San Onofre Nuclear Generating Station

Performance Monitoring

Report

Second Q

1986

Southern California

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San Onofre Nuclear Generating Station PERFORMANCE MONITORING REPORT Second Quarter, 1986

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INTRODUCTION

In January 1984, the San Onofre Nuclear Generation Site started collecting data for use in a performance monitoring program. This program was developed to follow the guidelines established in the Institute of Nuclear Power Operations (INPO) Good Practice OA-102, "Performance Monitoring - Management Information."

INPO initially identified ten Key Indicators to demonstrate overall utility performance. In response to comments from advisory committees and industry review groups, INPO revised items considered as key indicators in July, 1985 and clarified the duration of measurements in November, 1985.

Accordingly, this report has been revised to follow the INPO guidelines. Below is a listing of the indicators monitored, units measured, and units of measure.

1)	<u>Indicator</u> Equivalent Availability Factor	Units Measured Percent	<u>Units of Measure</u> Three Year Average
2)	Unplanned Automatic Scrams while Critical	Total	Total in the last 12 Months
3)	Unplanned Safety System Actuations	Total	Total in the last 12 Months
4)	Forced Outage Rate	Percent	Three Year Average
5)	Thermal Performance (Heat Rate)	BTU/kWh	Three Year Average
6)	Fuel Reliability (Iodine Activity)	Microcuries/gm	12 Month Average
7)	Collective Radiation Exposure	Man-Rem/Unit-Year	Three Year Average
8)	Volume of Low-level Solid Radioactive Waste	Cubic Meters/Unit-Year	Three Year Average

	Indicator	
·9)	Industrial	Safety

Units Measured Lost-time Accidents per 200,000 Hours Worked Units of Measure Last 12 Months

Additionally, INPO will be including a tenth indicator called "Safety System Unavailability." INPO will be establishing a method of calculation in the future.

SONGS Operating Highlights For the Second Quarter 1986

During the second quarter of 1986, Units 2 and 3 operated at 15.13% and 99.84% of capacity, respectively. Unit 1 remained off line the entire quarter for refueling while Unit 2 was off line for refueling during April and May.

<u>Unit 1</u> remained in the cold shutdown mode during the quarter, while continuing the Cycle IX Refueling Outage. Modifications of structural steel for seismic upgrade continued and the overhaul of the Number 2 Diesel Generator was completed. Receipt of NRC restraint acceptance criteria, requiring additional work on Control Room Ventilation Systems, resulted in the schedule date for outage completion being changed from June 1986 to July 1986.

Unit 2 entered the second quarter in the Cycle III Refueling Outage that began on March 15, 1986. Core alterations were completed on April 21. Seventeen (17) steam generator tubes were plugged following eddy current testing. On May 29, Reactor Coolant System temperature was raised to 140 degrees, ending Fuel Cycle II with a final gross capacity factor of 56.99%. The Unit entered Mode 1 on June 11 and on June 12, synchronized to the grid ending the Cycle III Refueling Outage. The Unit reached full power on June 19 and later that day, tripped due to a shorted capacitor in Class 1E 120 volt AC Vital Power Supply Inverter (Y003) (the power supply to Control Element Assembly Computer (CEAC) No. 2). Concurrently, CEAC No. 1 was out of service causing the core protection calculator to calculate higher penalty factors, resulting in a reactor trip. Y003 was repaired, the Unit synchronized to the grid on June 21, and achieved 100% power on June 23. On two occasions during the period of June 26 through June 29, reactor power was reduced to 85% to facilitate cleaning of condenser water boxes. Following each cleaning, the Unit returned to full power. On June 30, power was again reduced to 85%, where it remained at the close of the quarter, for condenser water box cleaning.

