
V496	G4	3	C	3"	CK	SA	C	O					NOTE 11
V497	G5	3	C	3"	CK	SA	C	O					NOTE 11
V521	F3	3	B	1"	GL	MAN	C	C	NA				NOTE 3
V621	F3	3	B	1"	GL	MAN	C	C	NA				NOTE 3
FV13	G5	3	B	3"	GA	AO	C	C					NOTE 11
FV14	G5	3	B	3"	GA	AO	C	C					NOTE 11

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
DIESEL GENERATOR (STARTING AIR)	M018-102	36 of 139.

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
FV15	G4	3	B	3"	GA	AO	C	C	NA				NOTE 3
FV16	G4	3	B	3"	GA	AO	C	C	NA				NOTE 3

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM DIESEL GENERATOR (JACKET WATER COOLING) | P & ID M018-106 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V317	D3	3	C	6"	CK	SA	C	O					NOTE 11
V318	E6	3	C	3"	CK	SA	O/C	O					NOTE 11
V399	F5	3	B	3"	BTF	MAN	O	O					NOTE 3
V417	D3	3	C	6"	CK	SA	C	O					NOTE 11
V418	E6	3	C	3"	CK	SA	O/C	O					NOTE 11
V499	F5	3	B	3"	BTF	MAN	O	O					NOTE 3
TCV269	E3	3	B	6"	TW	SA	O/C	O/C					NOTE 11
TCV270	E3	3	B	6"	TW	SA	O/C	O/C					NOTE 11

Arizona Public Service

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: DIESEL GENERATOR (JACKET WATER COOLING)

P & ID: M018-106

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
TCV271	B3	3	B	1¼"	GA	AO	O/C	O/C					NOTE 11
TCV272	B3	3	B	1¼"	GA	AO	O/C	O/C					NOTE 11
TCV273	C3	3	B	1¼"	GA	AO	O/C	O/C					NOTE 11
TCV274	C3	3	B	1¼"	GA	AO	O/C	O/C					NOTE 11

Arizona Public Service

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: DIESEL GENERATOR (FUEL OIL)

P & ID: M018-103

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V332	D5	3	C	1"	CK	SA	O/C	O					NOTE 11
V335	D4	3	B	1"	TW	MAN	O/C	O/C					NOTE 11
V337	E6	3	B	1"	TW	MAN	O/C	O/C					NOTE 11
V432	D5	3	C	1"	CK	SA	O/C	O					NOTE 11
V435	D4	3	B	1"	TW	MAN	O/C	O/C					NOTE 11
V437	E6	3	B	1"	TW	MAN	O/C	O/C					NOTE 11
V520	D3	3	C	1"	CK	SA	O/C	O					NOTE 11
V620	D3	3	C	1"	CK	SA	O/C	O					NOTE 11

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: DIESEL GENERATOR (FUEL OIL)

P & ID: M018-103

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV65	D5	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV66	D5	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: DIESEL GENERATOR (LUBE OIL)

P & ID: M018-105

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V339	C3	3	C	1½"	CK	SA	O/C	O					NOTE 11
V355	D5	3	C	6"	CK	SA	O/C	O					NOTE 11
V356	F4	3	B	6"	BA	MAN	O/C	O/C					NOTE 11
V357	G4	3	B	6"	BA	MAN	O/C	O/C					NOTE 11
V358	F4	3	B	6"	BA	MAN	O/C	O/C					NOTE 11
V359	G4	3	B	6"	BA	MAN	O/C	O/C					NOTE 11
V362	E5	3	B	3"	BA	MAN	O	O					NOTE 3
V363	G5	3	B	3"	BA	MAN	O	O					NOTE 3

Arizona Public Service

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
DIESEL GENERATOR (LUBE OIL)	M018-105	42 of 139

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V364	G5	3	C	3"	CK	SA	O/C	O					NOTE 11
V369	G4	3	B	6"	BA	MAN	O	O					NOTE 3
V370	H4	3	B	6"	BA	MAN	O	O					NOTE 3
V371	H4	3	B	6"	BA	MAN	C	O					NOTE 3
V380	C3	3	B	1½"	TW	MAN	O/C	O/C					NOTE 11
V439	C3	3	C	1½"	CK	SA	O/C	O					NOTE 11
V455	D5	3	C	6"	CK	SA	O/C	O					NOTE 11
V456	F4	3	B	6"	BA	MAN	O/C	O/C					NOTE 11

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
DIESEL GENERATOR (LUBE OIL)	M018-105	

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V457	G4	3	B	6"	BA	MAN	O/C	O/C					NOTE 11
V458	F4	3	B	6"	BA	MAN	O/C	O/C					NOTE 11
V459	G4	3	B	6"	BA	MAN	O/C	O/C					NOTE 11
V462	E5	3	B	3"	BA	MAN	O	O					NOTE 3
V463	G5	3	B	3"	BA	MAN	O	O					NOTE 3
V464	G5	3	C	3"	CK	SA	O/C	O					NOTE 11
V469	G4	3	B	6"	BA	MAN	O	O					NOTE 3
V470	H4	3	B	6"	BA	MAN	O	O					NOTE 3

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: DIESEL GENERATOR (LUBE OIL)

P & ID: M018-105

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V471	H4	3	B	6"	BA	MAN	C	C					NOTE 3
V480	C3	3	B	1½"	TW	MAN	O/C	O/C					NOTE 11
TCV97	H5	3	B	6"	TW	SA	O	O					NOTE 11
TCV98	H5	3	B	6"	TW	SA	O	O					NOTE 11
PCV67	C2	3	B	1½"	PCV	SA	O	O					NOTE 11
PCV68	C2	3	B	1½"	PCV	SA	O	O					NOTE 11
PSV81	D5	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV82	D5	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: DIESEL GENERATOR (LUBE OIL)

P & ID: M018-105

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV85	D4	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV86	D4	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
DEMINERALIZED WATER	13-M-DWP-002	46 of 139

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V061	C4	2	A	2"	GL	MAN	C	C	AJLT	RF			NOTES 1,8
V062	C3	2	A	2"	GL	MAN	C	C	AJLT	RF			NOTES 1, 8

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: ESSENTIAL CHILLED WATER

P & ID: 13-M-ECP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V001	F7	3	B	1½"	GA	MAN	O	O	NA				NOTE 3
V002	B8	3	B	6"	GA	MAN	O	O	NA				NOTE 3
V004	F6	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V005	H7	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V006	H6	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V007	H5	3	B	1½"	GA	MAN	O	O	NA				NOTE 3
V008	E7	3	B	4"	GA	MAN	O	O	NA				NOTE 3
V009	E5	3	B	2"	GA	MAN	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM ESSENTIAL CHILLED WATER | P & ID 13-M-ECP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V011	B5	3	B	6"	GA	MAN	O	O	NA				NOTE 3
V013	F7	3	B	1½"	GA	MAN	O	O	NA				NOTE 3
V015	F6	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V016	H7	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V017	H6	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V018	H5	3	B	1½"	GA	MAN	O	O	NA				NOTE 3
V019	E7	3	B	4"	GA	MAN	O	O	NA				NOTE 3
V020	E5	3	B	2"	GA	MAN	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM ESSENTIAL CHILLED WATER | P & ID 13-M-ECP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V031	C7	3	B	1"	GA	MAN	O	O	NA				NOTE 3
V032	C3	3	B	1"	GA	MAN	O	O	NA				NOTE 3
V038	D8	3	C	1½"	CK	SA	C	C	NA				NOTE 3
V039	D7	3	B	1½"	GL	MAN	O	O	NA				NOTE 3
V040	D7	3	B	1½"	GL	MAN	O	O	NA				NOTE 3
V041	C8	3	C	1½"	CK	SA	C	O	FST	OP			
V043	C7	3	C	1"	CK	SA	C	C	NA				NOTE 3
V045	F3	3	B	2½"	GA	MAN	O	O	NA				NOTE 3

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: ESSENTIAL CHILLED WATER

P & ID: 13-M-ECP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V046	F3	3	B	2½"	GA	MAN	O	O	NA				NOTE 3
V047	F2	3	B	1½"	GA	MAN	O	O	NA				NOTE 3
V048	H3	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V049	H3	3	B	1½"	GA	MAN	O	O	NA				NOTE 3
V050	F2	3	B	1½"	GA	MAN	O	O	NA				NOTE 3
V051	H2	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V052	H2	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V053	H1	3	B	1½"	GA	MAN	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: ESSENTIAL CHILLED WATER

P & ID: 13-M-ECP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V054	H1	3	B	1½"	GA	MAN	O	O	NA				NOTE 3
V055	F1	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V056	F1	3	B	2"	GA	MAN	O	O	NA				NOTE 3
(CT)V056	C8	3	B	1½"	GL	MAN	O	O	NA				NOTE 3
V057	E3	3	B	4"	GA	MAN	O	O	NA				NOTE 3
(CT) V057	C4	3	B	1½"	GL	MAN	O	O	NA				NOTE 3
V058	E3	3	B	4"	GA	MAN	O	O	NA				NOTE 3
V060	D4	3	C	1½"	CK	SA	C	C	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V061	D3	3	B	1½"	GL	MAN	O	O	NA				NOTE 3
V062	D3	3	B	1½"	GL	MAN	O	O	NA				NOTE 3
V064	C3	3	C	1"	CK	SA	C	C	NA				NOTE 3
V065	B4	3	B	6"	GA	MAN	O	O	NA				NOTE 3
V068	B1	3	B	6"	GA	MAN	O	O	NA				NOTE 3
V070	E1	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V071	E1	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V072	C4	3	C	1½"	CK	SA	C	O	FST	OP			

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
ESSENTIAL CHILLED WATER	13-M-ECP-001	53 Of 139

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V098	B7	3	B	1"	GA	MAN	C	C	NA				NOTE 3
V099	B6	3	B	1"	GA	MAN	C	C	NA				NOTE 3
V101	B3	3	B	1"	GA	MAN	C	C	NA				NOTE 3
V102	B2	3	B	1"	GA	MAN	C	C	NA				NOTE 3
V201	F5	3	B	3"	GA	MAN	O	O	NA				NOTE 3
V202	F5	3	B	3"	GA	MAN	O	O	NA				NOTE 3
V209	E5	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V210	E6	3	B	2"	GA	MAN	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: ESSENTIAL CHILLED WATER | P & ID: 13-M-ECP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V213	E1	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V214	E2	3	B	2"	GA	MAN	O	O	NA				NOTE 3
V220	B6	3	B	1"	GL	MAN	O	O	NA				NOTE 3
V222	B2	3	B	1"	GL	MAN	O	O	NA				NOTE 3
V228	E1	3	B	2"	GL	MAN	O	O	NA				NOTE 3
V229	E2	3	B	2"	GL	MAN	O	O	NA				NOTE 3
V230	E5	3	B	2"	GL	MAN	O	O	NA				NOTE 3
V231	E5	3	B	2"	GL	MAN	O	O	NA				NOTE 3

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: ESSENTIAL CHILLED WATER

P & ID: 13-M-ECP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
LV15	D7	3	B	1½"	GL	SOL	O/C	C	FST FT	OP OP			
LV16	D3	3	B	1½"	GL	SOL	O/C	C	FST FST	OP OP			
TV29	D7	3	B	2½"	TW	HY	O/C	O	FST	OP			
TV30	D3	3	B	2½"	TW	HY	O/C	O	FST	OP			
HCV35	D5	3	B	1"	TW	MAN	O	O	NA				NOTE 3
HCV36	D1	3	B	1"	TW	MAN	O	O	NA				NOTE 3
HCV41	F7	3	B	1"	TW	MAN	O	O	NA				NOTE 3
HCV42	F2	3	B	1"	TW	MAN	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
ESSENTIAL CHILLED WATER	13-M-ECP-001	

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HCV48	F3	3	B	1½"	TW	MAN	O	O	NA				NOTE 3
HCV53	F6	3	B	1"	TW	MAN	O	O	NA				NOTE 3
HCV54	F1	3	B	1"	TW	MAN	O	O	NA				NOTE 3
HCV59	H5	3	B	1"	TW	MAN	O	O	NA				NOTE 3
HCV60	G1	3	B	1"	TW	MAN	O	O	NA				NOTE 3
HCV65	G6	3	B	1½"	TW	MAN	O	O	NA				NOTE 3
HCV66	G2	3	B	1½"	TW	MAN	O	O	NA				NOTE 3
HCV71	G7	3	B	1"	TW	MAN	O	O	NA				NOTE 3

Arizona Public Service

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: ESSENTIAL CHILLED WATER

P & ID: 13-M-ECP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HCV72	G3	3	B	1"	TW	MAN	O	O	NA				NOTE 3
HCV115	F5	3	B	1½"	TW	MAN	O	O	NA				NOTE 3
HCV118	D2	3	B	1½"	TW	MAN	O	O	NA				NOTE 3
HCV119	D6	3	B	1½"	TW	MAN	O	O	NA				NOTE 3
PSV75	D7	3	C	1½"	PSV	SA	C	O	PSVT				NOTE 2
PSV76	D3	3	C	1½"	PSV	SA	C	O	PSVT				NOTE 2
PSV95	E5	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV96	E1	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2

Arizona Public Service

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV-97	E7	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV98	E3	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV99	F7	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV100	F2	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV101	F6	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV102	F1	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV103	H7	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV104	H4	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: ESSENTIAL CHILLED WATER

P & ID: 13-M-ECP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV105	H6	3	C	1"	PSV	SA	C	O	PVST				NOTE 2
PSV106	H2	3	C	1"	PSV	SA	C	O	PVST				NOTE 2
PSV107	H5	3	C	1"	PSV	SA	C	O	PVST				NOTE 2
PSV108	H1	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV109	F4	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV117	F5	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV120	E2	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV121	E6	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2

Arizona Public Service

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V005	F5	3	B	1"	GL	MAN	C	C	NA				NOTE 3
V021	C6	3	B	6"	GA	MAN	O	O	NA				NOTE 3
V022	C7	3	B	6"	GL	MAN	O	O	NA				NOTE 3
V029	H3	3	C	2"	CK	SA	C	C	NA				NOTE 3
V031	F2	3	B	1"	GL	MAN	C	C	NA				NOTE 3
V039	F1	3	B	1"	GL	MAN	C	C	NA				NOTE 3
V043	C1	3	B	6"	GA	MAN	O	O	NA				NOTE 3
V044	C3	3	B	6"	GL	MAN	O	O	NA				NOTE 3

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: ESSENTIAL COOLING WATER | P & ID: 13-M-EWP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V051	F6	3	B	1"	GL	MAN	C	C	NA				NOTE 3
V079	G7	3	C	2"	CK	SA	C	O	FST	OP			
V080	G3	3	C	2"	CK	SA	C	O	FST	OP			
V095	G6	3	B	1"	GL	MAN	O	O	NA				NOTE 3
V096	G2	3	B	1"	GL	MAN	O	O	NA				NOTE 3
V103	H7	3	C	2"	CK	SA	C	C	NA				NOTE 3
V104	H7	3	B	2"	GL	MAN	O	O	NA				NOTE 3
V105	H6	3	B	2"	GL	MAN	O	O	NA				NOTE 3

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V108	H3	3	B	2"	GL	MAN	O	O	NA				NOTE 3
V109	H3	3	B	2"	GL	MAN	O	O	NA				NOTE 3
V115	H7	3	B	2"	GL	MAN	C	C	NA				NOTE 3
V116	H3	3	B	2"	GL	MAN	C	C	NA				NOTE 3
V150	G7	3	B	2"	GL	MAN	O	O	NA				NOTE 3
V152	G4	3	B	2"	GL	MAN	O	O	NA				NOTE 3
LV91	H7	3	B	2"	GL	SOL	C	O/C	FST FT	OP OP			
LV92	H3	3	B	2"	GL	SOL	C	O/C	FST FT	OP OP			

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM ESSENTIAL COOLING WATER | P & ID 13-M-EWP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV65	C8	3	B	14"	BTF	MO	C	O/C	FST VPI	RF RF		VRR-2	NOTE 6
UV145	C4	3	B	14"	BTF	MO	C	O/C	FST VPI	RF RF		VRR-2	NOTE 6
HCV5	D6	3	B	20"	BTF	MAN	O	O	NA				NOTE 3
HCV6	D2	3	B	20"	BTF	MAN	O	O	NA				NOTE 3
HCV41	B6	3	B	20"	BTF	MAN	O	O	NA				NOTE 3
HCV42	B2	3	B	20"	BTF	MAN	O	O	NA				NOTE 3
HCV53	B7	3	B	20"	BTF	MAN	O	O	NA				NOTE 3
HCV54	B3	3	B	20"	BTF	MAN	O	O	NA				NOTE 3

Arizona Public Service

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: ESSENTIAL COOLING WATER

P & ID: 13-M-EWP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HCV66	C6	3	B	14"	BTF	MAN	C	C	NA				NOTE 3
HCV67	D7	3	B	10"	BTF	MAN	C	O	FST	OP			
HCV68	D8	3	B	10"	BTF	MAN	C	O	FST	OP			
HCV71	E7	3	B	30"	BTF	MAN	O	O	NA				NOTE 3
HCV72	E3	3	B	30"	BTF	MAN	O	O	NA				NOTE 3
HCV133	C6	3	B	10"	BTF	MAN	C	O	FST	OP			
HCV134	C2	3	B	10"	BTF	MAN	C	O	FST	OP			
HCV135	D5	3	B	20"	BTF	MAN	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: ESSENTIAL COOLING WATER | P & ID: 13-M-EWP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HCV136	D1	3	B	20"	BTF	MAN	O	O	NA				NOTE 3
HCV146	C2	3	B	14"	BTF	MAN	C	C	NA				NOTE 3
PSV47	B6	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV48	B2	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV61	D7	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV62	D3	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV79	E7	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV80	E3	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: ESSENTIAL COOLING WATER

P & ID: 13-M-EWP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV103	H6	3	C	2"	PSV	SA	C	O	PSVT				NOTE 2
PSV104	H2	3	C	2"	PSV	SA	C	O	PSVT				NOTE 2
PSV105	G5	3	C	2"	PSV	SA	C	O	PSVT				NOTE 2
PSV106	G2	3	C	2"	PSV	SA	C	O	PSVT				NOTE 2

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V089	E3	2	A	6"	GA	MAN	C	C	AJLT	RF			NOTE 1
V090	F4	2	AC	6"	CK	SA	C	C	AJLT	RF			NOTE 1

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: SERVICE GAS SYSTEM | P & ID: 13-M-GAP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V011	D6	2	AC	1"	CK	SA	O/C	C	AJLT	RF			NOTE 1
V015	F2	2	AC	1"	CK	SA	O/C	C	AJLT	RF			NOTE 1
V026	C2	3	C	1"	CK	SA	O/C	NA	NA				NOTE 7
V027	C2	3	C	1"	CK	SA	O/C	NA	NA				NOTE 7
UV1	D6	2	A	1"	GA	AO	C	C	AJLT	RF			NOTE 1
UV2	F6	2	A	1"	GA	AO	O	C	FST FT VPI AJLT	OP OP RF RF	10s		NOTE 1

Arizona Public Service

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV1	G7	2	A	1"	GL	SOL	O	C	FST VPI AJLT	OP RF RF	12s		NOTE 1
UV2	G7	2	A	1"	GL	SOL	O	C	FST VPI AJLT	OP RF RF	10s		NOTE 1

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: HVAC CONTAINMENT BUILDING | P & ID: 13-M-HCP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV44	E3	2	A	1"	GA	SOL	O	C	FST FT VPI AJLT	OP OP RF RF	1s		NOTE 9
UV45	E2	2	A	1"	GA	SOL	O	C	FST FT VPI AJLT	OP OP RF RF	1s		NOTE 9
UV46	D2	2	A	1"	GA	SOL	O	C	FST FT VPI AJLT	OP OP RF RF	1s		NOTE 9
UV47	D3	2	A	1"	GA	SOL	O	C	FST FT VPI AJLT	OP OP RF RF	1s		NOTE 9

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: CONTAINMENT HYDROGEN CONTROL

P & ID: 13-M-HPP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V001	E4	2	B	2"	GL	MAN	C	C	NA				NOTE 3
V002	F6	2	AC	2"	CK	SA	C	C	AJLT	RF			NOTE 8
V003	D4	2	B	2"	GL	MAN	C	C	NA				NOTE 3
V004	C6	2	AC	2"	CK	SA	C	C	AJLT	RF			NOTE 8
V005	E6	2	B	2"	GL	MAN	C	C	NA				NOTE 3
V006	D6	2	B	2"	GL	MAN	C	C	NA				NOTE 3
HV7A	F5	2	A	1"	GL	SOL	C	C	AJLT	RF			NOTE 8
HV7B	G6	2	A	1"	GL	SOL	C	C	AJLT	RF			NOTE 8

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HV8A	C5	2	A	1"	GL	SOL	C	C	AJLT	RF			NOTE 8
HV8B	B6	2	A	1"	GL	SOL	C	C	AJLT	RF			NOTE 8
UV1	E6	2	A	2"	GL	MO	C	C	AJLT	RF			NOTE 8
UV2	D6	2	A	2"	GL	MO	C	C	AJLT	RF			NOTE 8
UV3	E6	2	A	2"	GL	MO	C	C	AJLT	RF			NOTE 8
UV4	D6	2	A	2"	GL	MO	C	C	AJLT	RF			NOTE 8
UV5	F6	2	A	2"	GL	MO	C	C	AJLT	RF			NOTE 8
UV6	C6	2	A	2"	GL	MO	C	C	AJLT	RF			NOTE 8

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: CONTAINMENT HYDROGEN CONTROL

P & ID: 13-M-HPP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV23	G6	2	A	½"	GL	SOL	C	C	AJLT	RF			NOTE 8

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: INSTRUMENT AND SERVICE AIR

P & ID: 13-M-IAP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V072	G7	2	A	3"	GL	MAN	C	C	AJLT	RF			NOTES 1,8
V073	H7	2	AC	3"	CK	SA	C	C	AJLT	RF			NOTES 1,8

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INSTRUMENT AND SERVICE AIR	13-M-IAP-003	75 of 139

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V021	G2	2	AC	2"	CK	SA	O	C	AJLT	RF			NOTE 1
UV2	G3	2	A	2"	GA	AO	O	C	FST VPI FT AJLT	OP RF OP RF	10s		NOTE 1

Arizona Public Service

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: NUCLEAR COOLING WATER | P & ID: 13-M-NCP-002 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HCV244	B4	3	B	10"	BTF	MAN	O	C	FST	OP			
HCV245	A4	3	B	10"	BTF	MAN	O	C	FST	OP			
HCV258	C4	3	B	10"	BTF	MAN	O	C	FST	OP			
HCV259	B4	3	B	10"	BTF	MAN	O	C	FST	OP			
HCV262	F2	3	B	10"	BTF	MAN	O	O	NA				NOTE 3
HCV263	D2	3	B	10"	BTF	MAN	O	O	NA				NOTE 3
HCV264	E2	3	B	10"	BTF	MAN	O	O	NA				NOTE 3
HCV265	B2	3	B	10"	BTF	MAN	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: NUCLEAR COOLING WATER

P & ID: 13-M-NCP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV250	F2	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV251	D2	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: NUCLEAR COOLING WATER | P & ID: 13-M-NCP-003 | PAGE:

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V118	E7	2	AC	10"	CK	SA	O	C	FST AJLT	CS RF		VRR-15	NOTES 1,5
UV401	E7	2	A	10"	BTF	MO	O	C	FST VPI AJLT	CS RF RF	10s	VRR-15	NOTES 1,5,6
UV402	E7	2	A	10"	BTF	MO	O	C	FST VPI AJLT	CS RF RF	10s	VRR-15	NOTES 1,5,6
UV403	E7	2	A	10"	BTF	MO	O	C	FST VPI AJLT	CS RF RF	10s	VRR-15	NOTES 1,5,6

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1,2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: FUEL POOL COOLING AND CLEANUP | P & ID: 13-M-PCP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V011	D14	3	B	10"	DIA	MAN	O	O	NA				NOTE 3
V013	D14	3	C	8"	CK	SA	O/C	O	FST	OP			
V014	D13	3	B	8"	DIA	MAN	O	O	NA				NOTE 3
V015	D12	3	B	8"	DIA	MAN	O	O	NA				NOTE 3
V017	C13	3	C	8"	CK	SA	O/C	O	FST	OP			
V018	C13	3	B	8"	DIA	MAN	O	O	NA				NOTE 3
V019	C12	3	B	8"	DIA	MAN	O	O	NA				NOTE 3
V026	C11	3	B	8"	DIA	MAN	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V027	D11	3	B	8"	DIA	MAN	O	O	NA				NOTE 3
V028	C13	3	B	8"	DIA	MAN	C	O/C	FST	OP			
V036	G15	2	B	4"	DIA	MAN	C	C	NA				NOTE 3
V069	C14	3	B	10"	DIA	MAN	O	O	NA				NOTE 3
V070	G9	2	A	4"	GA	MAN	C	C	AJLT	RF			NOTES 1,8
V071	G9	2	A	4"	GA	MAN	C	C	AJLT	RF			NOTES 1,8
V074	E7	3	B	3"	GA	MAN	C	C	NA				NOTE 3
V075	G7	2	A	4"	GA	MAN	C	C	AJLT	RF			NOTES 1,8

Arizona Public Service

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V076	G6	2	A	4"	GA	MAN	C	C	AJLT	RF			NOTES 1, 8
V081	E7	3	B	3"	GA	MAN	C	C	NA				NOTE 3
V110	E6	3	B	3"	GA	MAN	C	C	NA				NOTE 3
V121	F14	3	B	4"	GA	MAN	C	C	NA				NOTE 3
V122	F14	3	B	1"	GA	MAN	C	C	NA				NOTE 3
V123	E9	3	B	4"	GA	MAN	C	C	NA				NOTE 3
V124	F6	3	B	4"	GA	MAN	C	C	NA				NOTE 3
V125	E11	3	B	4"	GA	MAN	C	C	NA				NOTE 3

Arizona Public Service

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: FUEL POOL COOLING AND CLEANUP

P & ID: 13-M-PCP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V126	E11	3	B	1"	GA	MAN	C	C	NA				NOTE 3
PSV35	E12	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV36	C12	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V056	G6	1	B	1"	GL	MAN	C	C	NA				NOTE 3
V057	G7	1	B	1"	GL	MAN	C	C	NA				NOTE 3
V059	G7	1	B	1"	GL	MAN	C	C	NA				NOTE 3
V060	G6	1	B	1"	GL	MAN	C	C	NA				NOTE 3
V210	A12	2	B	3/4"	GL	MAN	O	O	NA				NOTE 3
V211	B6	2	B	3/4"	GL	MAN	O	O	NA				NOTE 3
V212	D6	2	B	3/4"	GL	MAN	O	O	NA				NOTE 3
V213	B7	2	B	3/4"	GL	MAN	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: REACTOR COOLANT

P & ID: 13-M-RCP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V214	C5	1	B	3/4"	GL	MAN	C	C	NA				NOTE 3
V215	C5	1	B	2"	GL	MAN	C	C	NA				NOTE 3
V216	C5	1	B	2"	GL	MAN	C	C	NA				NOTE 3
V232	C2	1	B	2"	GL	MAN	C	C	NA				NOTE 3
V233	F2	1	B	2"	GL	MAN	C	C	NA				NOTE 3
V234	B10	1	B	2"	GL	MAN	C	C	NA				NOTE 3
V235	F10	1	B	2"	GL	MAN	C	C	NA				NOTE 3
V236	G6	1	B	3/4"	GL	MAN	O	O	NA				NOTE 3

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: REACTOR COOLANT

P & ID: 13-M-RCP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V237	G6	1	B	3/4"	GL	MAN	O	O	NA				NOTE 3
V238	G11	2	B	3/4"	GL	MAN	O	O	NA				NOTE 3
V240	F6	1	B	3"	GA	MAN	O	O	NA				NOTE 3
V241	F6	1	B	3"	GA	MAN	O	O	NA				NOTE 3
V242	G6	1	B	3"	GA	MAN	O	O	NA				NOTE 3
V243	G6	1	B	3"	GA	MAN	O	O	NA				NOTE 3
V244	H7	1	C	4"	CK	SA	O/C	C	FST	OP			NOTE 10
V332	C2	1	B	2"	GL	MAN	C	C	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V333	F2	1	B	2"	GL	MAN	C	C	NA				NOTE 3
V334	B10	1	B	2"	GL	MAN	C	C	NA				NOTE 3
V335	F10	1	B	2"	GL	MAN	C	C	NA				NOTE 3
HV101	G13	2	B	1"	GL	SOL	C	C	NA				NOTE 3
HV102	G13	2	B	1"	GL	SOL	C	C	NA				NOTE 3
HV103	G10	2	B	1"	GL	SOL	C	C	NA				NOTE 3
HV104	G10	2	B	1"	GL	SOL	C	C	NA				NOTE 3
HV105	H14	2	B	1"	GL	SOL	C	C	NA				NOTE 3

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1,2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HV106	G15	2	B	1"	GL	SOL	C	C	NA				NOTE 3
HV403	B6	2	B	3/4"	GL	SOL	O/C	C	FST FT VPI	OP OP RF			
PV100E	G6	1	B	3"	GL	AO	O/C	C	FST FT VPI	CS CS RF		VRR-19	NOTE 5
PV100F	G6	1	B	3"	GL	AO	O/C	C	FST FT VPI	CS CS RF		VRR-19	NOTE 5
PSV200	F13	1	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV201	F12	1	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV202	F12	1	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV203	F12	1	C	6"	PSV	SA	C	O	PSVT				NOTE 2

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: REACTOR COOLANT

P & ID: 13-M-RCP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V344	D10	2	B	3/4"	GL	MAN	O	O	NA				NOTE 3
V345	H10	2	B	3/4"	GL	MAN	O	O	NA				NOTE 3
V346	H2	2	B	3/4"	GL	MAN	O	O	NA				NOTE 3
V347	D2	2	B	3/4"	GL	MAN	O	O	NA				NOTE 3
HV430	D11	2	B	1"	GL	MO	O	O	NA				NOTE 3
HV431	H11	2	B	1"	GL	MO	O	O	NA				NOTE 3
HV432	H3	2	B	1"	GL	MO	O	O	NA				NOTE 3
HV433	D2	2	B	1"	GL	MO	O	O	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: REACTOR COOLANT

P & ID: 13-M-RCP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HV446	B12	1	B	1"	GL	MO	O	O					NOTE 3
HV447	E12	1	B	1"	GL	MO	O	O					NOTE 3
HV448	E4	1	B	1"	GL	MO	O	O					NOTE 3
HV449	B4	1	B	1"	GL	MO	O	O					NOTE 3
HV450	B10	1	B	1"	GL	MO	O	O					NOTE 3
HV451	E10	1	B	1"	GL	MO	O	O					NOTE 3
HV452	E2	1	B	1"	GL	MO	O	O					NOTE 3
HV453	B2	1	B	1"	GL	MO	O	O					NOTE 3

Arizona Public Service

INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: RADIOACTIVE WASTE DRAIN | P & ID: 13-M-RDP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV23	G5	2	A	3"	GA	MO	O	C	FST VPI AJLT	OP RF RF	10s		NOTES 1,6
UV24	G4	2	A	3"	GA	AO	O	C	FST FT VPI AJLT	OP OP RF RF	5s		NOTE 1

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: MAIN STEAM | P & ID: 13-M-SGP-001 | PAGE:

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V043	E12	3	C	6"	CK	SA	C	O	FST	OP			
V044	C12	3	C	6"	CK	SA	C	O	FST	OP			
V346	G12	3	C	1"	CK	SA	O/C	C	FST	OP			
V348	F12	3	C	1"	CK	SA	O/C	C	FST	OP			
V357	A12	3	C	1"	CK	SA	O/C	C	FST	OP			
V358	A12	3	C	1"	CK	SA	O/C	C	FST	OP			
HV178	E14	2	B	12"	GL	AO	C	O/C	FST FT VPI	CS CS RF		VRR-20	NOTE 5
HV179	A14	2	B	12"	GL	AO	C	O/C	FST FT VPI	CS CS RF		VRR-20	NOTE 5

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: MAIN STEAM

P & ID: 13-M-SGP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HV184	F14	2	B	12"	GL	AO	C	O/C	FST FT VPI	CS CS RF		VRR-20	NOTE 5
HV185	C14	2	B	12"	GL	AO	C	O/C	FST FT VPI	CS CS RF		VRR-20	NOTE 5
UV134	E12	2	B	6"	GA	MO	C	O/C	PST FST VPI	OP CS RF			NOTE 6
UV138	C12	2	B	6"	GA	MO	C	O/C	PST FST VPI	OP CS RF			NOTE 6
UV169	F11	2	B	4"	GA	AO	C	C	NA				NOTE 3
UV170	G10	2	B	28"	GA	HY	O	C	PST FST FT VPI	OP CS CS RF	5s		
UV171	D10	2	B	28"	GA	HY	O	C	PST FST FT VPI	OP CS CS RF	5s		
UV180	E10	2	B	28"	GA	HY	O	C	PST FST FT VPI	OP CS CS RF	5s		

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV181	B10	2	B	28"	GA	HY	O	C	PST FST FT VPI	OP CS CS RF	5s		
UV183	B11	2	B	4"	GA	AO	C	C	NA				NOTE 3
UV1133	D13	2	B	1"	GL	SOL	O	C	FST FT VPI	OP OP RF			
UV1134	C13	2	B	1"	GL	SOL	O	C	FST FT VPI	OP OP RF			
UV1135A	G10	2	B	1"	GL	SOL	O	C	FST FT VPI	OP OP RF			
UV1135B	E10	2	B	1"	GL	SOL	O	C	FST FT VPI	OP OP RF			
UV1136A	C10	2	B	1"	GL	SOL	O	C	FST FT VPI	OP OP RF			
UV1136B	B11	2	B	1"	GL	SOL	O	C	FST FT VPI	OP OP RF			

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: MAIN STEAM | P & ID: 13-M-SGP-001 | PAGE:

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV554	D12	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV555	D13	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV556	D13	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV557	D14	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV558	B14	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV559	B13	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV560	B13	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV561	B12	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM MAIN STEAM

P & ID 13-M-SGP-001

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV572	H13	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV573	H13	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV574	H14	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV575	H15	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV576	F14	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV577	F13	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV578	F13	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV579	F12	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: MAIN STEAM | P & ID: 13-M-SGP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV691	F15	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV692	H15	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV694	B15	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2
PSV695	D15	2	C	6"	PSV	SA	C	O	PSVT				NOTE 2

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INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: MAIN STEAM

P & ID: 13-M-SGP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V003	E10	2	C	24"	CK	SA	O	C	FST	CS		VRR-16	NOTE 5
V005	A10	2	C	24"	CK	SA	O	C	FST	CS		VRR-16	NOTE 5
V006	A10	2	C	24"	CK	SA	O	C	FST	CS		VRR-16	NOTE 5
V007	E10	2	C	24"	CK	SA	O	C	FST	CS		VRR-16	NOTE 5
V023	F4	2	B	3"	GL	MAN	C	C	NA				NOTE 3
V026	F3	2	B	2"	GL	MAN	C	C	NA				NOTE 3
V029	B4	2	B	3"	GL	MAN	C	C	NA				NOTE 3
V032	B3	2	B	2"	GL	MAN	C	C	NA				NOTE 3

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V039	B6	2	B	½"	GL	MAN	O	O	NA				NOTE 3
V041	F6	2	B	½"	GL	MAN	O	O	NA				NOTE 3
V289	E4	2	B	6"	GA	MAN	O	O	NA				NOTE 3
V290	A4	2	B	6"	GA	MAN	O	O	NA				NOTE 3
V291	G11	2	B	1"	GL	MAN	O	O	NA				NOTE 3
V292	C11	2	B	1"	GL	MAN	O	O	NA				NOTE 3
V295	E6	2	B	½"	GL	MAN	O	O	NA				NOTE 3
V296	B6	2	B	½"	GL	MAN	O	O	NA				NOTE 3

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: MAIN STEAM

P & ID: 13-M-SGP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V423	F7	2	B	½"	GL	MAN	O	O	NA				NOTE 3
V428	C7	2	B	½"	GL	MAN	O	O	NA				NOTE 3
V524	C11	2	C	3/8"	CK	SA	C	C	NA				NOTE 3
V525	F11	2	C	3/8"	CK	SA	C	C	NA				NOTE 3
V642	G11	2	C	8"	CK	SA	O	C	FST	CS		VRR-16	NOTE 5
V652	G10	2	C	8"	CK	SA	O	C	FST	CS		VRR-16	NOTE 5
V653	C10	2	C	8"	CK	SA	O	C	FST	CS		VRR-16	NOTE 5
V693	C11	2	C	8"	CK	SA	O	C	FST	CS		VRR-16	NOTE 5

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INSERVICE TESTING PROGRAM

ISI CLASS 1,2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: MAIN STEAM | P & ID: 13-M-SGP-002 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HV41	E5	2	B	6"	GA	MO	O	O	NA				NOTE 3
HV42	B5	2	B	6"	GA	MO	O	O	NA				NOTE 3
HV43	E5	2	B	6"	GA	MO	C	C	NA				NOTE 3
HV44	A5	2	B	6"	GA	MO	C	C	NA				NOTE 3
HV200	F11	2	B	3/8"	GA	SOL	C	C	NA				NOTE 3
HV201	C11	2	B	3/8"	GA	SOL	C	C	NA				NOTE 3
UV130	G12	2	B	8"	GA	AO	O	C	PST FST FT VPI	OP CS CS RF	5s		
UV132	E12	2	B	24"	GA	HY	O	C	PST FST FT VPI	OP CS CS RF	5s		

Arizona Public Service

INSERVICE TESTING PROGRAM

ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: MAIN STEAM | P & ID: 13-M-SGP-002 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV135	C12	2	B	8"	GA	AO	O	C	PST FST FT VPI	OP CS CS RF	5s		
UV137	A12	2	B	24"	GA	HY	O	C	PST FST FT VPT	OP CS CS RF	5s		
UV172	G12	2	B	8"	GA	AO	O	C	PST FST FT VPI	OP CS CS RF	5s		
UV174	E12	2	B	24"	GA	HY	O	C	PST FST FT VPI	OP CS CS RF	5s		
UV175	C12	2	B	8"	GA	AO	O	C	PST FST FT VPI	OP CS CS RF	5s		
UV177	A12	2	B	24"	GA	HY	O	C	PST FST FT VPI	OP CS CS RF	5s		
UV204	G3	2	B	½"	GL	SOL	O	C	FST FT VPI	OP OP RF	5s		
UV211	G3	2	B	½"	GL	SOL	O	C	FST FT VPI	OP RF RF	5s		

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INSERVICE TESTING PROGRAM

ISI CLASS 1,2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: MAIN STEAM | P & ID: 13-M-SGP-002 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV219	G2	2	B	½"	GL	SOL	O	C	FST FT VPI	OP OP RF	5s		
UV220	F6	2	B	½"	GL	SOL	O	C	FST FT VPI	OP OP RF	5s		
UV221	F5	2	B	½"	GL	SOL	O	C	FST FT VPI	OP OP RF	5s		
UV222	C3	2	B	½"	GL	SOL	O	C	FST FT VPI	OP OP RF	5s		
UV223	C2	2	B	½"	GL	SOL	O	C	FST FT VPI	OP OP RF	5s		
UV224	D3	2	B	½"	GL	SOL	O	C	FST FT VPI	OP OP RF	5s		
UV225	D2	2	B	½"	GL	SOL	O	C	FST FT VPI	OP OP RF	5s		
UV226	C6	2	B	½"	GL	SOL	O	C	FST FT VPI	OP OP RF	5s		

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV227	C5	2	B	½"	GL	SOL	O	C	FST FT VPI	OP OP RF	5s		
UV228	G2	2	B	½"	GL	SOL	O	C	FST FT VPI	OP OP RF	5s		
UV500P	E3	2	B	6"	GA	AO	O	C	FST FT VPI	OP OP RF	10s		
UV500Q	E2	2	B	6"	GA	AO	O	C	FST FT VPI	OP OP RF	10s		
UV500R	A3	2	B	6"	GA	AO	O	C	FST FT VPI	OP OP RF	10s		
UV500S	A2	2	B	6"	GA	AO	O	C	FST FT VPI	OP OP RF	10s		

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V040	B2	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V104	C13	2	B	18"	GA	MAN	O	O	NA				NOTE 3
V105	G13	2	B	18"	GA	MAN	O	O	NA				NOTE 3
V120	C12	2	C	½"	CK	SA	C	O	FST	OP			
V128	D13	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V130	E12	2	C	½"	CK	SA	C	O	FST	OP			
V148	D13	2	B	½"	GL	MAN	C	C	NA				NOTE 3
V152	F14	2	B	1"	GL	MAN	C	C	NA				NOTE 3

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V157	G13	2	C	18"	CK	SA	C	O	FST	OP			
V158	C13	2	C	18"	CK	SA	C	O	FST	OP			
V184	G13	2	B	16"	GA	MAN	C	C	NA				NOTE 3
V185	C13	2	B	16"	GA	MAN	C	C	NA				NOTE 3
V200	B12	2	C	20"	CK	SA	C	O	FST	OP			
V201	F12	2	C	20"	CK	SA	C	O	FST	OP			
V205	G14	2	C	24"	CK	SA	C	O	PST	RF		VRR-3	NOTE 4,5
V206	A14	2	C	24"	CK	SA	C	O	PST	RF		VRR-3	NOTES 4,5

