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RUEGER,G.M. Pacific Gas & Electric Co.
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 93-006-00:on 931006,determined that when hydrogen concentration in WGS exceeded 10% by vol,WG oxygen analyzer channel uncertainties exceeded setpoint requirements due to personnel error.Design revised.W/931105 ltr.

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TITLE: 50.73/50.9 Licensee Event Report (LER), Incident Rpt, etc.

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Gregory M. Rueger
Senior Vice President and
General Manager
Nuclear Power Generation

November 5, 1993

PG&E Letter No. DCL-93-258

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Re: Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
Licensee Event Report 1-93-006-00
Technical Specification 3.3.3.10 Explosive Gas Effluent Monitoring Action Requirement Violations Due to Personnel Error During the Original Procurement

Gentlemen:

Pursuant to 10 CFR 50.73(a)(2)(i)(B), PG&E is submitting the enclosed Licensee Event Report (LER) 1-93-006 concerning Technical Specification 3.3.3.10 action requirement violations due to personnel error during the original procurement of waste gas system oxygen analyzers. This LER is being submitted to report the root cause and applicable immediate corrective actions for this event. This event did not adversely affect the health and safety of the public.

Sincerely,

Gregory M. Rueger

cc: Bobby H. Faulkenberry
Ann P. Hodgdon
Mary H. Miller
Sheri R. Peterson
CPUC
Diablo Distribution
INPO

DCO-93-EN-N018

Enclosure

1155S/85K/KWR/2246

110097

IE22
1/1

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
DIABLO CANYON UNIT 1	0 5 0 0 0 2 7 5	1 OF 7

TITLE (4) TECHNICAL SPECIFICATION 3.3.3.10 EXPLOSIVE GAS EFFLUENT MONITORING ACTION REQUIREMENT VIOLATIONS DUE TO PERSONNEL ERROR DURING ORIGINAL PROCUREMENT

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MON	DAY	YR	YR	SEQUENTIAL NUMBER	REVISION NUMBER	MON	DAY	YR	FACILITY NAMES	DOCKET NUMBER (8)
10	06	93	93	- 0 0 6	- 0 0	11	05	96	DIABLO CANYON UNIT 2	0 5 0 0 0 3 2 3
										0 5 0 0 0

OPERATING MODE (9)	1
POWER LEVEL (10)	1 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR: (11)

X 10 CFR 50.73(a)(2)(i)(B)

OTHER -

(Specify in Abstract below and in text, NRC Form 366A)

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER AREA CODE	TELEPHONE NUMBER
DAVID P. SISK, SENIOR REGULATORY COMPLIANCE ENGINEER	805	545-4420

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
| | YES (if yes, complete EXPECTED SUBMISSION DATE)	| X | NO				

ABSTRACT (16)

On September 30, 1993, with Units 1 and 2 in Mode 1 (Power Operation) at 100 percent power, PG&E conservatively declared the waste gas oxygen analyzers inoperable due to unexpected inaccuracy.

On October 6, 1993, a PG&E Technical Review Group determined that when the hydrogen concentration in the waste gas system exceeded ten percent by volume, the waste gas oxygen analyzer channel uncertainties exceeded setpoint requirements and might not assure alarms in accordance with Technical Specification (TS) 3.11.2.5 limits. Thus, TS 3.3.3.10 was not met whenever the hydrogen concentration was greater than ten percent by volume, since grab samples were not collected at least once per four hours and analyzed within the following four hours.

The immediate corrective actions are to take and analyze grab samples in accordance with TS 3.3.3.10 until a design change has been implemented to replace the existing waste gas oxygen analyzers and associated loop instruments with equipment not subject to hydrogen interference. In addition, other analysis systems are being reviewed for possible interference mechanisms. Significantly improved engineering procedures, checklists, and guidelines (since the 1979 timeframe) should preclude this event from happening again.

I. Plant Conditions

Units 1 and 2 have been in various modes and at various power levels with the conditions described below.

II. Description of Event

A. Summary:

On September 30, 1993, with Units 1 and 2 in Mode 1 (Power Operation) at 100 percent power, PG&E conservatively declared the waste gas oxygen analyzers inoperable due to unexpected inaccuracy.

