ACCESSION #: 9804270093

NON-PUBLIC?: N

LICENSEE EVENT REPORT (LER)

FACILITY NAME: San Onofre Nuclear Generating Station PAGE: 1 OF 6

(SONGS) Unit 2

DOCKET NUMBER: 05000361

TITLE: Turbine Driven Auxiliary Feedwater Pump Speed Circuit

Collar Loose

EVENT DATE: 01/13/98 LER #: 98-001-01 REPORT DATE: 04/17/98

OTHER FACILITIES INVOLVED: None DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(i)

LICENSEE CONTACT FOR THIS LER:

NAME: R.W. Krieger, Vice President, Nuclear TELEPHONE: (714) 368-6255

Generation

COMPONENT FAILURE DESCRIPTION:

CAUSE: E SYSTEM: COMPONENT: T MANUFACTURER: ER

E M T R

REPORTABLE TO EPIX:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On 12/29/97, painters (non-utility, non-licensed) noted a loose collar on a component. An

operator (utility, licensed) determined the loose collar held in place a two pin plug that carries a signal to the auxiliary feedwater pump 2P140 turbine speed control system. In the absence of a speed feedback signal through the plug, the turbine would start, but would trip on mechanical overspeed. The operator tightened the collar. Pump 2P140 was then test run satisfactorily. It was determined on 1/13/98 (discovery date), that pump 2P140 was inoperable because the collar was not sufficiently engaged to prevent the pins being disconnected by an earthquake of sufficient magnitude.

The collar may not have been completely tight at the last documented reassembly in 1993. Subsequently, the collar was subject to vibration during periodic pump test runs which could have loosened it further. Painting activities begun on 12/11/97, could have inadvertently loosened the collar still further, finally rendering the assembly inoperable for a seismic event of sufficient magnitude.

Appropriate personnel will be informed of this occurrence and reminded of the need for caution in the vicinity of important to safety components. The maintenance procedure for installing the speed probe was enhanced.

Plant: San Onofre Nuclear Generating Station (SONGS) Unit 2

Reactor Vendor: Combustion Engineering

Event Date: January 13, 1998

Event Time: 1141

Mode: 1, Power Operation

Power: 100 percent

Background:

The Auxiliary Feedwater (AFW) System [BA] is comprised of three 100 percent capacity Auxiliary Feedwater Pumps [P]. Two of the pumps are driven by electric motors, with each pump's discharge piping lined up to one of the two steam generators. The third pump, 2P140, is driven by Terry steam turbine [TRB] 2K007. The AFW discharge from pump 2P140 is interconnected with both steam generators via the same piping used by the motor-driven pumps. The AFW pumps are normally isolated from the steam generators by two sets of remote actuated isolation valves. Pump 2P140 is test run monthly. Quarterly inservice test runs include collecting vibration data from a portable accelerometer threaded on to a test pad mounted atop a turbine journal bearing cap (Figure 1).

The room housing the three AFW pumps is classified as a harsh environment due to a postulated break in the steam line to turbine 2K007. Also, the AFW pumps may be subject to water spray from two types of fire suppression water systems [KP] that protect the room. One fire suppression water system is an automatic pre-action sprinkler type, in which infrared fire detectors open a fire water valve, but no water flows until individual sprinkler heads actuate from fire-generated heat. The other type of fire suppression water system is the water spray type.

Pump 2P140 and one of the two motor-driven AFW pumps are each protected

by this water spray system, in which thermal detectors open a valve that supplies fire suppression water through open spray nozzles.

Technical Specification Limiting Condition for Operation (LCO) 3.7.5 states: "Three AFW trains shall be OPERABLE" in Modes 1, 2, and 3...."

The LCO requires an inoperable turbine-driven AFW pump to be restored to operable status within 72 hours. Also, with one motor-driven pump and the turbine-driven pump inoperable, the LCO requires one of the two AFW trains be restored to operable status within 24 hours. Unit shutdown is required if these LCO requirements are not met.

Description of Event:

On 12/11/97, SONGS workers began painting activities (surface preparation, masking, scaffold erection) in the AFW pump room in the vicinity of pump 2P140. During painting activities in the vicinity of important to safety equipment, SONGS utilizes individuals designated as critical component checkers to help ensure components are not inadvertently disturbed. On 12/29/97, painters (non-utility, non-licensed) noted a loose threaded collar on a component and immediately reported it to the Control Room. An operator (utility, licensed) dispatched to investigate, determined the loose collar held in place a two pin plug that carries a signal from a speed sensor to the 2K007 speed control system. Although the pins (as-found) were connected, the loose assembly could be moved by hand laterally.

The operator confirmed that Unit 3 was not similarly affected and

reported to the Control Room, where he was directed to tighten the collar. The operator attempted to tighten the collar by turning it approximately five turns in the "on" direction, but it

did not appear to advance. He then turned the collar in the "off" direction approximately two turns, and the plug came apart. With the plug momentarily disconnected, pump 2P140 was disabled, because, in the absence of a speed feedback signal through the plug, the turbine would start, but would trip on mechanical overspeed. The operator then reconnected the plug and successfully tightened the collar. The Shift Technical Advisor verified correct reassembly when the operator demonstrated disassembly and reassembly. (Pump 2P140 was again momentarily disabled with the plug disconnected.) Pump 2P140 was then test run satisfactorily.