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V252	F16	2	B	½"	GL	MAN	C	C	NA				NOTE 3
V256	H15	2	B	12"	GA	MAN	C	C	NA				NOTE 3
V260	H7	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V262	G7	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V264	C7	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V266	C7	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V298	D5	2	B	6"	GA	MAN	C	C	NA				NOTE 3
V400	D10	2	B	2"	GL	MAN	C	C	NA				NOTE 3

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V402	A13	2	B	10"	GA	MAN	O	O	NA				NOTE 3
V404	F5	2	C	4"	CK	SA	C	O	FST	CS		VRR-7	NOTE 5
V405	B5	2	C	4"	CK	SA	C	O	FST	CS		VRR-7	NOTE 5
V418	B15	2	B	3"	GA	MAN	C	C	NA				NOTE 3
V419	H15	2	B	3"	GA	MAN	C	C	NA				NOTE 3
V420	D1	2	B	3"	GA	MAN	C	C	NA				NOTE 3
V421	H1	2	B	3"	GA	MAN	C	C	NA				NOTE 3
V424	F10	2	C	2"	CK	SA	C	O	FST	OP			

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V426	A10	2	C	2"	CK	SA	C	O	FST	OP			
V427	B7	2	B	3/4"	GL	MAN	O	O	NA				NOTE 3
V429	H14	2	B	½"	GL	MAN	O	O	NA				NOTE 3
V434	F9	2	C	10"	CK	SA	C	O	FST	OP			
V435	F8	2	B	10"	GL	MAN	O	O	NA				NOTE 3
V442	B15	2	B	12"	GA	MAN	C	C	NA				NOTE 3
V445	B14	2	B	½"	GL	MAN	O	O	NA				NOTE 3
V446	B9	2	C	10"	CK	SA	C	O	FST	OP			

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V447	B8	2	B	10"	GA	MAN	O	O	NA				NOTE 3
V448	B10	2	C	2"	CK	SA	C	O	FST	OP			
V451	G10	2	C	2"	CK	SA	C	O	FST	OP			
V455	C4	2	B	14"	GA	MAN	C	C	NA				NOTE 3
V458	G5	2	B	14"	GA	MAN	C	C	NA				NOTE 3
V459	D6	2	B	4"	GL	MAN	C	C	NA				NOTE 3
V460	E5	2	B	6"	GA	MAN	C	C	NA				NOTE 3
V463	D8	2	A	2"	GL	MAN	C	C	AJLT	RF			NOTE 8

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V464	D5	2	B	6"	GA	MAN	C	C	NA				NOTE 3
V465	F7	2	B	3/4"	GL	MAN	O	O	NA				NOTE 3
V470	E13	2	B	10"	GA	MAN	O	O	NA				NOTE 3
V476	F4	2	B	4"	GA	MAN	O	O	NA				NOTE 3
V478	B4	2	B	4"	GA	MAN	O	O	NA				NOTE 3
V484	C9	2	C	10"	CK	SA	C	O	FST	OP			
V485	H9	2	C	10"	CK	SA	C	O	FST	OP			
V486	G10	2	C	2"	CK	SA	C	O	FST	OP			

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V487	C10	2	C	2"	CK	SA	C	O	FST	OP			
V508	F2	2	B	2"	GL	MAN	C	C	NA				NOTE 3
V509	E2	2	B	2"	GL	MAN	C	C	NA				NOTE 3
V811	F2	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V821	G2	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V947	D11	2	B	2"	GL	MAN	O	O	NA				NOTE 3
HV306	G4	2	B	10"	GL	MO	O	O/C	FST VPI	OP RF			NOTE 6
HV307	B4	2	B	10"	GL	MO	O	O/C	FST VPI	OP RF			NOTE 6

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HV604	G3	2	B	3"	GA	MO	C	O	FST VPI	OP RF			NOTE 6
HV609	C3	2	B	3"	GA	MO	C	O	FST VPI	OP RF			NOTE 6
HV657	H3	2	B	16"	BTF	MO	C	O/C	FST VPI	OP RF			NOTE 6
HV658	C3	2	B	16"	BTF	MO	C	O/C	FST VPI	OP RF			NOTE 6
HV661	E11	2	B	1"	GL	AO	C	C	NA				NOTE 3
HV678	H9	2	B	10"	BTF	MO	O	O	NA				NOTE 3
HV679	C9	2	B	10"	BTF	MO	O	O	NA				NOTE 3
HV683	F13	2	B	20"	GA	MO	O	O	NA				NOTE 3

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HV684	H9	2	B	10"	GA	MO	O	O/C	FST VPI	OP RF			NOTE 6
HV685	G8	2	B	10"	GA	MO	C	O/C	FST VPI	OP RF			NOTE 6
HV686	H6	2	B	20"	GA	MO	C	O/C	FST VPI	OP RF			NOTE 6
HV687	G6	2	B	10"	GA	MO	O	O/C	FST VPI	OP RF			NOTE 6
HV688	G9	2	B	10"	GA	MO	C	O/C	FST VPI	OP RF			NOTE 6
HV689	C9	2	B	10"	GA	MO	O	O/C	FST VPI	OP RF			NOTE 6
HV692	B13	2	B	20"	GA	MO	O	O	NA				NOTE 3
HV693	C9	2	B	10"	GA	MO	C	O/C	FST VPI	OP RF			NOTE 6

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HV694	B8	2	B	10"	GA	MO	C	O/C	FST VPI	OP RF			NOTE 6
HV695	C6	2	B	10"	GA	MO	O	O/C	FST VPI	OP RF			NOTE 6
HV696	C6	2	B	20"	GA	MO	C	O/C	FST VPI	OP RF			NOTE 6
HV698	F3	2	B	4"	GA	MO	O	O	NA				NOTE 3
HV699	B3	2	B	4"	GA	MO	O	O	NA				NOTE 3
UV602	D15	2	B	½"	GL	SOL	C	O	FST FT VPI	OP OP RF			
UV603	D15	2	B	½"	GL	SOL	C	O	FST FT VPI	OP OP RF			
UV659	A6	2	B	4"	GL	SOL	O	C	FST FT VPI	OP OP RF			

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV660	F6	2	B	4"	GL	SOL	O	C	FST FT VPI	OP OP RF			
UV664	G10	2	B	2"	GL	MO	O	C	FST VPI	OP RF			NOTE 6
UV665	B10	2	B	2"	GL	MO	O	C	FST VPI	OP RF			NOTE 6
UV666	F10	2	B	2"	GL	MO	O	C	FST VPI	OP RF			NOTE 6
UV667	A10	2	B	2"	GL	MO	O	C	FST VPI	OP RF			NOTE 6
UV668	B10	2	B	2"	GL	MO	O	C	FST VPI	OP RF			NOTE 6
UV669	G10	2	B	2"	GL	MO	O	C	FST VPI	OP RF			NOTE 6
UV671	C6	2	A	8"	GA	MO	C	O/C	FST VPI AJLT	OP RF RF	10s		NOTE 6,9

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV672	G6	2	A	8"	GA	MO	C	O/C	FST VPI AJLT	OP RF RF	10s		NOTES 6,9
UV673	G16	2	A	24"	BTF	MO	C	O/C	FST VPI AJLT	OP RF RF	20s		NOTES 6,9
UV674	G14	2	A	24"	BTF	MO	C	O/C	FST VPI AJLT	OP RF RF	20s		NOTES 6,9
UV675	A16	2	A	24"	BTF	MO	C	O/C	FST VPI AJLT	OP RF RF	20s		NOTES 6,9
UV676	A14	2	A	24"	BTF	MO	C	O/C	FST VPI AJLT	OP RF RF	20s		NOTES 6,9
UV680	C13	2	B	½"	GL	SOL	C	O/C	FST FT VPI	OP OP RF			
UV681	E13	2	B	½"	GL	SOL	C	O/C	FST FT VPI	OP OP RF			
UV682	D10	2	A	2"	GL	AO	C	C	AJLT	RF			NOTE 8

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UV708	G15	2	A	½"	GL	SOL	C	O/C	FST FT VPI AJLT	OP OP RF RF			NOTE 9
UV709	F7	2	B	½"	GL	SOL	O/C	C	FST FT VPI	OP OP RF			
UV710	A7	2	B	½"	GL	SOL	O/C	C	FST FT VPI	OP OP RF			
PSV100	F15	2	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV118	F15	2	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV140	B15	2	AC	3/4"	PSV	SA	C	O	PSVT AJLT	RF			NOTES 2,9
PSV151	G15	2	AC	3/4"	PSV	SA	C	O	PSVT AJLT	RF			NOTES 2,9
PSV159	D15	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV160	D15	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV161	H6	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV178	D14	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV187	C14	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV191	D6	2	C	1½"	PSV	SA	C	O	PSVT				NOTE 2
PSV193	D6	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV194	H6	2	C	1½"	PSV	SA	C	O	PSVT				NOTE 2
PSV250	F14	2	C	1"	PSV	SA	C	O	PSVT				NOTE 2

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV285	F9	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV286	B9	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV287	C9	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV289	G9	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV409	B2	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV417	F2	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV439	H2	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV449	D2	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV473	E10	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV474	E9	2	AC	3/4"	PSV	SA	C	O	PSVT AJLT	RF			NOTES 2,9

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V113	F14	2	C	3"	CK	SA	C	O/C	FST	RF		VRR-7	NOTE 5
V114	F14	2	C	12"	CK	SA	C	O/C	FST	RF		VRR-4	NOTE 5
V123	F11	2	C	3"	CK	SA	C	O/C	FST	RF		VRR-7	NOTE 5
V124	F11	2	C	12"	CK	SA	C	O/C	FST	RF		VRR-4	NOTE 5
V133	F7	2	C	3"	CK	SA	C	O/C	FST	RF		VRR-7	NOTE 5
V134	F6	2	C	12"	CK	SA	C	O/C	FST	RF		VRR-4	NOTE 5
V-143	F4	2	C	3"	CK	SA	C	O/C	FST	RF		VRR-7	NOTE 5
V144	F4	2	C	12"	CK	SA	C	O/C	FST	RF		VRR-4	NOTE 5

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V164	F9	2	AC	10"	CK	SA	C	O/C	PST AJLT	RF RF		VRR-5	NOTES 4,5,9
V165	F6	2	AC	10"	CK	SA	C	O/C	PST AJLT	RF RF		VRR-5	NOTES 4,5,9
V210	C16	2	B	2"	GL	MAN	O	O	NA				NOTE 3
V215	B15	1	C	14"	CK	SA	C	O	PST	RF		VRR-6	NOTES 4,5
V217	B14	1	C	14"	CK	SA	C	O	FST	RF		VRR-9	NOTE 5
V220	C13	2	B	2"	GL	MAN	O	O	NA				NOTE 3
V225	B12	1	C	14"	CK	SA	C	O	PST	RF		VRR-6	NOTES 4,5
V227	B11	1	C	14"	CK	SA	C	O	FST	RF		VRR-9	NOTE 5

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V230	B9	2	B	2"	GL	MAN	O	O	NA				NOTE 3
V235	B8	1	C	14"	CK	SA	C	O	PST	RF		VRR-6	NOTES 4,5
V237	B6	1	C	14"	CK	SA	C	O	PST	RF		VRR-9	NOTE 5
V240	B6	2	B	2"	GL	MAN	O	O	NA				
V245	B5	1	C	14"	CK	SA	C	O	PST	RF		VRR-6	NOTES 4,5
V247	B4	1	C	14"	CK	SA	C	O	FST	RF		VRR-9	NOTE 5
V522	C3	1	C	3"	CK	SA	C	O	FST	RF		VRR-8	
V523	E2	1	AC	3"	CK	SA	C	O/C	FST AJLT	RF RF		VRR-10	NOTE 9

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INSERVICE TESTING PROGRAM
ISI CLASS 1, 2 & 3 VALVES
PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: SAFETY INJECTION AND SHUTDOWN COOLING

P & ID: 13-M-SIP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V532	C10	1	C	3"	CK	SA	C	O	FST	RF		VRR-8	
V533	F10	1	AC	3"	CK	SA	C	O/C	FST AJLT	RF RF		VRR-10	NOTE 9
V540	C14	1	C	12"	CK	SA	C	O	FST	RF		VRR-9	NOTE 5
V541	C11	1	C	12"	CK	SA	C	O	FST	RF		VRR-9	NOTE 5
V542	C6	1	C	12"	CK	SA	C	O	FST	RF		VRR-9	NOTE 5
V543	C4	1	C	12"	CK	SA	C	O	FST	RF		VRR-9	NOTE 5
HV321	G2	2	A	3"	GL	MO	C	O/C	FST VPI AJLT	OP RF RF	10s		NOTE 6
HV331	G10	2	A	3"	GL	MO	C	O/C	FST VPI AJLT	OP RF RF	10s		NOTE 6

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HV605	E15	2	B	1"	GL	SOL	C	C	NA				NOTE 3
HV606	E12	2	B	1"	GL	SOL	C	C	NA				NOTE 3
HV607	E8	2	B	1"	GL	SOL	C	C	NA				NOTE 3
HV608	E5	2	B	1"	GL	SOL	C	C	NA				NOTE 3
HV613	E15	2	B	1"	GL	SOL	C	C	NA				NOTE 3
HV619	D15	2	B	1"	GL	AO	C	C	NA				NOTE 3
HV623	E12	2	B	1"	GL	SOL	C	C	NA				NOTE 3
HV629	D12	2	B	1"	GL	AO	C	C	NA				NOTE 3

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SYSTEM: SAFETY INJECTION AND SHUTDOWN COOLING

P & ID: 13-M-SIP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HV633	E8	2	B	1"	GL	SOL	C	C	NA				NOTE 3
HV639	D8	2	B	1"	GL	AO	C	C	NA				NOTE 3
HV643	E5	2	B	1"	GL	SOL	C	C	NA				NOTE 3
HV649	D5	2	B	1"	GL	AO	C	C	NA				NOTE 3
HV690	H13	2	B	10"	GL	MO	C	C	NA				NOTE 3
HV691	H4	2	B	10"	GL	MO	C	C	NA				NOTE 3
UV322	E2	2	B	1"	GL	AO	C	C	NA				NOTE 3
UV332	E10	2	B	1"	GL	AO	C	C	NA				NOTE 3

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PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: SAFETY INJECTION AND SHUTDOWN COOLING

P & ID: 13-M-SIP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV611	C16	2	B	2"	GL	AO	C	C	NA				NOTE 3
UV614	C16	2	B	14"	GA	MO	O	O	NA				NOTE 3
UV615	G14	2	B	12"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
UV616	G14	2	B	2"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
UV617	G15	2	B	2"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
UV618	B16	1	B	1"	GL	AO	C	C	NA				NOTE 3
UV621	C13	2	B	2"	GL	AO	C	C	NA				NOTE 3
UV624	B12	2	B	14"	GA	MO	O	O	NA				NOTE 3

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PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: SAFETY INJECTION AND SHUTDOWN COOLING | P & ID: 13-M-SIP-002 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV625	G11	2	B	12"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
UV626	G11	2	B	2"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
UV627	G12	2	B	2"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
UV628	B13	1	B	1"	GL	AO	C	C	NA				NOTE 3
UV631	C9	2	B	2"	GL	AO	C	C	NA				NOTE 3
UV634	B8	2	B	14"	GA	MO	O	O	NA				NOTE 3
UV635	G6	2	B	12"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
UV636	G7	2	B	2"	GL	MO	C	O	FST VPI	OP RF			NOTE 6

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PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: SAFETY INJECTION AND SHUTDOWN COOLING

P & ID: 13-M-SIP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV637	G8	2	B	2"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
UV638	B9	1	B	1"	GL	AO	C	C	NA				NOTE 3
UV641	B6	2	B	2"	GL	AO	C	C	NA				NOTE 3
UV644	B5	2	B	14"	GA	MO	O	O	NA				NOTE 3
UV645	G4	2	B	12"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
UV646	G4	2	B	2"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
UV647	G5	2	B	2"	GL	MO	C	O	FST VPI	OP RF			NOTE 6
UV648	B6	1	B	1"	GL	AO	C	C	NA				NOTE 3

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ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: SAFETY INJECTION AND SHUTDOWN COOLING

P & ID: 13-M-SIP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV651	C3	1	B	16"	GA	MO	C	O/C	FST VPI	OP RF			NOTE 6
UV652	C10	1	B	16"	GA	MO	C	O/C	FST VPI	OP RF			NOTE 6
UV653	D3	1	A	16"	GA	MO	C	O/C	FST VPI AJLT	OP RF RF			NOTES 6,9
UV654	E10	1	A	16"	GA	MO	C	O/C	FST VPI AJLT	OP RF RF			NOTES 6,9
UV655	G3	2	A	16"	GA	MO	C	O/C	FST VPI AJLT	OP RF RF			NOTES 6,9
UV656	G10	2	A	16"	GA	MO	C	O/C	FST VPI AJLT	OP RF RF			NOTES 6,9
PSV166	H9	2	C	1½"	PSV	SA	C	O	PSVT				NOTE 2
PSV169	D10	1	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2

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PALO VERDE NUCLEAR GENERATING STATION

SYSTEM	P & ID	PAGE
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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV179	F3	2	AC	6"	PSV	SA	C	O	PSVT AJLT	RF			NOTE 2
PSV189	F10	2	AC	6"	PSV	SA	C	O	PSVT AJLT	RF			NOTE 2
PSV211	E15	2	C	2"	PSV	SA	C	O	PSVT				NOTE 2
PSV221	E12	2	C	2"	PSV	SA	C	O	PSVT				NOTE 2
PSV231	E8	2	C	2"	PSV	SA	C	O	PSVT				NOTE 2
PSV241	E5	2	C	2"	PSV	SA	C	O	PSVT				NOTE 2
PSV468	G2	2	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2
PSV469	D3	1	C	3/4"	PSV	SA	C	O	PSVT				NOTE 2

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SYSTEM: SAFETY INJECTION AND SHUTDOWN COOLING

P & ID: 13-M-SIP-003

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V941	E1	2	B	1"	GL	MAN	C	C	NA				NOTE 3
V944	D8	2	B	1"	GL	MAN	C	C	NA				NOTE 3

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PALO VERDE NUCLEAR GENERATING STATION

SYSTEM ESSENTIAL SPRAY POND | P & ID 13-M-SPP-001 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V012	D7	3	C	24"	CK	SA	C	O	FST	OP			
V041	D4	3	C	24"	CK	SA	C	O	FST	OP			
HV49A	D3	3	B	24"	BTF	MO	O	O/C	FST VPI	OP RF			NOTE 6
HV49B	D3	3	B	24"	BTF	MO	C	O/C	FST VPI	OP RF			NOTE 6
HV50A	D6	3	B	24"	BTF	MO	O	O/C	FST VPI	OP RF			NOTE 6
HV50B	D6	3	B	24"	BTF	MO	C	O/C	FST VPI	OP RF			NOTE 6

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PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: ESSENTIAL SPRAY POND | P & ID: 13-M-SPP-002 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V087	G4	3	B	1"	GL	MAN	O	O	NA				NOTE 3
V088	G2	3	B	1"	GL	MAN	O	O	NA				NOTE 3
V093	E7	3	B	1"	GL	MAN	O	O	NA				NOTE 3
V094	E6	3	B	1"	GL	MAN	O	O	NA				NOTE 3
HCV45	D4	3	B	20"	BTF	MAN	O	O	NA				NOTE 3
HCV46	D8	3	B	20"	BTF	MAN	O	O	NA				NOTE 3
HCV47	D2	3	B	20"	BTF	MAN	O	O	NA				NOTE 3
HCV48	D6	3	B	20"	BTF	MAN	O	O	NA				NOTE 3

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ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: ESSENTIAL SPRAY POND | P & ID: 13-M-SPP-002 |

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HCV125	F3	3	B	8"	BTF	MAN	O	O	NA				NOTE 3
HCV126	F8	3	B	6"	BTF	MAN	O	O	NA				NOTE 3
HCV127	F2	3	B	8"	BTF	MAN	O	O	NA				NOTE 3
HCV128	F6	3	B	6"	BTF	MAN	O	O	NA				NOTE 3
HCV129	F4	3	B	6"	BTF	MAN	O	O	NA				NOTE 3
HCV130	F8	3	B	6"	BTF	MAN	O	O	NA				NOTE 3
HCV131	F2	3	B	6"	BTF	MAN	O	O	NA				NOTE 3
HCV132	F6	3	B	6"	BTF	MAN	O	O	NA				NOTE 3

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ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: ESSENTIAL SPRAY POND

P & ID: 13-M-SPP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
HCV133	E4	3	B	6"	BTF	MAN	O	O	NA				NOTE 3
HCV134	F8	3	B	8"	BTF	MAN	O	O	NA				NOTE 3
HCV135	E2	3	B	6"	BTF	MAN	O	O	NA				NOTE 3
HCV136	F6	3	B	8"	BTF	MAN	O	O	NA				NOTE 3
PSV29	D4	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV30	D7	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV137	G2	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV1[illegible]	G6	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2

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SYSTEM: ESSENTIAL SPRAY POND

P & ID: 13-M-SPP-002

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
PSV139	F2	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV140	F6	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV141	F2	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV142	F6	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV143	E2	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2
PSV144	E6	3	C	1"	PSV	SA	C	O	PSVT				NOTE 2

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VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
UV200	G6	2	A	½"	GL	SOL	C	C	AJLT	RF			NOTE 8
UV201	F6	2	A	½"	GL	SOL	C	C	AJLT	RF			NOTE 8
UV202	E6	2	A	½"	GL	SOL	C	C	AJLT	RF			NOTE 8
UV203	G6	2	A	½"	GL	SOL	C	C	AJLT	RF			NOTE 8
UV204	F6	2	A	½"	GL	SOL	C	C	AJLT	RF			NOTE 8
UV205	E6	2	A	½"	GL	SOL	C	C	AJLT	RF			NOTE 8

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ISI CLASS 1, 2 & 3 VALVES

PALO VERDE NUCLEAR GENERATING STATION

SYSTEM: NORMAL CHILLED WATER | P & ID: 13-M-WCP-001 | PAGE:

VALVE NUMBER	COORDINATES	ISI CLASS	VALVE CATEGORY	VALVE SIZE	VALVE TYPE	ACTUATOR TYPE	NORMAL POSITION	STROKE DIRECTION	TEST	TEST MODE	MAX. STROKE TIME	RELIEF REQUEST	REMARKS
V039	G7	2	AC	10"	CK	SA	O	C	FST AJLT	OP RF			
UV61	F7	2	A	10"	GA	MO	O	C	FST VPI AJLT	OP RF RF	10s		NOTES 1,6
UV62	F6	2	A	10"	GA	MO	O	C	FST VPI AJLT	OP RF RF	10s		NOTES 1,6
UV63	G6	2	A	10"	GA	MO	O	C	FST VPI AJLT	OP RF RF	10s		NOTES 1,6

APPENDIX A

REQUEST FOR RELIEF

FOR PUMPS

PUMP RELIEF REQUEST NO. 1

SYSTEM: Safety Related

COMPONENT: All pumps listed in the program.

CLASS: 2 & 3

FUNCTION: To provide pumped liquid to safety related systems.

TEST REQUIREMENT: To measure bearing temperature.

BASIS FOR RELIEF: Industry data has shown that bearing temperature changes due to degrading bearings only occurs after major degradation has occured at the pump. Prior to this, the vibration measurement would provide the necessary information to warn the operator of an impending malfunction. Therefore, this parameter will not be measured since its information is after the fact.

ALTERNATE TESTING: None

PUMP RELIEF REQUEST NO. 2

SYSTEM: Diesel Generator Fuel Oil Transfer System

COMPONENTS: DFA-P01 and DFB-P01

P&ID & COORDINATES: DPF-001 @ B-6 and B-2

CLASS: 3

FUNCTION: To provide fuel oil to the standby diesel generators.

TEST REQUIREMENTS: Measure displacement vibration amplitude of pump.

BASIS FOR RELIEF: These pumps are immersable centrifugal sump pumps located in the emergency fuel oil storage tanks, therefore, are inaccessible for this type of testi

ALTERNATE TESTING: No alternate testing for this parameter is practical, however, all other parameters will be tested per Section XI requirements to show pump integrity.

PUMP RELIEF REQUEST NO. 3

SYSTEM: Diesel Generator System

COMPONENTS: DGA-P02, DGB-P02, DGA-P03, DGB-P03, DGA-P05, DGB-P05

P&ID AND COORDINATES: M018-106 @ D3, M018-105 @ D5, M018-103 @ D5

TEST REQUIREMENT: An inservice test shall be conducted with the pump operating at nominal motor nameplate speed. The resistance of the system shall be varied until either the measured differential pressure or the measured flow rate equals the reference value. The test parameters shall then be measured and observed and compared to the corresponding reference values.

BASIS FOR RELIEF: These pumps are supplied as an integral part of the Diesel Generator skid package. The operational readiness of these pumps will be ascertained by assuring the capacity of the pumps to fulfill their function during the monthly diesel generator Technical Specification surveillance test.

ALTERNATE TESTING: Operate the pumps monthly when the Diesel Generator is functionally tested in accordance with Technical Specification 3/4.8.1.

APPENDIX B

REQUEST FOR RELIEF

FOR VALVES

VALVE RELIEF REQUEST NO. 1

SYSTEM:	Chemical and Volume Control
COMPONENTS:	CHV305 and CHV306
P&ID & COORDINATES:	CHP-002 @ B-15 & C-13
CATAGORY:	C
CLASS:	2
FUNCTION:	Valves open with differential pressure to provide flow to the LPSI, HPSI, and CS pumps from Refueling Water Tank.
TEST REQUIREMENT:	Full stroke exercise test once every three months.
BASIS FOR RELIEF:	Flow will not be sufficient to completely stroke these valves during operation.
ALTERNATE TESTING:	These valves will be given a partial stroke test at least once every 90 days while testing the pumps. A full stroke test will be accomplished during the refueling mode when full flow can be established. At this time the test flow path will be from the Refueling Water Tank to the primary loop. Due to the primary loop back pressure this test can only be accomplished during the refueling mode when the reactor head is removed.

VALVE RELIEF REQUEST NO. 2

SYSTEM:	Essential Cooling Water.
COMPONENTS:	EW-UV65 and EW-UV145.
P&ID & COORDINATES:	EWP-001 @ C-8 and C-4.
CATEGORY:	B
CLASS:	3
FUNCTION:	Valves open to provide Normal Chilled Water System with Essential Chilled Water in the event that the Normal Chilled Water System is inoperable.
TEST REQUIREMENTS:	Full stroke exercise test every three months.
BASIS FOR RELIEF:	Opening these valves during operations or Cold Shutdown will produce a low pressure in the Normal Chilled Water System. This could lead to the system becoming inoperable.
ALTERNATE TESTING:	Perform a full stroke exercise test during the refueling mode.

VALVE RELIEF REQUEST NO. 3

SYSTEM:	Safety Injection and Shutdown Cooling.
COMPONENTS:	SIV205 and SIV206.
P&ID & COORDINATES:	SIP-001 @ G-14 and A-14.
CATEGORY:	C
CLASS:	2
FUNCTION:	These valves open to provide flow to the HPSI and CS pumps from the recirculation sump.
TEST REQUIREMENTS:	Full stroke exercise test every three months.
BASIS FOR RELIEF:	This recirculation sump is normally dry so full flow can not be established in this line.
ALTERNATE TESTING:	Perform a partial stroke exercise test during refueling using test connections.

VALVE RELIEF REQUEST NO. 4

SYSTEM:	Safety Injection and Shutdown Cooling.
COMPONENTS:	SIV114, SIV124, SIV134 and SIV144.
P&ID & COORDINATES:	SIP-002 @ F14, F-11, F-6 and F-4.
CATEGORY:	C
CLASS:	2
FUNCTION:	Valves open to provide flow paths from the low pressure safety injection headers to the primary loops,
TEST REQUIREMENTS:	Full stroke exercise test every three months.
BASIS FOR RELIEF:	Flow cannot be established to exercise valves during operation or cold shutdown due to the pressure in the Primary Coolant System.
ALTERNATE TESTING:	These valves will be full stroke exercised during refueling when the reactor head is removed.

VALVE RELIEF REQUEST NO. 5

SYSTEM:	Safety Injection and Shutdown Cooling.
COMPONENTS:	SIV164 and SIV165.
P&ID & COORDINATES:	SIP-002 @ F-9 and F-6.
CATEGORY:	C
CLASS:	2
FUNCTION:	Valves open to provide flow from the Containment Spray Pump to the discharge nozzles.
TEST REQUIREMENTS:	Full stroke exercise test every three months.
BASIS FOR RELIEF:	Flow can not be established without discharging water into containment.
ALTERNATE TESTING:	Perform a partial stroke exercise test during refueling using test connections.

VALVE RELIEF REQUEST NO. 6

SYSTEM:	Safety Injection and Shutdown Cooling.
COMPONENTS:	SIV215, SIV225, SIV235 and SIV245.
P&ID & COORDINATES:	SIP-002 @ B-15, B-12, B-8 and B-5
CATEGORY:	C
CLASS:	2
FUNCTION:	Valves open to provide a flowpath from the Safety Injection to the Primary Coolant Loop.
TEST REQUIREMENTS:	Full stroke exercise test every three months.
BASIS FOR RELIEF:	Full stroking is only possible when the Safety Injection Tank discharges into the Primary Coolant Loop.
ALTERNATE TESTING:	Full stroke exercise these valves during refueling.

VALVE RELIEF REQUEST NO. 7

SYSTEM:	Safety Injection and Shutdown Cooling.
COMPONENTS:	SIV113, SIV123, SIV133, SIV143, SIV404, and SIV 405
P&ID & COORDINATES:	13-M-SIP-002 @ F14, FII, F7, F4 13-M-SIP-001 @ G5, B5
CATEGORY:	A, C
CLASS:	2
FUNCTION:	Valves open to provide a flowpath from the Safety Injection System to the Primary Coolant Loop.
TEST REQUIREMENTS:	Full stroke exercise test every three months.
BASIS FOR RELIEF:	These valves can only be exercised by initiation of flow through the valves and into the Reactor Coolant System. Safety Injection Pumps are not sufficient to establish flow that will exercise these valves due to pressure of the Primary Coolant System.
ALTERNATE TESTING:	Full stroke exercise these valves during refueling utilizing the Safety Injection Pumps.

VALVE RELIEF REQUEST NO. 8

SYSTEM:	Safety Injection and Shutdown Cooling.
COMPONENTS:	SIV522 and SIV532.
P&ID & COORDINATES:	SIP-002 @ C-3 and C-10.
CATEGORY:	C
CLASS:	1
FUNCTION:	Valves open to provide a flowpath for the HPSI system to the shutdown cooling lines.
TEST REQUIREMENTS:	Full stroke exercise test every three months.
BASIS FOR RELIEF:	These valves can only be exercised by initiation of flow through the valves and into the Reactor Coolant System. The Safety Injection pumps are not sufficient to exercise these valves due to pressure of the Primary Coolant System.
ALTERNATE TESTING:	Full stroke exercise these valves during refueling when the reactor head is removed utilizing the Safety Injection System.

VALVE RELIEF REQUEST NO. 9

SYSTEM: Safety Injection and Shutdown Cooling.

COMPONENTS: SIV217, SIV227, SIV237, SIV247, SIV540, SIV541, SIV542, SIV543.

P&ID & COORDINATES: SIP-002 @ B-14, B-11, B-6, B-4, C-14, C-11, C-6 and C-4.

CATEGORY: C

CLASS: 1

FUNCTION: Valves open to provide a flowpath from the Safety Injection to the Primary Coolant Loop.

TEST REQUIREMENTS: Full stroke exercise test every three months.

BASIS FOR RELIEF: These valves can only be exercised by initiation of flow through the valves and into the Reactor Coolant System. Safety Injection Pumps are not sufficient to exercise these valves due to pressure of the Primary Coolant System.

ALTERNATE TESTING: Full stroke exercise these valves during refueling when the reactor head is removed utilizing the Safety Injection System.

VALVE RELIEF REQUEST NO. 10

SYSTEM:	Safety Injection and Shutdown Cooling.
COMPONENTS:	SIV523 and SIV533
P&ID & COORDINATES:	13-M-SIP-002 @ F2 and F10
CATEGORY:	A, C
CLASS:	1
FUNCTION:	Valves open to provide a flowpath for the HPSI system to the shutdown cooling lines.
TEST REQUIREMENTS:	Full stroke exercise test every three months.
BASIS FOR RELIEF:	These valves can only be exercised by initiation of flow through the valves and into the Reactor Coolant System. Safety Injection Pumps are not sufficient to exercise these values due to pressure of the Primary Coolant System.
ALTERNATE TESTING:	Full stroke exercise test these valves during the refueling mode when the reactor head is removed utilizing the Safety Injection System.

VALVE RELIEF REQUEST NO. 11

SYSTEM:	Auxiliary Feedwater
COMPONENTS:	AFV015, AFV024, AFV079, and AFV080
P&ID & COORDINATES:	AFP-001, E-5, C-6, E-1, C-1
CATEGORY:	C
CLASS:	2, 3
FUNCTION:	Valves open to provide a flowpath for auxiliary feedwater to the Stem Generators.
TEST REQUIREMENTS:	Full Stroke Test every 3 months or Partial Stroke Test every 3 months and Full Stroke Test during Cold Shutdown.
BASIS FOR RELIEF:	Stroking these valves during power operation would require injection of cold Auxiliary Feedwater into a hot steam generator. In addition to possibly causing an unwarranted plant transient, this reduces the quality of steam exiting the steam generator.
ALTERNATE TESTING:	Full stroke test at cold shutdown.

VALVE RELIEF REQUEST NO. 12

SYSTEM:	Chemical and Volume Control
COMPONENTS:	CHV431, CH-HV203, CH-HV205
P&ID & COORDINATES:	CHP-001 @ G11, H12, G12
CATEGORY:	C, B, B
CODE CLASS:	1, 2, 1
FUNCTION:	Valves open to provide a flow path for Auxiliary Spray to the pressurizer.
TEST REQUIREMENTS:	Full stroke exercise every 3 months or partial stroke exercise every 3 months and full stroke test during cold shutdown.
BASIS FOR RELIEF:	Exercising these valves is not possible during power operation. There function is to protect the charging system from Reactor Coolant System pressure during normal operation and to provide auxiliary spray to cool the pressurizer when the RCS pressure has dropped below the pressure required to use the reactor coolant pumps.
ALTERNATE TESTING:	Full stroke test at cold shutdown.

VALVE RELIEF REQUEST NO. 13

SYSTEM: Chemical Volume and Control

COMPONENTS: CHV787, CHV802, CHV807, CHV812, CHV866, CHV867, CHV868, CHV869, CHV835, HV255

P&ID & COORDINATES: CHP-001 @ H1, G1, F1, E1, H1, G1, F1, E1, G3, G4

CATEGORY: HV255 is Category B, all others are Category C.

CLASS: CHV835 and HV255 - Class 2, all others Class 1.

FUNCTION: Valves are open to provide a flow path for seal injection to the reactor coolant pumps.

TEST REQUIREMENTS: Full stroke test every 3 months or partial stroke test every 3 months and full stroke test at cold shutdown.

BASIS FOR RELIEF: These valves are open during normal operation to provide Seal Injection to the Reactor Coolant Pump. Stroking these valves would require discontinuing seal injection to the pumps and compromise Reactor Coolant Pump integrity.

ALTERNATE TEST: Full stroke test at cold shutdown.

VALVE RELIEF REQUEST NO. 14

SYSTEM:	Chemical and Volume Control
COMPONENTS:	CH-HV524, CH-VM70, V433, V435
P&ID & COORDINATES:	CHP-001 @ D16, F15, G9, F10.
CATEGORY:	A, AC, C, C
CLASS:	2, 2, 1, 1
FUNCTION:	Valves are open to provide a flowpath for the charging flow to the Reactor Coolant System and the pressurizer auxiliary spray.
TEST REQUIREMENTS:	Full stroke test every 3 months or partial stroke test every 3 months and full stroke test during cold shutdown.
BASIS FOR RELIEF:	These valves are open during normal operation to maintain reactor coolant system chemistry and purity and maintain RCS volume. Stroking these valves during normal operation could upset the chemical balance and cause unwarranted transients.
ALTERNATE TEST:	Full stroke test at cold shutdown.

.IEF REQUEST NO. 15

Nuclear Cooling Water.

NCV118, UV401, UV402, UV403.

NCP-003 @ E7

A, C

2

Valves open to provide a flowpath for nuclear cooling water supply to the reactor coolant pu lube oil coolers.

Full stroke tested every 3 months or partial stroke tested every 3 months and full stroke tested at cold shutdowns.

This valve is open during normal operation to allow a supply of nuclear cooling water to the reactor coolant pump coolers. Stroking these valves could cause overheating of the reactor coolant pump motor air coolers, lube oil coolers thrust bearing oil coolers, and seal coolers and ompromise the integrity of the pumps.

ıll stroke test these valves during cold ıutdown.

VALVE RELIEF REQUEST NO. 16

SYSTEM: Main Steam.

COMPONENTS: SGV003, SGV005, SGV006, SGV007, SGV642, SGV652, SGV653, SGV693.

P&ID & COORDINATES: SGP-002 @ E10, A10, G10, C10

CATEGORY: C

CLASS: 2

FUNCTION: Valves open to provide a flow path for feedwater flow to the steam generators.

TEST REQUIREMENTS: Full stroke test every 3 months or partial stroke test every 3 months and full stroke test during cold shutdown.

BASIS FOR RELIEF: These valves are in the feedwater inlet lines to each steam generator and are open during power operation. Full or partial stroking these valves during operation could secure feedwater and cause a reactor trip.

ALTERNATE TESTING: Full stroke test at cold shutdown.

VALVE RELIEF REQUEST NO. 17

SYSTEM:	Chemical and Volume Control.
COMPONENTS:	CHV190
P&ID AND COORDINATES:	13-M-CHP-002 @ B5.
CATEGORY:	C
CLASS:	2
FUNCTION:	Valves open with differential pressure to provide gravity flow from the Refueling Water Tank to the suction of the charging pumps.
TEST REQUIREMENT:	Full stroke exercise test once every three months.
BASIS FOR RELIEF:	The gravity feed suction path is isolated during normal operation. Stroking this valve during normal operation would disrupt normal letdown and charging.
ALTERNATE TESTING:	Full stroke test during cold shutdown.

VALVE RELIEF REQUEST NO. 18

SYSTEM:	Chemical and Volume Control.
COMPONENTS:	CH-UV505 and CH-UV506.
P&ID & COORDINATES:	13-M-CHP-002 @ F14 and F15.
CATEGORY:	A
CLASS:	2
FUNCTION:	Valves provide containment isolation on Reactor Coolant Pump seal water bleed off lines.
TEST REQUIREMENTS:	Full stroke exercise once every three months.
BASIS FOR RELIEF:	These valves are open during normal operation to provide seal water bleed off on the reactor coolant pumps. Stroking these valves would require discontinuing seal injection to the pumps and compromise Reactor Coolant Pump integrity.
ALTERNATE TESTING:	Full stroke test during Cold Shutdown.

VALVE RELIEF REQUEST NO. 19

SYSTEM:	Reactor Coolant.
COMPONENTS:	RC-PV100E and RC-PV100F.
P&ID & COORDINATES:	13-M-RCP-001 @ G6.
CATEGORY:	B
CLASS:	1
FUNCTION:	These valves automatically control pressurizer spray.
TEST REQUIREMENTS:	Full stroke exercise test once every three months.
BASIS FOR RELIEF:	Stroking these valves will direct spray to the pressurizer and could cause unwanted pressure transients.
ALTERNATE TESTING:	Operation of the valves will be observed during normal operation and the valves will be full stroke tested during cold shutdown.

VALVE RELIEF REQUEST NO. 20

SYSTEM:	Main Steam.
COMPONENTS:	SG-HV178, SG-HV179, SG-HV184, SG-HV185.
P&ID & COORDINATES:	13-M-SGP-001 @ E14, A14, F14, C14.
CATEGORY:	B
CLASS:	2
FUNCTION:	Main steam atmospheric dump valves for plant cooldown during loss of the condensor.
TEST REQUIREMENTS:	Full stroke exercise test once every 3 months.
BASIS FOR RELIEF:	Stroking the atmospheric dump valves during normal operation could initiate an unwarranted transient.
ALTERNATE TESTING:	Full stroke test during cold shutdown.

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FOREWORD

The engineering symbols used on piping and instrumentation diagrams (P&ID's) are shown on figure F-1. Standards used for editorial abbreviations and symbols are the latest editions of the following American National Standards Institute publications: ANSI-Y1.1, Abbreviations; ANSI-Y10.5, Letter Symbols for Quantities used in Electrical Science and Electrical Engineering; and ANSI-Y10.9, Letter Symbols for Units used in Science and Technology.