Unit 3 entered the second quarter at full power. On April 12, a turbine/reactor trip occurred from 100% power when a voltage transient in the non-1E Uninterruptable Power Supply caused a transient in relays in the Control Element Drive Mechanism Control System and the Turbine Generator Control System. On April 13, during unit startup, a reactor trip occurred, initiated by the Plant Protection System because of conservative penalty factors in the Core Protection Calculator which resulted from minor control element misalignments and coincident inward control element movement. Criticality was achieved on April 13 and on April 14, the Unit synchronized to the grid and reached full power. The Unit operated at full power until May 9 when a problem developed in the Turbine Control Test Circuitry in which several valves closed causing Unit output to decrease to 740 MWe. The Unit returned to full power as investigation into the problem proceeded. On May 10, following a power reduction to 80% to repair a faulty relay in the Turbine Control Test Circuit, the Unit returned to 100% power. On May 11, during the monthly Control Element Assembly rod exercises, the Unit experienced a dropped rod. Power was reduced to 70% to recover the dropped rod, and on May 12 the Unit returned to full power. The Unit operated at full power until June 3 when power was reduced to 1050 MWe to repair a tube leak in Third Point Feedwater Heater E041. Full Power resumed on June 11. The Unit ended the quarter operating at full power.





Equivalent Availability Factor (EAF) is the same as capacity factor except that EAF does not decrease when running at reduced power for "economic load management reasons."

- Unit 1 The Unit did not operate during the second quarter of 1986. The 3 Year EAF and the 1986 EAF Goal are both below the Industry Median due to the shutdown in 1983-84.
- Unit 2 In the second quarter, the Unit did not operate during the months of April and May. During the month of June the Unit achieved a 49% EAF.

Unit 3 Achieved a 98% EAF for the second quarter of 1986.

Units 2 and 3 are not expected to exceed industry averages until several years of operation.



Unit 1 The Unit was shutdown during the second quarter of 1986. Unit 2 The Unit had 2 trips during the second quarter of 1986. Unit 3 The Unit had 2 trips during the second quarter of 1986. The Nuclear Generation Site Trip Reduction Task force is working to bring the trip rate for Unit 2 below the industry median.

Unplanned Safety System Actuations

Total ECCS and Emergency AC Power

	Unit 1	Unit 2	Unit 3
Actual Last 12 Months	0	0	0
1986 Actual Second Quarter	0	0	0
1986 Goals	1	1	1
Industry Median (per unit)	1		

Definition:

In accordance with INPO standards, the number of Unplanned Safety System Actuations compiled above are the sum of Emergency AC Power System actuations and Safety System actuations that occur for any reason except planned manual actuations for the following emergency core cooling systems: High Pressure Injection, Low Pressure Injection, and Safety Injection Tank.



The INPO defines a forced outage as an outage due to equipment failure or other conditions that require the unit to be removed from service immediately or before the end of the next weekend. The Forced Outage Rate is the forced outage hours divided by the sum of the forced outage hours and the service hours for the period of interest, expressed as a percentage.

- Unit 1 Did not operate during the second quarter.
- Unit 2 Did not operate during the months of April and May. During the month of June, the Unit experienced an 18% forced outage rate due to, 1) a reactor trip during startup that was due to high steam generator level, and 2) a Unit trip due to a shorted capacitor in a Class IE 120 volt AC vital power supply inverter.
- Unit 3 Experienced a 2% forced outage rate during the second quarter for 1986.



INPO lists Heat Rate in BTU/kWh as a key indicator for all plants.

- Unit 1 Design 10,500 BTU/kWh. Unit 1 showed steadily improving performance from Return to Service to the end of cycle. Unit 1 cannot achieve its design heat rate due to the reduced operating temperature.
- Unit 2 Design 9,895 BTU/kWh. Unit 2 exhibited the best heat rate due to improved measurement techniques.
- Unit 3 Design 9,895 BTU/kWh. The elevated Unit 3 heat rate levels are attributed to the reductions to 60% and 55% reactor power, which occurred in the summer of 1985. The Unit is designed to operate most efficiently at full power.

The Units 2 & 3 chlorination skid has been replaced and chlorination commenced in June with the return to service of Unit 2. Unit 1 chlorination system design changes will be evaluated following an assessment of the Units 2 & 3 design changes. These modifications to the circulating water system should improve unit heat rates. 9



Fuel Reliability (iodine activity) is an indicator of the percentage of leaking fuel in the core.

- Unit 1 Did not operate during the second quarter of 1986.
- Unit 2 Did not operate during April and May. During June, operation of the Unit was not stable enough to provide a set of useful data.
- Unit 3 Had a 51.6E-3 average iodine activity during the second quarter of 1986. During the refueling outage all fuel bundles were inspected and 39 leaking rods were replaced. The recent decrease in Unit 3 iodine activity presented above is expected to continue.

