

PALO VERDE UNIT 1

Tonopah, AZ

Owner: Arizona Public Service Company

Outage dates (duration): March 5, 1989 to July 5, 1990 (1.3 years)

Reactor type: Pressurized water reactor

Reactor age when outage began: 3.1 years

Commercial operations began: January 28, 1986

Fleet status: Oldest of three reactors owned by the company

Synopsis

Palo Verde Unit 1 automatically tripped about a month before a scheduled refueling outage. Two days earlier, Unit 3 had tripped as well, and operators subsequently encountered problems with the reactor's atmospheric dump valves. As a result, the facility's owner, Arizona Public Service Company, began Unit 1's refueling outage ahead of schedule.

The refueling outage also lasted longer than planned due to a series of problems including: the NRC's Augmented Inspection Team (AIT) found Arizona Public Service Company had ignored known problems that played a key role in the Unit 3 trip; the Institute of Nuclear Power Operations (INPO) placed 9 of 10 training programs at Palo Verde on probation; and Unit 3 experienced a main transformer fire as operators attempted to put it back into service.

Process Changes

None.

Commentary

During this extended outage, the NRC lowered its Systematic Assessment of Licensee Performance (SALP) ratings for Palo Verde from 2 to 3 in the area of Operations, from 2 to 3 in the area of Radiological Controls, from 1 to 2 in the area of Emergency Planning, and from 2 to 3 in the area of Quality Assurance. The NRC's regional administrator transmitted the SALP report to Arizona Public Service Company with this admonition:

"The sign of a healthy organization is that they find their own problems. They don't wait for them to be self-revealed."

This reasoning ought to apply to the NRC's oversight of Palo Verde as well. The problems that led to the plant's across-the-board SALP score reductions did not suddenly occur during the first week of March 1989; they had been evolving over time, unrecognized or unappreciated by both Arizona Public Service Company and the NRC.

Consistent with the “defense-in-depth” philosophy of nuclear safety, neither party can wait for problems to reveal themselves. Yet this extended outage—and nearly four dozen like it—demonstrate beyond any doubt that the nuclear power industry and its regulator do in fact wait until it’s too late.

NRC Systematic Assessment of Licensee Performance (SALP) History

Date	Operations	Radiological Controls	Maintenance	Surveillance Testing	Emergency Preparedness	Fire Protection	Security	Outage Management	Quality Assurance	Licensing	Training
6/1983	2	1	2	n/a	n/a	n/a	n/a	n/a	n/a	1	n/a
6/1984	2	2	2	n/a	1	2	2	n/a	n/a	2	n/a
12/1985	2	2	2	2	2	1	2	1	2	2	n/a
1/1987	2	2	2	2	2	1	3	1	2	2	1
2/1988	2	2	2	2	1	1	2	1	2	2	2
	Operations	Radiological Controls	Maintenance/Surveillance Testing		Emergency Preparedness		Security	Engineering and Technology		Safety Assessment and Quality Verification	
3/1989	3	3	2		2		2	2		3	
1/1990	2	2	3		2		2	3		3	
	Operations		Maintenance		Engineering			Plant Support			
3/1991	2		2		2			2/1/2			
7/1992	2		2		2			1/1/2			
10/1993	2		2		2			2/1/2			
1/1995	2		2		2			2			
1/1996	1		1		1			2			

NOTE: A rating of 1 designated a superior level of performance where NRC attention may be reduced. A 2 rating designated a good level of performance with NRC attention at normal levels. A rating of 3 designated an acceptable level of performance where increased NRC attention may be appropriate.

Details

January 1989: The NRC issued its SALP report on Palo Verde, which stated:

“[The low rating of 3 in the area of Operations was] primarily due to events at unit 1 and senior management’s inability to establish a working atmosphere which encourages critical assessment during the conduct of operations and is reflective of a divergence between management expectations and staff performance. Unit 1 operators’ willingness to conduct safety significant evolutions without a questioning and cautious attitude overshadows the acceptable performance of operators at the other two units.”

“[The low rating of 3 in the area of safety assessment/quality verification was] due to several failures of management oversight and direction.... Management failures have combined to produce situations which permit working level errors to continue to go unchecked until the errors are self-revealed by events.”¹

March 3, 1989: Palo Verde Unit 3 was operating at 98 percent power when an electrical grid disturbance tripped the main generator. The reactor automatically reduced output to 45 percent power and the turbine bypass valves opened to handle the steam no longer flowing to the main turbine. However, the bypass valve controller failed, resulting in excessive steam flow, overcooling of the reactor coolant system, and a drop in pressure in the secondary side of the steam generator, triggering an automatic closure of the main steam isolation valves and an automatic reactor trip.

Operators next encountered problems with the atmospheric dump valves (ADV), which failed to open using handswitches in the control room and on the remote shutdown panel. Equipment operators dispatched to open the ADVs manually encountered insufficient emergency lighting, disengaged handwheels, poor labeling of components, and noise from the open main steam safety relief valves.