SCE began an investigation into the significance of the loose collar. While the operator's action corrected the as-found condition, it complicated engineering evaluation of that condition by eliminating the evidence. An analysis completed on 1/8/98, concluded the plug would have remained operable during a seismic event, based on the understanding that the collar was engaged by at least two threads (because the operator had turned it approximately two turns before the plug disconnected).

Upon further investigation and discussion with the operator, it was subsequently determined on 1/13/98, (discovery date when SCE recognized

that the event had occurred) that pump 2P140 was inoperable in the as-found condition because the collar was not sufficiently engaged to prevent the pins being disconnected by the seismic forces from an earthquake producing vertical spectral accelerations greater than 1 g. While pump vibration may have loosened the collar, it is not considered credible that the plug itself could have become disconnected due to pump operation alone.

The 1/13/98, conclusion was confirmed on 1/28/98, when, with Unit 2 in Mode 5, Cold Shutdown, the plant operator re-enacted his actions for plant engineers. The engineers judged the collar in the as-found condition could have allowed the plug to become disconnected during an earthquake of sufficient magnitude, and that pump 2P140 must therefore be conservatively considered inoperable with the collar in the as-found condition.

An extensive investigation has not identified exactly when the collar became loose. However, the proximity of the collar to the vibration test pad (Figure 2) and the large number of plant workers who routinely observe this component, make it unlikely this the condition could have existed unnoticed for long. Pump 2P140 had been last test run satisfactorily on 12/10/9/, when vibration data were collected; the operator collecting the data did not notice whether the collar was loose or tight.

While painting preparation (erecting scaffolding, masking equipment,

preparing surfaces) near this component began on 12/11/97, it is unlikely that these actions by themselves caused the collar to become loose. SCE postulates the collar may not have,been completely tight at the last documented reassembly in 1993. Subsequently, the collar was subject to vibration during periodic pump test runs which could have loosened it further. Painting activities begun on 12/11/97, could have inadvertently loosened the collar still further. The loose collar was first noticed on 12/29/97.

Unit 2 operated in Mode 1 throughout the period 12/11/97 to 12/29/97. During this period, one of the two motor-driven AFW pumps was inoperable for approximately 48 hours for planned maintenance activity. Because the inoperability of pump 2P140 may have extended for more than 24 hours with the motor-driven pump inoperable, or more than 72 hours total, with Unit 2 in Mode 1, SCE is reporting this occurrence in accordance with 10 CFR 50.73(a)(2)(i).

Cause of the Event:

As stated above, SCE concludes the collar was: (1) most likely not completely tight at the last documented reassembly in 1993 (but was still sufficiently engaged to remain operable during a seismic event); (2) subject to vibration-induced loosening during periodic pump test runs (but was still sufficiently engaged to remain operable during a seismic event); and, (3) inadvertently further loosened between the start of

painting activities on 12/11/97, and the date the loose collar was first noticed (12/29/97), finally rendering the assembly inoperable for a seismic event of sufficient magnitude.

Corrective Actions:

The collar and plug were reassembled, and pump 2P140 was test run satisfactorily. Appropriate personnel will be informed of this occurrence and reminded of the need for caution in the vicinity of important to safety components. The maintenance procedure for installing the speed probe was enhanced. SONGS personnel inspected or reviewed similar connectors on other plant components.

Safety Significance:

Seismic Qualification:

SCE has evaluated the increase in core damage risk for the period 12/11/97 to 12/29/97 at 3E-8 using actual plant configurations and anticipated operator actions. Operators are trained on the proceduralized action steps to be taken for a turbine driven auxiliary feedwater pump overspeed trip.

SCE has also evaluated the increase in core damage risk for periods prior to 12/11/97, had the condition existed prior to that date, at less than 7E-7 per year based on average plant configurations that may have existed.

Environmental Qualification:

A postulated break in the steam supply line to turbine 2K007 in the

AFW pump room could result in a high temperature, high humidity environment in the room. The loose collar in the as-found condition could have caused the pump to be disabled in this environment. However, a steam line break per se would render 2P140 inoperable, so that the as-found condition of the plug did not change the safety significance of a postulated steam line break.

Design Basis Fire:

If a fire were to occur in the AFW pump room, one or both of the fire suppression water systems would actuate, possibly causing pump 2P140 to have become disabled due to the loose collar. However, pump 2P140 is not credited for achieving or maintaining safe shut down in case of a fire in the AFW pump room.

Therefore, the as-found condition of the plug was of minimal safety significance.

Additional Information:

SCE reported a similar occurrence in LER 2-95-008. An aerosol spray can was inadvertently left in an electrical relay cubicle, rendering the equipment associated

with the cubicle seismically unqualified. The spray can was most likely inadvertently left following bus cleaning and inspection activities. Corrective action focused on the adverse consequences of leaving supplies or equipment inside of electrical switchgear, a condition not associated

with the loose collar.

SCE has reported no additional similar occurrences subsequent to LER

2-95-008.

Figures 1 and 2 omitted.

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