The ER-OL includes answers to NRC request for additional information in the NRC letter from Mr. D. G. Eisenhut to Mr. E. E. Van Brunt, Jr., dated June 18, 1980. The questions and responses or locations of responses are provided in Appendix A of the appropriate chapter of the ER-OL. The cross-reference list from NRC question number to ER-OL question number is as noted below:

NRC QUESTION NUMBER	ER-OL QUESTION NUMBER
Section 1.1.2	1A.1
Section 2.1.2.3	2A.1
Section 2.3	2A.2
Section 2.3	2A.3
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Section 6.1.5.5.3	6A.1
Section 6.2	6A.2

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CHAPTER 1

PURPOSE OF THE PROPOSED FACILITY AND ASSOCIATED TRANSMISSION

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TABLES (cont)

units such as PVNGS. The participants will continue seeking means to promote effectively prudent electric energy management practices.

1.1.1.3 Power Exchanges

Past and expected future net power sales and purchases outside the participants' combined system, which are applicable at the time of annual peak demand, are presented in table 1.1-1. Both firm and nonfirm sales and purchases are tabulated; they contribute respectively to load and generation totals. Firm purchases are not included in the calculation of reserve requirements as the reserve is provided by the seller. Reserve for firm sales is provided on the participants' combined system.

1.1.2 SYSTEM CAPACITY

System capabilities for each of the participants at the time of the annual peak demand for 1968 through 1988 are presented in table 1.1-8 along with a combined resources summary for all participants. Representative capacity factors are provided in table 1.1-8A. These resource schedules are the result of generation planning that makes use of the load forecasting discussed in section 1.1.1.2. 1

Each participant is responsible for determining its own criteria for bulk generation planning, including the methodology for load forecasting. The Reliability Council of the WSCC recently issued guidelines for the measurement of the adequacy of power supply, including as an alternative a reliability test that uses a loss-of-load probability (LOLP) criterion of one day of outage in 10 years.

Table 1.1-9 contains information showing the existing generation capability as of January 1, 1978, for the Arizona-New Mexico Power Area and the Southern California-Nevada Power Area, respectively, as defined in WSCC. Table 1.1-10 is a summary of generation additions for these two power areas.

1.1.3 RESERVE MARGINS

The participants do not participate jointly in any single regional power pool. Each participant is responsible for establishing and maintaining its own reserve. Reserve criteria vary with the participant. Each participant's reserve requirements are listed below in outline form.

A. Arizona Public Service Company: The APS generation reserve requirements are based on an LOLP criterion applied to the proposed Cactus Pool. The proposed pool includes Arizona Electric Power Cooperative, APS, EPE, Plains Electric Generation and Transmission Cooperative, Public Service Company of New Mexico, and Salt River Project. Although formal operating agreements have not been established for this pool, the pool concept has been used in planning studies to establish APS installed reserve requirements. The LOLP criterion is expressed in terms of the expected number of times in a specified period that the pool generating capacity fails to meet load.

   The criterion used by APS (in conjunction with the APS load forecast on May 31, 1978) is that the pool reserves shall be 16% of pool load from 1979 through 1981 and sufficient to yield an expected failure to meet pool load of no more than one occurrence in 3 years beyond 1981. This is sometimes referred to as a 1/3 LOLP index. A computer simulation that represents both forced and maintenance outages is used to compute the probability of failure to meet load on a daily basis, with the daily probabilities added to yield an annual index. Allocation of the pool reserves among individual utilities is in proportion to the sum of their peak load, plus twice their largest hazard.

1.3 CONSEQUENCES OF DELAY

The load forecasts presented in table 1.1-1 indicate that the combined annual peak demands of the PVNGS participants will increase an additional 6567 megawatts between 1980 and 1986. During this period the combined annual peak will be growing at an average rate of 1094 megawatts per year. To reliably meet this demand, the participants will need to obtain an additional 7385 megawatts of new installed resources between 1980 and 1986. The PVNGS units are an important part of these needed new resources.

The participants are responsible for meeting the growing electric needs of their customers, and by virtue of their franchises, are required by law to do so. Failure to provide power as needed would have serious social, environmental and economic effects on the entire area served by the participants.

If PVNGS-1,2,&3 are not constructed and do not begin commercial operation as scheduled in May 1983, May 1984, and May 1986, respectively, the participants will experience consequences of delay with respect to the adequacy, reliability and cost of their power supplies. The degree of the consequences will depend largely on whether the delays are short- or long-term, and on how much time the participants have to prepare for the delays. Lead times for constructing alternate types of generation are three years for combustion turbine units, four and one-half years for combined cycle units and seven and one-half years for coal-fired steam units. This does not include regulatory review times for environmental or project approval.

The effects of delays of one, two and three years in the commercial operation of the project on the reserve margins of the participants are shown in table 1.3-1. For example, information in table 1.3-1 shows that the PVNGS participants reserve

Table 1.3-1

MARGIN COMPARISON BETWEEN PARTICIPANTS RESERVE MARGIN WITH AND WITHOUT PVNGS-1, 2 & 3 DELAYED (Sheet 1 of 2)[a]

	1982	1983	1984	1985	1986	1987
1.1.1 Load characteristic						
Adjusted annual peak demand (AAPD)	25346	26166	26961	28079	29164	30300
<u>PVNGS-1,2&3 On Schedule</u>						
1.1.2 Power supply (MW)						
Participant capability less PVNGS 1, 2 & 3	30300	30844	31125	31619	31920	32945
PVNGS 1, 2 & 3 capacity		1270	2540	2540	3810	3810
Participant capability	30300	32114	33665	34159	35730	36755
1.1.3 Reserve capacity (MW)						
Reserve	4954	5948	6704	6080	6566	6455
Percent margin	19.5	22.7	24.9	21.7	22.5	21.3
<u>PVNGS-1,2&3 Delayed One Year</u>						
1.1.2 Power supply (MW)						
Participant capability less PVNGS 1, 2 & 3	30300	30844	31125	31619	31920	32945
PVNGS 1, 2 & 3 capacity			1270	2540	2540	3810
Participant capability	30300	30844	32395	34159	34460	36755
1.1.3 Reserve capacity (MW)						
Reserve	4954	4678	5434	6080	5296	6455
Percent margin	19.5	17.9	20.2	21.7	18.2	21.3

a. Data adjusted to reflect commercial operation date for PVNGS Unit 1 of May 1983.

Table 1.3-1

MARGIN COMPARISON BETWEEN PARTICIPANTS RESERVE MARGIN WITH AND WITHOUT PVNGS-1, 2 & 3 DELAYED (Sheet 2 of 2)[a]

	1982	1983	1984	1985	1986	1987
PVNGS-1,2&3 Delayed Two Years						
1.1.2 Power supply (MW)						
Participant capability less PVNGS 1, 2 & 3	30300	30844	31125	31619	31920	32945
PVNGS 1, 2 & 3 capacity				1270	2540	2540
Participant capability	30300	30844	31125	32889	34460	35485
1.1.3 Reserve capacity (MW)						
Reserve	4954	4678	4164	4810	5296	5185
Percent margin	19.7	17.9	15.4	17.1	18.2	17.1
PVNGS-1,2&3 Delayed Three Years						
1.1.2 Power supply (MW)						
Participant capability less PVNGS 1, 2 & 3	30300	30844	31125	31619	31920	32945
PVNGS 1, 2 & 3 capacity					1270	2540
Participant capability	30300	30844	31125	31619	33190	35485
1.1.3 Reserve capacity(MW)						
Reserve	4954	4678	4164	3540	4026	5185
Percent margin	19.5	17.9	15.4	12.6	13.8	17.1

margin in 1985 drops from the 21.7% shown for no delay to 12.6% if the PVNGS capacity or equivalent capacity is delayed three years. As reserve margins are reduced below the desired level, the Loss of Load Probability (LOLP) increases to a point of risk that is unacceptable to system integrity.

A delay in the units will increase the probability that one or more of the participants will be unable to meet its load requirements during this period. Also, the energy requirements expected to be met by the nuclear unit will have to be met by other sources. This would mean burning more oil and/or coal resources, possibly resulting in adverse environmental effects and higher costs. Moreover, since fuel oil is scarce, and since it is expected to remain in short supply, prudent planning dictates that it be conserved as much as possible. Delay of the nuclear units will work against the conservation of this resource.

Operating combustion turbine or combined cycle units as baseload units to replace nuclear energy is likely to present additional reliability problems, since this type of unit is not designed for baseload operation. If the delays are known several years in advance, other planned resources may be installed early. It may thus be possible to avoid the reliability problem stated previously. However, the problems related to environmental effect, costs, and fuel conservation will still apply.

While it may be possible for the participants to make some short- or long-term purchases to partially cover the delay of nuclear units, it is not likely that all participants will be able to make sufficient purchases to make up all of the delayed nuclear capacity. Neighboring utilities may be experiencing their own delay problems in installation of generation facilities, and therefore may not have excess power to sell to the participants. Another factor in this regard is the nature of the power supply in the areas served by the participants.

The participants generally rely on a high percentage of resources that are remote from their load areas, with power carried to the load areas over EHV transmission systems. There is a limited number of interconnections between the participants' service areas and surrounding systems. Even assuming that the large amounts of power that may be needed are available for purchase, the limited number of interconnections and high use of the EHV tranmission system will make it difficult for those large amounts of power to be transmitted to the participants' service areas.

Delays in the construction of PVNGS generating facilities will have the following adverse effects on systems planning and operation.

A. Longer Lead Times - Consistent delays in construction lengthen the lead time required for generation planning. This reduces the flexibility and adaptability of incorporating new technology or changes in load forecasts into the planning process.

B. Decreased System Reliability - Delays will result in lower reserve margins that decrease system reliability and thereby cause more frequent service interruptions.

C. Additional Costs - The delay of a generating facility may require the temporary substitution of a more costly alternative with the possibility of a greater environmental impact. Delays also result in additional costs for interest during construction of the planned facility.

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QUESTION 1A.1 (NRC comment on Section 1.1.2) (6/18/80) 1.1.2

No estimates of capacity factors. 1

RESPONSE: The response is given in revised section 1.1.2 and table 1.1-8A.

CHAPTER 2

THE SITE AND ENVIRONMENTAL INTERFACES

CONTENTS

CONTENTS (cont)

CONTENTS (cont)

TABLES

TABLES (cont)

TABLES (cont)

TABLES (cont)

FIGURES

Figures 2.1-4 through 2.1-12 illustrate the estimated residential population located within a 10-mile radius of the plant site for the years 1980, 1982, 1984, 1986, 1990, 2000, 2010, 2020, and 2030. Data are displayed at 1, 2, 3, 4, 5 and 10-mile distances from the centerline of the Unit 2 containment building, for the 16 compass sectors. Maricopa County population estimates provided by the Arizona State Department of Economic Security[3] for the years 1980, 1982, 1984, 1986, 1990, and 2000 were used for all six radii calculations. Maricopa County population projections for the years 2010, 2020, and 2030 were derived from the assumption that decennial growth rates from 2000 to 2030 would be held constant to the same rate of growth as experienced between 1990 and 2000. Population projections were calculated in the same manner as the 1978 estimated 5-10 mile radius population.

Listed below is a generalized Maricopa County age distribution for the year 2000.

Age Group	Percentage of Total Population
0-11 years	15
12-17 years	9
18-65+ years	76

These figures were derived from data prepared by the Arizona State Department of Economic Security.[3]

2.1.2.2 Population Between 10 and 50 Miles

Figure 2.3-1 illustrates population settlements located within a 50-mile radius of PVNGS. Figure 2.1-3 illustrates the 1978 estimated residential population located between 10 and 50 miles of the plant site. Figures 2.1-4 through 2.1-12 show the estimated residential population located between 10 and 50 miles of the plant site for the years 1980, 1982, 1984,

1986, 1990, 2000, 2010, 2020, and 2030. Data are displayed at 10, 20, 30, 40, and 50 mile distances from Unit 2 for 16 compass sectors. Population input data for Maricopa, Pinal, Yavapai, and Yuma Counties were prepared by the Arizona State Department of Economic Security[3] and calculated according to the methodology described in section 2.1.2.1.

Maricopa County age distribution projections for the year 2000, are given in section 2.1.2.1. It is assumed that the same age distribution projections will apply to Pinal, Yavapai, and Yuma Counties.

2.1.2.3 Transient Population

Transient population within a 10-mile radius of Unit 2 for 1978 is estimated to have been approximately 155 persons.[4-8,34] This is a conservative estimate based upon the consideration that 100 people included in the total represent migrant farm workers[4]. The remaining 55 persons are either employed at the Hassayampa Cotton Gin, the Ruth Fisher and Arlington School Districts, and Gila Compressor Station, or attend Arlington School. All students who attended Ruth Fisher School during the 1978-1979 academic year resided within 10 miles of PVNGS. Table 2.1-3 lists employment centers and schools within a 10-mile radius of PVNGS according to distance and direction from the plant site, number of employees and students, season of employment and school year, and combined residential and transient population totals per sector.

Construction phase manpower is discussed in section 8.1.

2.1.3 USES OF ADJACENT LANDS AND WATERS

2.1.3.1 Land Use Within a 5-Mile Radius of the PVNGS Plant Site

2.1.3.1.1 Residential Land Use

As indicated in section 2.1.2.1, residential land use within a 5-mile radius of the PVNGS site is low density, since most

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The types of establishments that exist include a combination grocery store-gas station and two cafes and bars.

2.1.3.1.3 Special Land Use

Within a 5-mile radius of PVNGS, there are two parcels zoned by the Maricopa County Planning Department for special use as a mobile home park and a travel trailer park, respectively.(9) Both are located near the intersection of Wintersburg and Buckeye-Salome Roads.

One parcel, located east of the Wintersburg and Buckeye-Salome Roads intersection has been given a special use permit for a mobile home park valid for 25 years, beginning in 1975.(12) The owner of the property has indicated that he intends to initiate development.(13)

The other parcel, located on the northwestern corner of the same intersection has been given a special use permit for travel trailer park valid for 3 years beginning March 27, 1978.(12) The representative of the property owner has indicated that he intends to develop the parcel.(14)

2.1.3.1.4 Institutional Land Use

There are no public facilities or institutional land uses within a 5-mile radius of the plant site.

2.1.3.1.5 Agricultural Land Use

Agricultural land uses are discussed in section 2.1.3.4.

2.1.3.1.6 Transportation Land Use

2.1.3.1.6.1 Roads. Figure 3.1-3 illustrates the road system within a 5-mile radius of the plant site. It is essentially a rectangular grid oriented on north-south and east-west axes, following township and sectional lines. The plant site is

bounded on two sides by Wintersburg Road and Ward (Elliot) Road. At its closest point, Buckeye-Salome Road is located 2 miles north-northeast of Unit 2. Table 2.1-4 lists Average Daily Traffic (ADT) counted within a 5-mile radius of the PVNGS plant site during a June, 1978 traffic survey.[15] These counts are well below design levels.[16]

2.1.3.1.6.2 Railroads. Figures 3.1-2 and 3.1-3 illustrate the Southern Pacific Transportation Company railroad located within a 5-mile radius of PVNGS. An average of 5 trains per day are operated on the railroad.[17] At its closest point, the railroad is located approximately 4.5 miles south-southeast of Unit 2. A railroad spur extends from this line to the site as shown in figure 3.1-4.

2.1.3.1.6.3 Airports. Figure 2.1-13 illustrates the Empire Machinery Company-owned airstrip located approximately 5.5 miles north-northwest of Unit 2.

The airstrip is used primarily as a base for crop dusting activities, although there are some company-related flights into the facility. Most airplanes that use the facility are single-engine.[18]

It is estimated that during heavy crop dusting periods of July through September, a maximum of 3 crop dusters, each making between 20 and 30 sorties daily, use the facility. During the rest of the year, it is estimated that one crop duster making one sortie daily uses the facility. Company-related travel to the airstrip averages about one or two flights monthly. Based on this information, the annual maximum number of operations are set at approximately 8600 flights.[18]

There are no plans for expansion and increased use of the facility is expected to be limited to company operations.[18]

Table 2.1-4

AVERAGE DAILY TRAFFIC (ADT) WITHIN A 5-MILE RADIUS OF THE PVNGS PLANT SITE, JUNE 1978

Traffic Count Location	ADT (Actual)
Buckeye-Salome Road between Wintersburg Road and 339th Avenue	4,859
Wintersburg Road between Buckeye-Salome Road and plant site entrance	3,814
Wintersburg Road between Buckeye-Salome Road and Buckeye Road	296

2.1.3.1.6.4 Pipelines. Figure 2.1-14 illustrates the Southern Pacific Pipe Lines, Inc. (SPPL) pipeline located within a 5-mile radius of PVNGS. At its closest point, the SPPL pipeline is located approximately 4.5 miles south-southeast of Unit 2.

SPPL owns and operates a 12-inch, high pressure, refined petroleum products pipeline. The pipeline was constructed in 1955 and buried at a depth of approximately 5 feet. An unmanned booster station is located approximately 11 miles east-southeast of Unit 2, at the intersection of the pipeline right-of-way and Palo Verde Road. SPPL is currently studying the feasibility of installing a second pipeline parallel to the existing one to be used in transporting refined petroleum products.(19)

2.1.3.1.7 Groundwater Use

The major use of groundwater in the Lower Hassayampa-Centennial area which encompasses the regional aquifer is water for irrigation. An average of 78,000 acre-feet per year was pumped during the period 1966 through 1972. Annual pumpage rates for

other forms of water use, such as municipal, livestock and industrial purposes represent less than 1% of the total.

Well depth and groundwater elevation in the vicinity of the site is provided in section 2.4.2.

2.1.3.2 Selected Land Use Within a 5 to 10-mile Radius of the PVNGS Plant Site

2.1.3.2.1 Industrial Land Use

Figure 2.1-13 illustrates the location of the only industrial facility within a 5 to 10-mile radius of PVNGS, the Hassayampa Cotton Gin. It is located approximately 6.0 miles southeast of Unit 2. Employment information is cited in table 2.1-3.

The only known industrial development proposed for location within a 5 to 10-mile radius of PVNGS is a combined energy research park and petroleum refinery. A report issued in June, 1977[20] was submitted to the Maricopa County Planning Department for information only.

2.1.3.2.2 Institutional Land Use

Figure 2.1-13 illustrates the location of the Ruth Fisher and Arlington Elementary Schools, approximately 7.5 miles north and 8 miles southeast of Unit 2, respectively. Employment information is cited in table 2.1-3.

There are no other public facilities or institutional land uses located within a 5 to 10-mile radius of PVNGS.

2.1.3.2.3 Agricultural Land Use

Agricultural land uses are discussed in section 2.1.3.4.

29. Collier, R., State of Arizona Dairy Commission, Phoenix, Arizona, Letter to Higman, S. L., NUS Corporation, June 15, 1979.

30. Lough, O. G., Agricultural Extension Agent, Maricopa County Cooperative Extension Service, Phoenix, Arizona, Letter to Higman, S. L., NUS Corporation, December 18, 1978.

31. Loughead, H. V., Agricultural Extension Agent, Maricopa County Cooperative Extension Service, Phoenix, Arizona, Personal Interview with Higman, S. L., NUS Corporation, October 13, 1978.

32. Duewer, L. A., U.S. Department of Agriculture, Economics, Statistics and Cooperative Services, Commodity Economic Division, Washington, D.C., Telephone Conversation with Wedgle, S. A., NUS Corporation, April 23, 1979.

33. Mikles, Dr., Assistant State Veterinarian, Disease Control Section, Arizona State Livestock Sanitary Board, Letter to Higman, S. L., NUS Corporation, October 30, 1978.

34. Hickman, J. L., Superintendent, Arlington School, District No. 47, Arlington, Arizona, Letter to Higman, S. L., NUS Corporation, July 8, 1980. 1

Table 2.3-24

SEASONAL AND ANNUAL FREQUENCY OF STABILITY CATEGORIES FOR PHOENIX (%)

(August 13, 1973 to August 13, 1978 and January 1, 1960 to January 1, 1964)

Season	Pasquill Stability Category						
	A	B	C	D	E	F	G
Spring:							
1973 to 1978	2.39	12.98	17.45	29.47	16.64	16.70	4.38
1960 to 1964	4.37	15.79	16.66	22.13	11.13	19.43	10.49
Summer:							
1973 to 1978	4.32	15.32	19.69	27.88	14.80	14.49	3.50
1960 to 1964	7.42	18.05	17.58	20.93	11.14	16.27	8.61
Fall:							
1973 to 1978	0.29	12.24	17.52	25.53	15.62	20.11	8.67
1960 to 1964	0.86	14.50	17.09	19.34	12.24	22.03	13.94
Winter:							
1973 to 1978	0.17	6.93	15.42	32.74	15.74	20.28	8.73
1960 to 1964	0.19	8.78	16.30	24.67	12.95	23.88	13.24
Annual:							
1973 to 1978	1.90	11.93	17.55	29.03	15.71	17.73	6.14
1960 to 1964	3.23	14.30	16.91	21.76	11.86	20.38	11.56

Appendix 2B includes grazing and growing season joint frequency distributions used to calculate some D/Q and χ/Q values. Monthly joint frequency distributions are not provided since hourly data on magnetic tape are also being provided.

2.3.2.2 Topographic Effects on Local Meteorological Conditions

The terrain in the region of the site is generally flat with an approximate elevation of 950 feet above mean sea level (msl). The Palo Verde Hills (elevation 2172 feet msl) are located approximately 5 miles to the west and north of the site. Other scattered hills are in the area (approximately 2 miles from the site) with peak elevations of 1100 feet above msl. One effect on site meteorology results from the mountains to the north and the north-to-south downward sloping terrain. At night, when stable atmospheric conditions are prevalent at the site, drainage wind flows from the north can occur. Figures 3.1-3 and 2.3-1 are topographic maps of the site area within 5-mile and 50-mile radii, respectively. Figures 2.3-15 through 2.3-22 are the topographic cross-sections of the site area, to distances of 10 miles. A more detailed site area map with proposed buildings, site boundary, meteorological tower location, etc., is provided in figure 3.1-4.

2.3.3 METEOROLOGICAL DATA RECOVERY

The meteorological data recovery rates for the PVNGS meteorological program (August 13, 1973 to August 13, 1978) are listed in table 2.3-25.

The data recovery for wind data at the 35-foot level and 200-foot level was 97% and 94%, respectively, for the report period. Data recovery of the dew point temperature was 94%. The data recovery for $\Delta T_{200'-35'}$ was 94%.

Table 2.3-25
METEOROLOGICAL DATA RECOVERY AT PVNGS (%)
(August 13, 1973 - August 13, 1978)

Month	200-Foot Wind Data	35-Foot Wind Data	ΔT_{200-35} Data	Joint Recovery 35-Foot Wind and ΔT_{200-35} Data	35-Foot Dew Point	35-Foot Temperature
August	79	93	93	92	93	93
September	92	94	93	92	91	93
October	98	98	90	90	95	95
November	96	96	94	92	93	94
December	98	97	90	89	93	90
January	93	98	97	96	97	97
February	97	99	98	98	98	98
March	97	99	99	98	96	97
April	97	97	97	97	94	96
May	94	99	98	98	95	96
June	93	95	96	94	92	92
July	95	96	84	83	95	92
Annual	94	97	94	93	94	94

2.3.4 ATMOSPHERIC DISPERSION ESTIMATES

Onsite meteorological data for the 5-year period August 13, 1973 through August 13, 1978 were analyzed to determine the atmospheric diffusion characteristics representative of the PVNGS site region. Dilution factors, χ/Q values, were calculated for input into dose computations for analysis of the environmental effects of accidents. Estimates of χ/Q values and relative deposition, D/Q values, were provided for dose calculations for determining the environmental effects of plant operation. These calculations are based on the meteorological models discussed in section 6.1.3. Table 2.3-26 provides short-term (50th percentile) χ/Q values as well as annual average χ/Q and D/Q values at the site boundary. Zero to 50 mile short-term χ/Qs are listed in table 2.3-27. Zero to 50-mile dispersion and deposition parameters are listed in tables 2.3-28 through 2.3-33.

2.3.5 ABSOLUTE HUMIDITY

Absolute humidity as a function of the various grazing seasons as well as the absolute humidity used for the dose analysis are presented in table 2.3-34.

2.7 NOISE

Ambient noise levels in the vicinity of the site were measured prior to construction and presented in ER-CP Section 2.9. L_{50} sound levels at 10 sampling points varied from 17 to 66 dBa with an overall average of 34 dBa. Daytime, evening, and nighttime sound levels are shown in figures 2.7-1 through 2.7-3. Preconstruction noise survey methodology is described in section 6.1.

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QUESTION 2A.3 (NRC comment on section 2.3) (6/18/80) 2.3

No monthly mixing height data.

RESPONSE: The seasonal mixing height data provided in ER-OL section 2.3.1.2.7 are adequate to represent the mixing heights of the region. These data are the same as that provided in the Environmental Report - Construction Permit Stage (ER-CP) for Units 1-3 and the ER-CP for Units 4-5. In all dispersion calculations σ_z was constrained to values less than 1000 meters. This is consistent with average afternoon mixing heights for all seasons. Therefore, dispersion calculations implicity account for mixing heights appropriate to the PVNGS climatic regime, regardless of whether monthly or seasonal data is used. 1

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TABLES

3.2 REACTOR AND STEAM-ELECTRIC SYSTEM

Design parameters of the reactor and steam-electric system have not changed significantly since the ER-CP. This section summarizes design details.

Each PVNGS unit contains a nuclear steam supply system (NSSS) powered by a light-water moderated and cooled, pressurized water reactor (PWR). Each reactor is fueled with 102,780 kg of slightly enriched uranium in the form of sintered uranium dioxide (UO_2) pellets clad in 56,876 zircalloy-4 fuel rods.

Four-fingered and 12-fingered control element assemblies (CEAs) are used in the core. The CEAs provide short-term reactivity control under normal and anticipated transient conditions.

Each NSSS has a rated core thermal power of 3800 MWt. The reactor coolant pumps add 17 MWt of heat for an NSSS power level of 3817 MWt. The turbine-generator gross generator output corresponding to 3817 MW is 1304 MWe at design condenser back pressure of 3.5 in. Hg absolute. The nominal net output of each PVNGS unit is 1270 MWe. Each turbine-generator consists of a tandem compound type, six flow exhaust, 1800 r/min, steam turbine with 43-inch last stage buckets (blades). The turbine-generator is hydrogen cooled with a 0.9 power factor and operates at 24 kV, 3-phase and 60 Hz.

The relationship between the station gross heat rate and unit load is summarized in table 3.2-1.

The condenser is a three shell, single pass, multipressure, reheat condenser. The circulating water is divided into two parallel paths for a total design flow of 560,000 gal/min. The heat rejection rate is 8.9×10^9 Btu/h with a temperature rise of 32.1F. The titanium tubes (25,426 per shell) provide a total effective surface area of 1,123,000 ft^2.

The design lifetime of each PVNGS unit is 40 years.

Table 3.2-1
STATION GROSS HEAT RATE VS. POWER LEVEL

Power	Station Gross Heat Rate[a] (Btu/kWh)
60%	11,014
80%	10,320
100% (3817 MWt)	9,987
Stretch (Valves Wide Open)	9,998

a. At design condenser backpressure of 3.5 in. Hg absolute.

3.3 PLANT WATER USE

Parameters of plant water use have not changed substantially from those presented in ER-CP Section 3.3 and the FES. This section provides additional information and summarizes PVNGS water use.

Figure 3.3-1 presents a schematic flow diagram of the basic plant water use and lists the expected maximum, average, minimum, and shutdown flow rates of those water systems that require makeup and/or generate waste.

3.3.1 INFLUENT WATER SOURCES

There are two influent water sources to PVNGS. The primary plant water source is waste water effluent from the City of Phoenix 91st Avenue Sewage Treatment Plant. The processed effluent is delivered to the onsite water reclamation plant via pipeline from the 91st Avenue Sewage Treatment Plant. It is further treated and then stored in the onsite reservoir. No surface diversion occurs. The secondary plant water source is from on-site wells that supply water to the domestic water system. The two onsite wells are shown in figure 3.1-4. The wells are located wholly within the site boundary. No well water will be used offsite. The effect of well water withdrawal on the local groundwater hydrology is discussed in section 5.6. The domestic water system supplies potable water to each generating unit for domestic, utility, and air conditioning services.

The total annual makeup water requirement for PVNGS from the city of Phoenix is estimated at 21,350 acre-feet per year per unit. The average well water requirement is approximately 1300 acre-feet per year for all PVNGS units.

The water reclamation plant and the domestic water system are described in section 3.6.

3.3.2 PLANT WATER USES

3.3.2.1 Circulating Water System

Each unit's circulating water system removes waste heat resulting from normal operation of the unit and rejects it to the atmosphere via the three cooling towers in each system. Heat rejection is accomplished by the evaporation of a portion of the circulating water flow. To maintain the chemical concentration of circulating water at or below 15 times that of makeup water (15 cycles of concentration), a quantity of water, called blowdown, must be discharged from the system. In addition to evaporation and blowdown losses, a small amount of water in the form of entrained droplets (drift) is carried away in the cooling tower air stream. Makeup water to replace these losses in each unit is drawn from the reservoir.

During the period when the reactor is shut down for refueling and maintenance, the circulating water system is not used and makeup water is not required.

3.3.2.2 Essential Spray Pond System

Each generating unit has two spray ponds that provide the ultimate heat sink for cooling the auxiliary systems required for reactor shutdown. The domestic water system provides makeup water to the essential spray ponds. The spray ponds are normally in use only during a reactor shutdown. Hence, makeup from the domestic water system during normal operation is only required to replace water lost by natural surface evaporation and periodic blowdown to the circulating water system. During a reactor shutdown, makeup requirements to the spray ponds are increased because of the increased evaporation to dissipate the imposed heat load and the drift associated with the operation of the ultimate heat sink sprays.

3.3.2.3 Domestic and Demineralized Water Systems

The onsite wells provide makeup to the domestic water system where it is processed in a reverse osmosis system to produce potable water. The product of the reverse osmosis system is used as makeup to the demineralized water system. Demineralized water is supplied to each unit.

3.3.3 PLANT WASTE WATER

The major source of waste water is blowdown from the circulating water system of each unit. Additional waste water is produced from sources such as: Nonradioactive demineralizer regenerants, demineralized water wastes, domestic water wastes and miscellaneous (e.g., floor drains) nonradioactive wastes. This wastewater is directed to the onsite evaporation ponds without requiring any offsite discharges.

Sanitary waste from each unit is kept separate from other plant wastes and is directed to the shared, onsite sanitary waste treatment facility. Liquid effluent from the sanitary waste treatment facility is returned to the water reclamation plant for reuse.

Treatment processes for the circulating water, domestic water, demineralized water, and condensate polishing systems, including chemical consumption, are discussed in section 3.6.

3.6 CHEMICAL AND BIOCIDE WASTES

Information presented in ER-CP Section 3.6 and the FES has been updated. As part of this update, detailed parameters such as flowrates, chemical consumption and operational frequencies are presented.

3.6.1 PREOPERATIONAL AND PERIODIC CLEANING WASTES

Prior to the initial startup of each unit, the feedwater system from the condensers to the containment isolation valves (approximately 450,000 gal) will be flushed and chemically cleaned to remove dirt, grease, oil, rust, and mill scale. This will be accomplished by the following operations:

A. Dirt and construction debris, estimated at 7470 lb, will be removed by flushing the piping with a high velocity water flush of approximately two system volumes of demineralized water.

B. Chemical cleaning is not expected to be required. Should it become necessary, however, the following steps would be performed:

   1. Grease, oil, and dirt, estimated at 3735 lb, will be removed by flushing each system with approximately 450,000 gallons of an alkaline phosphate solution of approximately 1% concentration. This will be followed with a rinse of approximately two system volumes of demineralized water.

   2. Rust and mill scale will be removed from each system by circulating a 3% organic acid (2% hydroxyacetic, 1% formic) solution containing a 0.2% acid inhibitor, such as Dow Chemical Co. A-145, for several hours. This will be followed with a rinse of approximately two system volumes of demineralized water containing an estimated 5600 lb of citric acid. An estimated 33,615 lb of iron will be removed.

C. The system may be passivated by filling with demineralized water containing 200-400 ppm hydrazine and 0-60 ppm ammonia, to a pH of 9.0-10.0.

Estimated total water volume used in a complete cleaning would be approximately 4,050,000 gallons.

Wastes from this cleaning process will be directed to the onsite evaporation ponds. Periodic, non-radioactive operational equipment cleaning wastes will be discharged to the evaporation ponds.

3.6.2 NONRADIOACTIVE OPERATIONAL WASTES

The plant is designed to have no requirement for offsite disposal of any chemical or liquid wastes. Operational nonradioactive liquid wastes are collected and discharged to the onsite evaporation ponds.

During normal operation of the plant, nonradioactive wastes come from the following sources:

- Water reclamation plant
- Circulating water system
- Demineralized water system
- Domestic water system
- Condensate polishing demineralizer system
- Laboratories and laundry
- Floor drains

Figure 3.3-1 diagrams all plant water and wastewater flows and includes a tabulation of the respective flow rates at various operating conditions. Table 3.6-1 includes a summary of the expected maximum and average concentrations of dissolved solids in the plant influent water from the City of Phoenix 91st Avenue Sewage Treatment Plant and the onsite wells. The table includes the quality of the circulating water which is discharged as cooling tower blowdown and drift.

Table 3.6-1

ESTIMATED MAXIMUM AND AVERAGE CONCENTRATION OF CHEMICALS IN THE INFLUENT AND EFFLUENT WATER SYSTEMS (ppm) (Sheet 1 of 2)

Chemical	Influent Streams				Effluent Streams	
	Influent from Phoenix 91st Avenue Sewage Treatment Plant		Influent from Onsite Wells		Effluent from Circulating Water System (Cooling Tower Blowdown and Drift)	
	Maximum	Average	Maximum	Average	Maximum (20 cycles)	Average (15 cycles)
Calcium	67.2	52.9	250.0	41.0	356.0	336.0
Magnesium	29.6	22.9	130.0	19.0	34.0	29.0
Sodium	192	186	1,800.0	590.0	5,400.0	4,620.0
Chloride	270	253	3,250.0	740.0	5,140.0	4,650.0
Sulfate	95.0	91.0	1,330.0	220.0	3,500.0	2,750.0
Nitrate	4.20	1.85	200.0	30.0	2,300.0	1,990.0
Silica	32.0	28.8	44.0	40.0	83.0	72.0
Phosphate	68.9	22.1	--	0.1	7.2	5.0
Fluoride	4.8	3.5	10.0	6.2	24.0	18.0
Potassium	14.7	13.8	8.0	3.2	--	--
Copper	0.022	0.017	0.1	0.04	6.0	2.3
Zinc	0.080	0.067	--	--	0.8	0.6
Iron	0.041	0.035	0.1	0.08	3.5	1.0
Arsenic	0.006	0.005	0.02	0.01	0.4	0.3

Table 3.6-1

ESTIMATED MAXIMUM AND AVERAGE CONCENTRATIONS OF CHEMICALS IN THE INFLUENT AND EFFLUENT WATER SYSTEMS (ppm) (Sheet 2 of 2)

Chemical	Influent Streams				Effluent Streams	
	Influent from Phoenix 91st Avenue Sewage Treatment Plant		Influent from Onsite Wells		Effluent from Circulating Water System (Cooling Tower Blowdown and Drift)	
	Maximum	Average	Maximum	Average	Maximum (20 cycles)	Average (15 cycles)
Boron	0.09	0.037	7.0	3.2	5.6	4.2
Ammonia-N	45.4	30.9	0.3	0.08	15.0	12.5
Phenol	0.018	0.009	0.01	0.009	0.01	0.006
Dissolved Oxygen	8.2	6.7	--	--	7.0	7.0
Suspended Solids	68	35.7	--	--	150.0	110.0
COD	187.7	87	14.0	6.0	660.0	514.0
Alkalinity	285	272	230.0	143.0	65.0	38.0
TDS	1,083	1,039	5,980.0	1,520.0	17,000.0	14,600.0

3.6.2.1 Water Reclamation Plant

The water reclamation plant receives the wastewater effluent from the City of Phoenix 91st Avenue Sewage Treatment Plant, processes it further in four stages of treatment, and stores it in the onsite reservoir. This onsite treatment of the station makeup water is required to reduce the concentration levels of calcium, phosphate, silica, magnesium, and ammonia. Some incidental removal of organics occurs. The removal of these compounds allows the treated effluent to be concentrated to approximately 15 cycles in each generating unit circulating water system without excessive scaling or fouling of system components and heat exchangers.

The water reclamation plant process is shown schematically in figure 3.6-1. The four stages of treatment are:

- Biological nitrification
- Lime treatment
- Filtration
- Chlorination

The influent to the water reclamation plant (WRP) consists of effluent from the Phoenix treatment plant which provides primary sedimentation and secondary activated sludge treatment.

No further removal of organics is required in order to use the WRP influent water for cooling purposes in the power plant; therefore, treatment processes in the WRP have not been designed to remove organics. However, some incidental removals will occur in certain processes as estimated by the following:

Treatment Process	Removal
Biological nitrification (see section 3.6.2.1.1)	10 to 20% removal of dissolved (or colloidal) organics, measured as BOD_5 (5-day

Treatment Process	Removal
	bio-chemical oxygen demand) or COD (chemical oxygen demand).
Lime soda softening and clarification (see section 3.6.2.1.2)	Better than 95% removal of suspended organics, measured as volatile suspended solids, and 5 to 10% removal of colloidal BOD_5 and COD.
Entire WRP, considered as a whole	Better than 95% removal of suspended organics, and 10 to 25% removal of dissolved or colloidal organics.

The WRP influent will contain an average of about 30 mg/ℓ BOD_5, 40 mg/ℓ suspended solids, and 100 mg/ℓ COD. Lime clarification should provide high removal rates for viruses and bacteria, so pathogen levels in the WRP effluent are expected to be low. However, this water is expected to contain the broad spectrum of organics which typically occur in secondary sewage effluent due to their relative resistance to biodegradation.

3.6.2.1.1 Biological Nitrification

Biological nitrification refers to the bacterial conversion of ammonia nitrogen to the nitrate nitrogen form. The following equations summarize the two-step reaction:

$$NH_4^+ + 3/2\ O_2 \xrightarrow{\text{bacteria}} NO_2^- + 2H^+ + H_2O$$

$$NO_2^- + 1/2\ O_2 \xrightarrow{\text{bacteria}} NO_3^-$$

For nitrification, the trickling filter process has been selected. In this process, nitrifying bacteria are attached to a solid medium along with other microorganisms. By distribution

3.6.2.2 Circulating Water System

Each generating unit is provided with an independent circulating water system. This system, shown schematically in figure 3.6-2, removes waste heat developed during normal operation and rejects it to the atmosphere via the three mechanical draft cooling towers. The circulating water system is discussed in section 3.4.

Waste from the circulating water system consists of blowdown and drift from the cooling towers. Blowdown is continuously discharged to the evaporation ponds as required to maintain water quality. Drift is maintained at approximately 0.0044% of the 587,000 gal/min combined flow of the circulating water and plant cooling water system by the use of integral drift eliminators in the cooling towers. Drift from the cooling towers is discussed in sections 5.1 and 5.3.

Chlorine is added to the circulating system, as a sodium hypochlorite solution, to control biological growth. The amount of chlorine added is dependent upon the rate of biological growth in the circulating water. During the summer, because of increased biological growth on warm days, chlorine is injected in approximately three 40-minute injection periods per day for shock treatment. During the winter, when chlorine demand is low, only two 40-minute injection periods per day are required. It is expected that approximately 3500 pounds per day per unit of chlorine during the summer, and approximately 2300 pounds per day per unit of chlorine during the winter will be required for biogrowth control. The process consists of injecting the chlorine into the circulating water and the plant cooling water pump suctions in sufficient quantity to maintain a chlorine residual at the discharge of the condenser and heat exchangers of approximately 1 to 2 parts per million. Since the chlorine is injected in the hypochlorite form, no elemental chlorine is released to the atmosphere.

Sulfuric acid is added to maintain the pH at approximately 7 to prevent deposition of calcium carbonate scale. Acid, 66^{o} Baumé, is diluted and distributed in the circulating water stream upstream of the circulating water pumps to ensure complete mixing and pH adjustment prior to entering the pumps. A dispersant is added to the circulating water to inhibit the formation of scale on condenser and heat exchanger tube surfaces.

The main condenser and heat exchanger tubes are titanium with negligible corrosion rate. No other sources of corrosion products are expected since the circulating water lines are constructed of concrete and the plant cooling water lines and cooling tower risers are suitably lined, as are all valves and ferrous fittings. Since the rate of corrosion is minimal, it is anticipated that no corrosion inhibitors will need to be added to the system.

3.6.2.3 Domestic Water System

The domestic water system consists of four reverse osmosis modules in parallel. The reverse osmosis product is shared between the domestic and demineralized water systems. Internal valves in the reverse osmosis system allow the output to be distributed on a 1:3, 1:1, or 3:1 basis to the receiving systems. A schematic flow diagram of the domestic water system is shown as figure 3.6-3.

The reverse osmosis modules rated at approximately 200 gallons per minute each, remove approximately 90% of the total dissolved solids (TDS) in the water, to bring the water quality within U.S. Public Health Service limits. The units reject approximately 20% of the incoming water as a concentrate containing the removed dissolved solids. This concentrate is discharged into the evaporation pond. Sodium hypochlorite is added downstream of the reverse osmosis units prior to storage in the domestic water chlorine contact tank.

Provisions are made to direct floor drains to the liquid radwaste system or to the neutralizer tanks, if necessary.