The 1986 Goals were established based on the expected unit performance. Units 2 and 3 have experienced early in life fuel problems that are attributed to manufacturing deficiencies. Efforts to correct these deficiencies are being taken with the fuel supply vendor. No specific actions to lower iodine activity, beyond normal careful operations, are planned until more data has been accumulated for this indicator. QUARTERLY PERFORMANCE REPORT

CE 26-293-2 NEW 6/84

SOUTHERN CALIFORNIA EDISON COMPANY

SONGS UNITS 1, 2 & 3

DATE SECOND QUARTER 1986

SUMMARY

HEALTH PHYSICS HIGHLIGHTS

Second Quarter 1986 Station radiation exposures were high, reflecting outage activities at Units 1 and 2. 391 person-rem were expended during the quarter, bringing the 1986 total to 823 person-rem. Achieving the Station Goal of maintaining the 1986 exposure total below 1000 person-rem should be possible, providing no unplanned maintenance activities occur.



1986 Goal	Industry
Three Year Average	Median

330 Man-rem/unit/year

449 man-rem/unit/year

During the second quarter of 1986, San Onofre had a collective radiation exposure of 391 man-rem, equivalent to 130 man-rem per unit.

The exposure accumulation for the second quarter was high due to the Units 1 & 2 refueling outages.



305 cubic meters/unit/year

351 cubic meters/unit/year

During the second quarter of 1986, SONGS generated 112 cubic meters of solid radioactive waste, equivalent to 37 cubic meters per unit.

The decrease in the volume of low-level solid radioactive waste is attributed to the success of the ongoing waste reduction programs. Achieving the 1986 goal will bring SONGS below the current industry median.



1986 Goal	Industry
12 Month Average	Median
0.3	0.36

The decreased accident rate during the Second Quarter 1986 is directly attributed to: (1) a commitment from top management to a strong administrative control program, (2) an increase in supervisory awareness when dealing with accidents, and (3) an increase in the overall safety awareness at all levels.

A painter injured his back on May 31, 1986, requiring corrective surgery. On May 16, 1986, prior to this injury, San Onofre accumulated 2.0 million work-hours since the last lost time accident.



The Institute of Nuclear Power Operations no longer requests reporting of capacity factor values as part of the Key Indicator Program. However, Unit Capacity Factors-Three Year Average is retained in this report in the form of an additional indicator of plant performance.

QUARTERLY PERFORMANCE REPORT

SOUTHERN CALIFORNIA EDISON COMPANY

DATE SECOND QUARTER 1986

SUMMARY

SONGS UNITS 1, 2 & 3

COMPLIANCE HIGHLIGHTS

The number of Unplanned Safety System Actuations for ECCS and Emergency AC Power remains at zero for the 2nd Quarter, reflecting careful plant operations.

The number of Licensee Event Reports (LERs) for all three Units is trending down, again reflecting careful plant operations and completion of system modifications to reduce the number of spurious Safety System actuations.

The overall number of Notices of Violation (NOVs) has increased to eight for the second quarter. Five of the NOVs were for Environmental Qualification problems not related to plant operations. A summary of the NOVs is on page 19, all are considered isolated occurrences and corrective actions been taken to prevent recurrence. None of the NOVs received in the 2nd quarter resulted in a Civil Penalty.



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NOTE: In general, the trend for LERs on all three Units is down. This is at least partially attributable to implementation of modifications and programs designed to reduce the number of spurious safety system actuations.