Following this event, the ADVs on Units 1 and 2 were tested, and four of eight failed. The valve manufacturer concluded that leakage past internal valve components pressurized the valve bonnet, preventing the valve from opening when signaled to do so.²

March 5, 1989: Unit 1 automatically tripped from 100 percent power due to a false signal generated by the core protection calculator. The reactor had been scheduled to begin a 90-day refueling outage on April 8.³

April 19, 1989: The NRC issued a report on the findings of the AIT dispatched to Palo Verde in early March to investigate the ADV problems.⁴ Regional Administrator John Martin pointed out that Arizona Public Service Company had been aware since 1985 of ADV problems and had improperly waived maintenance and testing of emergency lighting for five consecutive quarters.⁵

April 27, 1989: Arizona Public Service Company President and Chief Executive Officer Mark De Michele informed the NRC that Executive Vice President Don Kramer was being demoted and the company was bringing in William Conway to head up its nuclear operations. The projected restart date for Unit 1 slipped to July 10.⁶

May 30, 1989: Federal Bureau of Investigation (FBI) agents arrested three members of the radical group Earth First! who were preparing to cut the power lines to a pumping plant for Palo Verde.⁷

June 1989: Arizona Public Service Company Vice President Conway explained the problems at Palo Verde in the following terms:

“The mentality of building and the mentality of operating are two totally different things. It is almost like reading two different prayer books. Operations is another type of religion.”⁸

June 1989: INPO placed 9 of 10 training programs at Palo Verde on probation. Only radiation protection training had been found acceptable.⁹

September 5, 1989: The NRC proposed, and Arizona Public Service Company paid, a \$250,000 fine for 13 violations stemming from the March event at Unit 3.¹⁰

October 1989: INPO re-accredited the training programs at Palo Verde.¹¹

November 24, 1989: NRC Regional Administrator Martin transmitted the NRC’s new SALP report on Palo Verde to Arizona Public Service Company and commented:

“The sign of a healthy organization is that they find their own problems. They don’t wait for them to be self-revealed, or for them to be found by regulators. What I’m particularly looking for is that they’re finding the bulk of their problems. They are not doing that yet.”¹²

December 1989: The lengthy outages at Units 1 and 3 and the intermittent operation of Unit 2 prompted the California Public Utilities Commission to investigate whether Arizona Public Service Company should refund monies related to the outages. (Southern California Edison owned 15.8 percent of Palo Verde.)¹³

December 30, 1989: Unit 3 was connected to the electrical grid, ending the outage that began on March 3. However, a fire in the main transformer forced operators to manually shut down the reactor that same day.¹⁴

January 21, 1990: Unit 3 was re-connected to the electrical grid following replacement of the main transformer.¹⁵

July 5, 1990: Unit 1 was connected to the electrical grid, ending its extended outage.¹⁶

September 13, 1990: Operators manually shut down Unit 1 for a maintenance outage.¹⁷

September 24, 1990: Unit 1 was re-connected to the electrical grid after workers replaced one pressurizer relief valve and repaired another.¹⁸

October 16, 1990: The NRC proposed, and Arizona Public Service Company paid, a \$125,000 fine for violations related to emergency lighting, including “failure to implement an adequate Quality Assurance program for fire protection” and “failure to comply with the requirement to have emergency lighting capable of operating for a minimum of eight hours in all areas needed for operation of safe-shutdown equipment.”¹⁹

Notes

- ¹ *Inside NRC*. 1989. Performance declines in four areas at ANPP's Palo Verde, January 16.
- ² Nuclear Regulatory Commission. 1989. Atmospheric dump valve failures at Palo Verde Units 1, 2, and 3. Information Notice No. 89-38, April 5.
- ³ Hiruo, E. 1989. NRC augmented inspection team sent following Palo Verde-3 trip. *Nucleonics Week*, March 9.
- ⁴ Jordan, B. 1989a. Following critical NRC report, APS shakes up nuclear management. *Nucleonics Week*, May 4.
- ⁵ Jordan, B. 1989b. Management routinely ignored problems at Palo Verde, NRC asserts. *Inside NRC*, May 8.
- ⁶ Jordan, 1989a.
- ⁷ Russell, D. 1989. Earth last! Earth First! members arrest case. *The Nation*, July 17.
- ⁸ Rawson, W.F. 1989. Nuclear plant problems include shutdowns, management, training woes. Associated Press, December 8.
- ⁹ *Ibid.*
- ¹⁰ Jasper, J. 1989. NRC official tells Palo Verde personnel have made progress, more to go. *Energy Report*, December 11.
- ¹¹ Rawson, 1989.
- ¹² *Ibid.*
- ¹³ *Electric Utility Week*. 1990. Long Palo Verde outages trigger investigation by California PUC, January 8.
- ¹⁴ Hiruo, E. 1990. California PUC investigating cost of downtime for Palo Verde-1, -3. *Nucleonics Week*, January 11.
- ¹⁵ Arizona Public Service Company. 1990. Arizona Nuclear Power Project Palo Verde Unit 3 generating electricity again. *Business Wire*, January 22.
- ¹⁶ Arizona Public Service Company. 1990. Palo Verde Unit 1 resumes operation. *Business Wire*, July 5.
- ¹⁷ Arizona Public Service Company. 1990. Palo Verde Unit 1 returned to service. *Business Wire*, September 25.
- ¹⁸ *Ibid.*
- ¹⁹ Arizona Public Service Company. 1990. Palo Verde pays NRC civil penalty for emergency lighting. *Business Wire*, November 16.