3.6.3 NONRADIOACTIVE LIQUID WASTE DISPOSAL

All chemical and liquid waste is disposed of in the onsite evaporation ponds.

3.6.3.1 Evaporation Ponds

The onsite evaporation ponds receive liquid waste from the generating units and remove moisture by natural evaporation. Initially, 250 acres of evaporation ponds will be constructed. The evaporation ponds may be expanded to contain additional liquid wastes. The ponds will be lined with a suitable material to limit seepage to the groundwater. The evaporation ponds are sized to retain all liquid wastes.

3.7 SANITARY AND OTHER WASTE SYSTEMS

The information presented in ER-CP Section 3.7 and the FES has been updated to reflect peak construction work force and gaseous effluent quantities based on plant specific equipment data. The information is updated and summarized in this section.

3.7.1 LIQUID WASTES

3.7.1.1 Sanitary Wastes

Facilities are provided to treat sanitary wastes produced during construction and operation except for that produced by field construction workers. Chemical toilets are used by field construction workers; wastes from the chemical toilets are hauled approximately 10 miles to the Maricopa county land fill site for disposal.

The peak construction workforce (office plus field) was about 6200. The estimated quantity from chemical toilets is 34,000 gal/d based on 3400 field workers at 10 gal/d. It is estimated that a peak sanitary waste flowrate of 30,000 gal/d will be processed by the onsite sewage treatment package plants. This sanitary waste will contain approximately 300 ppm of 5-day BOD and 300 ppm suspended solids.

During construction, two package sewage treatment plants will be used, each with a rated capacity of 17,500 gal/d for a total capacity of 35,000 gal/d. During normal plant operation, the expected sewage load will be less than 15,000 gal/d. The treated effluent is recycled to the onsite water reclamation plant. Solid wastes are transported to the onsite solid waste disposal area discussed in section 3.7.2.2.

3.7.1.2 Other Liquid Wastes

Chemical laboratory wastes, dry cleaning waste, and decontamination solutions are described in section 3.6.2.

3.7.2 SOLID WASTES

3.7.2.1 Sources of Solid Waste

3.7.2.1.1 Water Reclamation Plant

Sludge produced by the two-stage lime treatment process from the water reclamation plant is further concentrated in a classification centrifuge. A portion of the concentrated sludge is recalcined to recover lime for reuse in the lime softening process. Approximately 15,500 tons of sludge per PVNGS unit requiring disposal is produced annually at the water reclamation plant.

3.7.2.1.2 Sanitary Waste Treatment Plant

Sanitary sludge is produced in the package sewage treatment plants. Approximately 8 tons of dried sludge are produced annually during normal plant operation.

3.7.2.1.3 Service Buildings

Wastes from the service buildings consist of paper, rags, grit, and other nonrecyclable materials. This waste essentially is in solid form. Approximately 150 tons per year are expected from this source.

3.7.2.1.4 Miscellaneous

Various other solid wastes, such as those obtained in intermittent cleaning of the plant cooling tower basins and water storage reservoir, are anticipated and require disposal. The quantities produced will be small compared to other sources.

3.7.2.2 Solid Waste Disposal Area

The solid waste disposal area is approximately 200 acres. Sludge waste will be spread in the area to dry out. Water reclamation plant waste is centrifuge dried prior to disposal in the solid waste disposal area.

3.7.3 GASEOUS EFFLUENTS

3.7.3.1 Diesel Generators

Each diesel generator (two per unit) nominally operates for test purposes once a month for approximately 1 hour, and discharges approximately 2300 pounds NO_x, 540 pounds SO_x, and 35 pounds of hydrocarbons annually. Each diesel generator discharges through its own stack approximately 93 feet above plant grade.

3.7.3.2 Auxiliary Boilers

During operation, the auxiliary boilers are available for backup and are not normally used after initial startup. The three units share one set of two auxiliary boilers. When the boilers operate (approximately 8 days per unit per initial startup) they will produce about 2300 pounds NO_x, 2812 pounds SO_x, and 682 pounds of hydrocarbons anually. The auxiliary boilers discharge through their own stacks 50 feet above plant grade.

3.7.3.3 Water Reclamation Plant

Gaseous wastes from the wastewater reclamation system will be generated from the lime recalcination operations. The furnace exhaust gas discharged will contain a maximum of 84 pounds particulate matter, 144 pounds SO_x, 23 pounds CO, 17 pounds

hydrocarbons, and 456 pounds NO_x, daily, after treatment in a wet scrubber. Under normal plant operating conditions, the major portion of the exhaust gases will be injected into the water in the second stage solids contact clarifiers as a source of CO_2 for recarbination. This will tend to reduce the discharges of all of the above pollutants from the maximum levels specified.

3.9.1.4.3 PVNGS To Devers Structure

Information concerning the PVNGS to Devers line is contained in the U.S. Department of Interior Bureau of Land Management and U.S. Nuclear Regulatory Commission Final Environmental Statement, Palo Verde-Devers 500 kV Transmission Line, February, 1979. Descriptions are presented for preferred and laternate routes. Final route approval has not been received from the Bureau of Land Management.

3.9.2 PVNGS WASTEWATER CONVEYANCE SYSTEM

Information presented in ER-CP Section 3.9.2 and the FES has been updated to reflect final pipeline routing. Description of the wastewater conveyance system is updated and summarized in this section.

As shown in figure 3.9-5, the wastewater conveyance system route extends from the City of Phoenix 91st Avenue Sewage Treatment Plant approximately 36.5 miles to the PVNGS site.

A 114-inch diameter pipeline leaves the 91st Avenue Sewage Treatment Plant, conveying treated wastewater effluent by gravity flow for about 6 miles, where it is reduced to a 96-inch diameter. The 96-inch diameter pipeline continues gravity flow for about 4 miles to a turnout for delivery of effluent to the Buckeye Irrigation Company (BIC) canal. From the turnout, the 96-inch pipeline proceeds by gravity flow generally parallel to the BIC canal for about 18.5 miles to a pumping station near the Hassayampa River. The remaining 8 miles to the PVNGS site are traversed by a 66-inch diameter pipeline. The entire 36.5 miles of pipeline will be underground with above ground structures limited to manholes approximately each 1/2 mile and vents, at high points, about 6 feet above grade; these are anticipated to have minimal visual impact. A 50 foot wide permanent access right-of-way will be required for the entire length of the pipeline.

The majority of the wastewater conveyance pipeline passes through agricultural land. The remaining areas are scattered residential, mostly associated with the agricultural activities, and some scattered light industry. There are no existing recreational areas along the route. After construction the right-of-way will be regraded, and topsoil will be replaced in agricultural areas for future cultivation. Table 3.9-1 lists the land types and the distances associated with the wastewater conveyance pipeline route.

Table 3.9-1

LAND TYPE ADJACENT TO WASTEWATER CONVEYANCE PIPELINE

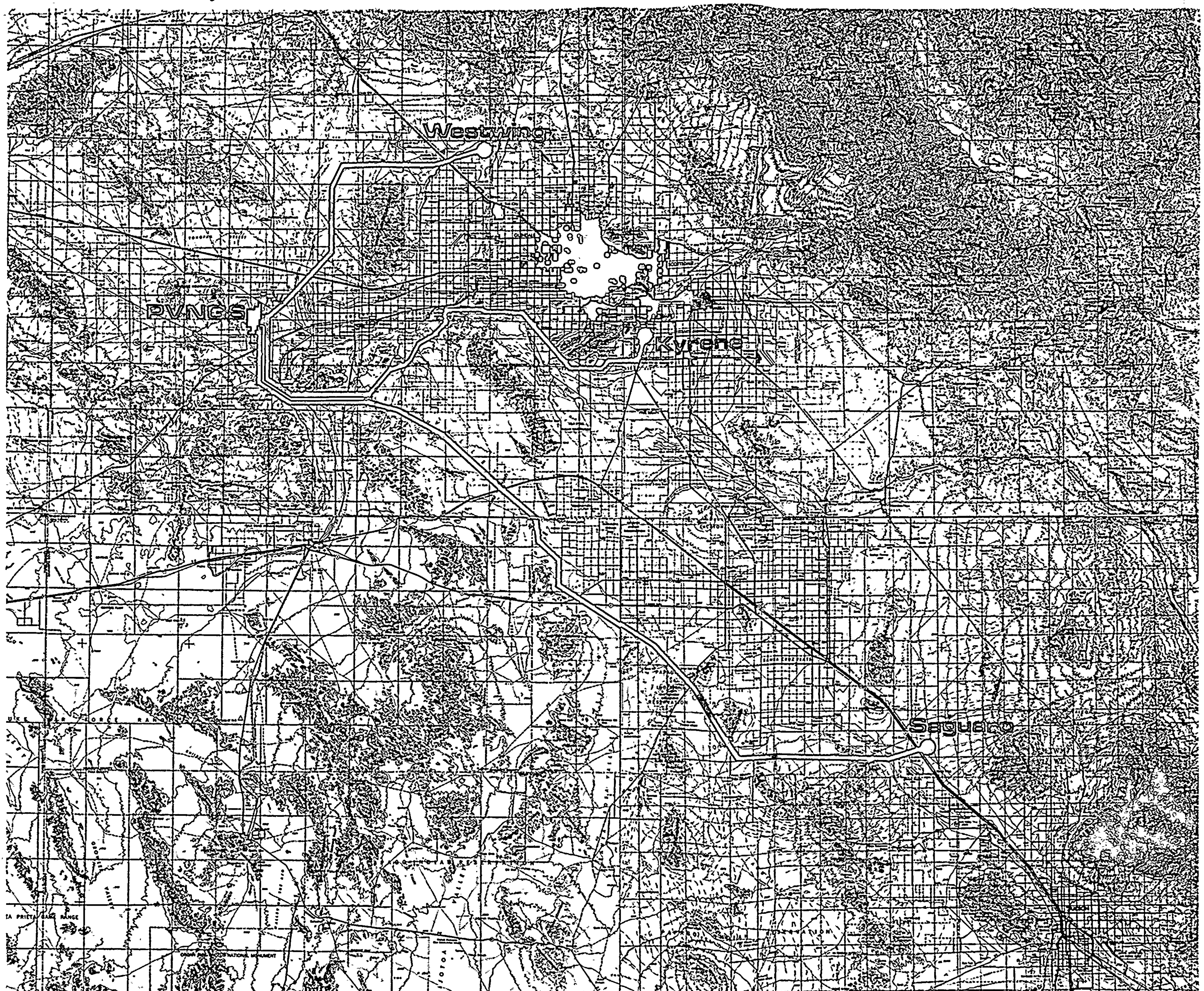
Land Use Types	Route
Open land	12.5 miles
Agricultural land	19.0 miles
Residential areas	3.5 miles
Industrial areas	0.5 mile
Other	1.0 mile

3.9.3 REFERENCES

1. Letter dated December 7, 1978 from E. E. Van Brunt, Jr., Arizona Public Service Company, Vice President, Nuclear Projects to Dr. Robert A. Gilbert, Project Manager, Environmental Projects Branch 3, U.S. Nuclear Regulatory Commission.

2. Letter dated January 4, 1979 from W. H. Regan, Jr., Chief, Environmental Projects Branch 2, U.S. Nuclear Regulatory Commission to E. E. Van Brunt, Jr.

3. Letter dated December 3, 1979 from E. E. Van Brunt, Jr., Arizona Public Service Company, Vice President, Nuclear Projects to Dr. Robert A. Gilbert, Project Manager, Environmental Projects Branch 3, U.S. Nuclear Regulatory Commission.



Palo Verde Nuclear Generating Station
ER-OL

TRANSMISSION LINE ROUTES
PROJECT 1

Figure 3.9-1

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<u>QUESTION 3A.1</u> (NRC comment on section 3.1.3.1) (6/18/80) 3.1.3-1
Location of release points not illustrated on figure 3.1-9. 1

RESPONSE: The response is given in revised section 3.1.3.1

CHAPTER 5

ENVIRONMENTAL EFFECTS OF STATION OPERATION

CONTENTS

CONTENTS (cont)

CONTENTS (cont)

TABLES

FIGURES

are the characteristics and quantity of effluent air, the height of the effluent plume rise, and the downwind dispersion of the effluent plume.

Potential horizontal and vertical icing conditions were not considered in the analysis. A day or more of subfreezing temperatures is necessary for any ice to accumulate to significant thickness. Therefore, because the maximum daily temperature in the site vicinity has never been reported below 32F,[2-5] no quantitative estimates were made of potential icing conditions.

The fogging results were calculated based on the visibility criterion that a liquid water content of 1.2×10^{-5} pound liquid water per pound of dry air (0.015 g H_2O/m^3 of dry air) would result in a visibility of 1000 meters or less.[6]

5.1.4.2.1 Effects on Ground Transportation

Generally, driving conditions can be affected by visibility reductions caused by fogging over roadways resulting from moisture emissions from the operation of cooling systems. The surrounding roadways within 10 miles of PVNGS include Wintersburg Road, Buckeye-Salome Road, 339th Avenue, Ward Road, and Interstate 10. The location and orientation of each of these roadways relative to the site are listed in table 5.1-2. The predicted annual mean frequencies of occurrence of reduced ground-level visibility to less than 1000 meters (5/8 mile) were less than 1 h/yr for all roads except Ward Road which is predicted not to have any reduced ground-level visibility.

These predictions of insignificant fogging occurrences produced by the operation of the cooling towers for PVNGS are consistent with the experience of the Arizona Public Service Company (APS) with operating cooling towers in the Phoenix area.

Table 5.1-2

MAJOR ROADWAYS WITHIN 10 MILES OF PVNGS

Major Roadways and Orientation	Classification	Distance and Direction from PVNGS (miles)[a]
Wintersburg Road (N-S)	Asphalt	0.8 W
Ward Road (E-W)	Dirt	1.4 S
Buckeye-Salome Road (NW-SE)	Asphalt	2.0 NE
339th Avenue (N-S)	Asphalt/ Dirt	4.5 SE
I-10 (NW-SE)	Interstate highway	5.8 NE

a. 8-point compass used.

5.1.4.2.2 Effects on Air Transportation

The closest air carrier airport to the plant site is the Phoenix Sky Harbor International Airport, approximately 50 miles east of the site. At this distance, the cooling systems would not affect airport operations.

5.1.4.2.3 Effects on Water Transportation

There are no major waterways in the vicinity of the site; therefore, the cooling tower system would not affect water transportation.

5.1.4.3 <u>Elevated Visible Plumes</u>

The predicted occurrences of elevated visible plumes from the cooling towers, and their environmental impact on surrounding area airports and population centers, are discussed in this section.

5.1.4.3.1 Maximum Occurrence of Elevated Visible Plumes

Isopleths of the predicted annual frequency of occurrence of elevated visible plumes are presented in figure 5.1-1. The maximum predicted occurrences are approximately 530 h/yr in the immediate vicinity of the cooling towers.

5.1.4.3.2 Occurrence of Elevated Visible Plumes at Airports

Sky Harbor International Airport is located at too great a distance to be affected by elevated visible plumes generated by the operation of the cooling towers.

5.1.4.3.3 Occurrence of Elevated Visible Plumes at Surrounding Population Centers

The surrounding population centers within 10 miles include Wintersburg, Arlington, Dixie, Hassayampa, and Tonopah, Arizona. The location of these population centers relative to the site are listed in table 5.1-3. The predicted annual mean frequencies of occurrences of elevated visible plumes are approximately 1 h/yr for Wintersburg, less than 1 h/yr for Arlington and 0 h/yr for Dixie, Hassayampa, and Tonopah, Arizona.

Table 5.1-3
POPULATION CENTERS WITHIN 10 MILES OF PVNGS

Population Center	Distance and Direction from PVNGS (miles)
Wintersburg	3.5 N
Arlington	7.5 SE
Dixie	6.5 ESE
Hassayampa	8.8 ESE
Tonopah	9.0 NNW

5.1.4.3.4 Occurrence of Elevated Visible Plumes by Month

Table 5.1-4 presents the maximum frequencies of occurrence of elevated visible plumes greater than 0.50 mile in length for each month of the year and for each of the 16 compass directions. The tabulated values are of plumes from the nine round mechanical draft cooling towers. The results show a maximum frequency of approximately 15 h/mo during March in a northeast direction from the round mechanical draft cooling towers. Table 5.1-5 presents the predicted maximum monthly visible plume lengths for the cooling towers.

5.1.4.4 <u>Solids Discharge from the Cooling System</u>

5.1.4.4.1 Dissolved Solids Deposition

To evaluate the environmental impacts associated with dissolved solids in the cooling tower drift, the predicted deposition was separated into deposition as dry drift particles, as droplets, and as total. Figure 5.1-2 displays isopleths of the predicted annual solids deposition for dry particles that remain after the water completely evaporates from the drift droplets. Predictions of the annual solids deposited in droplet form are presented in figure 5.1-3. The predicted total annual solids deposition patterns--solid materials deposited as dry particles and in droplet form--are shown in figure 5.1-4.

5.1.4.4.2 Airborne Concentration of Dry Drift Particles

Figure 5.1-5 presents isopleths of the predicted annual mean airborne concentrations of dry drift particles. The maximum calculated values at the site boundary were 51 $\mu g/m^3$ and approximately 1 $\mu g/m^3$ for 24-hour and annual time periods, respectively.

The maximum 24-hour airborne dry drift concentration of 51 $\mu g/m^3$ was calculated at the site boundary northeast of the towers. This concentration decreased with downwind distance. For example, at 1 mile beyond the site boundary, the estimated concentrations are reduced to approximately 47 percent of the maximum value, at 2 miles they are approximately 22 percent, and at 3 miles they are approximately 20 percent.

5.1.4.5 Increased Ground-Level Temperature

The round mechanical draft cooling towers for PVNGS are predicted to have a negligible effect on ground-level temperature. The maximum predicted increased ground-level temperature was less than 0.1F.

5.1.4.6 Increased Ground-Level Relative Humidity

The mean annual increases of ground-level relative humidity beneath the plume from the cooling system were calculated on a polar grid centered on the cooling system. These values represent represent the mean predicted increases of ground-level relative humidity above ambient when the cooling system plume is overhead. Figure 5.1-6 presents isopleths of the annual predicted increase of ground-level relative humidity caused by the operation of the round mechanical draft cooling towers. As can be seen, these annual ground-level relative humidity increases are less than 1% and would be difficult to detect.

5.1.4.7 Cooling Tower Plume Behavior

Upper-air soundings taken at the Sky Harbor International Airport were used by the NUS LVPM computer code as basic states of meteorological conditions to investigate the general cooling tower plume behavior. (Refer to section 6.1). The reference or basic state at PVNGS is generally similar to that at Phoenix. Soundings were averaged by month and hour of observation during

the period July 1952 through May 1957. This period represents the latest 5 years of data on magnetic tape. Subsequent to this period, the Sky Harbor station no longer took soundings. Behavior of the cooling tower plume predicted by the model represents the mean for a given month.

Average January and July soundings were used as representative winter and summer conditions, respectively. For an average winter morning (0800 Mountain Standard Time), a strong ground-based inversion (12.1F per 1000 feet) with surface temperature at 42F existed to the first 850-foot level. Surface windspeed was 4.0 mi/h from the east, increasing to 11.5 mi/h at a height of about 2300 feet. Relative humidity was 75 percent at the surface, decreasing to 40 percent at the 2300-foot level.

The average summer morning sounding (0800 Mountain Standard Time) reveals a constant temperature lapse rate of approximately 4.2F per 1000 feet for the first 6560 feet. In the evening (2000 Mountain Standard Time), the atmosphere is in neutral condition because of daytime surface heating. Average surface temperature is 88F in the summer morning, and 100.4F in the summer evening. Relative humidity during an average summer morning is about 49 percent near the ground, decreasing to 45 percent at 2170 feet. A nearly constant relative humidity was observed in the average summer evening sounding with a value near 32 percent in the lower 2170 feet.

The initial momentum and buoyancy of the effluent from the cooling towers are expected to raise the vapor plume to a height of approximately 920 feet during the average winter morning. Neutral buoyancy height is about 630 feet. No major difference in plume rise was predicted between winter mornings and evenings. For all wind directions, a saturated plume extending through the maximum height of penetration was predicted.

During the average summer morning, a plume can penetrate through a height of approximately 1900 feet. Plume buoyancy becomes neutral at a height of 1210 feet. No saturated plume was predicted for the average summertime condition for any hour of the day.

Figures 5.1-7 and 5.1-8 show some of the plume parameters as a function of height for winter and summer mornings, respectively. The height of maximum penetration is determined by taking the height where the vertical velocity of the plume becomes zero. Neutral buoyancy height (equilibrium level of buoyancy) is defined as the level where the plume and ambient temperatures are identical. Cloud water is defined as condensed water droplets that have a negligible terminal velocity and are carried by the updraft in the plume.

The average visible plume length is estimated to be 870 feet during the average winter morning and 780 feet during the average winter evening. Ground-level moisture excess over ambient in the vicinity of the cooling towers is estimated to be insignificant under normal weather conditions in the area, as listed in table 5.1-6. Figures 5.1-9 and 5.1-10 show the excess relative humidity profile at the plume centerline at various distances downwind from the cooling towers under average winter and summer morning conditions. Significant weather modification from the operation of the cooling tower system is not expected.

5.1.4.8 Parametric Study of Plume Rise

To examine expected plume rise in the site area, a parametric analysis was performed for the average winter and summer morning conditions. The LVPM computer code was used (see section 6.1). Two major parameters influence the plume rise: the

Table 5.1-6

RELATIVE HUMIDITY EXCESS, AT GROUND LEVEL, CAUSED BY OPERATION OF COOLING TOWER SYSTEM

Ambient Condition	Ambient Relative Humidity	Excess Relative Humidity at Ground Level (%)			
		1 km Downwind	3 km Downwind	5 km Downwind	10 km Downwind
Mean winter morning (0800 MST)	72	0.01	0.03	0.06	0.11
Mean winter afternoon (2000 MST)	55	0.07	0.17	0.23	0.22
Mean summer morning (0800 MST)	49	0.00	0.00	0.00	0.00
Mean summer afternoon (2000 MST)	34	0.00	0.00	0.00	0.00

ambient temperature lapse rate and the ambient windspeed. Using these parameters, the following analyses were performed:

- Plume rise was examined as a function of vertical temperature gradient, assuming the gradient is constant with height. (See figure 5.1-11.)
- Examination of plume rise as a function of ambient windspeed at the tower top. (See figure 5.1-12.)

In the second analysis, the wind profile was assumed to vary according to the empirical power law:

$$U_z = U_H\left(\frac{z}{H}\right)^P$$

where

U_z = windspeed at height z

U_H = windspeed at tower height H

P = empirical constant, which is 0.25 for the winter morning and 0.12 for the summer morning from Phoenix upper-air soundings

The average January and July morning soundings were used as representative winter and summer morning reference states, respectively, when not defined in the above analysis. The plume height from the cooling tower system can be expected to exceed 410 feet for all seasons, as shown in figure 5.1-12. Lowest plume rise is found under strong ground-based inversions in the summer morning.

The effect of windspeed on plume rise is pronounced. Very strong winds (on the order of 30 to 40 mi/h) could limit the plume rise to less than 310 feet from the tower top as illustrated in figure 5.1-12.

5.1.4.9 Noise

The noise sources associated with the round mechanical draft cooling towers are described in section 5.6.

5.1.4.10 Consumptive Water Loss

For the round mechanical draft cooling towers, the major consumptive water loss will be through the evaporative cooling process. The entrainment of droplets as drift in the effluent plume will cause additional water losses. Table 5.1-7 presents a summary of the average consumptive water losses by month. The values in this table are based upon a 95-percent load factor for each month and were calculated from monthly averages of meteorological data obtained from 5 years of hourly onsite data. Each of the generating units will be shut down for refueling during 1 month in each year. Correcting the annual average consumptive water loss for refueling shutdowns leads to an annual average consumptive water loss for the three units of approximately 64,000 acre-ft per year. The effects of this water use is discussed in section 5.6.

Blowdown from the cooling towers will be directed to the evaporation ponds.

5.4 EFFECTS OF SANITARY AND OTHER WASTE DISCHARGES

This section has been revised to reflect updated meteorological data and current PVNGS system design.

5.4.1 SANITARY WASTES

During plant operation, treated effluent from the package sewage treatment plant will be delivered to the water reclamation plant. The treated onsite sewage effluent will be available as additional water for cooling system makeup during normal operations. When the water reclamation plants are temporarily not operating, chlorinated effluent from the package sewage treatment plant will be delivered to the onsite evaporation pond. No major adverse environmental impact is anticipated from this operation, because there will be no direct discharges from the evaporation pond. Lining the evaporation pond limits seepage of the impounded effluent into local groundwater aquifers. Therefore, the evaporation pond is not expected to significantly affect recharge to the aquifers.

5.4.2 GASEOUS EFFLUENTS

There are three groups of facilities on the PVNGS site that are stationary sources of pollutants; the diesel generators, auxiliary boilers and recalciners. Source operational modes and emission parameters are described in section 3.7 and listed in table 5.4-1.

The diesel generators and auxiliary boilers are operated only on a limited basis:

A. The diesel generators are each tested for about 1 hour per month. This testing is not concurrent and the generators are not otherwise operated except under abnormal conditions.

B. The auxiliary boilers are operated for approximately 8 days per year for each unit served during the initial startup of the nuclear generating units.

Since the diesel generators and auxiliary boilers are operated only a small fraction of the year, only the highest offsite short-term concentrations of sulfur oxides (SO_2), particulate matter (PM), and carbon monoxide (CO), are calculated for comparison with the applicable National Ambient Air Quality Standards (NAAQS). Since these facilities are not expected to be operated simultaneously, the highest offsite concentrations are predicted only for the operation of each of the facilities separately. No nitrogen oxides (NO_x) concentrations are predicted, as there is only an annual NAAQS for NO_x.

The highest short-term offsite concentration is determined for each pollutant using an NUS modification of the EPA dispersion model RAN. The model was modified to account for the effects of aerodynamic downwash because the sources are close enough to the unit structures to be within the "region of building influence." Methodology described by Briggs[(1)] was used to determine conditions of downwash and concentrations during downwash. Four years of onsite meteorological data (1974 through 1977) was used to predict short-term concentrations.

Because the recalciners are operated continuously throughout the year, predicted offsite concentrations for the operation of these facilities are compared with the annual and short-term NAAQS for SO_2, PM, CO, and NO_x. The concentrations are calculated using the EPA dispersion model CRSTER[(2)] modified to accept terrain elevations higher than the lowest stack height. Four years of onsite meteorological data (1974 through 1977) are used to predict these annual and short-term concentrations. A constant mixing height of 500 meters is used because no mixing height information is currently available in a format

acceptable to CRSTER for the surface data examined. This mixing depth is selected based on the tabulated mixing height information of Holzworth. The low effective stack heights (less than 100 meters) of the plumes under all stability conditions means that plume reflection from the top of the mixing layer is insignificant for these emissions.

The maximum expected short-term offsite concentrations caused by the operation of auxiliary boilers and the diesel generators located closest to the PVNGS site boundary are presented in table 5.4-2. These predicted concentrations are less than the short-term NAAQS for the respective pollutants. The primary 24-hour average NAAQS for SO_2 and PM are 365 and 260 $\mu g/m^3$, respectively. The secondary 24-hour average NAAQS for total suspended particulates (TSP) is 150 $\mu g/m^3$. The highest 24-hour average concentrations of SO_2 and PM predicted at the PVNGS site boundary due to the emissions from the auxiliary boilers are 365 and 27 $\mu g/m^3$. The highest 24-hour average SO_2 and PM concentrations predicted at the site boundary due to the diesel generators at Unit 1 are 23 and 7 $\mu g/m^3$, while those predicted at the site boundary due to the diesel generators at Unit 3 are 35 and 11 $\mu g/m^3$. Because the Units 1 and 2 generators are located further from the site boundary than the Unit 3 generator, offsite concentrations due to their operation are lower. The primary 8-hour average NAAQS for carbon monoxide standard is 10,000 $\mu g/m^3$ and the concentrations predicted at the site boundary due to the auxiliary boiler emissions is 136 $\mu g/m^3$. The highest 8-hour average carbon monoxide concentrations predicted at the site boundary due to the diesel generators at Units 1 and 3 are 65 and 99 $\mu g/m^3$.

Maximum annual and short-term offsite concentrations modeled for each year of meteorological data due to the operation of

Table 5.4-1

EMISSION PARAMETERS FOR FOSSIL FUEL-FIRED FACILITIES

Parameter	Diesel Generator	Auxiliary Boilers		Recalciner
		Large	Small	
Stack diameter (in)	32	84	44	36
Stack height (above grade) (ft)	93	50	50	80
Exhaust temperature (°F)	910	622	579	165
Exhaust flow rate (ACFM)	48,950	100,000	24,000	-
Exhaust velocity (ft/min)	-	-	-	1,800
Fuel type	No. 2 diesel	No. 2 diesel [d]	No. 2 diesel	No. 2 diesel
Operational mode	1 h/mo	8 d/yr/unit	8 d/yr/unit	Continuous
Emissions:				
Nitrogen oxides	2,300 [a]	2,300 [b]	-	456 [e]
Sulfur Oxides	540 [a]	2,812 [b]	-	144 [e]
Hydrocarbons	35 [a]	682 [b]	-	17 [e]
Particulates	164 [a,c]	209 [b,c]	-	84 [e]
Carbon monoxide	766 [a]	522 [b,c]	-	23 [e]

ACFM = Actual cubic feet per minute.

a. Per diesel generator. Two generators per PVNGS unit. Emissions in units of pounds per year.

b. Based on both boilers. Ratio by ACFM to separate between boilers. Emissions in units of pounds per year.

c. Emission ratioed from those for NO_x by means of emission factors for diesel-powered industrial equipment and distillate oil-burning industrial boilers in reference 3.

d. 0.37% sulfur fuel.

e. Emission in units of pounds per day.

the recalciners are listed in table 5.4-2. For each pollutant and each averaging period, the highest expected offsite concentration calculated is less than the applicable primary NAAQS. The maximum annual average offsite concentrations of SO_2, NO_x, and PM, 0.39, 1.3, and 0.23 $\mu g/m^3$, respectively, occur with the 1974 meteorological data base and are well below the primary NAAQS for the respective pollutants of 80, 100, and 75 $\mu g/m^3$ and the secondary NAAQS for PM of 60 $\mu g/m^3$.

The maximum offsite 24-hour average concentrations of SO_2 and PM are 16.9 and 10.1 $\mu g/m^3$, respectively, and occur with the 1976 meteorological data as a basis for modeling. These concentrations are much less than the applicable primary NAAQS of the respective pollutants.

The maximum offsite 3-hour average concentration for CO of 4.9 $\mu g/m^3$ is obtained using the 1974 meteorological data base. Because the 8-hour average concentrations would be less than this value, the expected 8-hour average concentration is much less than the applicable primary NAAQS of 10,000 $\mu g/m^3$.

In summary, no offsite violations of the NAAQS are predicted for SO_2, PM, NO_x, or CO due to the operation of the diesel generators, auxiliary boilers, or recalciners at PVNGS.

Table 5.4-2

MAXIMUM EXPECTED OFFSITE CONCENTRATIONS AND COMPARISON WITH STANDARDS

Maximum Offsite Concentrations Expected Due to Operation of Auxiliary Boilers and Diesel Generators

Pollutant	Short-Term National Ambient Air Quality Standard (and Averaging Period) ($\mu g/m^3$)	Maximum Offsite Concentration ($\mu g/m^3$) Expected for Given Averaging Period due to Operation of Auxiliary Boilers, for Units 1, 2, & 3	Diesel Generators for Unit 1	Diesel Generators for Unit 3
Sulfur oxides	365 (24-h)	365	23	35
Particulates	260 (primary 24-h) / 150 (secondary 24-h)	27	7	11
Carbon monoxide	10,000 (8-h)	136	65	99

Maximum Offsite Concentrations Expected Due to Operation of Recalciner

Pollutant	National Ambient Air Quality Standard (and Averaging Period) ($\mu g/m^3$)	Maximum Offsite Concentration ($\mu g/m^3$) Modeled for Given Averaging Period[a] Due to Operation of Recalciner, Using Surface Met Data from Year 1974	1975	1976	1977
Sulfur oxides	80 (annual)	.39	.35	.28	.34
	365 (24-h)	11.5	6.5	16.9	8.4
Particulates	75 (Primary annual) / 60 (Secondary annual)	.23	.21	.16	.20
	260 (Primary 24-h) / 150 (Secondary 24-h)	6.8	3.9	10.1	5.0
Nitrogen oxides	100 (annual)	1.3	1.1	0.9	1.1
Carbon monoxide	10,000 (8-h)	4.9	4.8	4.9	4.9

a. In the case of carbon monoxide, the maximum concentration as modeled is for an averaging period of time of 3 hours.

5.4.3 REFERENCES

1. Briggs, Gary, "Diffusion Estimation for Small Emissions," Air Resources Atmospheric Turbulence and Diffusion Laboratory, National Oceanic and Atmospheric Administration, ATDL Contribution File No. 769 (Draft), Oak Ridge, Tennessee, May 1973.

2. "User's Manual for Single-Source (CRSTER) Model," Office of Air and Waste Management, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Report No. EPA-450/2-77-013, Research Triangle Park, North Carolina, July 1977.

3. Computation of Air Pollution Emission Factors, USEPA Office of Air and Water Programs Research, Triangle Park, North Carolina, April 1973.

5.5 EFFECTS OF OPERATION AND MAINTENANCE OF THE TRANSMISSION AND CONVEYANCE SYSTEMS

5.5.1 TRANSMISSION SYSTEM

The transmission systems associated with PVNGS are described in section 3.9.1. Information presented in ER-CP Section 5.6.1 and the FES has been updated to reflect final line routing and the addition of a transmission line from PVNGS to Devers Substation in California. The impacts expected due to operation and maintenance of the Projects 1 and 3 transmission systems are updated and summarized in this section. Information concerning the expected impacts of the PVNGS to Devers line is presented in the U.S. Department of Interior Bureau of Land Management and U.S. Nuclear Regulatory Commission Final Environmental Statement, Palo Verde-Devers 500 kV Transmission Line, February 1979. Descriptions are presented for preferred and alternate routes.

5.5.1.1 Transmission System Impacts

5.5.1.1.1 Maintenance Program

Maintenance programs are not expected to have significant environmental effects, however, those environmental effects that do occur from maintenance will be short term. Transmission-system construction practices will result in stable open-field associations and therefore minimal right-of-way maintenance. Where maintenance clearing is required the biotic association as a whole will not be adversely affected.

Maintenance will be conducted on an as-required basis. Frequent ground access to the transmission lines for maintenance will not be required. The same environmental precautions that were taken during construction will be taken for non-emergency maintenance and repairs. The comfort and safety of local residents will be provided for by controlling noise and dust created by maintenance-vehicle traffic.

Access roads built during the construction phase of the transmission systems ordinarily will not be maintained.

Herbicides and pesticides will not be used for maintenance of transmission-system corridors. Soil sterilants may be used within the confines of substations to control weed growth.

5.5.1.1.2 Electrical Effects

No adverse effects resulting from corona or electrical field effects are expected. Standard procedures will be followed to eliminate the interference with communication or railroad systems. Grounding systems will be installed to handle currents that occur under fault conditions.

5.5.1.1.3 Ecological Resources

The effects of transmission-line operation and maintenance relate primarily to the access roads that create increased access to areas that were previously difficult to reach. The operation and maintenance activities will have very little, if any, adverse effects on terrestrial and aquatic systems once construction activities have been completed.

In sensitive areas with species such as Gila monster, desert tortoise and bighorn sheep, and in areas vegetated with endangered and threatened plant species, fences and gates will be placed appropriately to inhibit unauthorized off-highway vehicle use of access roads. It is expected that no changes of long-term significance to the area's fauna will result from operation and maintenance activities.

5.5.1.1.4 Cultural and Paleontological Resources

Cultural and paleontological resources are likely to be impacted the greatest during the construction phase of the project. Access and spur roads will be closed as required
1 (and contingent on the consent of the land owner) after construction to minimize relic hunting.

5.5.1.1.5 Land Use

Land use can be affected in two ways by a transmission line. The presence of the transmission line can change current practices and/or alter future flexibility in land use. These effects will vary depending on existing land use.

Land used for grazing will not be significantly impaired by the transmission line systems. Normal grazing practices will be maintained because cattle will be able to graze under the lines. Cultivation practices on agricultural lands may be slightly modified due to the presence of the proposed transmission system. The aerial application of seed, herbicides, and other materials to the crops may be altered by the transmission lines.

5.5.2 WASTEWATER CONVEYANCE PIPELINE

Information presented in ER-CP Section 5.6.2 and the FES remain valid. The impacts expected due to the operation and maintenance of the wastewater conveyance pipeline as well as mitigation measures are summarized in this section.

5.5.2.1 General Maintenance

Pipeline maintenance will be minimal. The pipeline will be underground and the land in the right-of-way will revert to its original state, which is either agricultural or natural desert. The existing service roads and highways will be used for the minimal maintenance access that may be required.

5.5.2.2 Effects of Operation Maintenance

No significant environmental effects are expected as a result of the operation and maintenance programs. Ecological impact of maintenance of the pipeline will be minimal. Since portions

of the right-of-way will not be returned to agricultural use, certain noxious weeds will rapidly emerge. APS has proposed to mitigate this ecological detriment by judicious application of a suitable weed control chemical in the affected areas.[1] Adverse archaeological and ecological effects of the maintenance of the wastewater pipeline, once installed, should be minimal because additional maintenance roads are not required.

5.5.3 REFERENCES

1. Letter to the Nuclear Regulatory Commission, from E. E. Van Brunt Jr., October 2, 1979.

5.6 OTHER EFFECTS

5.6.1 ENVIRONMENTAL EFFECTS OF WATER DIVERSION

5.6.1.1 Wastewater Effluent Use

Information presented in ER-CP Section 5.7 and the FES has been updated by the following changes:

A. Condenser cooling water requirements for PVNGS have been revised to 21,350 acre-ft/yr/unit.

B. Estimates of sewage effluent availability have been prepared by the City of Phoenix Water and Sewer Department and by the Maricopa Association of Governments (MAG) Regional Council.

C. A number of reports have been prepared on the water use, reuse, and associated habitats along the Salt and Gila Rivers from 23rd Avenue in Phoenix to Gillespie Dam.

5.6.1.1.1 PVNGS Condenser Cooling Water Requirements

As discussed in section 3.3.1, the per-unit condenser cooling water requirement at the Palo Verde site is estimated to be 21,350 acre-ft/yr. This requirement is based on the following assumptions:

A. City of Phoenix wastewater effluent is utilized as the source of condenser cooling water.

B. Wastewater effluent is obtained from the 91st Avenue Sewage Treatment Plant.

C. The planned unit capacity factor is 95%.

D. Annual average ambient meteorological conditions.

E. There will be no blowdown treatment.

F. Losses will be as defined in figure 3.3-1.

G. One month per year allowed for refueling.

PVNGS water requirements vary by month. The sum of the requirements for each month gives the per-unit requirement of 21,350 acre-ft/yr. Annual peak water requirements are shown in figure 5.6-1 as the peak month requirement times 12.

5.6.1.1.2 Effluent Availability Projections

Projections of effluent availability from the 91st Avenue Sewage Treatment Plant have been made by the City of Phoenix Water and Sewer Department and by the Maricopa Association of Governments.

5.6.1.1.2.1 City of Phoenix Projections. Projections of sewage effluent availability have been prepared by the City of Phoenix Water and Sewer Department(1) in accordance with the wastewater effluent contract (Agreement No. 13904) between the six municipalities that own the 91st Avenue Plant and Arizona Public Service Company (APS) and Salt River Project. These projections are prepared annually. The September 1979 projection is presented in figure 5.6-1.

5.6.1.1.2.2 MAG Projections. Projections of sewage effluent availability have been prepared by Maricopa Association of Governments (MAG) Regional Council for the purpose of developing an areawide wastewater management plan for Maricopa County, pursuant to Section 208 of P.L. 92-500 (Federal Water Pollution Control Act Amendments of 1972). In the development of such a plan a number of studies were conducted to determine the needs, timetable, and alternatives for additional sewage treatment facilities and the potential for reuse of wastewater effluent from such facilities.

These studies (hereinafter the MAG 208 Studies), which were conducted by the Corps of Engineers (COE) with portions being performed by various engineering firms under contracts with MAG

and COE, led to the initial identification of 36 areawide alternatives which, through the process of review and selection, were reduced to 20 and then to 7 alternatives. These seven alternatives were then broken into two subregional areas (i.e., eastside and westside) for detailed analysis and consideration by the MAG 208 advisory group structure. The MAG 208 advisory group structure consisted of a citizens' advisory group, a technical advisory group, an agricultural advisory group, a management subcommittee, and an executive committee. After receipt of the initial recommendations of the advisory groups, the MAG Regional Council in July 1978 designated three preferred eastside and three preferred westside alternatives for further study and consideration. During the ensuing process one of the westside alternatives was eliminated and four areawide alternatives were presented to the MAG Regional Council for consideration. In November 1978, the Council selected alternative 2 as the approved regional plan for Maricopa County (hereinafter referred to as the "MAG Approved Plan"). Subsequently, in February 1979, the Arizona State Water Quality Control Council approved the MAG Approved Plan. It was adopted by the Governor and subsequently accepted by the Administrator of the Environmental Protection Agency (EPA) Region IX.

