South Texas Project Unit 2

Bay City, TX

Owner: STP Nuclear Operating Company

Reactor type: Pressurized water reactor

Commercial operations began: June 19, 1989

Outage dates (duration): February 3, 1993 to May 22, 1994 (1.3 years)

Reactor age when outage began: 3.6 years

Fleet status: Youngest of two reactors owned by the company

Synopsis

Following a series of problems with the Unit 1 turbine-driven auxiliary feedwater pumps (which were considered operable at the time), the South Texas Project operations manager directed that they be tested on February 1, 1993. The pumps failed, placing Unit 1 in a 72-hour limiting condition for operation. On February 3, operators manually tripped Unit 2 in anticipation of an automatic trip due to low water level in the steam generators. The Unit 2 turbine-driven auxiliary feedwater pump received an automatic start signal, but immediately tripped on overspeed. The NRC issued a Confirmatory Action Letter on February 5 listing items that had to be completed prior to restart. The NRC revised the restart list in May and October to include 16 items.

In April 1993, the NRC invoked its Manual Chapter 0350 process, and in May, the agency fined Houston Light & Power, the parent company of STP Nuclear Operating Company, $325,000 for violations related to the auxiliary feedwater pump and emergency diesel generator problems. The NRC added South Texas Project to its Watch List in June, and NRC senior managers presented their concerns about the plant to the company's board of directors in August. Houston Light & Power submitted its restart plan to the NRC that same month. On May 17, 1994, the NRC authorized the restart of Unit 2.

Process Changes

The NRC issued Information Notice 93-51 to all plant owners, alerting them to the auxiliary feedwater problems encountered at South Texas Project. Even though the facility also suffered from work environment problems, and correction of these problems was an explicit item on the restart list, the NRC did *not* communicate this aspect of the South Texas Project experience to other plant owners.

Commentary

Judged from February 5, 1993, onward, the NRC's performance at South Texas Project was very good. The NRC communicated clear expectations to the company about what needed to be done for the agency to approve restart, revised those expectations as new information surfaced, and escalated its concerns all the way to the board of directors, ensuring these concerns were fully understood and that sufficient corporate

resources would be available to resolve them. There is little in the record from February 5, 1993, through February 25, 1994, with which to criticize the NRC.

Prior to February 5, 1993, however, the NRC's list of 16 items that absolutely had to be fixed before restart included:

2. Improve the process for reporting and correcting problems affecting equipment operability.
3. Reduce the backlog of open service requests and the number of operator workarounds.
4. Improve the post-maintenance test program.
5. Reduce the backlog of outstanding design modifications and temporary modifications.
6. Provide adequate staffing in the operations department.
9. Improve management effectiveness in identifying and correcting plant problems.

The NRC is not doing its job when it merely compiles a lengthening list of things it expects a plant owner to fix if and when an opportunity arises. Worse, the NRC's South Texas Project restart list reveals the agency to be as guilty as the plant owner in many areas. For example, items 3 and 5 represent a backlog of items that the NRC should have sought to reduce *prior* to February 5, 1993—unless, that is, the agency wants to argue that it was totally clueless that any of these problems existed.

An effective regulator would monitor safety levels and intercede when necessary to stem declining performance. An ineffective regulator merely monitors safety levels and compiles a list of things to fix. That the NRC's list for South Texas Project took more than a year to complete strongly suggests that the agency's regulatory effectiveness has ample room for improvement.

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
08/1988	2	2	2	2	2	2	3	n/a	2	2	2

	Operations	Radiological Controls	Maintenance/Surveillance Testing	Emergency Preparedness	Security	Engineering and Technology	Safety Assessment and Quality Verification
05/1989	2	2	2	2	2	2	1
06/1990	1	2	1	2	1	2	1

	Operations	Maintenance	Engineering	Plant Support
09/1991	2	2	2	1/2/1
11/1992	2	2	2	1/2/2
10/1994	2	2	2	2
05/1996	2	1	2	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

