

TURKEY POINT UNIT 3

Florida City, FL

Owner: Florida Power & Light Company

Outage dates (duration): February 11, 1981 to April 11, 1982 (1.2 years)

Reactor type: Pressurized water reactor

Reactor age when outage began: 8.2 years

Commercial operations began: December 14, 1972

Fleet status: Oldest of three reactors owned by the company

Synopsis

Florida Power & Light (FP&L) voluntarily shut down Unit 3 on February 11, 1981, to replace the steam generators. Tube degradation had been abundantly evident for nearly seven years prior to the outage. Steps undertaken to limit the tube degradation rate proved futile, so replacement of the steam generators with ones made from more resistant materials became the better option. FP&L restarted Unit 3 on April 11, 1982, with three new steam generators.

Process Changes

Steam generator tube integrity was a concern of both the nuclear power industry and the NRC prior to this outage and it remains an unresolved issue to this day.

Commentary

Unlike the majority of extended outages, the year-plus length of this outage represented the period needed to conduct a complex single activity more than it represented the depth below acceptable safety levels to which performance had fallen. For about four years prior to this outage, FP&L and the NRC clearly struggled to cope with an unanticipated problem. Following a significant tube leak at Virginia's Surry nuclear plant in September 1976, the NRC adopted a very conservative regulatory posture by allowing Turkey Point Unit 3 to only operate for six months between steam generator inspections. The frequency of shut-downs for inspections and their results obviously played a key role in FP&L's decision to replace the steam generator tubes instead of sustaining an ineffective "band-aid" tactic. Thus, the NRC's reaction to the situation at Unit 3 was appropriately timely and thorough.

However, the NRC could have, and perhaps should have, done more to have prevented this potentially unsafe and definitely uneconomical situation. Unit 3 only operated for about two or three years before significant steam generator tube degradation became apparent. The materials with which the original steam generator tubes were constructed were very poor matches for the operating conditions to which they were subjected. The steam generator tubes were the only parts of the entire plant that function both as part of the reactor coolant boundary and also as part of the containment boundary. Their integrity was expected to

match the 40-year lifetime of the plant, yet they barely lasted six years. Rather than conduct a materials experiment at Turkey Point Unit 3 and other production reactor sites across the United States, the NRC could have required more prototype testing to confirm, rather than hope, the right materials were being used.

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
1/1/1981	2	2	2	2	2	2	2	2	2	n/a	n/a
1/1/1983	2	1	2	2	2	2	2	1	n/a	2	n/a
12/1/1983	3	1	2	2	2	n/a	2	2	1	2	n/a
2/1/1985	3	2	3	2	2	2	2	2	3	1	n/a
8/1/1986	3	2	3	2	1	2	2	2	3	2	3
11/1/1987	2	2	2	2	1	n/a	3	2	2	2	3
11/1/1988	3	2	3	2	2	2	3	2	2	2	3
	Operations	Radiological Controls	Maintenance/Surveillance Testing		Emergency Preparedness		Security	Engineering and Technology		Safety Assessment and Quality Verification	
12/1/1989	2	2	2		2		3	2		2	
10/1/1990	2	2	2		2		2	2		1	
	Operations		Maintenance		Engineering			Plant Support			
12/1/1991	1		2		2			2/1/1			
5/1/1993	1		2		2			1/1/1			
9/1/1994	1		1		1			1			

NOTE: A rating of 1 designates a superior level of performance where NRC attention may be reduced. A 2 rating designates a good level of performance with NRC attention at normal levels. A rating of 3 designates an acceptable level of performance where increased NRC attention may be appropriate. A rating of n/a was given in those areas that were not assessed on that date.

Details

June 29, 1979: The NRC issued its environmental impact appraisal on the proposed replacement of the steam generators for Turkey Point Units 3 and 4. The units began operating with a sodium phosphate secondary water chemistry treatment program and switched to the all-volatile chemistry program around August 1974.¹

December 1979: Unit 3 was shut down for steam generator tube inspections.

January 25, 1980: The NRC issued an amendment to the Unit 3 operating license that imposed the condition that the steam generator tubes be inspected within six months of operation from January 24, 1980.²

March 13, 1980: The NRC issued an amendment to the Unit 3 operating license setting the steam generator tube plugging level at 22 percent.³

May 15, 1980: Following receipt, review, and acceptance of an updated safety analysis of emergency core cooling system performance, the NRC issued an amendment to the Unit 3 operating license that increased the steam generator tube plugging level to 25 percent.⁴

June 12, 1980: Following receipt of a corrected calculation for the analysis of emergency core cooling system performance, the NRC issued an amendment to the Unit 3 operating license revising some of the basis numbers associated with the 25 percent steam generator tube plugging level. The NRC scolded the plant owner: "In view of the fact that computational errors have occurred three times in less than a year, we request that you inform us of your plans to prevent recurrence of computational errors in the future."⁵

July 30, 1980: The NRC issued an amendment to the Unit 3 operating license that imposed the condition that the steam generator tubes be inspected within 8.5 months of operation from January 24, 1980.⁶

October 1980: Unit 3 was shut down for steam generator tube inspections.

October 30, 1980: The NRC issued an amendment to the Unit 3 operating license that imposed the condition that the steam generator tubes be inspected within six months of operation from October 24, 1980.⁷

February 11, 1981: Unit 3 was shut down for a refueling outage.⁸

April 1981: As Unit 3 was being restarted from its refueling outage, an electrical generator failed. With the repair of the generator expected to require six months, FP&L opted to switch the steam generator replacement schedules and proceed with the replacement of the Unit 3 steam generators.⁹

June 23, 1981: The NRC issued an amendment to the Unit 3 operating license that imposed the condition that the steam generator tubes be inspected within six months.¹⁰

June 23, 1981: The NRC issued an amendment to the Unit 3 operating license that increased the steam generator tube plugging level to 28 percent.¹¹

June 24, 1981: The NRC issued an amendment to the Unit 3 operating license approving the steam generator repair plan.¹²

March 24, 1982: The NRC issued an amendment to the Unit 3 operating license incorporating steam generator tube in-service inspection requirements.¹³

April 11, 1982: Unit 3 returned to service.¹⁴

Notes

- ¹ Nuclear Regulatory Commission (NRC). 1979. Environmental impact appraisal, June 29.
- ² NRC. 1980. Amendment no. 52 to operating license no. DPR-31, January 25.
- ³ NRC. 1980. Amendment no. 54 to operating license no. DPR-31, March 13.
- ⁴ NRC. 1980. Amendment no. 57 to operating license no. DPR-31, May 15.
- ⁵ NRC. 1980. Amendment no. 58 to operating license no. DPR-31, June 12.
- ⁶ NRC. 1980. Amendment no. 59 to operating license no. DPR-31, July 30.
- ⁷ NRC. 1980. Amendment no. 60 to operating license no. DPR-31, October 30.
- ⁸ Cannon-Brown, S. 1982. Massive steam generator replacement job taken in stride by Florida P&L. *Nucleonics Week*, April 29.
- ⁹ Cannon-Brown, 1982.
- ¹⁰ NRC. 1981. Amendment no. 67 to operating license no. DPR-31, June 23.
- ¹¹ NRC. 1981. Amendment no. 68 to operating license no. DPR-31, June 23.
- ¹² NRC. 1981. Amendment no. 69 to operating license no. DPR-31, June 24.
- ¹³ NRC. 1982. Amendment no. 81 to operating license no. DPR-31, March 24.
- ¹⁴ Cannon-Brown, 1982.