The MAG Approved Plan includes the following:

A. Expansion of the 91st Avenue Plant immediately to increase its capacity by 30 Mgal/d providing a total capacity of 120 Mgal/d (135,000 acre-ft/yr).

B. Later expansion of 91st Avenue Plant to increase capacity to 134.6 Mgal/d (151,000 acre-ft/yr), to serve anticipated requirements through year 2000.

C. Upgrading the City of Phoenix 23rd Avenue Sewage Treatment Plant from a current rating 31 to 40 Mgal/d (44,800 acre-ft/yr).

Effluent projections for the 91st Avenue Plant made by COE in connection with the MAG. 208 Water Quality Management Program[2] are presented in figure 5.6-1.

5.6.1.1.3 Environmental Effects of Water Diversion

A number of reports have been prepared on the water use, reuse, and associated habitats along the Salt and Gila Rivers from 23rd Avenue in Phoenix to Gillespie Dam.[3-8] These reports point out that the total water balance of the beds of the Salt and Gila Rivers from the City of Phoenix 23rd Avenue Sewage Plant, downstream to Gillespie Dam (hereinafter described as the River Study Area), must be considered in order to accurately predict the ecological effects of wastewater use.

Although the surface water and groundwater regimes are interdependent, the major potential ecological impacts from use of the wastewater effluent can be classified as those resulting from alterations of habitats which are primarily dependent on groundwater (e.g., the areas supporting phreatophytes) and habitats primarily dependent on surface water.

5.6.1.1.3.1 Groundwater Dependent Habitat. Based on historical rates of groundwater recharge, it does not appear that piping the wastewater effluent required to meet the cooling requirements will substantially alter the groundwater-dependent habitats of the River Study Area. The important phreatophyte habitats in the River Study Area are largely recharged from other sources. For example, the winter flood of 1965-1966 contributed to substantial replenishment of the underground water supply in the greenbelt region between 91st Avenue and Buckeye Heading, and this stretch of the river currently receives underflows from the Gila River (estimated to be 3500 acre-feet per year).[3,4]

Considering the next reach of river between Buckeye Heading and the South Extension Canal, it is anticipated that Buckeye Irrigation District (BID) will continue to exercise its appropriative rights and divert almost all the water in the Gila River at Buckeye Heading during much of the year. Therefore, this region is expected to change little in phreatophyte habitat quality. The BID has under contract 30,000 acre-ft/yr of wastewater effluent from the 91st Avenue Sewage Treatment Plant. When the PVNGS pipeline becomes operational, this wastewater effluent will be delivered via the pipeline and may result in BID having to pump less groundwater to supplement its irrigation needs. Therefore, the nearby adjacent section of the River Study Area could have a faster groundwater recharge rate.

The last region of the River Study Area, extending from the South Extension Canal to Gillespie Dam, presently supports an extensive phreatophyte habitat which is heavily used by white-winged doves. This stretch of the River Study Area has historically had a shallow water table, resulting in water-logged conditions in lands adjacent to the river. Sewage effluent has never had a very important role in the continual maintenance of this portion of the River Study Area,[3] and it is not anticipated to have a significant role in the future.

5.6.1.1.3.2 Surface Water Dependent Habitats. Use of wastewater effluent for PVNGS would result in a gradual reduction of the surface water-dependent habitats during the 1983-1986 period. The resulting impact on the surface water habitat is expected to be minimal. It is known that decreasing the amount of surface water will result in altering wildlife habitat, making it less favorable to some species and more favorable to others.[8] Although it is speculative to determine what the everchanging river channel will be like in the future, it has been documented that one endangered species, the Yuma Clapper Rail, inhabited the 107th Avenue Flushing Meadows Marsh as early as 1970.[9]

The seasonal and daily fluctuations in water levels in the river channel can affect various biological phenomena ranging from plant germination to mosquito breeding. The upper reaches of the River Study Area (whose surface water habitats are comprised primarily of wastewater effluent) presently have a wide fluctuation of water level over a 24-hour period, since maximum effluent discharges can be up to four times the minimum discharges into the river. The River Study Area also undergoes irregular seasonal fluctuations as a result of runoff from rains, rain interception, and periodic flooding. Use of wastewater effluent at PVNGS will result in wider seasonal (although not daily) fluctuations of the surface water levels in the upper reaches of the River Study Area compared to those existing presently.

Although reducing the wastewater flow will cause a temporary loss of open water aquatic habitat, this loss would not substantially reduce the number of any wildlife species which may be using the area. For example, the Yuma Clapper Rail is most prevalent in the Colorado River Delta in Mexico and along the southern portions of the Colorado River in the United States.(10) The status of Yuma Clapper Rail populations remains uncertain; however, its numbers are apparently greater than originally thought when this species was classified as endangered.(11)

5.6.1.1.4 Conclusions

The ultimate effect of using wastewater effluent at PVNGS is dependent upon the actual quantities of effluent available. Using the MAG estimates, the effects are expected to be more severe than with the City of Phoenix estimates. However, even using the MAG estimates, which are considered to be a lower bound of effluent availability, it is anticipated that transporting water to PVNGS would have no substantial long-term negative impacts on the Sonoran desert riparian or aquatic ecosystems. PVNGS water use would have negligible ecological

power level of the turbines, transformers, and pumps and motors is based on published source-term data that has been appropriately scaled to the size of the PVNGS equipment.[13,14,15]

Operational sound levels were predicted using the computer code SOCON. SOCON calculates resultant sound levels, including background sound, on a grid basis from an arbitrary number of noise sources at different locations, assuming uniform hemispherical sound propagation and frequency-dependent atmospheric absorption. Inputs include the sound-power frequency spectrum and grid coordinates of each source. Outputs include coordinates of A-weighted sound-level isopleths, which are then plotted on a site map.

The attenuation factors used to account for atmospheric absorption in the analysis are based on information presented by Beranek.[16] The basic model is conservative in that no credit is given for excess attenuation by vegetation, ground effects, topographical effects, or meteorological effects such as shadow zones induced by wind or thermal gradients.

Point sources were considered in this analysis, including the three cooling towers for each unit, the equipment within each unit, the switchyards, and the reclamation plant. Predicted sound levels from the operation of PVNGS are presented in figure 5.6-2. Because the sound power level of each source is assumed to be constant, the predicted sound levels are approximately equal to the L_{eq} sound levels (refer to section 6.1.1.2). Actual sound levels will vary depending on the operation of auxiliary equipment, the use of equipment producing intermittent noise, and atmospheric conditions.

The maximum predicted sound level at the site boundary will occur along the west boundary near the cooling towers of Unit 3 where the maximum predicted L_{dn} sound level is 64 dBa. Sound levels due to plant operation are conservatively predicted not to exceed the HUD acceptable noise criteria of 65 dBa for L_{dn} in any offsite areas.

Along the Buckeye-Salome Road the noise levels, due primarily to traffic, exceed the HUD acceptable noise criterion of $L_{dn} \leq 65$ dBA for residential areas and fall within the HUD normally unacceptable range of 65 dBa < L_{dn} < 75 dBa. Information on the background sound levels is presented in section 2.7. Traffic noise levels will tend to mask the noise of plant operation along and to the north of the Buckeye-Salome Road. Plant operation noise will not significantly increase the noise levels at the residences along Buckeye-Salome Road. However, because of the low ambient noise levels in areas other than along the Buckeye-Salome Road, the plant operation noise may be audible approximately 4 miles from the plant cooling towers.

5.6.3 REFERENCES

1. Letter from Robert B. Steytler, Assistant Director, City of Phoenix Wastewater Operations, to Mr. Terry Hudgins, Arizona Public Service Company, September 20, 1979.

2. Maricopa Association of Governments, 208 Water Quality Management Program, Final Plan, July, 1979.

3. Halpenny, L. C. and Greene, D. K., Water Balance Investigation of River Bed, Salt and Gila Rivers, 23rd Avenue to Gillespie Dam, Arizona Water Development Corp., Tucson, Arizona, 1975.

4. Halpenny, L. C. and Clark, S. D., 1977 Supplement to Water Balance Investigation of River Bed, Salt and Gila Rivers, 23rd Avenue to Gillespie Dam, Arizona Water Development Corp., Tucson, Arizona, 1977.

5. Water Resources Associates, Inc., Report on Water Balance, Salt and Gila Rivers, 23rd Avenue to Gillespie Dam, Scottsdale, Arizona, 1975.

6. Water Resources Associates, Inc., Explanatory Notes on Mapping of Vegetation Types, Salt and Gila Rivers, 23rd Avenue, Phoenix, to Gillespie Dam, Scottsdale, Arizona, 1976.

7. Potential Reuse Options for Wastewater Effluent and Residual Solids, U.S. Army Corps of Engineers, Los Angeles District, Phoenix urban study, 1977.

8. Haase, E. F., 1973. Draft Environmental Study. Gila River from the Confluence of the Salt River Downstream to Gillespie Dam. Submitted to the U.S. Army Engineer District, Los Angeles, California.

9. Personal communications. B. Pinkowski, NUS Corp. with Richard Todd, Arizona Game and Fish Dept., November 4, 1977.

10. Tomlinson, R. E. and Todd, R. L., "Distribution of Two Western Clapper Rail Races as Determined by Responses to Taped Calls", The Condor, Vol. 75, No. 2, 1973, pp. 177-183.

11. American Ornithologists Union, Report of the American Ornithologists Union Committee on Conservation, 1976-1977, supplement to AUK, Vol. 94, No. 4, 1977.

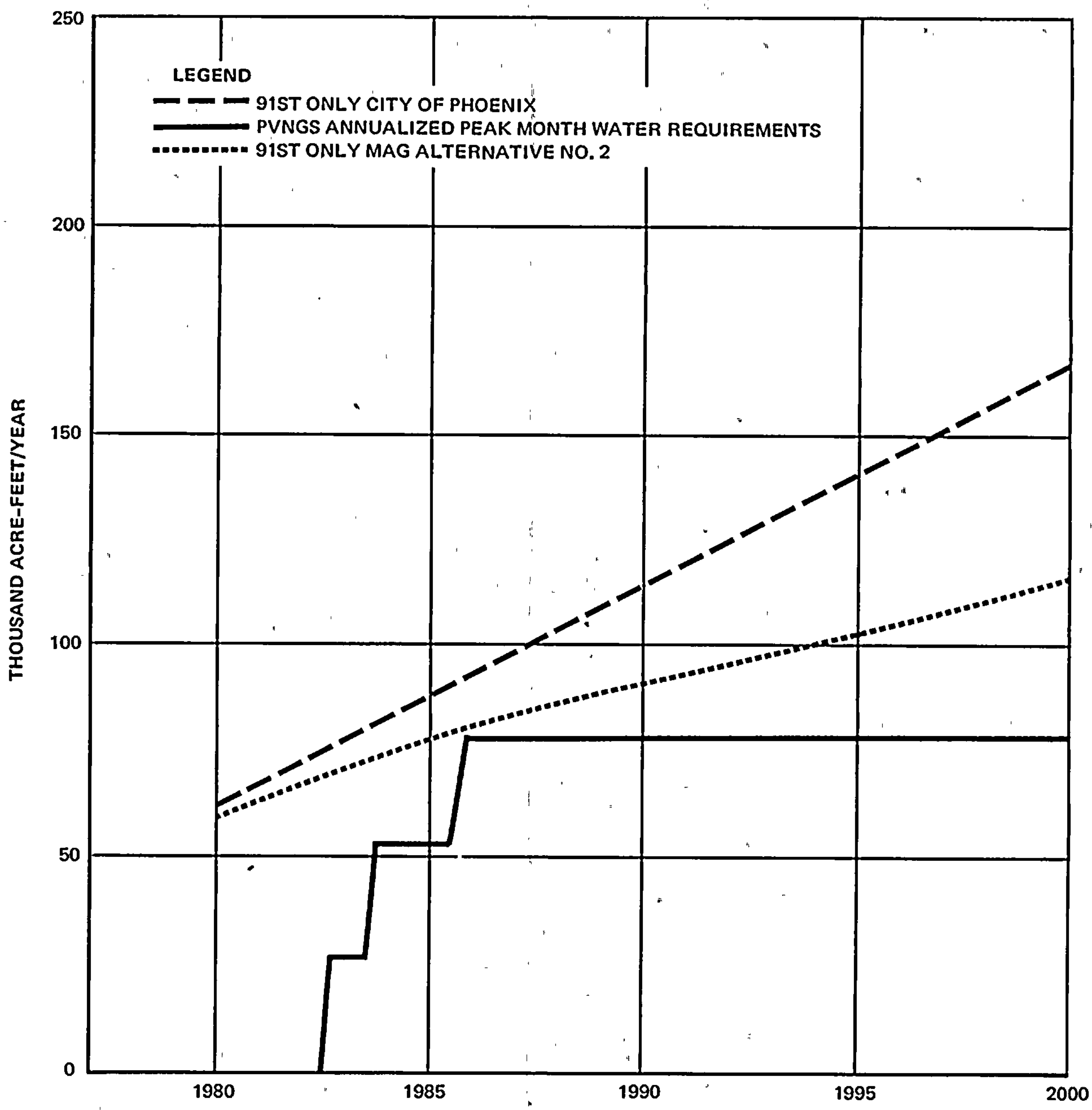
12. Personal communication, R. Andes, NUS Corp., with J. S. Gosmano, Marley Cooling Tower Company, September 23, 1977.

13. Heitner, I., "How to Estimate Plant Noise," Hydrocarbon Processing, December 1968.

14. Harris, C. M., Handbook of Noise Control, McGraw-Hill Book Company, Inc., New York, 1957.

15. Berger, B., et al., "Transformer Noise," Philosophical Transactions of the Royal Society, Series A, Vol. 263, pp 381-411, 1968.

16. Beranek, L. L. Noise and Vibration Control, McGraw-Hill Book Co., Inc., New York, 1971.



NOTE:

QUANTITIES AVAILABLE IN EXCESS OF PRIOR COMMITMENTS TO OTHERS IN THE AMOUNT OF 37,300 ACRE-FEET/YEAR.

Palo Verde Nuclear Generating Station
ER-OL

PEAK WATER REQUIREMENTS AND AVAILABLE EFFLUENT UNDER CONTRACT

Figure 5.6-1

5B.4 COST-BENEFIT ANALYSIS

The maximum individual doses presented in table 5B-2 are much less than the design objectives of Appendix I. However, section II of Appendix I to 10CFR50 requires not only that design objective dose limitations to the maximum individual be met but also that "...the radwaste system include all items of reasonably demonstrated technology that when added to the system sequentially and in order of diminishing cost-benefit return can, for a favorable cost-benefit ratio, effect reduction in dose to the population reasonably expected to be within 50 miles of the reactor."

This cost-effective ratio has been designated as $1,000 per total body man-rem and $1,000 per thyroid man-rem, annualized cost. Based on this requirement, a cost-benefit analysis was performed.

Based upon the population dose results discussed in the previous section, the total annual cost of any augment, which would reduce noble gas releases to zero and still be justified would be $1,340. For radioiodine and particulates this cost would be $2,060. The radioiodine and particulate cost is based on the total particulate dose of 2.06 thyroid man-rem, since H-3 and C-14 are excluded from the cost-benefit because with present technology it is impractical to remove or reduce the release of either nuclide. In reality, no augment will reduce releases to zero. Therefore, more benefit credit is calculated than would actually exist.

The following cost-benefit analysis was performed using the procedures and data outlined in Regulatory Guide 1.110. Since the annual cost of equipment cannot be greater than $1,340 for any augments for the reduction of noble gas doses and $2,060 for radioiodine and particulate doses, Tables A-2 and A-3 of Regulatory Guide 1.110 were first examined to determine what potential equipment, if any, could be maintained and operated

below these costs. Combining the annual costs of operating and maintenance, costs yield four augments with less than an annual cost of $2,500. Table 5B-8 shows these augments and the breakdown between operating and maintenance costs. Further cost-benefit analysis were then performed only on these four augments.

The direct labor cost for the particular augment was obtained from Table A-1 of Regulatory Guide 1.110. The appropriate labor cost correction factor for the Arizona area (1.2) was taken from Table A-4 of that guide and multiplied by the direct labor cost to obtain the labor cost in Arizona for that augment. To this value was added the direct cost of equipment and materials from Table A-1 of the guide to obtain the total direct cost (TDC). Table 5B-9 shows the total direct costs. The TDC was then multiplied by the indirect cost factor (ICF) of 1.58 from Table A-5 of the guide to produce the total capital cost (TCC), which was in turn multiplied by the capital recovery factor (CRF) to obtain the annual fixed cost (AFC). In this analysis, the CRF was calculated to be 0.1012 based upon the cost of money being 9.45% per year and a 30-year plant lifetime and the equation presented in Table A-6 of Regulatory Guide 1.110.

The total annualized cost is the sum of the annual fixed costs (table 5B-10) plus the annual operating and maintenance costs (table 5B-8). Table 5B-11 presents the total annualized cost. As can be seen from table 5B-11 addition of none of the augments could be justified on a cost-benefit basis.

Table 5B-8

ANNUAL OPERATING AND MAINTENANCE COSTS OF SELECTED AUGMENTS

Item	1975 $1000				
	Operating Cost	+	Maintenance Cost	=	Total O+M Cost
3-ton charcoal absorber	neg[a]	+	neg[a]	=	neg[a]
Main condenser vacuum pump charcoal/HEPA filtration system	0.4	+	1.	=	1.4
600 ft^3 gas decay tank	neg[a]	+	neg[a]	=	neg[a]
Steam generator flash tank vent to main condenser	1	+	1	=	2

a. Negligible

Table 5B-9

TOTAL DIRECT COSTS OF SELECTED AUGMENTS

Item	Direct Costs (1975 $1000)				
	Equipment/ Material	+	Arizona Labor Cost	=	Total Direct Cost
3-ton charcoal absorber	53	+	16.8	=	69.8
Main condenser vacuum pump charcoal/HEPA filtration system	40	+	9.6	=	49.6
600 ft^3 gas decay tank	33	+	28.8	=	61.8
Steam generator flash tank vent to main condenser	19	+	16.8	=	35.8

Table 5B-10

ANNUAL FIXED COST OF SELECTED AUGMENTS

Item	1975 $1000									
	Total Direct Cost (TDC)	x	Indirect Cost Factor (ICF)	=	Total Capital Cost (TCC)	Total Capital Cost (TCC)	x	Capital Recovery Factor (0.1012)	=	Annual Fixed Cost (AFC)
3-ton charcoal absorber	69.8	x	1.58	=	110.3	110.3	x	0.1012	=	11.2
Main condenser vacuum pump charcoal/HEPA filtration system	49.6	x	1.58	=	78.4	78.4	x	0.1012	=	7.9
600 ft^3 gas decay tank	61.8	x	1.58	=	97.6	97.6	x	0.1012	=	9.9
Steam generator flash tank vent to main condenser	35.8	x	1.58	=	56.6	56.6	x	0.1012	=	5.7

Table 5B-11

TOTAL ANNUALIZED COST FOR SELECTED AUGMENTS

Item	1975 $1000				
	Annual Fixed Cost	+	Annual O+M Cost	=	Total Annual Cost
3-ton charcoal absorber	11.2	+	neg[a]	=	11.2
Main condenser vacuum pump charcoal/HEPA filtration system	7.9	+	1.4	=	9.3
600 ft^3 gas decay tank	9.9	+	neg	=	9.9
Steam generator flash tank vent to main condenser	5.7	+	2.	=	7.7

a. Negligible

TABLES

The drift deposition routines in FOG consist of the following three calculational procedures: (1) the sequential release of the entrained drift droplets from the effluent plume, (2) the subsequent horizontal transport of the drift droplets as they fall to the ground, and (3) the calculation of the airborne concentrations and deposition rates at pre-specified downwind distances for each of the 16 wind directions.

It is assumed in the FOG model that the excess water vapor, the temperature excess, the vertical velocity, and the concentration of drift droplets follow a Gaussian distribution normal to the plume axis. The plume is assumed to extend two standard deviations (i.e., $2\sigma_y$ and $2\sigma_z$) away from the plume axis. The release of the entrained droplets at any point within the plume depends on the relative magnitudes of the terminal fall velocity of the droplets and the vertical velocity of the air in the plume. At each downwind distance under consideration, these two velocities are compared for the various size categories of droplets in the plume, and a fraction of the droplets is released. This process is repeated until all droplets are released from the plume. When the plume reaches its maximum height, the vertical velocity throughout the plume is zero. Any droplets remaining in the plume at the leveloff point are then released. Droplets released from the plume then fall, first through the plume air, and then through the ambient air beneath the plume. This drift is carried downstream by the ambient wind until it is deposited on the ground. The rate of fall of the drift droplets is proportional to their terminal velocity, which in turn is dependent on the droplet size. The droplet size can change by evaporative processes, which depend on the physical and transport properties of the liquid droplets and the surrounding air. For relative humidities below 50%, complete evaporation of the drift droplets to dry particles is possible. A stepwise

procedure is employed in FOG to compute the trajectory of the droplets by considering the above effects.

Drift deposition rates and airborne concentrations of dry drift particles are calculated for each of the sequential meteorological records included in the 5-year meteorological data set. These are then summarized to obtain the deposition (in terms of lb/acre-year) and airborne concentrations of dry particles (in $\mu g/m^3$) over the entire grid. The airborne concentration calculation is made at a height of 2 meters above the ground surface.

6.1.3.3.3.4 Detailed Plume Analysis Model. Cooling tower plume trajectories were calculated by the Lagrangian Vapor Plume Model (LVPM).[11] LVPM is a one-dimensional numerical mmodel capable of predicting the detailed behavior of either wet or dry plumes for a given meteorological condition. The model incorporates the thermodynamics and microphysics of condensation and evaporation, superimposed upon a dynamic model of buoyant convection. In the case of wet plumes, the release of latent heat through the condensation of moisture enhances the vertical growth of the effluent plume. This situation is somewhat similar to the development of an isolated cumulus cloud, where condensation enhances the growth in the core of the plume, while mixing and evaporation take place near its edge.

The dynamic framework of LVPM is described by the equations of motion for a quasi-incompressible fluid. A steady-state plume is assumed to simulate the continuous efflux to a horizontally homogeneous atmosphere. This assumption simplifies the numerical computation and leads to practical and economical application. Ambient meteorological conditions are obtained by reducing standard rawinsonde data.

4. NUS Corporation, "NUSPUF, A Segmented Plume Dispersion Program for the Calculation of Average Concentration Time-Dependent Meteorological Regime," NUS-TM-260, Rockville, Maryland, March 1976.

5. Fisher, G. E., FOG Model Description, NUS-TM-S-185, July 1974.

6. Briggs, G. A., Plume Rise, Atomic Energy Commission Critical Review Series, TID-25075, 1969.

7. Briggs, Gary A., Plume Rise from Multiple Sources, Cooling Tower Environment, Energy Research and Development Administration, Conf-740302, 1974.

8. Nuclear Regulatory Commission, Subroutine POLYN, developed by Bob Kornasiewiez to compute dispersion parameters σ_y and σ_z for desert like meteorological situations.

9. Huschke, R. E., Glossary of Meteorology, American Meteorological Society, Boston, Massachusetts, pp. 227-228, 1959.

10. Petterssen, S., Weather Analysis and Forecasting, Volume II, McGraw-Hill, New York, 1956.

11. Lee, J., "The Lagrangian Vapor Plume Model - Version 3," NUS Corporation, NUS-TM-S-184, Rockville, Maryland, July 1974.

12. U. S. Environmental Protection Agency, "Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with Adequate Marginal Safety," EPA550/9-74-004, March 1974.

13. Department of Housing and Urban Development, "Environmental Criteria and Standards," (44FR 40860-6) July 12, 1979.

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right-of-way for weed control during construction only [Reference (3)]. For these reasons, environmental technical specifications (non-radiological) have not been proposed.

REFERENCES

1. U.S. NRC "Rules and Regulations", Title 10, Chapter 1, Part 50, Code of Federal Regulations 1

2 NUREG-75/078 Final Environmental Statement Palo Verde Nuclear Generating Station, Units 1, 2, and 3, Docket STN-528/529/530, September 1975, pages 5-17.

3. Letter to E. E. Van Brunt, Jr. from the Nuclear Regulatory Commission, dated November 30, 1979

CHAPTER 8

ECONOMIC AND SOCIAL EFFECTS OF STATION CONSTRUCTION AND OPERATION

CONTENTS

TABLES

Table 8.1-3

CONSTRUCTION STAGE MANPOWER AND DIRECT PAYROLL

(Sheet 1 of 2)

Time Period	Average Manpower	$1,000 Average Direct Payroll
1st Quarter 1976	176	1,115
2nd Quarter 1976	692	4,303
3rd Quarter 1976	864	5,418
4th Quarter 1976	1,036	6,533
1st Quarter 1977	1,048	6,533
2nd Quarter 1977	1,588	9,880
3rd Quarter 1977	1,760	10,995
4th Quarter 1977	2,272	14,182
1st Quarter 1978	2,996	18,485
2nd Quarter 1978	3,552	21,831
3rd Quarter 1978	4,416	27,250
4th Quarter 1978	5,328	32,827
1st Quarter 1979	6,028	50,454
2nd Quarter 1979	6,208	51,939
3rd Quarter 1979	5,676	47,489
4th Quarter 1979	5,316	44,518
1st Quarter 1980	5,316	44,518
2nd Quarter 1980	5,316	44,518
3rd Quarter 1980	5,316	44,518
4th Quarter 1980	5,120	43,035
1st Quarter 1981	4,644	38,587
2nd Quarter 1981	4,644	38,587
3rd Quarter 1981	3,716	31,166
4th Quarter 1981	3,540	29,683
1st Quarter 1982	3,540	29,683
2nd Quarter 1982	3,380	28,193
3rd Quarter 1982	3,176	26,711
4th Quarter 1982	3,176	26,711
1st Quarter 1983	3,176	26,711
2nd Quarter 1983	3,176	26,711
3rd Quarter 1983	2,676	22,261
4th Quarter 1983	2,676	22,261

Table 8.1-3

CONSTRUCTION STAGE MANPOWER AND DIRECT PAYROLL

(Sheet 2 of 2)

Time Period	Average Manpower	$1,000 Average Direct Payroll
1st Quarter 1984	2,320	19,290
2nd Quarter 1984	1,960	16,324
3rd Quarter 1984	1,592	13,357
4th Quarter 1984	1,592	13,357
1st Quarter 1985	1,220	10,385
2nd Quarter 1985	1,040	8,903
3rd Quarter 1985	872	7,420
4th Quarter 1985	708	5,938
1st Quarter 1986	352	3,012
April 1986	276	785
Approximate Total Direct Payroll		976,400

Economic and Business Research at Arizona State University[1], the employment multiplier for Maricopa County was determined to be 3.6; that is, for each new base job created, 2.6 secondary jobs would result.

8.1.2.1.2 Operation

A staff of approximately 454 will be required to operate and maintain PVNGS. In 1986 the full staff will be employed, at which time the annual payroll for permanent personnel will be approximately $18.7 million. The actual secondary impact of these permanent employees will depend on how many of the jobs represent a net increase in utilities employment. When compared to a personal income of $10.1 billion for Maricopa County in 1978[2], the net addition of PVNGS payroll is not likely to have significant impact on county-wide employment.

8.1.2.2 Tax Benefits

Major tax benefits in the area of income, excise, and ad valorem taxes will accrue to the Federal Government and the State of Arizona as a result of the construction and operation of PVNGS. State and local political subdivisions affected are as follows:

- State of Arizona
- Maricopa County, Arizona
- Ruth Fisher Elementary District No. 90
- Arlington Elementary District No. 47
- Buckeye Union High School District
- Maricopa County Community College District
- Central Arizona Water Conservation District
- Flood Control District of Maricopa County

8.1.2.2.1 Income Tax

Income tax revenues resulting from employment during the construction phase can be estimated for both the State of Arizona and the United States. The estimates are based on existing tax rates.

Approximately 1.3% of personal income earned in Arizona is paid in taxes to the state.(3) The United States income tax estimates are based on the assumption of a typical worker with a family of four who uses the standard deduction. This results in an average tax rate of 20%, based on tax schedules in effect from 1977 to 1979. Table 8.1-4 presents the annual payroll and estimated state and federal income taxes expected during the construction phase. Taxes on the 1986 operating payroll are estimated to be $243,000 for Arizona income tax and $3,740,000 for United States income tax.

Table 8.1-4

ANNUAL CONSTRUCTION STAGE PAYROLL INCOME AND SALES TAX ESTIMATES (in Millions of Dollars)

Year	Estimated Average Direct Payroll	Estimated Arizona Income Tax	Estimated United States Income Tax	Estimated Sales Tax Revenue
1976	17.4	0.226	3.48	0.574
1977	41.6	0.541	8.32	1.373
1978	100.4	1.305	20.08	3.313
1979	194.4	2.527	38.88	6.415
1980	176.6	2.296	35.32	5.828
1981	138.0	1.794	27.60	4.554
1982	111.3	1.447	22.26	3.673
1983	97.9	1.273	19.58	3.231
1984	62.3	0.810	12.46	2.056
1985	32.7	0.425	6.54	1.079
1986	3.8	0.049	0.76	0.125
Total	976.4	12.69	195.3	32.2

8.1.2.2.2 Excise Taxes

In addition to the state income tax revenues, the State of Arizona and its municipalities will benefit from the sales tax revenues which can be anticipated on the basis of payroll generated by PVNGS. Approximately 3.3% of personal income is paid in the form of state sales tax levies(4). Table 8.1-4 provides an estimate of the annual sales tax collected during the construction phase. It has been assumed that all wages generate sales tax. Sales tax revenues for the 1986 operating payroll are estimated to be $617,000.

8.1.3 OTHER BENEFITS

8.1.3.1 Local Expenditures

A substantial amount of the total expenditures during construction for materials, equipment, and services will be spent in Arizona. The experience of the participating utilities and the constructor indicates that approximately $285 million will be spent in Maricopa County. This impacts secondary employment, personal income, and local taxes in a favorable manner.

8.1.3.2 Purchase of Wastewater Effluent

A current benefit of PVNGS is the revenue received by Phoenix and five other municipalities through an option and purchases agreement with APS and Salt River Project for the sale of wastewater effluent not committed as of the contract date (April 1973) to other parties (hereafter referred to as uncommitted effluent). The City of Phoenix operates two sewage treatment plants near the Salt River. The first, at 23rd Avenue, is owned by Phoenix; the second, at 91st Avenue, is a joint venture of Phoenix and five other municipalities. At the present time, the participants pay $2.00 per year per acre-foot option payment for uncommitted wastewater effluent being discharged by these plants. The contract provides that APS and Salt River Project may purchase uncommitted effluent, when available, up to a maximum amount of 140,000 acre-feet per year for electric generation purposes.

For the period, April 23, 1979, to April 22, 1980, the participants made option payments for 89,192 acre-feet of uncommitted effluent; 30,604 acre-feet from the 23rd Avenue plant and 58,588 acre-feet from the 91st Avenue plant, based on actual effluent flow records for 1978. Table 8.1-6 shows the option revenue derived by each of the cities participating in the 91st Avenue plant. The option payment for the 23rd Avenue discharge goes solely to the City of Phoenix.

Table 8.1-6

PROJECTED MINIMUM ANNUAL REVENUE RECEIVED FOR UNCOMMITTED EFFLUENT FROM THE CITY OF PHOENIX 91st AVENUE SEWAGE TREATMENT PLANT

City	Percent of Revenue[a]	1979 Actual Option Revenue	Range of Anticipated Revenue[b]	
			$20 per Acre-Ft Delivered	$30 per Acre-Ft Delivered
Phoenix	51.76	$ 60,650	$ 663,046	$ 994,568
Glendale	13.79	16,176	176,650	264,975
Tempe	12.75	14,936	163,327	244,991
Mesa	10.93	12,810	140,013	210,020
Scottsdale	10.45	12,242	133,865	200,797
Youngtown	0.32	382	4,099	6,149
Total	100.0	$117,176	$1,281,000	$1,921,500

a. Calculated, based on a letter dated March 19, 1979 from P. W. Slagel, City of Phoenix Wastewater Operations to the 91st Avenue Sewage Treatment Plant Multi-City Participants.

b. Based on station water use of 64,050 acre-ft/yr with no additional uncommitted effluent available.

The price to be paid for uncommitted effluent purchased for PVNGS is tied to the price for Central Arizona Project municipal and industrial water subject to a minimum price of $20 per acre-foot and a maximum price of $30 per acre-foot. When Unit 3 becomes operational, it is expected that the price for the purchased uncommitted effluent will be $30 per acre-foot. In addition to purchase payments, the participating utilities will make option payments of $2 per acre-foot per

year, for each acre-foot of effluent, reserved for use at PVNGS but not delivered. Each of the communities will share the revenue generated on that portion of the effluent coming from the 91st Avenue plant on the basis of their respective deliveries of sewage for treatment at the 91st Avenue plant.

A range of minimum revenues which could be realized by each of the participating cities is presented in table 8.1-6. This projection is based on:

- Influent ratios of the participating cities being constant with 1978 values.
- Annual station water use of 64,050 acre-ft (21,350 acre-ft/yr/unit).
- Availability of no uncommitted effluent in excess of the annual station requirement of 64,050 acre-ft/year.
- Payments of $20 and $30 per acre-ft of delivered effluent.
- All effluent for PVNGS will come from the 91st Avenue plant.

It is assumed that all residents of the cities participating in the 91st Avenue Plant will derive economic benefits.

8.1.4 IMPACTS IF OPERATION IS DELAYED

As discussed in chapter 1, load requirements for the PVNGS participants will increase substantially during the early 1980s. In order for the participants to reliably meet the needs of their customers in those years (1980 to 1986), additional generation of 7385 megawatts will be required from new resources. PVNGS makes a major contribution toward meeting these needs.

Any delays in the construction of these units could seriously affect the reliability of the system. The level of impact of the delay varies with the participant. If PVNGS Unit 1 is not put into operation as planned, the reserve margin for PVNGS Units 1,2&3 participants will drop as described in section 1.3.

The service areas of the participants cover sizable portions of four states; consequently, significant differences exist in the geographic, demographic, economic, and social characteristics as well as total load and load characteristics of each participant. These differences make it difficult to quantify the impact of electrical shortages. Some electric utilities have experienced some major bulk power failures during the last several years. The severity of these failures varies. Major power failures are very costly. There are no dollar figures on the cost of load shortages for the participants. However, the blackout of the northeast portion of the U.S. in 1965 affected approximately 30 million people and cost an estimated $100 million. The New York City blackout in 1978 led to widespread looting and rioting.

8.1.5 REFERENCES

1. Arizona State University, College of Business Administration, Bureau of Economic and Business Research, "Maricopa County: An Economic Base Analysis", Tempe Arizona, December 1973.

2. Ellis, T., Marketing Services Staff, First National Bank of Arizona, Phoenix, Arizona, personal communication, June 27, 1979.

3. Merrill, R., Income Tax Division, Arizona Department of Revenue, personal communication, June 27, 1979.

4. Townsend, J., Sales Tax Division, Arizona Department of Revenue, personal communication, June 27, 1979.

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7.2 Tab	Original	Appx 11A Title Page	Original
7.2-1	Original	Chapter 12 Tab	Original
7.3 Tab	Original	12-i - 12-ii	Original
7.3-1 - 7.3-4	Original	12-1 - 12-12	Original

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12A Tab	Original
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13-i	Original
13-1	Original
13A Tab	Original
Appx 13A Title Page	Original

FOREWORD

The Environmental Report - Operating License Stage (ER-OL) for the Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2 & 3 is part of the joint application for licenses authorizing Arizona Public Service Company to construct, operate and maintain PVNGS on its own behalf and as agent for all other joint applicants.

Palo Verde Nuclear Generating Station, including each of Palo Verde Units 1, 2 and 3, is currently jointly owned by the joint-applicants listed below, sometimes referred to as "Participants," as tenants in common with undivided ownership interests in the respective percentages hereinafter set forth, all in accordance with the Arizona Nuclear Power Project Participation Agreement, dated as of August 23, 1973, as amended by Amendment Nos. 1 through 4.

Joint Applicants		Undivided Interest
Arizona Public Service Company	(APS)	29.1%
Salt River Project Agricultural Improvement and Power District	(SRP)	29.1%
Southern California Edison Company	(SCE)	15.8%
El Paso Electric Company	(EPE)	15.8%
Public Service Company of New Mexico	(PNM)	10.2%

However, pursuant to an agreement dated August 18, 1977, between SRP and the Department of Water and Power of the City of Los Angeles (LADWP), SRP will transfer to LADWP, and LADWP will acquire from SRP, a 5.7% undivided ownership interest as a tenant in common with the other Participants in the Palo Verde Nuclear Generating Station, including each of Palo Verde Units 1, 2 and 3, at such time as Palo Verde Unit 1 is placed into commercial operation (i.e., when it is deemed to be available

as a reliable source of electric generation). For this reason, LADWP has been included in the descriptions of the need for PVNGS (Chapter 1) and the benefits derived from PVNGS (Chapter 8).

The PVNGS Units 1, 2 and 3 are scheduled for commercial operation in May 1983, May 1984, and May 1986, respectively.

The ER-OL presents a description of PVNGS and its environmental impacts, as well as changes to the description since the Environmental Report - Construction Permit Stage (ER-CP), Docket Numbers STN-50-528, 529, and 530 and Final Environmental Statement (FES) NUREG-75/078. For those instances in which there have been no changes, the reader is so informed and the ER-CP is briefly summarized.

The ER-OL adheres to the format, content, style, composition, and physical specifications required by NRC Regularory Guide 4.2, Revision 2, as modified by the August 24, 1976 Errata sheet.

This environmental report incorporates by reference applicable portions of the PVNGS Final Safety Analysis Report (FSAR) to the extent allowed by Regulatory Guide 4.2 for reference to the FSAR or the Preliminary Safety Analysis Report (PSAR).

All text pages are numbered by chapter and section as required by Regulatory Guide 4.2. Tables and illustrations are numbered in a similar manner; e.g. table 1.1-1 is the first table in section 1.1. Each table is placed in the text following the page on which it is first referenced. Figures are placed at the end of each section.

FOREWORD

The engineering symbols used on piping and instrumentation diagrams (P&ID's) are shown on figure F-1. Standards used for editorial abbreviations and symbols are the latest editions of the following American National Standards Institute publications: ANSI-Y1.1, Abbreviations; ANSI-Y10.5, Letter Symbols for Quantities used in Electrical Science and Electrical Engineering; and ANSI-Y10.9, Letter Symbols for Units used in Science and Technology.

The ER-OL includes answers to NRC requests for additional information in the NRC letters from Mr. D. G. Eisenhut to Mr. E. E. Van Brunt, Jr., dated June 18, 1980, and from Mr. R. L. Tedesco to Mr. E. E. Van Brunt, Jr., dated February 13, 1981. The questions and responses or locations of responses are provided in Appendix A of the appropriate chapter of the ER-OL. The cross-reference list from NRC question number to ER-OL question number is as noted below:

NRC QUESTION NUMBER	ER-OL QUESTION NUMBER	
Section 1.1.2	1A.1	
Section 2.1.2.3	2A.1	
Section 2.3	2A.2	2
Section 2.3	2A.3	
Section 3.1.3.1	3A.1	
Section 6.1.5.5.3	6A.1	
Section 6.2	6A.2	
240.1	3A.2	
240.2	3A.3	
240.3	3A.4	
240.4	3A.5	
290.1	6A.3	
290.2	3A.6	

NRC QUESTION NUMBER	ER-OL QUESTION NUMBER
290.3	6A.4
290.4	5A.1
290.5	5A.2
290.6	5A.3
290.7	5A.4
290.8	3A.7
290.9	5A.5
290.10	5A.6
291.1	3A.8
291.2	3A.9
291.3	3A.10
291.4	3A.11
291.5	3A.12
291.6	3A.13
291.9	3A.14
291.10	3A.15
291.11	3A.16
291.12-3.7.3.3	3A.17
291.12-5.6.2	5A.7
291.13	5A.8
291.15	2A.4
291.16	2A.5
291.17	3A.18
291.18	3A.19
291.19	3A.20
291.20	3A.21
291.21	3A.22
291.22	3A.23
291.23	3A.24
291.24	3A.25
291.25	3A.26
310.1	5A.9

2

NRC QUESTION NUMBER	ER-OL QUESTION NUMBER
310.2	5A.10
310.3	2A.6
310.4	2A.7
310.5	2A.8
310.6	2A.9
310.7	5A.11
310.8	8A.1
310.9	8A.2
311.1	2A.10
311.2	2A.11
311.3	2A.12
311.4	2A.13
311.5	2A.14
320.1	1A.2
320.2	1A.3
320.3	1A.4
320.4	1A.5
320.5	1A.6
320.6	1A.7
450.1	2A.15

2

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CHAPTER 1

PURPOSE OF THE PROPOSED FACILITY AND ASSOCIATED TRANSMISSION

CONTENTS

TABLES

CONTENTS (cont)

TABLES (cont)

2

TABLES (cont)

2

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This table and all other tables and figures in this section for PVNGS present the cumulative data as well as individual data for all participants. Where appropriate (that is, sales and purchases between participants), the cumulative data have been adjusted to prevent duplication.