March 18, 1988: The NRC issued Information Notice 88-09 to plant owners about a problem with steam-driven auxiliary feedwater pump testing at the Calvert Cliffs facility in Maryland. Workers had pre-warmed the pumps prior to conducting the required monthly surveillance tests. During a loss of offsite power event on July 23, 1987, a steam-driven auxiliary feedwater pump received an automatic start signal but immediately tripped on overspeed. During the ensuing cold quick-start testing, the pump failed to run or ran erratically. Subsequent investigation revealed that moisture accumulation in the steam supply piping and impaired governor response caused the pump problems.[1]

July 18, 1991: The NRC issued Information Notice 91-46 to plant owners about problems experienced at the Byron (Illinois), McGuire (North Carolina), and Palo Verde (Arizona) nuclear plants caused by paint being improperly applied to emergency diesel generators. The paint would have disabled the emergency diesel generators by binding parts in place and preventing either the flow of fuel to the engine or control of engine speed.[2]

December 27, 1992: During a monthly surveillance test of the South Texas Project Unit 1 turbine-driven auxiliary feedwater pump, the pump tripped on overspeed immediately after receiving a start signal. Operators were able to manually start and operate the pump. The pump worked following a second attempt at an automatic start and was considerable operable.[3]

January 1993: South Texas Project was first discussed during the NRC's senior management meeting process because of two consecutive assessment periods showing declining performance levels. The performance declines manifested themselves in the form of repetitive hardware problems resulting in numerous transients, reactor trips, and engineered safety feature actuations.[4]

January 23, 1993: Unit 2 automatically tripped from 100 percent power due to a low water level in one of the steam generators. The turbine-driven auxiliary feedwater pumps automatically started and were later turned off by the operators when they were no longer needed. Operators encountered problems re-latching the trip/throttle valve for the turbine-driven auxiliary feedwater pump. Following extensive testing and troubleshooting, the pump was declared operable and the reactor was restarted on January 25, 1993.[5]

January 28, 1993: During a monthly surveillance test of the Unit 1 turbine-driven auxiliary feedwater pump, the pump tripped on overspeed immediately after receiving a start signal and was declared inoperable. Extensive testing and troubleshooting identified problems with overspeed tripping, lack of speed control, flow oscillations, and inability to maintain rated speed. The turbine-driven auxiliary feedwater pump was declared operable on January 30, 1993, following maintenance and successful completion of the surveillance test.[6]

February 1, 1993: The operations manager directed that the Unit 1 turbine-driven auxiliary feedwater pump be tested to ensure operability following its recent problems. The pump tripped on overspeed immediately after receiving a start signal and was declared inoperable, starting a 72-hour clock to either fix the pump or shut down the reactor.[7]

February 3, 1993: Operators manually tripped the Unit 2 reactor in anticipation of a pending automatic trip due to low water level in the steam generators. The startup feedwater pump had tripped during realignment of its lubricating oil duplex strainers. The turbine-driven auxiliary feedwater pump received an automatic start signal, but the pump immediately tripped on overspeed.[8]

February 4, 1993: Operators manually shut down the Unit 1 reactor because its turbine-driven auxiliary feedwater pump was still inoperable and the 72-hour period permitted to restore it to service had come to an end.[9]

February 5, 1993: The NRC issued a Confirmatory Action Letter (CAL) identifying items to be resolved before the South Texas Project reactors could be restarted. The NRC supplemented its CAL on May 7, 1993, and October 15, 1993. The CAL ultimately contained 16 items:

1. Correct the oversight trip condition that afflicts the turbine-driven auxiliary feedwater pumps.
2. Improve the process for reporting and correcting problems affecting equipment operability.
3. Reduce the backlog of open service requests and the number of operator work-arounds.
4. Improve the post-maintenance test program to provide confidence that equipment removed from service for maintenance is properly restored to operability.
5. Reduce the backlog of outstanding design modifications and temporary modifications.
6. Provide adequate staffing in the operations department.
7. Institute adequate training of the fire brigade leader.
8. Upgrade the reliability of the fire protection computers.
9. Improve management effectiveness in identifying and correcting plant problems.
10. Improve the effectiveness of the Speakout program.
11. Improve diesel generator reliability.
12. Improve essential chiller reliability.
13. Institute the System Certification Program.
14. Improve the reliability of the feedwater isolation bypass valves.
15. Institute periodic testing of tornado dampers for safety-related ventilation systems.
16. Improve performance on emergency preparedness accountability drills.[10]