13 LERs were issued for all 3 units in the 1st quarter of 1986 versus only 10 for the 2nd quarter of 1986.



NOVs per Month

NOV. INS UNIT 1	PECTION R UNIT 2	EPORT NO. UNIT 3	. NOV DATE	SUBJECT OF NOV	SEVERITY LEVEL	CIVIL PENALTY
85-30	85-29	85-28	4/ <u>02/8</u> 6	Environmental Qualifi- cation file on Galite thermocouple extension cable did not establish qualification.	IV	
				Environmental Qualifi- cation file on Rockbes- tos Firewall EP cable did not establish quali- fication.	IV	-
·				Environmental Qualifi- cation file on Target Rock solenoid valve SV- 119 established erron- eous qualification.	IV	-
				Environmental Qualifi- cation on Honeywell E/P transducer FCV-1115D incomplete.	IV	-
				Environmental Qualifi- cation file on Rockbes- tos Firewall III cable did not establish quali- fication.	IV	-
	86-08	86-08	4/25/86	Housekeeping/Fire Pro- tection/Safety: accum- ulation of excessive ma- terials, storage of non- fire retardant wooden pallets, and improperly secured compressed gas cylinders.	IV	-
		86–11	6/20/86	Installation of a qual- ity affecting water le- vel indicator (tygon man- ometer for RCS level) without an appropriate procedure.	IV	-
	86-11		6/20/86	Failure to comply with Station Procedures SO23- 3-1.1 for reactor startup.	IV	-

QUARTERLY PERFORMANCE REPORT

SOUTHERN CALIFORNIA EDISON COMPANY

DATE SECOND QUARTER 1986

SONGS UNITS 1, 2 & 3

SUMMARY

CHEMISTRY HIGHLIGHTS

Unit 1

The Unit remained shutdown the entire quarter for plant modifications. Steam generators were kept in wet lay-up during the quarter.

Units 2/3

Unit 2 was in a refueling outage for the majority of the quarter.

Condensate oxygen levels in Unit 3 were above the limit of 10 ppb for most of the month of April. The air in-leakage task force continued to investigate and repair sources of the in-leakage.

Effluent Dose

When compared to a year ago, there has been a site wide reduction, by a factor of ten (10), of Curies discharged. This is due to the attention and efforts of site personnel to reduce liquid curies discharged.

The gaseous dose for Unit 1, for the first and second quarters 1986, reflects the outage of the Unit that began in November, 1985. During this outage, only one saltwater pump was used for dilution of liquid effluent. This caused a higher measured effluent dose.





....Denotes time not in Mode 1 operation. Shown for graph continuity.

* Procedural limit.



.... Denotes time not in Mode 1 operation. Shown for graph continuity.

* Procedural limit.

Billion

Per

Parts

Values off the scale occurred on February 19 when chlorides in the Unit 3 Steam Generators peaked at an average value of 105 parts per billion.



Billion

Parts Per

Condensate Oxygen



.... Denotes time not in Mode 1 operation. Shown for graph continuity.

* Procedural limit.





* Procedural limit.



Abbreviation: GI/LLI - Gastrointestinal/Lower Large Intestine



Abbreviation: GI/LLI - Gastrointestinal/Lower Large Intestine



Maintenance Work Requests/

Preventive Maintenance, Units 1, 2, & 3

The decrease in Maintenance Work Requests (MWRs) completed, which was accompanied by an increase in the manhours expended to complete those MWRs, was due to 1) the recovery of Unit 2 from the second refueling outage, and 2) the continuing Unit 1 Refueling/Retrofit outage.

With Maintenance Division efforts geared towards equipment overhauls and outage related corrective maintenance, the Preventive Maintenance Items were reprioritized accordingly and in some cases, deferred until periods when the Units are operating. This in turn has resulted in an increasing number of open Preventive Maintenance Items. With the units in an operating configuration, it is expected that these trends will reverse.

SONGS Unit 1 Event Rates and Causal Factors

This represents the results of evaluation of the Unit 1 SIR data base during the period which began in July, 1985 to the present. The analysis utilized the INPO criteria developed to analyze industry data for the years 1983 and 1984.

The analysis indicates a continued downward trend of incidents which began in March, 1985 and continued until the unit was shutdown for refueling in November, 1985. This period represents typical power operation (~400 MWe) with occasional small load drops of short duration and a few short unit outages. The downward trend of incidents during this period can be attributed to additional experience accumulated by the operating and maintenance personnel and replacement or repair of faulty equipment discovered since return-to-service of the unit in November, 1984. This period does not include the loss of off-Site power/water hammer incident which forced the unit to shutdown slightly ahead of schedule for the refueling outage in November, 1985 as this SIR has not been issued as yet.

The unit was shutdown during the remainder of the time covered in this analysis. This fact tends to influence the type and number of incidents due to the nature of the work being performed. Long shutdowns of this type are not normal and cannot be compared with periods of operation. The small number of incidents reported during this period does not lend itself to trending analysis and it is difficult to draw any conclusions concerning root causes.