Information in table 1.1-1 shows that the participants had a combined demand compound growth rate of about 5.6% per annum from 1968 to 1978, and that they anticipate a combined growth rate of 3.8% per annum between 1978 and 1988. Between 1988 and 1992, it is expected that the combined system demand will be growing at an average rate of more than 1170 megawatts per year.

All participants are summer peaking utilities. The electric demand and energy growth rate in the areas served by the participants can be attributed to a rate of population expansion greater than the national average, increased use of air conditioning, and a general trend toward higher per capita use of electricity.

Most of the participants do not have and do not anticipate having any interruptible load. SCE includes interruptible loads in its load management reductions, which reduce the peak forecast used in SCE planning studies.

Monthly demand and energy requirements for 1981 through 1988 for the combined systems of all participants as well as for an individual participant's systems, are presented in table 1.1-2. Figures 1.1-1 through 1.1-7 are projected 1987 to 1988 load duration curves for the participants' combined system as well as for each participant. The anticipated 1987 to 1988 load factor for the combined system is 60.3%, with individual load factors ranging from 57.4 to 70.2%. Analysis of the load duration curves indicates that nuclear energy production can displace higher priced coal resources, and that the full potential production of the nuclear units can be used in the combined systems of all participants. The displacement of coal resources

will in turn displace the need for the addition of oil-burning units, such as combined cycle and combustion turbine units. Thus, the use of domestic coal and nuclear resources will, each in turn, result in the area being less dependent on oil, an expensive and uncertain future energy resource.

All of the participants are members of the WSCC. Part of their membership obligation is to periodically report certain of the above load-resource data to the WSCC for use in various reports and studies. These data are compiled and published annually in the WSCC Summary of Estimated Loads and Resources. The loads and resources for the PVNGS Arizona and New Mexico participants are included in the total for Region III, Arizona-New Mexico Power Area; the PVNGS Southern California participants are included in the totals for Region IV, Southern California-Nevada Power Pool. Figure 1.1-8 shows the geographic boundaries of these areas.

The total annual peak demand and energy requirements for these two areas, as extracted from WSCC reports, are listed in table 1.1-3. These data, compiled from the 1972-1987 report period, pertain to all utilities in the geographical area and therefore are larger in magnitude than the data compiled solely for the PVNGS participants. Table 1.1-4 is a list of the monthly demand and energy requirements for the areas as extracted from the WSCC report for 1982 through 1987.

1.1.1.2 Demand Projections

The need for PVNGS and other additional generating capacity rests on the validity of the forecasts made by the participants for their respective loads through 1990. To establish this validity the following topics are addressed:

- Methodology of forecasting
- Historical accuracy of forecasting
- Impact of energy conservation measures

units such as PVNGS. The participants will continue seeking means to promote effectively prudent electric energy management practices.

1.1.1.3 Power Exchanges

Past and expected future net power sales and purchases outside the participants' combined system, which are applicable at the time of annual peak demand, are presented in table 1.1-1. Both firm sales and purchases and nonfirm sales and purchases are tabulated; they contribute respectively to load and generation totals. Firm purchases are not included in the resources requiring reserves as the reserves are provided by the seller. Reserve for firm sales is provided on the participants' combined system.

On a load and resource tabulation, firm sales appear as load additions. Firm purchases appear as reductions in load.

A nonfirm sale is a sale of power if that power is available. The delivery of power is contingent on the operation of the stipulated source. The buyer must provide the reserves to back up a nonfirm purchase. 2

On a load and resource tabulation nonfirm sales and purchases are treated as resources. A nonfirm sale of power reduces the capacity of the machine the sale is made from and the resources total is reduced by the amount of the sale. A nonfirm purchase is added to the resources total.

Table 1.1-1, Loads and Resources Summary, tabulates firm sales, firm purchases, nonfirm sales and nonfirm purchases. Table 1.1-2, Load and Energy Requirements by Month, tabulates loads but not resources. It includes firm sales and firm purchases. Table 1.1-3 is a loads and resources summary. It includes firm sales, firm purchases, nonfirm sales and nonfirm purchases. Table 1.1-4 is a monthly loads summary and includes firm sales

and firm purchases. Table 1.1-8, Capability of Resources,
2 tabulates resources but not loads. It includes nonfirm sales
and nonfirm purchases.

1.1.2 SYSTEM CAPACITY

System capabilities for each of the participants at the time of the annual peak demand for 1968 through 1988 are presented in table 1.1-8 along with a combined resources summary for all participants.. Representative capacity factors are provided
1 in table 1.1-8A. These resource schedules are the result of generation planning that makes use of the load forecasting discussed in section 1.1.1.2.

Each participant is responsible for determining its own criteria for bulk generation planning, including the methodology for load forecasting. The Reliability Council of the WSCC recently issued guidelines for the measurement of the adequacy of power supply, including as an alternative a reliability test that uses a loss-of-load probability (LOLP) criterion of one day of outage in 10 years.

Table 1.1-9 contains information showing the existing generation capability as of January 1, 1978, for the Arizona-New Mexico Power Area and the Southern California-Nevada Power Area, respectively, as defined in WSCC. Table 1.1-10 is a summary of generation additions for these two power areas.

The participants generally rely on a high percentage of resources that are remote from their load areas, with power carried to the load areas over EHV transmission systems. There is a limited number of interconnections between the participants' service areas and surrounding systems. Even assuming that the large amounts of power that may be needed are available for purchase, the limited number of interconnections and high use of the EHV tranmission system will make it difficult for those large amounts of power to be transmitted to the participants' service areas.

Delays in the construction of PVNGS generating facilities will have the following adverse effects on systems planning and operation.

A. Longer Lead Times - Consistent delays in construction lengthen the lead time required for generation planning. This reduces the flexibility and adaptability of incorporating new technology or changes in load forecasts into the planning process.

B. Decreased System Reliability - Delays will result in lower reserve margins that decrease system reliability and thereby cause more frequent service interruptions.

C. Additional Costs - The delay of a generating facility may require the temporary substitution of a more costly alternative with the possibility of a greater environmental impact. Delays also result in additional costs for interest during construction of the planned facility. The impact of delay on production costs is shown in table 1.3-8. The assumptions regarding heat rate, fuel cost, O&M costs, and discount rates are presented in table 1.3-9. 2

Table 1.3-1

1981

RESERVE MARGIN DUE TO DELAY OF PVNGS

(MW) (Sheet 1 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	697	697	697	697	697
LADWP	326	326	326	326	326
El Paso Electric	153	153	153	153	153
Public Service of New Mexico	238	238	238	238	238
Salt River Project	1037	1037	1037	1037	1037
Southern California Edison	2197	2197	2197	2197	2197
Participants Total	4648	4648	4648	4648	4648

2

Table 1.3-1
1982
RESERVE MARGIN DUE TO DELAY OF PVNGS
(MW) (Sheet 2 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	451	451	451	451	451
LADWP	205	205	205	205	205
El Paso Electric	144	144	144	144	144
Public Service of New Mexico	212	212	212	212	212
Salt River Project	861	861	861	861	861
Southern California Edison	2537	2537	2537	2537	2537
Participants Total	4410	4410	4410	4410	4410

2

Table 1.3-1

1983

RESERVE MARGIN DUE TO DELAY OF PVNGS

(MW) (Sheet 3 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	611	495	495	495	495
LADWP	531	542	542	542	542
El Paso Electric	286	86	86	86	86
Public Service of New Mexico	256	126	126	126	126
Salt River Project	1114	758	758	758	758
Southern California Edison	3551	3364	3364	3364	3364
Participants Total	6349	5371	5371	5371	5371

2

Table 1.3-1
1984
RESERVE MARGIN DUE TO DELAY OF PVNGS
(MW) (Sheet 4 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	740	384	268	268	268
LADWP	470	476	488	488	488
El Paso Electric	442	242	42	42	42
Public Service of New Mexico	222	92	0	0	0
Salt River Project	1327	971	615	615	615
Southern California Edison	3532	3345	3158	3158	3158
Participants Total	6733	5510	4571	4571	4571

2

Table 1.3-1
1985
RESERVE MARGIN DUE TO DELAY OF PVNGS
(MW) (Sheet 5 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	634	634	278	162	162
LADWP	467	455	461	473	473
El Paso Electric	391	391	191	(9)	(9)
Public Service of New Mexico	278	278	148	18	18
Salt River Project	1166	1166	810	454	454
Southern California Edison	2800	2800	2613	2426	2426
Participants Total	5736	5724	4501	3524	3524

2

Table 1.3-1
1986
RESERVE MARGIN DUE TO DELAY OF PVNGS
(MW) (Sheet 6 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	604	248	248	(108)	(224)
LADWP	371	382	369	375	388
El Paso Electric	541	341	341	141	(59)
Public Service of New Mexico	303	173	173	43	0
Salt River Project	1357	1001	1001	645	289
Southern California Edison	2704	2517	2517	2330	2142
Participants Total	5880	4662	4649	3426	2536

2

Table 1.3-1
1987
RESERVE MARGIN DUE TO DELAY OF PVNGS
(MW) (Sheet 7 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	689	689	333	333	(379)
LADWP	397	390	400	388	407
El Paso Electric	519	519	319	319	(81)
Public Service of New Mexico	321	321	191	191	0
Salt River Project	1274	1274	918	918	206
Southern California Edison	2856	2856	2669	2669	2294
Participants Total	6056	6049	4830	4818	2447

Table 1.3-1
1988
RESERVE MARGIN DUE TO DELAY OF PVNGS
(MW) (Sheet 8 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	692	692	692	336	(376)
LADWP	452	447	440	450	456
El Paso Electric	472	472	472	272	(128)
Public Service of New Mexico	344	344	344	214	0
Salt River Project	1164	1164	1164	808	96
Southern California Edison	2816	2816	2816	2629	2254
Participants Total	5940	5935	5456	4709	2302

Table 1.3-1
1989
RESERVE MARGIN DUE TO DELAY OF PVNGS
(MW) (Sheet 9 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	763	763	763	763	(305)
LADWP	433	433	428	421	437
El Paso Electric	399	399	399	399	(201)
Public Service of New Mexico	337	337	337	337	0
Salt River Project	1058	1058	1058	1058	(10)
Southern California Edison	2983	2983	2983	2983	2421
Participants Total	5973	5973	5968	5961	2342

2

Table 1.3-1
1990
RESERVE MARGIN DUE TO DELAY OF PVNGS
(MW) (Sheet 10 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	839	839	839	839	(229)
LADWP	516	516	516	511	520
El Paso Electric	327	327	327	327	(273)
Public Service of New Mexico	469	469	469	469	79
Salt River Project	954	954	954	954	(114)
Southern California Edison	3103	3103	3103	3103	2541
Participants Total	6208	6208	6208	6203	2524

Table 1.3-2
1981
RESERVE MARGIN DUE TO DELAY OF PVNGS
(% OF PEAK) (Sheet 1 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	25.7	25.7	25.7	25.7	25.7
LADWP	28.7	28.7	28.7	28.7	28.7
El Paso Electric	20.6	20.6	20.6	20.6	20.6
Public Service of New Mexico	23.9	23.9	23.9	23.9	23.9
Salt River Project	45.8	45.8	45.8	45.8	45.8
Southern California Edison	16.6	16.6	16.6	16.6	16.6
Participants Average	26.9	26.9	26.9	26.9	26.9

2

Table 1.3-2
1982
RESERVE MARGIN DUE TO DELAY OF PVNGS
(% OF PEAK) (Sheet 2 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	15.8	15.8	15.8	15.8	15.8
LADWP	18.2	18.2	18.2	18.2	18.2
El Paso Electric	18.6	18.6	18.6	18.6	18.6
Public Service of New Mexico	20.0	20.0	20.0	20.0	20.0
Salt River Project	36.5	36.5	36.5	36.5	36.5
Southern California Edison	18.6	18.6	18.6	18.6	18.6
Participants Average	21.3	21.3	21.3	21.3	21.3

2

Table 1.3-2
1983
RESERVE MARGIN DUE TO DELAY OF PVNGS
(% OF PEAK) (Sheet 3 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	20.7	16.7	16.7	16.7	16.7
LADWP	43.6	44.9	44.9	44.9	44.9
El Paso Electric	35.4	10.6	10.6	10.6	10.6
Public Service of New Mexico	23.6	11.6	11.6	11.6	11.6
Salt River Project	45.2	30.8	30.8	30.8	30.8
Southern California Edison	25.6	24.2	24.2	24.2	24.2
Participants Average	32.4	23.1	23.1	23.1	23.1

2

Table 1.3-2
1984
RESERVE MARGIN DUE TO DELAY OF PVNGS
(% OF PEAK) (Sheet 4 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	24.2	12.5	8.8	8.8	8.8
LADWP	38.8	39.5	40.9	40.9	40.9
El Paso Electric	52.2	28.6	5.0	5.0	5.0
Public Service of New Mexico	20.0	8.3	0	0	0
Salt River Project	50.9	37.3	23.6	23.6	23.6
Southern California Edison	24.7	23.4	22.1	22.1	22.1
Participants Average	35.1	24.9	16.7	16.7	16.7

2

Table 1.3-2
1985
RESERVE MARGIN DUE TO DELAY OF PVNGS
(% OF PEAK) (Sheet 5 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	20.0	20.0	8.8	5.1	5.1
LADWP	38.9	37.5	38.2	39.5	39.5
El Paso Electric	43.8	43.8	21.4	(1.0)	(1.0)
Public Service of New Mexico	23.4	23.4	12.5	1.5	1.5
Salt River Project	43.1	43.1	30.0	16.8	16.8
Southern California Edison	19.0	19.0	17.7	16.5	16.5
Participants Average	31.4	31.1	21.4	13.1	13.1

2

Table 1.3-2
1986
RESERVE MARGIN DUE TO DELAY OF PVNGS
(% OF PEAK) (Sheet 6 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	18.3	7.5	7.5	(3.3)	(6.8)
LADWP	31.0	32.3	30.8	31.5	32.9
El Paso Electric	57.8	36.4	36.4	15.1	(6.3)
Public Service of New Mexico	24.1	13.8	18.8	3.4	0
Salt River Project	48.1	35.5	35.5	22.9	10.2
Southern California Edison	17.8	16.6	16.6	15.3	14.1
Participants Average	32.9	23.7	24.3	14.2	7.4

2

Table 1.3-2
1987
RESERVE MARGIN DUE TO DELAY OF PVNGS
(% OF PEAK) (Sheet 7 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	19.9	19.9	9.6	9.6	(11.0)
LADWP	30.6	29.9	30.9	29.7	31.6
El Paso Electric	52.8	52.8	32.5	32.5	(8.2)
Public Service of New Mexico	23.9	23.9	14.2	14.9	0
Salt River Project	43.9	43.9	31.6	31.6	7.1
Southern California Edison	18.3	18.3	17.1	17.1	14.7
Participants Average	31.6	31.5	22.7	22.6	5.7

2

Table 1.3-2
1988
RESERVE MARGIN DUE TO DELAY OF PVNGS
(% OF PEAK) (Sheet 8 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	19.0	19.0	19.0	9.2	(10.3)
LADWP	32.4	31.9	31.2	32.2	32.7
El Paso Electric	45.8	45.8	45.8	26.4	(12.4)
Public Service of New Mexico	23.9	23.9	23.9	14.9	0
Salt River Project	38.6	38.6	38.6	26.8	3.2
Southern California Edison	17.5	17.5	17.5	16.3	14.0
Participants Average	29.5	29.5	29.3	21.0	4.5

2

Table 1.3-2
1989
RESERVE MARGIN DUE TO DELAY OF PVNGS
(% OF PEAK) (Sheet 9 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	20.0	20.0	20.0	20.0	(8.0)
LADWP	29.6	29.6	29.2	28.6	30.0
El Paso Electric	36.8	36.8	36.8	36.8	(18.5)
Public Service of New Mexico	22.2	22.2	22.2	22.2	0
Salt River Project	33.9	33.9	33.9	33.9	(0.3)
Southern California Edison	18.0	18.0	18.0	18.0	14.6
Participants Average	26.7	26.7	26.7	26.6	3.0

2

Table 1.3-2
1990
RESERVE MARGIN DUE TO DELAY OF PVNGS
(% OF PEAK) (Sheet 10 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	21.1	21.1	21.1	21.1	(5.8)
LADWP	32.0	32.0	32.0	31.6	32.4
El Paso Electric	28.7	28.7	28.7	28.7	(23.9)
Public Service of New Mexico	29.3	29.3	29.3	29.3	4.9
Salt River Project	29.6	29.6	29.6	29.6	(3.5)
Southern California Edison	18.1	18.1	18.1	18.1	14.8
Participants Average	26.5	26.5	26.5	26.4	3.2

2

Table 1.3-3

EFFECT OF DELAY ON PARTICIPANT'S SYSTEM RELIABILITY

(Sheet 1 of 5)

ARIZONA PUBLIC SERVICE

RELIABILITY INDEX (ONE DAY IN _ YEARS)

Year	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
1981	29.52	29.52	29.52	29.52	29.52
1982	5.62	5.62	5.62	5.62	5.62
1983	40.99	3.09	3.09	3.09	3.09
1984	47.66	3.67	0.18	0.18	0.18
1985	15.43	10.07	0.45	0.08	0.08
1986	6.86	0.66	0.47	0.06	0.01
1987	4.61	3.43	0.48	0.23	0.01
1988	5.64	4.23	3.16	0.42	0.01
1989	6.92	6.28	4.75	3.59	0.01
1990	6.90	6.90	6.31	4.82	0.01

2

Table 1.3-5

EFFECT OF DELAY ON PARTICIPANT'S GAS CONSUMPTION
(Sheet 4 of 7)
PUBLIC SERVICE OF NEW MEXICO

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Year	10^9 CF	10^9 CF	10^9 CF	10^9 CF	10^9 CF
1981	10.328	10.328	10.328	10.328	10.328
1982	10.667	10.667	10.667	10.667	10.667
1983	8.370	11.181	11.181	11.181	11.181
1984	8.568	10.890	12.637	12.637	12.637
1985	8.949	9.659	11.760	13.750	13.750
1986	6.931	10.055	10.712	12.635	13.462
1987	6.637	6.835	9.448	9.976	12.463
1988	5.762	6.173	6.445	8.937	12.362
1989	5.677	5.517	5.951	6.183	11.523
1990	4.428	4.881	4.584	4.914	11.685
Total	76.317	86.186	93.713	85.708	120.058
Year	10^{12} BTU	10^{12} BTU	10^{12} BTU	10^{12} BTU	10^{12} BTU
1981	10.829	10.829	10.829	10.829	10.829
1982	11.186	11.186	11.186	11.186	11.186
1983	8.774	11.702	11.702	11.702	11.702
1984	8.979	11.397	13.220	13.220	13.220
1985	9.392	10.125	12.317	14.384	14.384
1986	7.273	10.538	11.223	13.218	14.086
1987	6.973	7.175	9.894	10.446	13.036
1988	6.053	6.483	6.858	9.359	12.931
1989	5.970	5.794	6.251	6.486	12.041
1990	6.661	5.133	4.819	5.173	12.225
Total	82.090	90.662	98.299	106.003	125.640

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Table 1.3-5

EFFECT OF DELAY ON PARTICIPANT'S GAS CONSUMPTION
(Sheet 5 of 7)
SALT RIVER PROJECT

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Year	10^9 CF	10^9 CF	10^9 CF	10^9 CF	10^9 CF
1981	5.222	5.217	5.217	5.217	5.194
1982	7.405	7.305	7.304	7.304	7.256
1983	6.032	9.366	9.373	9.372	9.263
1984	4.743	8.148	10.855	10.860	10.861
1985	5.022	5.243	9.076	10.275	10.395
1986	4.880	5.991	6.160	7.076	7.074
1987	3.436	3.609	4.209	4.326	4.331
1988	1.655	1.655	1.656	1.655	1.659
1989	.086	.087	.086	.085	.086
1990	.001	.001	.001	.001	.001
Total	38.482	46.622	53.937	56.171	56.120
Year	10^{12} BTU	10^{12} BTU	10^{12} BTU	10^{12} BTU	10^{12} BTU
1981	5.744	5.739	5.739	5.739	5.713
1982	8.146	8.036	8.034	8.034	7.982
1983	6.635	10.303	10.310	10.309	10.189
1984	5.217	8.963	11.941	11.946	11.947
1985	5.524	5.767	9.984	11.303	11.435
1986	5.368	6.590	6.776	7.784	7.781
1987	3.780	3.970	4.630	4.759	4.764
1988	1.821	1.821	1.822	1.821	1.825
1989	.095	.096	.095	.094	.095
1990	.001	.001	.001	.001	.001
Total	42.330	51.284	59.331	61.788	61.732

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March 1981

Table 1.3-6

EFFECT OF DELAY ON PARTICIPANT'S COAL CONSUMPTION
(Sheet 3 of 7)
EL PASO ELECTRIC

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Year	1000 Tons	1000 Tons	1000 Tons	1000 Tons	1000 Tons
1981	283	283	283	283	283
1982	303	303	303	303	303
1983	313	313	313	313	313
1984	217	278	311	311	311
1985	176	200	268	303	303
1986	153	192	216	272	301
1987	155	174	223	246	318
1988	155	165	195	244	319
1989	166	163	167	179	303
1990	300	285	293	303	523
Total	2221	2356	2572	2757	3277
Year	10^{12} BTU	10^{12} BTU	10^{12} BTU	10^{12} BTU	10^{12} BTU
1981	4.929	4.929	4.929	4.929	4.929
1982	5.245	5.245	5.245	5.245	5.245
1983	5.416	5.416	5.416	5.416	5.416
1984	3.785	4.865	5.400	5.400	5.400
1985	3.085	3.501	4.666	5.228	5.228
1986	2.650	3.377	3.734	4.748	5.205
1987	2.681	3.015	3.931	4.248	5.525
1988	2.716	2.885	3.381	4.300	5.557
1989	2.891	2.803	2.914	3.120	5.273
1990	5.132	4.916	5.017	5.227	8.925
Total	38.530	40.952	44.333	47.861	56.703

Table 1.3-6

EFFECT OF DELAY ON PARTICIPANT'S COAL CONSUMPTION
(Sheet 4 of 7)
PUBLIC SERVICE OF NEW MEXICO

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Year	1000 Tons	1000 Tons	1000 Tons	1000 Tons	1000 Tons
1981	3139	3139	3139	3139	3139
1982	3866	3866	3866	3866	3866
1983	4166	4233	4233	4233	4233
1984	4192	4276	4297	4297	4297
1985	4111	4135	4203	4223	4223
1986	3976	4114	4137	4170	4176
1987	3981	4014	4140	4153	4215
1988	3969	3973	4014	4160	4270
1989	3796	3742	3733	3788	4052
1990	3768	3752	3736	3796	4056
Total	38964	39244	39498	39825	40527
Year	10^{12} BTU	10^{12} BTU	10^{12} BTU	10^{12} BTU	10^{12} BTU
1981	55.857	55.857	55.857	55.857	55.857
1982	68.959	68.459	68.959	68.959	68.959
1983	74.499	75.711	75.711	75.711	75.711
1984	76.889	78.405	78.769	78.769	78.769
1985	76.664	77.096	78.332	78.665	78.665
1986	76.302	76.862	77.299	77.949	78.089
1987	74.325	75.033	77.324	77.601	78.761
1988	74.067	74.176	75.017	77.645	79.835
1989	73.499	72.452	72.299	73.320	78.554
1990	72.819	72.503	72.248	73.427	78.535
Total	723.880	759.554	662.225	737.903	751.735

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Table 1.3-9

AVERAGE SYSTEM DATA

SOUTHERN CALIFORNIA EDISON[f] (Sheet 6 of 6)

Year	Heat Rate (BTU/KWH)	Fuel Cost ($/MWH)	O&M Cost ($/MWH)
1981	9880	42.40	3.50
1982	9850	49.70	4.40
1983	9860	49.20	4.40
1984	10080	53.60	4.90
1985	10170	58.60	5.30
1986	10290	60.90	6.10
1987	10430	63.80	6.90
1988	10520	65.50	8.10
1989	10560	69.10	8.80
1990	10520	73.60	9.60

f. SCE discount rate is 15%

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The types of establishments that exist include a combination grocery store-gas station and two cafes and bars.

2.1.3.1.3 Special Land Use

Within a 5-mile radius of PVNGS, there are two parcels zoned by the Maricopa County Planning Department for special use as a mobile home park and a travel trailer park, respectively.[9] Both are located near the intersection of Wintersburg and Buckeye-Salome Roads.

One parcel, located east of the Wintersburg and Buckeye-Salome Roads intersection has been given a special use permit for a mobile home park valid for 25 years, beginning in 1975.[12] The owner of the property has indicated that he intends to initiate development.[13]

The other parcel, located on the northwestern corner of the same intersection has been given a special use permit for travel trailer park valid for 3 years beginning March 27, 1978.[12] The representative of the property owner has indicated that he intends to develop the parcel.[14]

2.1.3.1.4 Institutional Land Use

There are no public facilities or institutional land uses within a 5-mile radius of the plant site.

2.1.3.1.5 Agricultural Land Use

Agricultural land uses are discussed in section 2.1.3.4.

2.1.3.1.6 Transportation Land Use

2.1.3.1.6.1 Roads. Figure 3.1-3 illustrates the road system within a 5-mile radius of the plant site. It is essentially a rectangular grid oriented on north-south and east-west axes, following township and sectional lines. The plant site is

bounded on two sides by Wintersburg Road and Ward (Elliot) Road. At its closest point, Buckeye-Salome Road is located 2 miles north-northeast of Unit 2. Table 2.1-4 lists Average Daily Traffic (ADT) counted within a 5-mile radius of the PVNGS plant site during a June, 1978 traffic survey.[15] These counts are well below design levels.[16]

Based on a traffic volume survey[35] made by the Maricopa County Highway Department, the average 1980, 24-hour weekday traffic in the vicinity of the plant site is:

344th Avenue

- Between Broadway Road and Salome Highway: 79
- Between I-10 and Van Buren: 75

Elliot (Ward) Road

- West of Wintersburg Rd (383 Ave.): 90
- East of Wintersburg Rd (383 Ave.): 402

2 339th Avenue

- Between Broadway Road and Salome Highway: 100
- Between I-10 and Van Buren: 150

Van Buren Street

- East of 379 Avenue: 100

Wintersburg Road heading south from the site.

- No counts have been made on Wintersburg Road heading south from the site. However the sum of the counts, east and west of Wintersburg on Elliot Road can provide an approximate estimate. This sum is 492.

following items will be sent under separate cover in fulfillment of this request:

Zoning Information

1. Maricopa County, Unincorporated Area, Zoning District Maps, various dates.

2. City of Phoenix Zoning Maps, various dates.

3. Pinal County Zoning Map, including Hidden Valley area inset, May 13, 1968.

4. Yuma County Zoning Maps (Area No. 4).

Current and Future Land Use Plans

1. Maricopa Association of Governments, Transportation and Planning Office: Guide for Regional Development and Transportation, July 23, 1980.

2. Maricopa County Planning and Zoning Department, Westcentral Maricopa County, Arizona Plan, October 1971. 2

3. City of Phoenix, Arizona, Phoenix Concept Plan 2000: A Program for Planning.

4. City of Phoenix, Arizona, Interim 1985 Plan.

5. Northern Arizona Council of Governments, "Regional Comprehensive Plan" and "Existing Population/Land Use" (Youapai County).

QUESTION 2A.8 (NRC No. 310.5) 2.1.2

Explain the method by which the 5-50 mile radius population figures in Section 2.1.2.1 were calculated.

RESPONSE: The 5-50 mile radius population figures were calculated in the same manner as the 5-10 mile radius population figures, as noted in sections 2.1.2.1 and 2.1.2.2.

QUESTION 2A.9 (NRC No. 310.6) 2.1.3

In addition to traffic counts provided in the OL-ER Table 2.1-4, please provide traffic counts on the following roads:

355th Avenue
Elliot (Ward) Road
339th Avenue
Van Buren Street
Wintersburg road heading south from the site, and
U.S. Highway approaches (I-10).

Identify any places where traffic congestion or problems of interference with patterns of local and pedestrian traffic might be anticipated.

2 RESPONSE: The response is provided in the revised section 2.1.3.1.6.

QUESTION 2A.10 (NRC No. 311.1) 2.1

A number of discrepancies between information supplied in the PSAR vs. the FSAR have been noted regarding information concerning the site vicinity. Examples of such discrepancies are as follows:

(a) The CP lists the PVNGS site as being 15 miles west of Buckeye and 36 miles west of Phoenix, whereas the FSAR lists these distances as 16 and 34 miles, respectively.

(b) The PSAR lists the elevation of the northern site boundary as 975 feet MSL, whereas the FSAR indicates 1030 feet MSL.

(c) There are some differences between the PSAR and FSAR in the distances and even some directions of the towns and communities listed.

CHAPTER 3

THE STATION

CONTENTS

CONTENTS (cont)

Table 3.4-2
ANTICIPATED MONTHLY EVAPORATION VARIATION (1 of 2)
(EACH UNIT)

Month	Temp (F)	RH (%)	Evaporation (GPM)	Blowdown (GPM)	Makeup (GPM)	Circulating Water Temperature (F)
			25% HEAT LOAD			
January	50	51	3820	247	4090	55
February	53	35	4280	280	4590	54
March	60	43	4540	298	4860	60
April	63	28	5050	335	5410	59
May	77	21	6130	412	6570	64
June	88	17	6700	474	7200	68
July	90	35	6350	427	6800	76
August	89	29	6540	441	7010	73
September	84	30	6230	419	6680	71
October	72	35	5400	360	5790	65
November	57	47	4290	280	4600	58
December	49	47	3820	247	4090	54
			50% HEAT LOAD			
January	50	51	6590	445	7060	62
February	53	35	7010	475	7510	61
March	60	43	7370	501	7900	66
April	63	28	7850	535	8410	65
May	77	21	9030	619	9680	70
June	88	17	9970	686	10680	73
July	90	35	9480	651	10160	79
August	89	29	9620	661	10310	77
September	84	30	9260	635	9920	75
October	72	35	8330	569	8930	70
November	57	47	7110	482	7620	65
December	49	47	6570	443	7040	61

Table 3.4-2
ANTICIPATED MONTHLY EVAPORATION VARIATION (2 of 2)
(EACH UNIT)

Month	Temp (F)	RH (%)	Evaporation (GPM)	Blowdown (GPM)	Makeup (GPM)	Circulating Water Temperature (F)
			75% HEAT LOAD			
January	50	51	9420	647	10090	67
February	53	35	9820	676	10520	67
March	60	43	10260	707	10990	70
April	63	28	10710	739	11480	70
May	77	21	11960	828	12810	74
June	88	17	11950	899	12880	77
July	90	35	12580	873	13480	82
August	89	29	12680	880	13590	80
September	84	30	12280	852	13160	78
October	72	35	11280	780	12090	74
November	57	47	9990	687	10700	70
December	49	47	9380	644	10050	66
			100% HEAT LOAD			
January	50	51	12090	838	12950	71
February	53	35	12490	866	13380	70
March	60	43	12980	901	13910	74
April	63	28	13410	932	14370	73
May	77	21	14710	1025	15760	77
June	88	17	15730	1098	16850	79
July	90	35	15450	1078	16550	84
August	89	29	15510	1082	16620	82
September	84	30	15100	1053	16180	80
October	72	35	14050	978	15050	77
November	57	47	12700	881	13610	73
December	49	47	12040	835	12900	70

Table 3.5-12
NORMAL RADIOLOGICAL RELEASES
(Curies per year per unit)

Nuclide	Release Activity
Kr-83m	8.0 (-1)
Kr-85m	4.3
Kr-85	2.0 (+4)
Kr-87	2.2
Kr-88	7.9
Kr-89	8.7 (-2)
Xe-131m	3.3 (+2)
Xe-133m	9.9
Xe-133	1.9 (+3)
Xe-135m	3.5 (-1)
Xe-135	1.5 (+1)
Xe-137	1.7 (-1)
Xe-138	1.2
BR-83	3.1 (-4)
BR-84	9.9 (-5)
BR-85	2.6 (-6)
I-130	2.1 (-4)
I-131	4.0 (-2)
I-132	6.5 (-3)
I-133	4.3 (-2)
I-134	2.2 (-3)
I-135	1.7 (-2)
Cs-134	5.0 (-4)
Cs-137	8.0 (-4)
Sr-89	3.6 (-5)
Sr-90	5.6 (-6)
H-3	1.0 (+3)
C-14	8.0
Ar-41	2.5 (+1)
Mn-54	4.5 (-4)
Fe-59	1.6 (-4)
Co-58	1.6 (-3)
Co-60	7.0 (-4)

Table 3.5-13

SRS INPUT ACTIVITIES[(a)] (Ci/hr) (Sheet 1 of 4)

(PER UNIT)

Nuclide	Evaporator Concentrates	Spent Resin Beads	SGB IX Regenerants	Cartridge Filters	Disposable Crud Filters	Dry Wastes
BR-83	0.0	0.0	5.9(-06)	0.0	0.0	(b)
BR-84	0.0	4.3(-01)	2.0(-07)	0.0	0.0	(b)
BR-85	0.0	0.0	2.0(-10)	0.0	0.0	(b)
I-129	0.0	4.4(-03)	0.0	0.0	0.0	(b)
I-130	0.0	0.0	3.3(-05)	0.0	0.0	(b)
I-131	1.9(-03)	1.4(+04)	1.0(-01)	0.0	0.0	(b)
I-132	0.0	3.7(-01)	1.1(-04)	0.0	0.0	(b)
I-133	0.0	1.9(+03)	1.2(-02)	0.0	0.0	(b)
I-134	0.0	1.2(+01)	9.2(-08)	0.0	0.0	(b)
I-135	0.0	4.0(+02)	1.2(-03)	0.0	0.0	(b)
RB-86	1.2(-04)	0.0	7.3(-05)	0.0	0.0	(b)
RB-88	0.0	1.3(+01)	4.8(-06)	0.0	0.0	(b)
RB-89	0.0	1.2	0.0	0.0	0.0	(b)
CS-134	4.9	6.7(+03)	2.1(-01)	0.0	0.0	(b)
CS-136	3.2(-03)	2.7(+02)	7.8(-03)	0.0	0.0	(b)

a. Expected waste generation conditions only, maximum waste generation conditions are not tabulated because they are short-term inputs that are not representative of a year's continuous operation.

b. Nuclide breakdown was not made. Total activity is based on WASH 1258 estimates.

3.6 CHEMICAL AND BIOCIDE WASTES

Information presented in ER-CP Section 3.6 and the FES has been updated. As part of this update, detailed parameters such as flowrates, chemical consumption and operational frequencies are presented.

3.6.1 PREOPERATIONAL AND PERIODIC CLEANING WASTES

Prior to the initial startup of each unit, the feedwater system from the condensers to the containment isolation valves (approximately 450,000 gal) will be flushed and chemically cleaned to remove dirt, grease, oil, rust, and mill scale. This will be accomplished by the following operations:

A. Dirt and construction debris, estimated at 7470 lb, will be removed by flushing the piping with a high velocity water flush of approximately two system volumes of demineralized water.

B. Chemical cleaning is not expected to be required. Should it become necessary, however, the following steps would be performed:

   1. Grease, oil, and dirt, estimated at 3735 lb, will be removed by flushing each system with approximately 450,000 gallons of an alkaline phosphate solution of approximately 1% concentration. This will be followed with a rinse of approximately two system volumes of demineralized water.

   2. Rust and mill scale will be removed from each system by circulating a 3% organic acid (2% hydroxyacetic, 1% formic) solution containing a 0.2% acid inhibitor, such as Dow Chemical Co. A-145, for several hours. This will be followed with a rinse of approximately two system volumes of demineralized water containing an estimated 5600 lb of citric acid. An estimated 33,615 lb of iron will be removed.

C. The system may be passivated by filling with demineralized water containing 200-400 ppm hydrazine and 0-60 ppm ammonia, to a pH of 9.0-10.0.

Estimated total water volume used in a complete cleaning would be approximately 4,050,000 gallons.

Wastes from this cleaning process will be directed to the onsite evaporation ponds. Periodic, non-radioactive operational equipment cleaning wastes will be discharged to the evaporation ponds.

3.6.2 NONRADIOACTIVE OPERATIONAL WASTES

The plant is designed to have no requirement for offsite disposal of any chemical or liquid wastes. Operational nonradioactive liquid wastes are collected and discharged to the onsite evaporation ponds.

During normal operation of the plant, nonradioactive wastes come from the following sources:

- Water reclamation plant
- Circulating water system
- Demineralized water system
- Domestic water system
- Condensate polishing demineralizer system
- Laboratories and laundry
- Floor drains

Figure 3.3-1 diagrams all plant water and wastewater flows and includes a tabulation of the respective flow rates at various operating conditions. Table 3.6-1 includes a summary of the expected maximum and average concentrations of dissolved solids in the plant influent water from the City of Phoenix 91st Avenue Sewage Treatment Plant and the onsite wells. The

Table 3.6-1

ESTIMATED MAXIMUM AND AVERAGE CONCENTRATION OF CHEMICALS IN THE INFLUENT AND PROCESS WATER SYSTEMS (mg/l) (Sheet 1 of 3) 2

	Influent Streams				Process Streams		
	Influent from Phoenix 91st Avenue Sewage Treatment Plant		Influent from Onsite Wells		Water Reclamation Plant Effluent	Circulating Water System (Cooling Tower Blowdown and Drift)	
Chemical	Maximum	Average	Maximum	Average	Average	Maximum (20 cycles)	Average (15 cycles)
Calcium	67.2	52.9	16.0	14.0	28.0	560.0	420.0
Magnesium	29.6	22.9	8.0	4.6	10.0	200.0	150.0
Sodium	192	186	269.0	225.0	225.0	4,500.0	3,375.0
Chloride	270	253	290.0	232.0	160.0	3,200.0	2,400.0
Sulfate	95.0	91.0	131.0	103.0	150.0	3,000.0	2,250.0
Nitrate	4.20	1.85	12.0	6.5	110.0	2,200.0	1,650.0
Silica	32.0	28.8	55.0	45.0	10.0	200.0	150.0
Phosphate	68.9	22.1	0.1	0.1	<0.1	2.0	1.5
Fluoride	4.8	3.5	10.0	6.2	--	70.0	52.5
Potassium	14.7	13.8	2.0	1.1	--	276.0	207.0
Copper	0.26	0.017	0.1	0.02	0.013	0.4	0.3
Zinc	0.080	0.067	--	--	0.05	1.3	1.0

Table 3.6-1

ESTIMATED MAXIMUM AND AVERAGE CONCENTRATION OF CHEMICALS IN THE INFLUENT AND PROCESS WATER SYSTEMS (mg/l) (Sheet 2 of 3) 2

	Influent Streams				Process Streams		
	Influent from Phoenix 91st Avenue Sewage Treatment Plant		Influent from Onsite Wells		Water Reclamation Plant Effluent	Circulating Water System (Cooling Tower Blowdown and Drift)	
Chemical	Maximum	Average	Maximum	Average	Average	Maximum (20 cycles)	Average (15 cycles)
Iron	0.15	0.035	0.1	0.8	0.005	0.1	0.075
Arsenic	0.02	0.007	0.02	0.01	0.008	0.16	0.12
Boron	0.09	0.037	7.0	3.2	--	0.74	0.56
Ammonia-N	45.4	30.9	0.3	0.08	5.0	100.0	75.0
Phenol	0.018	0.009	0.01	0.009	--	0.18	0.14
Dissolved Oxygen	8.2	6.7	--	--	--	134.0	100.5
Suspended Solids	68	35.7	--	--	10.0	200.0	150.0
COD	187.7	87	14.0	6.0	--	1740.0	1305.0
Alkalinity	285	272	230.0	143.0	100.0	2000.0	1500.0
TDS	1,083	1,039	886.0	740.0	800.0	16,000.0	12,000.0
Silver	0.02	<0.006	--	--	0.003	0.06	0.05

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2

3.6.2.4 Demineralized Water System

The demineralized water system consists of three mixed bed ion exchangers, two normally operating in series and one on standby. Water is supplied to the demineralized water system from the reverse osmosis units in the domestic water system. A schematic flow diagram of the demineralized water system is shown as figure 3.6-4.

The reverse osmosis product water is next passed through a degasifier, then is pumped through two mixed ion exchangers in series to remove dissolved solids to produce demineralized water.

Periodically, the resins become depleted and the ion exchangers must be regenerated. The regeneration cycle consists of a backwash to remove particulate matter, and to loosen and separate the resins, regeneration with an acid or caustic solution as appropriate, and a rinse to remove the spent regenerant. The backwash, spent regenerant, and rinse water are discharged into the spent regenerant sump. The neutralized waste in the sump is pumped to the evaporation ponds.

It is estimated that the total PVNGS use of regenerant chemicals is approximately 850 lb of sodium hydroxide and 1000 lb of sulfuric acid per day.

3.6.2.5 Condensate Polishing Demineralizer System

The secondary system fullflow condensate polishing demineralizer system, shown in figure 3.6-5, removes dissolved solids in the secondary system. The system consists of six mixed bed demineralizers (five normally in service and one on standby) with the required regeneration equipment.