April 12, 1993: The NRC invoked the use of its Manual Chapter 0350 process to govern efforts related to the restart decision.[11]

May 1993: The NRC fined South Texas Project $325,000 for multiple violations related to inadequate testing and maintenance of the auxiliary feedwater pumps and the emergency diesel generators.[12]

June 3, 1993: The NRC provided the plant owner with the findings from the diagnostic evaluation conducted at South Texas Project in March and April 1993.[13]

June 28, 1993: The NRC placed both South Texas Project reactors on its Watch List.[14]

July 9, 1993: The NRC issued Information Notice 93-51 to plant owners about the turbine-driven auxiliary feedwater pump problems at South Texas Project. The NRC reported that the root cause of the repetitive problems was a combination of moisture accumulation in the steam supply piping (due to non-functioning steam traps) and an improperly geared trip/throttle valve that impaired governor response.[15]

August 4, 1993: NRC senior managers presented their concerns about South Texas Project to Houston Light & Power's board of directors.[16]

August 1993: Houston Light & Power submitted its Operational Readiness Plan to the NRC, describing the specific actions to be taken prior to restarting either South Texas Project reactor.[17]

December 1993: NRC inspectors reviewed the Employee Concerns Program at South Texas Project.[18]

May 17, 1994: The plant owner notified the NRC that all required restart items for Unit 2 had been completed and requested permission to restart. The NRC concurred.[19]

May 22, 1994: Operators restarted the reactor.[20]

September 1994: The NRC issued a report on 16 significant events that occurred in 1993 at U.S. nuclear power plants. NRC inspectors had identified none of these events: all 16 were either identified by plant workers or were self-revealing.[21]

January 1995: The NRC removed both units at the South Texas Project from its Watch List.[22]

Notes

[1] Nuclear Regulatory Commission (NRC). 1988. Reduced reliability of steam-driven auxiliary feedwater pumps caused by instability of Woodward PG-PL type governors. Information Notice No. 88-09, March 18.

[2] NRC. 1991. Degradation of emergency diesel generator fuel oil delivery systems. Information Notice No. 91-46, July 18.

[3] NRC. 1993. Repetitive overspeed tripping of turbine-driven auxiliary feedwater pumps. Information Notice No. 93-51, July 9.

[4] NRC. 1994. Senior management meeting handout, April 20.

[5] NRC, 1993.

[6] Ibid.

[7] Ibid.

[8] Ibid.

[9] Ibid.

[10] Cottle, W.T. 1994. Status of confirmatory action letter issues. Letter to L.J. Callan, regional administrator, Nuclear Regulatory Commission, January 29. W.T. Cottle was group vice president, nuclear, at Houston Light & Power Company.

[11] Collins, S.J. 1994. Completion of South Texas Project Unit 1 restart action plan. Memo to L.J. Callan, regional administrator, Nuclear Regulatory Commission, and L.A. Reyes, acting associate director, projects, Nuclear Regulatory Commission, March 2. Samuel J. Collins was South Texas Project restart panel chairman at the Nuclear Regulatory Commission.

[12] General Accounting Office (GAO). 1995. *Nuclear regulation: Weaknesses in NRC's inspection program at a South Texas nuclear power plant*. GAO/RCED-96-10, October. Washington, DC.

[13] NRC, 1994.

[14] Houston Industries Incorporated. 1993. South Texas Project named to NRC 'watch list.' Press release, June 29.

[15] NRC, 1993.

[16] NRC, 1994.

[17] Cottle, 1994.

[18] NRC, 1994.

[19] GAO, 1995.

[20] Ibid.

[21] Ibid.

[22] Ibid.