SONGS 2&3 Event Rates and Causal Factors

This represents the results of evaluation of the Units 2/3 SIR data base for the period July 1, 1985 to June 30, 1986. The analysis utilized the INPO criteria developed to analyze industry data for the years 1983 and 1984.

It should be noted that several SIRs have not been issued as yet for the last quarter of 1985 and the first two quarters of 1986. This missing data will influence the final analysis of the data for these periods and any conclusions reached at this time concerning trends and root causes. Units 2 and 3 were also involved in long refueling and maintenance outages during this period such that at least one unit was out of service during most of this time. This fact also influences the data due to the different types and frequency of incidents which occur during an outage versus those which occur during operation.

Regardless of the missing data and the effect of long outages on the type data, a downward trend in the total and human performance categories which began in May, 1985 continues. This downward trend may be attributed to additional experience of operations and maintenance personnel and repair or replacement of deficient equipment. An extended period of operation of both units is required to verify these assumptions and determine more accurately trends which may exist. The extremely small data base makes identification of trends and determination of factors affecting root causes difficult.

A review of the data related to the increase in component failures during the third quarter of 1985 did not identify any specific cause for the increase. The incidents consisted of various component failures due to non-related causes. A downward trend in the number of such instances continued to the end of the reporting period. A final evaluation will be made when the remainder of the data for this period is available.



Data Available Thru April 1986

NSG1 - ESTIMATED ANNUAL FREQUENCY OF SIGNIFICANT CORE DAMAGE DUE TO INTERNAL INITIATING EVENTS

Shown below are the calculated annual frequencies of significant core damage due to certain internal initiating events. Approximately fifteen (15) initiating events would be studied in a complete Level 1 probabilistic risk assessment (PRA) of internal events. (External initiating events include fires, floods, and earthquakes).

The NRC policy statement on safety goals published in 1983 established a goal of 1.0E-4 per reactor-year as the frequency of significant core damage due to all internal initiating events.

Extrapolating from the available data, the frequency of significant core damage at San Onofre Units 1, 2, and 3 due to all internal initiating events is expected to be within the limit set by the NRC.

NSG2 - TREND IN ESTIMATED FREQUENCY OF SIGNIFICANT CORE DAMAGE DUE TO INTERNAL INITIATING EVENTS AS A FUNCTION OF EQUIPMENT OUT-OF-SERVICE TIMES

The trend in the <u>estimated</u> (extrapolated from a few initiators) annual frequency of significant core damage due to internal initiating events is shown below as a function of equipment out-of-service times. Out-of-service time accrues whenever test or maintenance activities render a piece of equipment incapable of performing its design function or whenever a piece of equipment is discovered to have been inoperable.

The slight increase in risk at Unit 1 during the second period resulted from increased levels of maintenance on the steam driven AFW pump and the emergency diesel generators.

The estimated frequencies of core damage at Units 2 and 3 show dramatic decreases after each unit's first refueling outage. This is attributable to the installation of DCP 6204 which provided the capability of backflushing the CCW heat exchangers.

Despite the significant improvement of the second period over the first, the frequency of core damage could be lowered further at both Units 2 and 3. During this second period, the CCW heat exchangers at Unit 2 were taken out of service for over 120 hours to repair leaking flanges, repair epoxy coatings, and clean tubes.

At Unit 3, the steam driven AFW pump was found to be unable to start on May 6, 1986. The time out-of-service was estimated to have been approximately 345 hours.

UNIT 1 (CYCLE 9 CONFIGURATION)

UNIT 3

UNIT 2

UNITS 2 AND 3 TECHNICAL SPECIFICATIONS PROGRESS

The graph represents cumulative (since issuance of the Unit 2 Low Power License) progress made in the area of Units 2 and 3 Technical Specifications. During the second quarter, 14 technical specifications changes were approved by the NRC, three new changes were submitted and two new changes were identified. Ten of the changes which were approved during this quarter were in support of Cycle 3 operation of Units 2 and 3 and allowed restart from the Unit 2 refueling outage. One of the other changes which was approved (shutdown cooling flow reduction) resulted in a savings of approximately four critical path days in the Unit 2 refueling outage. The newly identified and submitted changes will enhance specifications in the upcoming Unit 3 refueling outage scheduled to begin in the fourth quarter of this year.