In the event of a steam generator tube leak, radioactive chemical regenerant waste will be directed to the liquid radwaste system, as discussed in section 3.5. Nonradioactive, concentrated chemical regenerant waste is directed to the evaporation

ponds. Dilute waste is discharged to the main circulating water system.

An additional demineralizer system is provided for the steam generator blowdown. This system consists of a heat exchanger, mixed bed demineralizers, and the required regeneration equipment. Upon depletion of the resin in a given mixed bed, the resin is regenerated in place. The concentrated regenerant wastes are neutralized, analyzed for radioactivity, and are discharged to the evaporation ponds or to the liquid radwaste system as appropriate. Wastes low in dissolved solids are analyzed for radioactivity and are discharged to the radwaste system or to the main circulating water system.

It is estimated that one condensate polisher per unit will be regenerated every 140 hours, and that 1040 lb of sodium hydroxide and 1870 lb of sulfuric acid will be required for each regeneration. It is estimated that a blowdown polisher will be regenerated every 900 hours, using 560 lb of sodium hydroxide and 750 lb of sulfuric acid for each regeneration.

3.6.2.6 Laboratories and Dry Cleaning Laundries

Laboratories are provided for routine chemical analyses. Any radioactive samples are analyzed in separate "hot" laboratories, and all drains are directed to the liquid radwaste system. Other laboratory wastes are directed to the neutralizing tanks in the chemical waste system along with condensate and blowdown demineralizer wastes. The quantity of laboratory wastes is expected to be very small.

The laundries are dry cleaning laundries; sludge wastes are sent to the solid radwaste system.

3.6.2.7 Floor Drains

Floor drains from each unit are routed to the unit's oily-water separator prior to discharge to the evaporation ponds.

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QUESTION 3A.25 (NRC No. 291.24) 3.6.3.2

Identify the type of liner and specifications (e.g., permeability, thickness, composition, temperature and pH tolerance, susceptability to chemical degradation) of the liner to be used in the evaporation ponds. Describe the inspection and maintenance procedures to be used to assure the integrity of the liner. Provide the Resource Conservation and Recovery Act determination as to whether all contaminants contained in the plant waste streams discharging to the evaporation ponds may be as discharged.

RESPONSE: Liner specifications and maintenance procedures are provided in the revised section 3.6.3.1. Wastewater flow to the evaporation pond will come from three sources: (1) cooling tower blowdown; (2) spent demineralizer regenerants and (3) power plant washdown. Flow is made via a retention basin. The approximate composition and concentration of these sources as they exist in the retention basin was estimated and submitted to the Arizona Department of Health Services. It was their conclusion that the material would be nonhazardous according to current criteria established in their regulations[a]. A sample solution was also analyzed by an independent laboratory and was determined to be nonhazardous per EPA criteria. As there is no appreciable holdup time at the retention basin prior to transfer to the evaporation pond, the chemical concentrations at the inlet to the evaporation pond should be essentially the same as the retention basin. However, a final determination of RCRA compliance for the evaporation ponds will not be made until the chemical composition can be exactly determined. 2

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a Letter from Mapes, S.L., Hazardous Waste Specialist, Division of Environmental Health Services, Arizona Department of Health Services, to Lay, T., Arizona Public Service, August 26, 1980

QUESTION 3A.26 (NRC No. 291.25)

2 Estimate the final total area to be occupied by the evaporation ponds over the life of the plant, assuming that no additional water recovery/reclamation plans are implemented at the site.

RESPONSE: The response is given in the revised section 3.6.3.1.

Atmospheric concentrations are calculated using the release estimates of section 3.5 and the atmospheric dispersion parameters of section 2.3. For the continuous release model, used to estimate long term effects, the annual average χ/Q is used. The atmospheric concentrations (C_a) are estimated simply as

$$C_{ai}(\bar{r}) = 3.17 \times 10^4 \, Q_i \chi/Q(\bar{r}) \tag{1}$$

Where

$C_{ai}(\bar{r})$ = picocuries/m^3 at position $\bar{r}$ of isotope i

Q_i = curies of isotope i released per year

3.17×10^4 = number of pCi/Ci divided by number of sec per yr

$\chi/Q(\bar{r})$ = annual average atmosphere dispersion parameter at position of interest ($\bar{r}$), s/m^3.

This model predicts highest concentrations nearest the emission source because of the ground level release model used for determination of χ/Q's. In reality, the maximum ground level concentrations may be at some more distant point because of elevated release points and possibility of plume rise. In this event, the maximum value from elevated releases would be smaller than the maximum value predicted by the ground level release model. The maximum site boundary concentrations due to emissions predicted from a unit are shown in table 5.2-1.

Ground concentrations are calculated on the basis of equilibrium values resulting from continuous deposition and continuous radiological decay. The expression for equilibrium ground concentrations (Cg) is

$$C_{g_i}(\bar{r}) = \frac{3.17 \times 10^4 \, Q_i \, D/Q(\bar{r})(1-e^{-\lambda_i t})}{\lambda_i} \tag{2}$$

Table 5.2-1

MAXIMUM SITE BOUNDARY CONCENTRATIONS (Sheet 1 of 2)

Radio-nuclide	Maximum Site Boundary Ground Level Air Concentration (pCi/m^3)[a]	Maximum Site Boundary Ground Surface Concentration (pCi/m^2)[b]
H-3	2.5×10^{2}	--[c]
C-14	2.0	--
Ar-41	6.4	--
Kr-83	2.0×10^{-1}	--
Kr-85m	1.1	--
Kr-85	$5.1 \times 10^{+3}$	--
Kr-87	5.6×10^{-1}	--
Kr-88	2.0	--
Kr-89	2.2×10^{-2}	--
Xe-131m	$8.4 \times 10^{+1}$	--
Xe-133m	2.5	--
Xe-133	$4.8 \times 10^{+2}$	--
Xe-135m	8.9×10^{-2}	--
Xe-135	3.8	--
Xe-137	4.3×10^{-2}	--
Xe-138	3.1×10^{-1}	--
Mn-54	1.1×10^{-4}	8.6
Fe-59	4.1×10^{-5}	4.6×10^{-1}
Co-58	4.1×10^{-4}	7.2
Co-60	1.8×10^{-4}	$7.3 \times 10^{+1}$
Br-83	7.8×10^{-5}	2.0×10^{-3}
Br-84	2.5×10^{-5}	1.4×10^{-4}
Br-85	6.6×10^{-7}	3.4×10^{-7}

a. Maximum site boundary annual average $\chi/Q = 8.02 \times 10^{-6}\ s/m^3$

b. Maximum site boundary annual average $D/Q = 1.6 \times 10^{-6}\ m^{-2}$

c. Negligible

Table 5.2-1

MAXIMUM SITE BOUNDARY CONCENTRATIONS (Sheet 2 of 2)

Radio-nuclide	Maximum Site Boundary Ground Level Air Concentration (pCi/m^3)[(a)]	Maximum Site Boundary Ground Surface Concentration (pCi/m^2)[(b)]
Sr-89	9.2×10^{-6}	1.2×10^{-1}
Sr-90	1.0×10^{-6}	1.1
I-130	5.4×10^{-5}	6.9×10^{-3}
I-131	1.0×10^{-2}	$2.0 \times 10^{+1}$
I-132	1.7×10^{-3}	3.9×10^{-2}
I-133	1.1×10^{-2}	2.4
I-134	5.6×10^{-4}	5.1×10^{-3}
I-135	4.3×10^{-3}	3.0×10^{-1}
Cs-134	1.3×10^{-4}	$2.4 \times 10^{+1}$
Cs-137	2.0×10^{-4}	$1.6 \times 10^{+2}$

Where

$$Cg_i(\bar{r}) = \frac{\text{picocuries at position r of isotope i}}{m^2}$$

Q_i = curies of isotope i released per year

$D/Q\ (\bar{r})$ = annual average atmospheric deposition parameter at position of interest $(\bar{r})$, m^{-2}

λ_i = radiological decay constant of isotope i, s^{-1}

3.17×10^4 = number of pCi/Ci divided by number of seconds per yr

$t = 4.73 \times 10^8$ s(15 yr)

The maximum site boundary ground concentrations resulting from ground level releases for a unit are shown in table 5.2-1.

5.2.3 DOSE RATE ESTIMATES FOR BIOTA OTHER THAN MAN

Calculations have been performed to determine maximum dose rates to biota due to operation of PVNGS. Results are based on a per unit operation. Calculations are performed for unspecified flora due to ground deposition and cloud immersion, and for two species of fauna, the blacktailed jackrabbit and the kit fox.

5.2.3.1 Flora Dose Rate Estimates

Using the maximum site boundary ground level air concentrations and surface concentrations, maximum dose rates for each unit to flora are presented in table 5.2-2.

The dose estimates were based on values calculated by an NUS version of GASPAR for the air dose and ground plane dose.

5.2.3.2 Fauna Dose Rate Estimates

Doses are calculated for the kit fox and for the blacktailed jackrabbit, which makes up most of the diet of the kit fox and which consumes vegetation (100 g/d) upon which radioiodines may be deposited. It is assumed that the jackrabbits are living at the location of maximum site boundary ground deposition and that the kit fox obtains 100% of his diet (175 g/d) from these jackrabbits. External doses are also considered due to ground deposition and cloud immersion at those same locations.

The jackrabbit dose model assumes that the ingestion dose is proportional to vegetable ingestion dose for a child. The dose was based on GASPAR results, corrected for the ratio of the vegetable ingestion rates and total body weights between a jackrabbit and a child. The kit fox ingestion dose model assumes that the ingestion dose is proportional to the child meat ingestion dose from GASPAR, corrected for the ratio of

Table 5.2-2

MAXIMUM SITE BOUNDARY FLORA DOSES

Pathway	Doses (mrad/yr/unit)					
	Unit 1		Unit 2		Unit 3	
	Flora Surface	Total Body	Flora Surface	Total Body	Flora Surface	Total Body
Cloud immersion[a]	8.6	0.31	9.4	0.33	10.6	0.38
Deposited Radionuclides[b]	0.013	0.011	0.014	0.012	0.017	0.014

a. Maximum site boundary cloud immersion doses occur at

- 1037m N of Unit 1 for Unit 1 releases
- 1836m SSW of Unit 2 for Unit 2 releases
- 1607m SSW of Unit 3 for Unit 3 releases

b. Maximum site boundary deposited radionuclide surface doses occur at

- 1057m NNE of Unit 1 for Unit 1 releases
- 993m W of Unit 2 for Unit 2 releases
- 871 W of Unit 3 for Unit 3 releases

grass and meat ingestion rates and total body weights between a kit fox and a child. The jackrabbit was assumed to obtain 100% of its diet from grasses.

Table 5.2-3 presents the doses to both the jackrabbit and kit fox. No observable effects are expected at these dose rates.

5.2.4 DOSE RATE ESTIMATES FOR MAN

The evaluation of compliance with Appendix I of 10CFR50 and 40CFR190 is presented in appendix 5B.

5.2.4.1 Liquid Pathways

The liquid radwaste system is designed so that during normal operation no offsite releases of radioactive liquids originate from the plant.

5.2.4.2 Gaseous Pathways

Appendix 5B presents detailed individual and population dose estimates to man from the gaseous pathways. Table 5.2-4 summarizes the maximum individual dose estimates; the child dose is the limiting case. The location of the highest dose is the residence 2300 meters north of Unit 1.

5.2.4.3 Direct Radiation from Facility

Appendix 5B presents the methodology used in the calculation of direct radiation doses. Dose rates at the nearest school and hospital, both of which are more than 5 miles from PVNGS, are negligible.

5.2.4.4 Annual Population Doses

Table 5.2-5 presents the annual population doses evaluated at mid-plant life as represented by the projected year 2000 population. The methodology is described in appendix 5B.

Table 5.2-3

MAXIMUM SITE BOUNDARY FAUNA DOSES (MRAD/YR/UNIT) (Sheet 1 of 2)

Organ	Unit 1					
	Jack Rabbit			Kit Fox		
	Plume	Ground Plane	Ingestion	Plume	Ground Plane	Ingestion
Total body[(a)]	0.27	0.011	26.	0.27	0.011	0.27
Bone[(a)]	0.27	0.011	67.	0.27	0.011	0.98
Thyroid[(b)]	0.27	0.011	23.	0.27	0.011	0.24
Skin[(a)]	8.5	0.013	26.	8.5	0.013	0.27

a. All plume doses and total body, bone, and skin doses from ingestion occur at:

- 1037m N of Unit 1 for Unit 1 releases
- 1836m SSW of Unit 2 for Unit 2 releases
- 1607m SSW of Unit 3 for Unit 3 releases

b. All ground plane and thyroid ingestion doses occur at:

- 1057m NNE of Unit 1 for Unit 1 releases
- 993m W of Unit 2 for Unit 2 releases
- 871m W of Unit 3 for Unit 3 releases

Table 5.2-3

MAXIMUM SITE BOUNDARY FAUNA DOSES (MRAD/YR/UNIT) (Sheet 2 of 2)

	Unit 2					
	Jack Rabbit			Kit Fox		
Organ	Plume	Ground Plane	Ingestion	Plume	Ground Plane	Ingestion
Total body	0.30	0.012	29.	0.30	0.012	0.30
Bone	0.30	0.012	73.	0.30	0.012	1.1
Thyroid	0.30	0.012	32.	0.30	0.012	0.33
Skin	9.3	0.014	20.	9.3	0.014	0.30
	Unit 3					
	Jack Rabbit			Kit Fox		
Organ	Plume	Ground Plane	Ingestion	Plume	Ground Plane	Ingestion
Total body	0.33	0.014	32.	0.33	0.014	0.33
Bone	0.33	0.014	83.	0.33	0.014	1.2
Thyroid	0.33	0.014	36.	0.33	0.014	0.38
Skin	11.	0.017	32.	11.	0.017	0.33

Table 5.2-4

MAXIMUM INDIVIDUAL DOSE[(a)]

	Child Dose (mrem/yr/unit)			
	Total Body	Bone	Thyroid	Skin
Plume	0.11	0.11	0.11	3.6
Ground plane	0.0032	0.0032	0.0032	--
Vegetable ingestion	1.9	4.6	2.0	1.9
Inhalation	0.14	0.00049	0.24	0.16
Direct radiation	0.00046	0.00046	0.00046	0.00046
Total	2.2	4.7	2.4	5.7

a. Refer to table 5B-1 for a complete listing of individual doses.

Table 5.2-5

POPULATION DOSES

(man-rem/year/unit)

Pathway	Total Body	Thyroid
Plume	1.3	1.3
Ground plane	0.0078	0.0078
Inhalation	2.4	3.4
Vegetation ingestion	18.	19.
Meat ingestion	0.53	0.53
Milk ingestion	1.7	1.8
Total	24.	26.

5.2.5 SUMMARY OF ANNUAL RADIATION DOSES

Table 5.2-6 presents a table of individual doses compared with the design objectives of Appendix I of 10CFR50. Table 5.2-7 presents a comparison of doses to the individual and the limits of 40CFR190. The details of the calculations are described in appendix 5B.

Table 5.2-6

MAXIMUM INDIVIDUAL DOSES COMPARED TO APPENDIX I OF 10CFR50

	Dose (mrem/yr/unit)	Appendix I Limit (mrem/yr/unit)
Noble gases		
Total body	0.11	5
Skin	3.6	15
Radioactive iodine and particulates		
Maximum organ	4.6 (child bone)	15

Table 5.2-7

MAXIMUM INDIVIDUAL DOSES COMPARED TO 40CFR190

	Dose (mrem/yr)	40CFR190 Limit (mrem/yr)
Total body	6.0	25
Thyroid	6.5	75
Maximum organ (child bone)	13.0	25

all four age groups and both locations. For the vegetable pathway, the doses were calculated for both growing seasons. Assuming all vegetable consumption for a year resulted from one growing season, the higher organ dose of the two growing seasons was then used (November-June for total body and thyroid, August-January for bone). Although neither Locations A or B have cattle, for those locations which were identified as having cattle, it was assumed that both milk and meat would be obtained. It was also assumed that both cows and meat animals would obtain 35% of the dietary requirements from pasture or fresh cut silage (a similar feeding regime as is used in dairy feedlot practices).

For noble gas exposure the locations receiving the highest dose from each unit were the same as those for radioiodines and particulates. Table 5B-2 presents the noble gas doses for both the total body and skin from all units.

Direct radiation is a very small contributor to the doses. An individual at the closest site boundary would receive approximately 3.2×10^{-3} millirem/year per unit from direct radiation. Table 5B-3 presents the annual direct radiation doses for several locations. The direct radiation doses outside the site boundary were calculated by ratioing the site boundary dose by the inverse square of the distances.

Table 5B-4 compares the potential doses resulting from the normal operation of PVNGS with 10CFR50 Appendix I limits. The maximum organ as seen in table 5B-1 is the child bone. In order to compare

Table 5B-2
MAXIMUM INDIVIDUAL DOSES FROM NOBLE GASES

Dose Location	Unit of Release	Doses (mrem/yr/unit)			
		Total Body	Bone	Thyroid	Skin
Location A	1	1.14(-1)	1.14(-1)	1.14(-1)	3.59
	2	1.00(-1)	1.00(-1)	1.00(-1)	3.16
	3	9.73(-2)	9.73(-2)	9.73(-2)	3.06
Location B	1	8.63(-2)	8.63(-2)	8.63(-2)	2.72
	2	9.38(-2)	9.38(-2)	9.38(-2)	2.95
	3	1.03(-1)	1.03(-1)	1.03(-1)	3.24

Table 5B-3
DIRECT RADIATION DOSES

Dose Location	Unit of Release	Distance from Unit (meters)	Dose (mrem/yr/unit)
Site Boundary (highest dose)	3	871	3.2×10^{-3}
Location A	1	2300	4.6×10^{-4}
	2	2600	3.6×10^{-4}
	3	3000	2.7×10^{-4}
Location B	1	4700	1.1×10^{-4}
	2	5100	9.3×10^{-4}
	3	5500	8.0×10^{-5}
Population distances	-	8000	3.7×10^{-5}
	-	32200	2.3×10^{-6}

Table 5B-4

MAXIMUM INDIVIDUAL DOSES COMPARED TO APPENDIX I OF 10CFR50

	Dose (mrem/yr/unit)			Appendix I Limit (mrem/yr/unit)
	Unit 1	Unit 2	Unit 3	
Noble Gases				
Total Body	0.11	0.10	0.10	5
Skin	3.6	3.2	3.2	15
Radioactive Iodines and Particulates				
Maximum Organ	4.6	4.0	4.2	15

the potential doses from the normal operation of PVNGS with 40CFR190 limits, the total dose that an individual receives must be calculated. The total doses factor in all operating units on a site not only combine liquid and gaseous effluent doses but also direct radiation from the site. Since there are no liquid effluents from PVNGS during normal operation, liquids do not contribute to the 40CFR190 doses. Table 5B-5 compares the maximum individual doses with the limits of 40CFR190.

Table 5B-6 presents the highest Beta and Gamma air doses at the site boundary from each unit.

2. Population Doses

Population doses on a per unit basis were evaluated using appropriate meteorology. The population dose resulting from vegetable ingestion was evaluated assuming the 0-50 mile population would consume their yearly quantity of vegetables raised during either of the two seasons. The higher of

Table 5B-5

MAXIMUM INDIVIDUAL DOSES COMPARED TO 40CFR190

	Doses (mrem/yr)				40CFR190
	Unit 1	Unit 2	Unit 3	Total for Site	
Total Body					
Direct Radiation	0.0005	0.0004	0.0003		
Noble Gases	0.11	0.10	0.10		
Radioactive Iodine and Particulates	2.07	1.84	1.78		
Total	2.18	1.94	1.88	6.0	25
Thyroid					
Direct Radiation	0.0005	0.0004	0.0003		
Noble Gases	0.11	0.10	0.10		
Radioactive Iodine and Particulates	2.28	2.01	1.94		
Total	2.39	2.11	2.04	6.5	75
Maximum Organ (Bone)					
Direct Radiation	0.0005	0.0004	0.0003		
Noble Gases	0.11	0.10	0.10		
Radioactive Iodine and Particulates	4.57	4.03	3.91		
Total	4.68	4.13	4.01	12.8	25

Table 5B-6
SITE BOUNDARY AIR DOSES

Unit	Direction	Air Dose (mrad/yr/unit)	
		Beta	Gamma
1	N	8.55	0.31
2	SSW	9.37	0.33
3	SSW	10.6	0.38

the two doses (November-June growing season) was then reported. Table 5B-7 presents the particulate doses by pathway for both the total body and thyroid doses. The population dose resulting from the exposure to noble gas plume immersion was calculated to be 1.34 man-rem total body and 58.5 man-rem skin.

When calculating direct radiation doses to the population within 50 miles, the total population was grouped into concentric zones of 0 to 5 miles, 5 to 10 miles, and 10 to 50 miles. For the population within 5 miles, the dose rate at the site boundary was assumed. For the population in the 5 to 10-mile annulus, the dose rate at 5 miles was used; for the 10 to 50-mile annulus, the dose rate at 20 miles was used.

Using the population data presented, the population dose from direct radiation within 50 miles has been projected to be approximately 1.7×10^{-2} person-rem/year per unit in the year 2000.

Table 5B-7
0-50 MILE POPULATION RADIOIODINE AND PARTICULATE DOSES

Including Tritium and Carbon-14		
Pathway	Dose (man-rem/yr/unit)	
	Total Body	Thyroid
Ground plane	0.00784	0.00784
Inhalation	2.42	3.35
Vegetable ingestion	17.6	18.5
Cow milk ingestion	1.68	1.84
Meat ingestion	0.529	0.530
Total	22.2	24.2

Excluding Tritium and Carbon-14		
Pathway	Dose (man-rem/yr/unit)	
	Total Body	Thyroid
Ground plane	0.00784	0.00784
Inhalation	0.00237	0.926
Vegetable ingestion	0.00603	0.960
Cow milk ingestion	0.00107	0.166
Meat ingestion	0.0000443	0.000157
Total	0.0174	2.06

5B.4 COST-BENEFIT ANALYSIS

The maximum individual doses presented in table 5B-2 are much less than the design objectives of Appendix I. However, section II of Appendix I to 10CFR50 requires not only that design objective dose limitations to the maximum individual be met but also that "...the radwaste system include all items of reasonably demonstrated technology that when added to the system sequentially and in order of diminishing cost-benefit return can, for a favorable cost-benefit ratio, effect reduction in dose to the population reasonably expected to be within 50 miles of the reactor."

This cost-effective ratio has been designated as $1,000 per total body man-rem and $1,000 per thyroid man-rem, annualized cost. Based on this requirement, a cost-benefit analysis was performed.

Based upon the population dose results discussed in the previous section, the total annual cost of any augment, which would reduce noble gas releases to zero and still be justified would be $1,340. For radioiodine and particulates this cost would be $2,060. The radioiodine and particulate cost is based on the total particulate dose of 2.06 thyroid man-rem, since H-3 and C-14 are excluded from the cost-benefit because with present technology it is impractical to remove or reduce the release of either nuclide. In reality, no augment will reduce releases to zero. Therefore, more benefit credit is calculated than would actually exist.

The following cost-benefit analysis was performed using the procedures and data outlined in Regulatory Guide 1.110. Since the annual cost of equipment cannot be greater than $1,340 for any augments for the reduction of noble gas doses and $2,060 for radioiodine and particulate doses, Tables A-2 and A-3 of Regulatory Guide 1.110 were first examined to determine what potential equipment, if any, could be maintained and operated

below these costs. Combining the annual costs of operating and
2| maintenance, costs yield two augments with less than an annual
cost of $2,500. Table 5B-8 shows these augments and the break-
down between operating and maintenance costs. Further cost-
2| benefit analysis were then performed only on these two
augments.

The direct labor cost for the particular augment was obtained from Table A-1 of Regulatory Guide 1.110. The appropriate labor cost correction factor for the Arizona area (1.2) was taken from Table A-4 of that guide and multiplied by the direct labor cost to obtain the labor cost in Arizona for that augment. To this value was added the direct cost of equipment and materials from Table A-1 of the guide to obtain the total direct cost (TDC). Table 5B-9 shows the total direct costs. The TDC was then multiplied by the indirect cost factor (ICF) of 1.58 from Table A-5 of the guide to produce the total capital cost (TCC), which was in turn multiplied by the capital recovery factor (CRF) to obtain the annual fixed cost (AFC). In this analysis, the CRF was calculated to be 0.1012 based upon the cost of money being 9.45% per year and a 30-year plant lifetime and the equation presented in Table A-6 of Regulatory Guide 1.110.

The total annualized cost is the sum of the annual fixed costs
(table 5B-10) plus the annual operating and maintenance costs
(table 5B-8). Table 5B-11 presents the total annualized cost.
2| As can be seen from table 5B-11 addition of neither of the aug-
ments could be justified on a cost-benefit basis.

Table 5B-8

ANNUAL OPERATING AND MAINTENANCE COSTS OF SELECTED AUGMENTS

Item	1975 $1000					
	Operating Cost	+	Maintenance Cost	=	Total O+M Cost	
3-ton charcoal absorber	neg[a]	+	neg[a]	=	neg[a]	2
600 ft^3 gas decay tank	neg[a]	+	neg[a]	=	neg[a]	2

a. Negligible

Table 5B-9

TOTAL DIRECT COSTS OF SELECTED AUGMENTS

Item	Direct Costs (1975 $1000)					
	Equipment/ Material	+	Arizona Labor Cost	=	Total Direct Cost	
3-ton charcoal absorber	53	+	16.8	=	69.8	2
600 ft^3 gas decay tank	33	+	28.8	=	61.8	2

Table 5B-10

ANNUAL FIXED COST OF SELECTED AUGMENTS

Item	1975 $1000										
	Total Direct Cost (TDC)	x	Indirect Cost Factor (ICF)	=	Total Capital Cost (TCC)	Total Capital Cost (TCC)	x	Capital Recovery Factor (0.1012)	=	Annual Fixed Cost (AFC)
3-ton charcoal absorber	69.8	x	1.58	=	110.3	110.3	x	0.1012	=	11.2
600 ft^3 gas decay tank	61.8	x	1.58	=	97.6	97.6	x	0.1012	=	9.9

Table 5B-11

TOTAL ANNUALIZED COST FOR SELECTED AUGMENTS

Item	1975 $1000					
	Annual Fixed Cost	+	Annual O+M Cost	=	Total Annual Cost	
3-ton charcoal absorber	11.2	+	neg[a]	=	11.2	2
600 ft^3 gas decay tank	9.9	+	neg	=	9.9	2

a. Negligible

 Superseded pgs per Suppl 4 to ER dtd. 12-21-81

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FOREWORD

The Environmental Report - Operating License Stage (ER-OL) for the Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2 & 3 is part of the joint application for licenses authorizing Arizona Public Service Company to construct, operate and maintain PVNGS on its own behalf and as agent for all other joint applicants.

Palo Verde Nuclear Generating Station, including each of Palo Verde Units 1, 2 and 3, is currently jointly owned by the joint-applicants listed below, sometimes referred to as "Participants," as tenants in common with undivided ownership interests in the respective percentages hereinafter set forth, all in accordance with the Arizona Nuclear Power Project Participation Agreement, dated as of August 23, 1973, as amended by Amendment Nos. 1 through 4.

Joint Applicants		Undivided Interest
Arizona Public Service Company	(APS)	29.1%
Salt River Project Agricultural Improvement and Power District	(SRP)	29.1%
Southern California Edison Company	(SCE)	15.8%
El Paso Electric Company	(EPE)	15.8%
Public Service Company of New Mexico	(PNM)	10.2%

However, pursuant to an agreement dated August 18, 1977, between SRP and the Department of Water and Power of the City of Los Angeles (LADWP), SRP will transfer to LADWP, and LADWP will acquire from SRP, a 5.7% undivided ownership interest as a tenant in common with the other Participants in the Palo Verde Nuclear Generating Station, including each of Palo Verde Units 1, 2 and 3, at such time as Palo Verde Unit 1 is placed into commercial operation (i.e., when it is deemed to be available

as a reliable source of electric generation). For this reason, LADWP has been included in the descriptions of the need for PVNGS (Chapter 1) and the benefits derived from PVNGS (Chapter 8).

In addition, pursuant to an assignment agreement to be signed
by SRP and the Southern California Public Power Authority
(SCPPA), SRP will transfer to SCPPA, and SCPPA will acquire from
SRP, a 5.91% undivided ownership interest as a tenant in common
with the other Participants in the Palo Verde Nuclear Generating
Station, including each of Palo Verde Units 1, 2 and 3, follow-
ing (a) receipt of the approval of such transfer and acquisition
by the Commission and (b) the sale by SCPPA of revenue bonds or
notes, or any combination thereof, in an aggregate principal
amount at least sufficient to make the payment required under
3 the terms of the Assignment Agreement. SCPPA is a public entity
created pursuant to Section 6500 <u>et seq</u>. of the California
Government Code and the Joint Powers Agreement among its members
dated as of November 1, 1980. The members of SCPPA are the
California Cities of Anaheim, Azusa, Banning, Burbank, Colton,
Glendale, Los Angeles, Pasadena, Riverside and Vernon, and the
Imperial Irrigation District. Because of the transfer to SCPPA,
load, resource and energy mix data applicable to the members of
SCPPA have been included in the descriptions of the need for
PVNGS (Chapter 1).

The PVNGS Units 1, 2 and 3 are scheduled for commercial operation in May 1983, May 1984, and May 1986, respectively.

The ER-OL presents a description of PVNGS and its environmental impacts, as well as changes to the description since the Environmental Report - Construction Permit Stage (ER-CP), Docket Numbers STN-50-528, 529, and 530 and Final Environmental Statement (FES) NUREG-75/078. For those instances in which there

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Tables (cont)

3

2

Tables (cont)

This table and all other tables and figures in this section for PVNGS present the cumulative data as well as individual data for all participants. Where appropriate (that is, sales and purchases between participants), the cumulative data have been adjusted to prevent duplication.

Information in table 1.1-1 shows that the participants had a combined demand compound growth rate of about 5.6% per annum from 1968 to 1978, and that they anticipate a combined growth rate of 3.8% per annum between 1978 and 1988. Between 1988 and 1992, it is expected that the combined system demand will be growing at an average rate of more than 1170 megawatts per year.

All participants are summer peaking utilities. The electric demand and energy growth rate in the areas served by the participants can be attributed to a rate of population expansion greater than the national average, increased use of air conditioning, and a general trend toward higher per capita use of electricity.

Most of the participants do not have and do not anticipate having any interruptible load. SCE includes interruptible loads in its load management reductions, which reduce the peak forecast used in SCE planning studies.

Monthly demand and energy requirements for 1981 through 1988 for the combined systems of all participants as well as for an individual participant's systems, are presented in table 1.1-2. Figures 1.1-1 through 1.1-7 are projected 1987 to 1988 load duration curves for the participants' combined system as well as for each participant. The anticipated 1987 to 1988 load factor for the combined system is 60.3%, with individual load factors ranging from 57.4 to 70.2%. Analysis of the load duration curves indicates that nuclear energy production can displace higher priced coal resources, and that the full potential production of the nuclear units can be used in the combined systems of all participants. The displacement of coal resources

will in turn displace the need for the addition of oil-burning units, such as combined cycle and combustion turbine units. Thus, the use of domestic coal and nuclear resources will, each in turn, result in the area being less dependent on oil, an expensive and uncertain future energy resource.

All of the participants are members of the WSCC. Part of their membership obligation is to periodically report certain of the above load-resource data to the WSCC for use in various reports and studies. These data are compiled and published annually in the WSCC Summary of Estimated Loads and Resources. The loads and resources for the PVNGS Arizona and New Mexico participants are included in the total for Region III, Arizona-New Mexico Power Area; the PVNGS Southern California participants are included in the totals for Region IV, Southern California-Nevada Power Pool. Figure 1.1-8 shows the geographic boundaries of these areas.

The total annual peak demand and energy requirements for these two areas, as extracted from WSCC reports, are listed in table 1.1-3. These data, compiled from the 1972-1987 report period, pertain to all utilities in the geographical area and therefore are larger in magnitude than the data compiled solely for the PVNGS participants. Table 1.1-4 is a list of the monthly demand and energy requirements for the areas as extracted from the WSCC report for 1982 through 1987.

3 The loads and resources of SCPPA members except Los Angeles Department of Water and Power are presented in table 1.1-12. Comparable data for LADWP is presented in table 1.1-1, sheet 3 of 7.

1.1.1.2 Demand Projections

The need for PVNGS and other additional generating capacity rests on the validity of the forecasts made by the participants

for their respective loads through 1990. To establish this validity the following topics are addressed:

- Methodology of forecasting
- Historical accuracy of forecasting
- Impact of energy conservation measures

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Table 1.1-12

SCPPA MEMBERS LOADS AND RESOURCES (Sheet 11 of 11)

IMPERIAL IRIGATION DISTRICT ELECTRIC UTILITY SYSTEM

(CALENDAR YEAR)

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	Actual	Projected									
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Hydro:											
Drop No. 4 Unit 1.......	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Drop No. 4 Unit 2.......	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Drop No. 3 Unit 1.......	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
Drop No. 3 Unit 2.......	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
Drop No. 2 Unit 1.......	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
Drop No. 2 Unit 2.......	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
Pilot Knob Unit 1.......	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Subtotal..............	39	39	39	39	39	39	39	39	39	39	39
Geothermal:											
Additions (1)...........	0	0	0	0	0	3	6	9	12	15	18
Nuclear:											
Palo Verde 1............	-	-	-	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Palo Verde 2............	-	-	-	-	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Palo Verde 3............	-	-	-	-	-	-	3.5	3.5	3.5	3.5	3.5
Subtotal..............	0	0	0	4	7	7	11	11	11	11	11
Other:											
WAP-Parker-Davis........	33	33	33	33	33	33	33	33	33	33	33
SCE-Axis Plant..........	25	25	25	25	25	25	25	25	25	25	25
Purchases...............	40	40	40	40	40	100	100	100	250	250	261
Subtotal	98	98	98	98	98	158	158	158	308	308	319
Total...............	452	477	477	531	534	597	604	607	760	763	777
Margin for Reserves/Losses..	84	86	56	84	70	115	102	85	217	198	190
Percent Margin.............	23	22	13	19	15	24	20	16	40	35	32

(1) - Expected to be met by participation in one or more of the following projects: Heber Geothermal, Brawley or Niland.

3

CONSEQUENCES OF DELAY

The participants generally rely on a high percentage of resources that are remote from their load areas, with power carried to the load areas over EHV transmission systems. There is a limited number of interconnections between the participants' service areas and surrounding systems. Even assuming that the large amounts of power that may be needed are available for purchase, the limited number of interconnections and high use of the EHV tranmission system will make it difficult for those large amounts of power to be transmitted to the participants' service areas.

Delays in the construction of PVNGS generating facilities will have the following adverse effects on systems planning and operation.

A. Longer Lead Times - Consistent delays in construction lengthen the lead time required for generation planning. This reduces the flexibility and adaptability of incorporating new technology or changes in load forecasts into the planning process.

B. Decreased System Reliability - Delays will result in lower reserve margins that decrease system reliability and thereby cause more frequent service interruptions.

C. Additional Costs - The delay of a generating facility may require the temporary substitution of a more costly alternative with the possibility of a greater environmental impact. Delays also result in additional costs for interest during construction of the planned facility. The impact of delay on production costs is shown in table 1.3-8. The assumptions regarding heat rate, fuel cost, O&M costs, and discount rates are presented in table 1.3-9. 2

The energy mix of SCPPA members that have their own generation is shown in table 1.3-10. 3

Table 1.3-1
1981
RESERVE MARGIN DUE TO DELAY OF PVNGS
(MW) (Sheet 1 of 10)

	No Delay	1 Year Delay	2 Year Delay	3 Year Delay	Indefinite Delay
Arizona Public Service	697	697	697	697	697
LADWP	1464	1464	1464	1464	1464
El Paso Electric	153	153	153	153	153
Public Service of New Mexico	238	238	238	238	238
Salt River Project	1037	1037	1037	1037	1037
Southern California Edison	2197	2197	2197	2197	2197
Participants Total	5786	5786	5786	5786	5786

Table 1.3-9

AVERAGE SYSTEM DATA

SOUTHERN CALIFORNIA EDISON[f] (Sheet 6 of 6)

Year	Heat Rate (BTU/KWH)	Fuel Cost ($/MWH)	O&M Cost ($/MWH)
1981	9880	42.40	3.50
1982	9850	49.70	4.40
1983	9860	49.20	4.40
1984	10080	53.60	4.90
1985	10170	58.60	5.30
1986	10290	60.90	6.10
1987	10430	63.80	6.90
1988	10520	65.50	8.10
1989	10560	69.10	8.80
1990	10520	73.60	9.60

f. SCE discount rate is 15%

Table 1.3-10

SCPPA MEMBERS ENERGY MIX[a]

MEMBER	HYDRO	GAS	DIESEL	COAL
LADWP	14%	27%	28%	31%
Burbank	3%	72%	25%	0
Glendale	10%	78%	12%	0
Pasadena	17%	72%	11%	0
Imperial Irrigation District	52%	34%	14%	0

a. Excludes member agencies without their own generation.

Table 2.3-24A

SUMMARY OF AMBIENT AIR QUALITY STANDARDS ($\mu g/m^3$)

Pollutant	Averaging Time	Arizona[a] Standard	National[b]	
			Primary	Secondary
Carbon Monoxide	1 hr	40	40	-
	8 hr	10	10	-
Nitrogen Dioxide	Annual	100	100	-
Oxidants (Ozone)	1 hr	160	235	-
Particulates	24 hr	150	260	150
	Annual (geom mean)	75	75	60
Sulfur Dioxide	2 hr	1300	-	1300
	24 hr	365	365	-
	Annual	80	80	-

a. Not to be exceeded more than once per year.

b. Not to be exceeded more than once per year except in the case of ozone, not to be exceeded more than once per year based on a 3-year running average. 2

Table 2.3-24B

1979 BUCKEYE STATION AIR QUALITY DATA SUMMARY ($\mu g/m^3$)

2

Pollutant	Annual	24 Hr	3 Hr	1 Hr
Particulate[a]	150	1654 max 597 second high		
Sulfur dioxide	3	103 max	173 max	
Ozone				147 max 147 second high

a. Influenced by dust storms and agricultural activities

3.3 PLANT WATER USE

Parameters of plant water use have not changed substantially from those presented in ER-CP Section 3.3 and the FES. This section provides additional information and summarizes PVNGS water use.

Figure 3.3-1 presents a schematic flow diagram of the basic plant water use and lists the expected maximum, average, minimum, and shutdown flow rates of those water systems that require makeup and/or generate waste.

3.3.1 INFLUENT WATER SOURCES

There are two influent water sources to PVNGS. The primary plant water source is waste water effluent from the City of Phoenix 91st Avenue Sewage Treatment Plant. The processed effluent is delivered to the onsite water reclamation plant via pipeline from the 91st Avenue Sewage Treatment Plant. It is further treated and then stored in the 2300 acre-foot onsite reservoir. To retard seepage, the reservoir will be spray-lined at the bottom with rubberized asphalt at least 200 mils thick. The sides of the reservoir will be lined with 45-mil thick reinforced hypalon. No surface diversion occurs. The secondary plant water source is from on-site wells that supply water to the domestic water system. The two onsite wells are shown in figure 3.1-4. The wells are located wholly within the site boundary. No well water will be used offsite. The effect of well water withdrawal on the local groundwater hydrology is discussed in section 5.6. The domestic water system supplies potable water to each generating unit for domestic, utility, and air conditioning services. 2

The total annual makeup water requirement for PVNGS from the city of Phoenix is estimated at 21,350 acre-feet per year per unit. The average well water requirement is approximately 1300 acre-feet per year for all PVNGS units.

The water reclamation plant and the domestic water system are described in section 3.6.

3.3.2 PLANT WATER USES

3.3.2.1 Circulating Water System

Each unit's circulating water system removes waste heat resulting from normal operation of the unit and rejects it to the atmosphere via the three cooling towers in each system. Heat rejection is accomplished by the evaporation of a portion of the circulating water flow. To maintain the chemical concentration of circulating water at or below 15 times that of makeup water (15 cycles of concentration), a quantity of water, called blowdown, must be discharged from the system. In addition to evaporation and blowdown losses, a small amount of water in the form of entrained droplets (drift) is carried away in the cooling tower air stream. Makeup water to replace these losses in each unit is drawn from the reservoir.

During the period when the reactor is shut down for refueling and maintenance, the circulating water system is not used and makeup water is not required.

3.3.2.2 Essential Spray Pond System

Each generating unit has two spray ponds that provide the ultimate heat sink for cooling the auxiliary systems required for reactor shutdown. The domestic water system provides makeup water to the essential spray ponds. The spray ponds are normally in use only during a reactor shutdown. Hence, makeup from the domestic water system during normal operation is only required to replace water lost by natural surface evaporation and periodic blowdown to the circulating water system. During a reactor shutdown, makeup requirements to

3.6.2.1 Water Reclamation Plant

The water reclamation plant receives the wastewater effluent from the City of Phoenix 91st Avenue Sewage Treatment Plant, processes it further in four stages of treatment, and stores it in the onsite reservoir. This onsite treatment of the station makeup water is required to reduce the concentration levels of calcium, phosphate, silica, magnesium, and ammonia. Design effluent chemical concentrations are shown in table 3.6-1. 2
Some incidental removal of organics occurs. The removal of these compounds allows the treated effluent to be concentrated to approximately 15 cycles in each generating unit circulating water system without excessive scaling or fouling of system components and heat exchangers.

The water reclamation plant process is shown schematically in figure 3.6-1. The four stages of treatment are:

- Biological nitrification
- Lime treatment
- Filtration
- Chlorination

The influent to the water reclamation plant (WRP) consists of effluent from the Phoenix treatment plant which provides primary sedimentation and secondary activated sludge treatment.

No further removal of organics is required in order to use the WRP influent water for cooling purposes in the power plant; therefore, treatment processes in the WRP have not been designed to remove organics. However, some incidental removals will occur in certain processes as estimated by the following:

Treatment Process	Removal
Biological nitrification (see section 3.6.2.1.1)	10 to 20% removal of dissolved (or colloidal) organics,

Treatment Process	Removal
	measured as BOD_5 (5-day bio-chemical oxygen demand) or COD (chemical oxygen demand).
Lime soda softening and clarification (see section 3.6.2.1.2)	Better than 95% removal of suspended organics, measured as volatile suspended solids, and 5 to 10% removal of colloidal BOD_5 and COD.
Entire WRP, considered as a whole	Better than 95% removal of suspended organics, and 10 to 25% removal of dissolved or colloidal organics.

The WRP influent will contain an average of about 30 mg/ℓ BOD_5, 40 mg/ℓ suspended solids, and 100 mg/ℓ COD. Lime clarification should provide high removal rates for viruses and bacteria, so pathogen levels in the WRP effluent are expected to be low. However, this water is expected to contain the broad spectrum of organics which typically occur in secondary sewage effluent due to their relative resistance to biodegradation.

2 Chlorinated hydrocarbons, chlorophenoxys and polychlorinated biphenyls (PCBs) biocides have been routinely monitored at the 91st Avenue Plant since August, 1975. With the exception of two months, these biocides have been at levels less than the minimum detectable. Detection limits are provided in table 3.6-3. During June, 1976, PCB was detected at 0.0221 mg/ℓ. It is believed the cause of the PCB was a transformer failure. During August, 1976, Aldrin, Dieldrin, p,p′-DDT and 2,4,5-TP (Silvex) were detected at concentrations of 0.002, 0.002, 0.005, and 0.08 mg/ℓ, respectively, during a period of significantly lower than normal effluent flow rates. Consequently,

Provisions are made to direct floor drains to the liquid radwaste system or to the neutralizer tanks, if necessary.

3.6.3 NONRADIOACTIVE LIQUID WASTE DISPOSAL

Chemical and liquid waste is disposed of in the onsite evaporation ponds and retention basin.

3.6.3.1 Evaporation Ponds

The onsite evaporation ponds receive liquid waste from the generating units and remove moisture by natural evaporation. Initially, 250 acres of evaporation ponds will be constructed. The evaporation ponds may be expanded to contain additional liquid wastes. It is expected that such expansion would be of no more than 420 acres for a total of 670 acres.

The bottom of the initial 250 acre evaporation ponds will be lined with rubberized asphalt. The rubberized asphalt compound will be a blend of asphalt cement, aromatic rubber extender oil and 22 percent of powdered rubber by weight combined so as to produce an impermeable material with minimum softening point of 135 F and maximum brittle point of 10 F. The material is hot spray applied at temperatures below 425 F. The minimum thickness of the lining shall be 200 mils.

The interior side slopes of the initial 250 acre pond will be lined with hypalon. The hypalon lining will be reinforced with a polyester scrim. The minimum thickness of the hypalon lining will be 45 mils. 2

The permeability of the initial 250 acre lined ponds shall be 10^{-10} cm/sec. or lower. Liner material resists chemical degradation to the limits specified in table 3.6-4.

The liner integrity will be confirmed by periodic monitoring of the leak detection system liquid collection points and groundwater monitoring wells.

Table 3.6-4

CHEMICAL TOLERANCE SPECIFICATION FOR LINER[a][b]

Species	Concentration (mg/l)
Total Dissolved Solids	300,000
Sodium (as Na)	105,000
Chloride (as Cl)	98,900
Sulphate (as SO_4)	48,000
Nitrate (as NO_3)	47,500
Calcium (as Ca)	4,000
Silicon (as SiO_2)	2,000
Alkalinity (as $CACO_3$)	700
Magnesium (as Mg)	500
Ammonia (as NH_3)	50
Fluoride (as F)	200
Hydrazine (N_2H_4)	10

2

a. pH is essentially neutral and corresponds to the species in solution.

b. Liner resists oxidative degradation

RESPONSE: The onsite reservoir will have capacity for approximately 2300 acre feet of water. To retard seepage, the reservoir will be spray-lined at the bottom with rubberized asphalt at least 200 mils thick. The sides of the reservoir will be lined with 45-mil thick reinforced hypalon. As the reservoir will contain essentially clean water, there are no plans to monitor seepage.

QUESTION 3A.10 (NRC No. 291.3) 3.6.2

Provide an updated estimate of the types and amounts of pathogens, heavy metals, and biocides expected in: the influent from the Phoenix 91st Avenue Sewage Treatment Plant; the effluent from the Water Reclamation Plant; and in blowdown and cooling tower drift.

RESPONSE: The response is provided in the revised section 3.6.2.1 and in the response to Question 3A.20. 2

QUESTION 3A.11 (NRC No. 291.4) 3.6.2

Identify the dispersant to be added to the circulating water and provide the EPA Registration No. If proprietary, provide toxicity data.

RESPONSE: Dispersant is Nalco 345. It does not have an EPA registration number as it is not a biocide. The LD_{50} for guppies is >1000 ppm. Normal concentration is 20-30 ppm.

QUESTION 3A.12 (NRC No. 291.5) 3.6.2

Provide an updated estimate of the concentrations and annual discharges of heavy metals, toxic and deleterious substances, and biocides in the cooling tower drift using a drift rate of 0.0044%.

RESPONSE: The response is provided in the revised section 3.6.2.

QUESTION 3A.13 (NRC No. 291.6) 3.6.2

Identify types and amounts (providing concentration and flow rates) of chemicals to be used in the Reverse Osmosis Units during RO operation or layup.

RESPONSE: The response is provided in the revised section 3.6.2.3.

QUESTION 3A.14 (NRC No. 291.9) 3.7.1.1

The CP-FES describes the two packaged sanitary waste treatment units as activated sludge units using aeration, final clarification, continuous sludge recirculation and chlorination. If
2 there have been any changes in the sanitary waste system besides the decrease in the rated capacity of each unit, please provide an update.

RESPONSE: There have been no changes to the sanitary waste system.

QUESTION 3A.15 (NRC No. 291.10) 3.7.2.1.4

Identify the types and amounts of constituents expected in the solid wastes obtained from cleaning of the cooling tower basins and the water storage reservoir. Identify the location of the disposal site.

RESPONSE: The response is provided in the revised section 3.7.2.

CHAPTER 5

ENVIRONMENTAL EFFECTS OF STATION OPERATION

CONTENTS

CONTENTS (cont)

5.4 EFFECTS OF SANITARY AND OTHER WASTE DISCHARGES

This section has been revised to reflect updated meteorological data and current PVNGS system design.

5.4.1 SANITARY WASTES

During plant operation, treated effluent from the package sewage treatment plant will be delivered to the water reclamation plant. The treated onsite sewage effluent will be available as additional water for cooling system makeup during normal operations. When the water reclamation plants are temporarily not operating, chlorinated effluent from the package sewage treatment plant will be delivered to the onsite evaporation pond. No major adverse environmental impact is anticipated from this operation, because there will be no direct discharges from the evaporation pond. Lining the evaporation pond limits seepage of the impounded effluent into local groundwater aquifers. Therefore, the evaporation pond is not expected to significantly affect recharge to the aquifers.

5.4.2 GASEOUS EFFLUENTS

There are three groups of facilities on the PVNGS site that are stationary sources of pollutants; the diesel generators, auxiliary boilers and recalciners. Source operational modes and emission parameters are described in section 3.7 and listed in table 5.4-1.

The diesel generators and auxiliary boilers are operated only on a limited basis:

A. The diesel generators are each tested for about 1 hour per month. This testing is not concurrent and the generators are not otherwise operated except under abnormal conditions.

Table 5.4-1

EMISSION PARAMETERS FOR FOSSIL FUEL-FIRED FACILITIES

Parameter	Diesel Generator	Auxiliary Boilers		Recalciner
		Large	Small	
Stack diameter (in)	32	84	44	36
Stack height (above grade) (ft)	93	50	50	80
Exhaust temperature (^oF)	910	622	579	165
Exhaust flow rate (ACFM)	48,950	100,000	24,000	-
Exhaust velocity (ft/min)	-	-	-	1,800
Fuel type	No. 2 diesel[d]	No. 2 diesel[d]	No. 2 diesel[d]	No. 2 diesel[d]
Operational mode	1 h/mo	8 d/yr/unit	8 d/yr/unit	Continuous
Emissions:				
Nitrogen oxides	2,300[a]	2,300[b]	-	456
Sulfur Oxides	675[a]	7,583[b]	-	180
Hydrocarbons	35[a]	682[b]	-	17
Particulates	164[a,c]	209[b,c]	-	84
Carbon monoxide	766[a]	522[b,c]	-	23

ACFM = Actual cubic feet per minute.

a. Per diesel generator. Two generators per PVNGS unit. Emissions in units of pounds per year.

b. Based on both boilers. Ratio by ACFM to separate between boilers. Emissions in units of pounds per day.

c. Emission ratioed from those for NO_x by means of emission factors for diesel-powered industrial equipment and distillate oil-burning industrial boilers in reference 5.

d. Normalized to 1% sulfur fuel with no SO_2 removal from flue gases.

B. The auxiliary boilers are operated for approximately 8 days per year for each unit served during the initial startup of the nuclear generating units.

The diesel generators and auxiliary boilers are operated only a small fraction of the year and are not expected to be operated simultaneously. Therefore, the offsite concentrations are predicted only for the operation of each of the facilities separately. No nitrogen oxides (NO_x) concentrations are predicted, as there is only an annual NAAQS for NO_x. 2

The offsite concentration values for SO_2 and other pollutants presented in table 5.4-2 were determined for the diesel generators using the EPA dispersion model RAM[1] and for the auxiliary boilers using the EPA dispersion model ISC[2]. Since both sources are close enough to the unit structures to be within the "region of building influence," the RAM model was modified to account for the effects of aerodynamic downwash by a methodology described by Briggs[3] to determine conditions of downwash and concentrations during downwash. The existing ISC model includes the effects of aerodynamic downwash and was therefore not modified. 2

The comprehensive ISC model was used with four years of onsite meteorological data (1974 through 1977) to predict the short-term concentrations presented in table 5.4-2 for SO_2 and other criteria pollutants due to operation of the auxiliary boilers. A recent summary of the ISC Model obtained from the EPA "Guideline on Air Quality Models" is provided in Appendix 5A. The use of four years of meteorological data as input to this model allows the use of the highest second-highest calculated concentration for any given year to be compared to NAAQS for SO_2 due to the operation of the two auxiliary boilers.

Table 5.4-2

MAXIMUM EXPECTED OFFSITE CONCENTRATIONS AND COMPARISON WITH STANDARDS

Maximum Offsite Concentrations Expected Due to Operation of Auxiliary Boilers and Diesel Generators

Pollutant	Short-Term National Ambient Air Quality Standard (and Averaging Period) ($\mu g/m^3$)	Maximum Offsite Concentration ($\mu g/m^3$) Expected for Given Averaging Period due to Operation of			
		Auxiliary Boilers for Units 1, 2, & 3	Diesel Generators for Unit 1	Diesel Generators for Unit 2	Diesel Generators for Unit 3
Sulfur oxides	365 (primary 24-h)	45	36	30	38
	1300 (secondary 3-h)	185	68	56	70
Particulates	260 (primary 24-h) 150 (secondary 24-h)	1.2	9	7	9
Carbon monoxide	10,000 (8-h)	21	83	67	86

Maximum Offsite Concentrations Expected Due to Operation of Recalciner

Pollutant	National Ambient Air Quality Standard (and Averaging Period) ($\mu g/m^3$)	Maximum Offsite Concentration ($\mu g/m^3$) Modeled for Each Averaging Period
Sulfur oxides	80 (annual)	.45
	365 (primary 24-h)	8.3
	1300 (secondary 3-h)	15.4
Particulates	75 (Primary annual) 60 (Secondary annual)	.21
	260 (Primary 24-h) 150 (Secondary 24-h)	3.8
Nitrogen oxides	100 (annual)	1.1
Carbon monoxide	10,000 (8-h)	2.1

2

is 10,000 μg/m^3 and the concentrations predicted at the site boundary due to the auxiliary boiler emissions is 21 μg/m^3. 2
The highest 8-hour average carbon monoxide concentrations predicted at the site boundary due to the diesel generators at Units 1 and 3 are 83 and 86 μg/m^3, respectively.

The short-term NAAQS for SO_2 is 365 μg/m^3 for 24 hours and 1300 μg/m^3 for three hours which is not to be exceeded more than once per year. The short-term SO_2 concentrations presented in table 5.4-2 due to the operation of the auxiliary boilers is the second highest value predicted for any given year (this is sometimes referred to by the EPA as the highest second-highest concentration). The short-term SO_2 concentrations presented in table 5.4-2 due to the operation of the diesel generators and recalciner represent the highest value predicted for any given year.

In summary, no offsite violations of the NAAQS are predicted for SO_2 or any other criteria pollutants due to the operation of the diesel generators, auxiliary boilers or recalciners 2
at PVNGS.

5.4.3 REFERENCES

1. User's Guide for RAM Volume 1 & II, Environmental Sciences Research Laboratory, Research Triangle Park, North Carolina EPA-600/8-78-106, November, 1978

2. Bowers, J. F., J. R. Bjorklund and C. S. Cheney. "Industrial Source Complex (ISC) Dispersion Model User's Guide, Volumes 1 and 2." Publication Nos. EPA-450/4-79-0, 1 (NTIS PB-80-133044, 133051, Magnetic tape PB-80-133036), Office of Air Quality Planning and Standards, U. S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, December 1979

3. Briggs, Gary, "Diffusion Estimation for Small Emissions," Air Resources Atmospheric Turbulence and Diffusion Laboratory, National Oceanic and Atmospheric Administration, ATDL Contribution File No. 769 (Draft), Oak Ridge, Tennessee, May 1973.

2 4. "User's Manual for Single-Source (CRSTER) Model," Office of Air and Waste Management, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Report No. EPA-450/2-77-013, Research Triangle Park, North Carolina, July 1977.

5. Holzworth, George C., "Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States", Environmental Protection Agency, Office Of Air Programs, Research Triangle Park, North Carolina, January 1972.

5.6 OTHER EFFECTS

5.6.1 ENVIRONMENTAL EFFECTS OF WATER DIVERSION

5.6.1.1 Wastewater Effluent Use

Information presented in ER-CP Section 5.7 and the FES has been updated by the following changes:

A. Condenser cooling water requirements for PVNGS have been revised to 21,350 acre-ft/yr/unit.

B. Estimates of sewage effluent availability have been prepared by the City of Phoenix Water and Sewer Department and by the Maricopa Association of Governments (MAG) Regional Council.

C. A number of reports have been prepared on the water use, reuse, and associated habitats along the Salt and Gila Rivers from 23rd Avenue in Phoenix to Gillespie Dam.

5.6.1.1.1 PVNGS Condenser Cooling Water Requirements

As discussed in section 3.3.1, the per-unit condenser cooling water requirement at the Palo Verde site is estimated to be 21,350 acre-ft/yr. This requirement is based on the following assumptions:

A. City of Phoenix wastewater effluent is utilized as the source of condenser cooling water.

B. Wastewater effluent is obtained from the 91st Avenue Sewage Treatment Plant.

C. The planned unit capacity factor is 95%.

D. Annual average ambient meteorological conditions.

E. There will be no blowdown treatment.

F. Losses will be as defined in figure 3.3-1.

G. One month per year allowed for refueling.

PVNGS water requirements vary by month. The sum of the requirements for each month gives the per-unit requirement of 21,350 acre-ft/yr.

5.6.1.1.2 Effluent Availability Projections

Projections of effluent availability from the 91st Avenue Sewage Treatment Plant have been made by the Corps of Engineers and U.S. Environmental Protection Agency for the Maricopa Association of Governments (MAG) and by the City of Phoenix Water and Sewer Department.

The Corps of Engineers and the U.S. Environmental Protection Agency have estimated[18] the quantity of effluent discharges from the 91st Avenue Plant as follows:

1980	1983	1985	1990	1995	2000
84.5 MGD	98.0 MGD	102.9 MGD	113.7 MGD	124.3 MGD	137.0 MGD

In comparison to the foregoing estimates, in September, 1979, the City of Phoenix estimated[1] effluent discharges from the 91st Avenue Plant for the same years as follows:

1980	1983	1985	1990	1995	2000
100,200 a-f[a]	116,000 a-f	126,600 a-f	153,060 a-f	179,500 a-f	205,900 a-f
(89.5 MGD)	(104 MGD)	(113 MGD)	(137 MGD)	(160 MGD)	(184 MGD)

On the basis of these two independent estimates (extrapolating the increase in flows from 1985 to 1986 from the differential between the estimates for 1983 and 1985), the effluent discharges in 1986 are expected to fall within the range of 105.35 MGD to 117.5 MGD, or 118,000 to 131,600 acre-feet. The validity of estimates is confirmed at least partially by

a. acre-feet

comparison of estimates for 1980 with the actual flows from the 91st Avenue Plant, as follows:

COE/EPA 1980 Estimate	84.5 MGD
Phoenix 1980 Estimate	89.5 MGD
Actual 1980 Effluent Discharges[19]	88.46 MGD

Assuming that the total effluent produced at the 91st Avenue Plant in 1986 will be in the range of 118,000 to 131,600 acre-feet, the amount available for use at Palo Verde will be in the range of 79,500 to 93,100 acre-feet. The basis used to determine the amount available for use at Palo Verde assumes that 38,500 acre-feet will be delivered or discharged to users having prior rights to use at Palo Verde pursuant to Agreement No. 13904, as follows:

Buckeye Irrigation District	30,000 acre-feet
Arizona Game & Fish Department	7,300 acre-feet
U.S. Water Conservation Lab	1,200 acre-feet

This deduction is conservative insofar as predicting the amounts available to Palo Verde, because the U.S. Water Conservation Laboratory has completed its experiments and is no longer using its reserved effluent and the Arizona Game & Fish Department has abandoned its wildlife project for which 7,300 acre-feet were reserved. There are no other users of effluent with rights prior to Palo Verde. 2

The only other user of effluent from the 91st Avenue Plant is the Buckeye Irrigation District, which, in the five-year period from 1972 to 1977, diverted on the average 82,000 acre-feet per year from the Gila River at the Buckeye Heading. Of this average amount, the source of 14,500 acre-feet was the Salt River Project feeder ditch. The balance, or 67,500 acre-feet, is assumed to be effluent from the 91st Avenue and the 23rd Avenue Plants (Reference 18, page 3-42). Of such

67,500 acre-feet of effluent, 30,000 acre-feet was discharged into the river pursuant to the agreement between BID and the City of Phoenix. Assuming that in 1987 (the first year in which all three Palo Verde units will be in operation for a full year) the total effluent discharges from the 91st Avenue Plant are the same as in 1986, the amount of effluent available to BID for agricultural irrigation would be 54,000 to 67,600 acre-feet, determined as follows:

	COE/EPA Estimate (acre-feet)	Phoenix Estimate (acre-feet)
Total Effluent Available	118,000	131,600
BID/Phoenix Contract	30,000	30,000
PVNGS Use	64,000	64,000
Total	94,000	94,000
2 Balance discharged to River and available to BID	24,000	37,600
Total Effluent Available to BID	54,000	67,000

If the Phoenix estimates prove to be accurate, there will be sufficient effluent available to meet BID's 1972-77 average uses. If the COE/EPA estimates are assumed, then the difference between the total amount available to BID (54,000 acre-feet) and its average 1972-77 usage (67,500 acre-feet) will have to be made up from one or more of the following sources:

(1) Annual increases in effluent discharges from 91st Avenue Plant - (COE/EPA Est. 1985-1990) ..... 2,400 acre-feet/year

(2) Effluent discharges from 23rd Avenue Plant .... 41,000 acre-feet/year[b]

(3) Pumped Water .... Difference between 13,500 acre-feet and the sum of sources (1) and (2)

On the basis of the foregoing assumptions, there will be no apportionment of effluent (except pursuant to contract) and none will be required.

Assuming each of the three Palo Verde units is shut down for one month each year for refueling and maintenance, and operates at a 95% capacity factor during the balance of the year, and assuming average ambient conditions, the effluent usage is estimated to be (refer to figure 3.3-1).

2

	Each Unit	3 Units
Miscellaneous Pipeline and Reclamation Plant Losses	--	0.10 MGD
Reservoir Evaporation and Seepage	--	0.26 MGD
Miscellaneous Unit Waste	--	0.26 MGD
Cooling Tower Evaporation, Drift and Blowdown	19	57 MGD
Essential Spray Pond Evaporation and Drift	0.01	0.03 MGD
Domestic and Demineralized Water Systems Wastes	--	0.25 MGD
Output from Onsite Wells	--	(1.14) MGD
	Total	57 MGD

b. Roosevelt Irrigation District has a prior right (which has not yet been exercised) to purchase up to 20,000 acre-feet of effluent from the 23rd Avenue Plant.

The criteria used in evaluating losses included specification requirements for pipe leakage, solar evaporation rates appro-
2 priate for the site, design permeability of the reservoir liner, and specification details of the cooling towers and other plant systems.

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2 5.6.1.1.3 Environmental Effects of Water Diversion

A number of reports have been prepared on the water use, reuse, and associated habitats along the Salt and Gila Rivers from 23rd Avenue in Phoenix to Gillespie Dam.[3-8] These reports point out that the total water balance of the beds of the Salt and Gila Rivers from the City of Phoenix 23rd Avenue Sewage Plant, downstream to Gillespie Dam (hereinafter described as the River Study Area), must be considered in order to accurately predict the ecological effects of wastewater use.

Although the surface water and groundwater regimes are interdependent, the major potential ecological impacts from use of the wastewater effluent can be classified as those resulting from alterations of habitats which are primarily dependent on groundwater (e.g., the areas supporting phreatophytes) and habitats primarily dependent on surface water.

5.6.1.1.3.1 <u>Groundwater Dependent Habitat</u>. Based on historical rates of groundwater recharge, it does not appear that piping the wastewater effluent required to meet the cooling requirements will substantially alter the groundwater-dependent habitats of the River Study Area. The important phreatophyte habitats in the River Study Area are largely recharged from other sources. For example, the winter flood of 1965-1966 contributed to substantial replenishment of the underground water supply in the greenbelt region between 91st Avenue and Buckeye Heading, and this stretch of the river currently receives underflows from the Gila River (estimated to be 3500 acre-feet per year).[3,4]

12. Personal communication, R. Andes, NUS Corp., with J. S. Gosmano, Marley Cooling Tower Company, September 23, 1977.

13. Heitner, I., "How to Estimate Plant Noise," Hydrocarbon Processing, December 1968.

14. Harris, C. M., Handbook of Noise Control, McGraw-Hill Book Company, Inc., New York, 1957.

15. Berger, B., et al., "Transformer Noise," Philosophical Transactions of the Royal Society, Series A, Vol. 263, pp 381-411, 1968.

16. Beranek, L. L., Noise and Vibration Control, McGraw-Hill Book Co., Inc., New York, 1971.

17. Beranek, L. L., Noise Reduction, McGraw-Hill Book Co., Inc., New York, 1960.

18. Final Environmental Impact Statement on the Maricopa Association of Governments Point Source Metro Phoenix 208 Waste Water Management Plan, U.S. Environmental Protection Agency, July 1979. 2

19. Memo from K. E. Spiker to R. B. Stextler, Phoenix Water & Sewer Department, January 23, 1981

5.7 RESOURCES COMMITTED

Resources committed due to plant operation were estimated in ER-CP Section 5.8 and the FES and have not changed significantly. What follows is a summary of information previously presented.

5.7.1 REPLACEABLE COMPONENTS AND CONSUMABLE MATERIALS

Uranium is the principal natural resource material irretrievably consumed as a result of plant operation. Other materials include fuel-cladding materials, reactor core component materials, fuels and various chemicals such as sodium hypochlorite, nitrogen, sulfuric acid, and sodium hydroxide.

In view of the quantities of these consumable materials in natural reserves, resources, stockpile, and the quantities produced annually, the expenditure of such materials for operation of PVNGS is justified by the benefits of the electrical energy produced.

5.7.2 CONSUMPTIVE WATER USE

Plant operation requires a significant commitment of water resources. Based upon annual average requirements, a total of approximately 66,300 acre-ft of water will be used to operate PVNGS. Approximately 97% of this water requirement will be satisfied by using wastewater effluent from the City of Phoenix 91st Avenue Sewage Treatment Plant. The remaining 3%, requiring a potable water source, will be obtained from groundwater.

5.7.3 ENVIRONMENTAL LOSSES

There are no significant environmental losses associated with operation of PVNGS.

5.7.4 LAND RESOURCES

The amount and types of land committed depend on the eventual decommissioning plan adopted (refer to section 5.8).

APPENDIX 5A

QUESTION 5A.1 (NRC No. 290.4) 5.1

State the distance from the towers for which Figures 5.1-7 and 5.1-8 are valid. Are these values for 3-unit operation?

RESPONSE: The response is provided in the revised section 5.1.4.7.

QUESTION 5A.2 (NRC No. 290.5) 5.4

Describe in more detail how the value of 365 $\mu g/m^3$ of SO_2 was calculated in Table 5.4-2. Was it assumed that 1 or 3 units were in operation for the full 24 hours? Also, the NAAQS standard is that 365 $\mu g/m^3$ is not to be exceeded more than once per year (indicated as the second highest calculated value).

RESPONSE: The response is provided in the revised section 5.4.

2

QUESTION 5A.3 (NRC No. 290.6) 5.4

Please provide information on existing air quality at the site so that the staff can determine if applicable air quality standards will be violated by emissions from the plant. Are the air pollution standards given in Section 5.4 still valid? If not, present the new values.

RESPONSE: The response is given in the revised section 2.3.2.1 and below.

The federal air standards presented in section 5.4 are still valid. Supplementary standards of the State of Arizona are provided in table 2.3-24A.

QUESTION 5A.4 (NRC No. 290.7) 5.6.1

Describe how the Buckeye Irrigation Company will receive its water from the 91st Avenue Sewage Plant during PVNGS operation. Identify the location where water for the Buckeye Irrigation Company is diverted from water sent to PVNGS. Describe the mitigation measures planned to preserve the riparian habitates and green belts (CP-FES Section 2.7) once the water is diverted from the 91st Avenue Sewage Treatment Plant to PVNGS.

RESPONSE: The Buckeye Irrigation Company diversion location is provided in the revised section 3.9.

2 The mitigation measures that can be taken to preserve the riparian habitats and green belts referred to in the question are dependent primarily upon the steps that are taken to process the treat wastewater produced in the Phoenix metropolitan area. Such steps hinge, in turn, upon the development and implementation of areawide water quality management plans pursuant to Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) and the Clean Water Act of 1977 (P.L. 95-217), which amends P.L. 92-500. Pursuant to such statutory provisions, the Maricopa Association of Governments (MAG) has been designated as Section 208 planning agency for Maricopa County. After extensive studies conducted for MAG by the Corps of Engineers with substantial public input, MAG adopted in 1979 its Point Source Metro Phoenix 208 Wastewater Management Plan (hereinafter, the "Plan"). The Plan has been approved, as required by law, by the Governor and by the U.S. Environmental Protection Agency (EPA). In July, 1979, the EPA issued its Final Environmental Impact Statement on the Maricopa Association of Governments Point Source Metro Phoenix 208 Wastewater Management Plan (EPA-FEIS).

Under the Plan, approximately 85% of the wastewater from the Phoenix area would be treated at the 91st Avenue and

CHAPTER 6

EFFLUENT AND ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

CONTENTS

CONTENTS (cont)

TABLES

6.1.5.3 Preoperational Phase Radiological Monitoring

The preoperational phase of the offsite program of sampling and measuring radioactivity, as noted in tables 6.1-4 and 6.1-5, permits a general characterization of the radiation levels and concentrations in existence prior to plant operation along with an indication of the degree of natural variation to be expected.

Implementation of the preoperational monitoring program fulfills the following objectives:

A. Identification of pathways to be monitored during operation

B. Measurement of background levels and their variations along major pathways in the areas surrounding the plant

Complete implementation of the preoperational phase of the radiological survey program is not scheduled until approximately 2 years prior to the anticipated issuance of the operating license.

The criteria for selecting sample types are based on the sources of the radioactivity expected to be released to the environment and the exposure pathways for these radionuclides to man and important biota. Sampling locations have been selected on the basis of local meteorology, physical characteristics of the terrain, and demographic and cultural features of the region. The frequency of sampling and the duration of the sampling period are dependent on the radionuclide of interest, and the biological behavior of the environmental media and the radionuclide. Sufficient samples are included in the program to define the spatial and temporal variation of radioactivity levels where necessary.

The radiological survey program is generally characterized at this time but some details of the program will not be established until just prior to the time the program is to be

Table 6.1-4

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Sampling and Collection Frequency	Type and Frequency of Analysis	Sampling Locations[a]
Airborne radioiodine and particulates	Continuous sampling collected weekly	Gross beta weekly; I-131 weekly; gamma spectrum monthly; composite of filters	1-5
Direct radiation	Two dosimeters at each location changed quarterly; one dosimeter at locations 2 to 5 changed annually	Gamma dose quarterly	1-8
Waterborne			
Surface	Composite sample over one-month period	Gamma spectrum monthly; tritium quarterly	9,10[b]
Ground	Quarterly grab sample	Tritium and gamma spectrums quarterly	11,12
Drinking (well)	Monthly composite of weekly grab sample	Gross beta and gamma spectrums monthly; tritium quarterly	5, 13-15
Ingestion			
Milk[a]	Semimonthly for animals on pasture; otherwise, monthly	Gamma spectrum and radioiodine semimonthly or monthly	16
Food products	Monthly when available	Gamma spectrum and radioiodine monthly	Local farms

a. Description of sampling site locations and distances from Unit 1 is given in table 6.1-5

b. As available

Table 6.1-5
DESCRIPTION OF RADIOLOGICAL SAMPLING SITE LOCATIONS
AND DISTANCES FROM UNIT 1

Sampling Site Number	Location	Distance from Unit 1		
		Miles	km	Direction
1	South-southwest at site boundary	2.0	3.2	SSW
2	Ward Road, south site boundary	3.0	4.8	S
3	Ward Road, east of Desert Farms Well No. 1	3.5	5.6	SW
4	Wintersburg	2.2	3.5	N
5	Gila Bend	30	48	SSE
6	West site boundary	1.0	1.6	W
7	Northeast corner of site	2.0	3.2	NE
8	East site boundary	1.5	2.4	SE
9	Water storage reservoir	0	0	(a)
10	Evaporation pond	0	0	(a)
11	Onsite well	0	0	(a)
12	Onsite well	0	0	(a)
13	Wintersburg	2.2	3.5	N
14	Buckeye Road at 355th Avenue	4.2	7	NE
15	Desert Farms Well No. 1	4.4	7	SW
16	Dairy	6	9.7	E

a. Not applicable

implemented. It is expected that the program may be modified periodically to take full advantage of the experience and knowledge obtained while conducting the program.

The following sections describe the general program to be instituted, including the expected types of samples, the collection frequency, and the analyses to be performed on each sample type.

6.1.5.3.1 Airborne Pathway

Airborne particulate and iodine activity will be sampled at a minimum of five locations using continuous low-volume air samplers. These samplers will be equipped with filters for the retention of particulate material greater than 0.3 micrometer in diameter and charcoal canisters for adsorption of airborne iodine. The pumping rate will be automatically adjustable to compensate for resistance to air flow due to loading of dust on the filter. A constant, known rate of flow can then be maintained throughout the sampling period.

Three of the air sampling systems will be placed in the vicinity of the site boundary in the three sectors of highest calculated χ/Q. Because all releases will be at ground level or from roof vents, the highest predicted offsite ground-level concentrations of airborne releases occur at the site boundary regardless of direction. These sectors are the south, south-southwest, and southwest.

Since Wintersburg is the only nearby community, it has the highest calculated community ground level χ/Q, and an air sampler will be placed there, approximately 2.2 miles north of Unit 1.

The particulate filters and charcoal canisters will be exchanged at least once every 7 days. Gross beta activity on

the filters and I-131 activity on the charcoal will be determined weekly. The gamma spectrum will be determined once per quarter.

6.1.5.3.2 Direct Radiation

Ambient external radiation will be measured by thermoluminescent dosimeters (TLDs). Quarterly doses will be determined at each of the locations where air samples are to be taken. To estimate annual fading characteristics caused by climatic factors, a third dosimeter will be placed at locations 1 to 5 noted in table 6.1-4.

TLDs will also be placed:

A. On the west site boundary, 1 mile west of Unit 1

B. Near the northeast corner of the site boundary, 2 miles northeast of Unit 1

C. On the east site boundary, 1.5 miles southeast of Unit 1

6.1.5.4 Waterborne Pathway

Preoperational monitoring of offsite surface waters is not planned.

6.1.5.4.1 Groundwater

Groundwater samples of the regional aquifer will be taken quarterly from the two onsite wells. Drinking water will be sampled from wells at Ward Road (Desert Farms Well No. 1), in Wintersburg (Winters Wells), and at Buckeye Road and 355th Avenue. These samples will be monthly composites of weekly grab samples. Gross beta and gamma spectrum analysis will be performed monthly; tritium will be determined in quarterly composites. Water from the community drinking water supply at Gila Bend will be taken for analysis as a control.

6.1.5.5 Ingestion Pathway

6.1.5.5.1 Milk

The grass-cow-milk or grass-goat-milk pathways for radioiodine will be monitored. Milk is produced at one dairy in the region about 6 miles east of Unit 1 as noted in section 2.1.3.

While the dairy cattle are out on pasture or are being fed green chop, samples will be obtained at least twice per month. Otherwise, the samples will be obtained at least monthly. Gamma spectrum and I-131 analyses of each sample will be performed.

There are isolated head of cattle within 5 miles of the plant; however, it appears that most of the cattle are on stored feed and are not grazing on pasture.

At the time of implementation of the preoperational program, it will be determined, for analytical purposes, if any milk can be obtained from cows or goats within a 5-mile radius of the site. Potential milk locations will be surveyed annually during the growing season to determine whether any milk is being produced for human consumption.

6.1.5.5.2 Fish and Invertebrates

There are no fish or invertebrates to be sampled.

6.1.5.5.3 Food Products

No vegetable gardens of any size have been observed within a 5-mile radius of Unit 2, since October, 1978. This information was presented in section 2.1.3.4.1 as a part of the general
1 character of agricultural land use in the site vicinity. A survey will be made routinely during environmental sample collection to see if any vegetable gardens greater than 500 $ft.^2$ have appeared. Locally grown leafy vegetables will

be sampled and analyzed by gamma spectroscopy, if available. A vegetable garden in Tonopah (approximately 9 miles NNW) was discovered in September, 1979, and permission has been obtained to routinely collect samples for analysis of any vegetables available. This is the closest garden greater than 500 square feet found to date. 1

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CHAPTER 8

ECONOMIC AND SOCIAL EFFECTS OF STATION CONSTRUCTION AND OPERATION

CONTENTS

TABLES

8.1.3 OTHER BENEFITS

8.1.3.1 Local Expenditures

A substantial amount of the total expenditures during construction for materials, equipment, and services will be spent in Arizona. The experience of the participating utilities and the constructor indicates that approximately $285 million will be spent in Maricopa County. This impacts secondary employment, personal income, and local taxes in a favorable manner. Local purchases will be approximately equivalent to 40% of the annual operations budget during the years 1981 to 1986. The percentage could increase based upon qualifications of local suppliers. 2

8.1.3.2 Purchase of Wastewater Effluent

A current benefit of PVNGS is the revenue received by Phoenix and five other municipalities through an option and purchases agreement with APS and Salt River Project for the sale of wastewater effluent not committed as of the contract date (April 1973) to other parties (hereafter referred to as uncommitted effluent). The City of Phoenix operates two sewage treatment plants near the Salt River. The first, at 23rd Avenue, is owned by Phoenix; the second, at 91st Avenue, is a joint venture of Phoenix and five other municipalities. At the present time, the participants pay $2.00 per year per acre-foot option payment for uncommitted wastewater effluent being discharged by these plants. The contract provides that APS and Salt River Project may purchase uncommitted effluent, when available, up to a maximum amount of 140,000 acre-feet per year for electric generation purposes.

For the period, April 23, 1979, to April 22, 1980, the participants made option payments for 89,192 acre-feet of uncommitted effluent; 30,604 acre-feet from the 23rd Avenue plant and 58,588 acre-feet from the 91st Avenue plant, based

on actual effluent flow records for 1978. Table 8.1-6 shows the option revenue derived by each of the cities participating in the 91st Avenue plant. The option payment for the 23rd Avenue discharge goes solely to the City of Phoenix.

The price to be paid for uncommitted effluent purchased for PVNGS is tied to the price for Central Arizona Project municipal and industrial water subject to a minimum price of $20 per acre-foot and a maximum price of $30 per acre-foot.

Table 8.1-6

PROJECTED MINIMUM ANNUAL REVENUE RECEIVED FOR UNCOMMITTED EFFLUENT FROM THE CITY OF PHOENIX 91st AVENUE SEWAGE TREATMENT PLANT

City	Percent of Revenue[a]	1979 Actual Option Revenue	Range of Anticipated Revenue[b]	
			$20 per Acre-Ft Delivered	$30 per Acre-Ft Delivered
Phoenix	51.76	$ 60,650	$ 663,046	$ 994,568
Glendale	13.79	16,176	176,650	264,975
Tempe	12.75	14,936	163,327	244,991
Mesa	10.93	12,810	140,013	210,020
Scottsdale	10.45	12,242	133,865	200,797
Youngtown	0.32	382	4,099	6,149
Total	100.0	$117,176	$1,281,000	$1,921,500

a. Calculated, based on a letter dated March 19, 1979 from P. W. Slagel, City of Phoenix Wastewater Operations to the 91st Avenue Sewage Treatment Plant Multi-City Participants.

b. Based on station water use of 64,050 acre-ft/yr with no additional uncommitted effluent available.

When Unit 3 becomes operational, it is expected that the price for the purchased uncommitted effluent will be $30 per acre-foot. In addition to purchase payments, the participating utilities will make option payments of $2 per acre-foot per year, for each acre-foot of effluent, reserved for use at PVNGS but not delivered. Each of the communities will share the revenue generated on that portion of the effluent coming from the 91st Avenue plant on the basis of their respective deliveries of sewage for treatment at the 91st Avenue plant.

A range of minimum revenues which could be realized by each of the participating cities is presented in table 8.1-6. This projection is based on:

- Influent ratios of the participating cities being constant with 1978 values.
- Annual station water use of 64,050 acre-ft (21,350 acre-ft/yr/unit).
- Availability of no uncommitted effluent in excess of the annual station requirement of 64,050 acre-ft/year.
- Payments of $20 and $30 per acre-ft of delivered effluent.
- All effluent for PVNGS will come from the 91st Avenue plant.

It is assumed that all residents of the cities participating in the 91st Avenue Plant will derive economic benefits.

8.1.4 IMPACTS IF OPERATION IS DELAYED

As discussed in chapter 1, load requirements for the PVNGS participants will increase substantially during the early 1980s. In order for the participants to reliably meet the needs of their customers in those years (1980 to 1986), additional generation of 7385 megawatts will be required from new

resources. PVNGS makes a major contribution toward meeting these needs.

Any delays in the construction of these units could seriously affect the reliability of the system. The level of impact of the delay varies with the participant. If PVNGS Unit 1 is not put into operation as planned, the reserve margin for PVNGS Units 1,2&3 participants will drop as described in section 1.3.

The service areas of the participants cover sizable portions of four states; consequently, significant differences exist in the geographic, demographic, economic, and social characteristics as well as total load and load characteristics of each participant. These differences make it difficult to quantify the impact of electrical shortages. Some electric utilities have experienced some major bulk power failures during the last several years. The severity of these failures varies. Major power failures are very costly. There are no dollar figures on the cost of load shortages for the participants. However, the blackout of the northeast portion of the U.S. in 1965 affected approximately 30 million people and cost an estimated $100 million. The New York City blackout in 1978 led to widespread looting and rioting.

8.1.5 REFERENCES

1. Arizona State University, College of Business Administration, Bureau of Economic and Business Research, "Maricopa County: An Economic Base Analysis", Tempe Arizona, December 1973.
2. Ellis, T., Marketing Services Staff, First National Bank of Arizona, Phoenix, Arizona, personal communication, June 27, 1979.

3. Merrill, R., Income Tax Division, Arizona Department of Revenue, personal communication, June 27, 1979.

4. Townsend, J., Sales Tax Division, Arizona Department of Revenue, personal communication, June 27, 1979.