On October 6, 1993, a PG&E Technical Review Group determined that when the hydrogen concentration in the waste gas system exceeded ten percent by volume, the waste gas oxygen analyzer channel uncertainties exceeded setpoint requirements and might not assure alarms in accordance with Technical Specification (TS) 3.11.2.5 limits. Thus, TS 3.3.3.10 was not met whenever the hydrogen concentration was greater than ten percent by volume since grab samples were not collected at least once per four hours and analyzed within the following four hours.

B. Background:

The gaseous radwaste system (GRS)[WE] collects, stores and releases radioactive gaseous wastes that are generated during plant operation. The main constituents of the gases processed by GRS during normal plant operation are nitrogen, hydrogen and small amounts of oxygen, and various radioactive gases. These waste gases are discharged into the GRS vent header [WE][VX], compressed by the waste gas compressors [WE][CMP], and then transferred for storage under pressure in the gas decay tanks (GDTs) [WE][TK]. The waste gases are stored until the radioactivity has decayed to acceptable levels and then released to the environment.

TS 3.3.3.10 states that during GRS operation, the explosive gas monitoring instrumentation channels (ANR-75 or ANR-76) [WE][ARK] shall be operable with their alarm/trip setpoints [WE][ALM] set to ensure that the limits of TS 3.11.2.5 are not exceeded. TS 3.11.2.5 states that at all times, the concentration of oxygen in the GRS shall be limited to less than or equal to two percent by volume whenever the hydrogen concentration exceeds four percent by volume. With the concentration of oxygen in the GRS greater than two percent by volume but less than or equal four percent by volume, reduce the oxygen concentration to the above limits within 48 hours. With the oxygen concentration in the GRS greater than four percent by volume and the hydrogen concentration greater than four percent by volume, immediately suspend all additions of waste gases to the system and

reduce the concentration of oxygen to less than or equal to four percent by volume. With no channels operable, operation of the GRS may continue provided grab samples are collected at least once per four hours and analyzed within the following four hours. The provisions of TS 3.0.3 are not applicable.

Per the surveillance requirements of TS 3.3.3.10, each explosive gas monitoring instrumentation channel shall be demonstrated operable by performance of a daily channel check, a monthly channel functional test, and a quarterly channel calibration. The channel calibration shall include the use of standard gas samples containing a nominal (a) two volume percent oxygen, balance nitrogen, and (b) four volume percent oxygen, balance nitrogen.

C. Event Description:

On September 17, 1993, during the performance of Unit 2 Surveillance Test Procedure (STP) I-79 A&B, "Functional Test and Calibration of Waste Gas System Oxygen Analyzers 75 (76) Loop 24-17," it was noted that one sensor (CEL-76) [WE][AE] was reading 1.1 percent oxygen concentration and the other sensor (CEL-75) was reading 0.4 percent oxygen concentration. A chemistry sample was requested and the results showed that the actual oxygen concentration was 1.0 percent. CEL-75 was removed from service and CEL-76 was recalibrated using the TS surveillance required two percent and four percent oxygen calibration gas for the analyzers and was returned to service.

During a comparison review of a waste gas header sample against the oxygen analyzer readings, a concern was identified regarding a high hydrogen concentration and the potential for impact on the accuracy of the oxygen analyzers. A review of the vendor manual indicated that the analyzers may not be accurate for hydrogen concentrations above 10 percent by volume. The vendor was contacted to determine an instrument accuracy adjustment factor for hydrogen concentrations exceeding 10 percent. The vendor stated that they could not provide assurance of instrument accuracy in a hydrogen environment exceeding 10 percent.

Therefore, on September 30, 1993, ANR-75 and 76 (waste gas oxygen analyzers) for both units were conservatively declared inoperable. TS 3.3.3.10 action requirements were met by taking grab samples on a four-hour basis. A Technical Review Group (TRG) was formed to investigate this concern. The TRG reviewed available vendor information, previous operating and maintenance history, and comparisons between grab samples and instrument readings. The TRG concluded that the installed sensors for ANR 75 and 76 were not fully suitable for the expected environment. Hydrogen gas interferes with

oxygen detection by the sensors such that they are not reliable and often read low (less oxygen than actually present) with a hydrogen concentration greater than 10 percent.

Available information was inconclusive regarding the accuracy of the sensors in a high hydrogen concentration environment. Testing was performed using a calibration gas containing two and four percent oxygen in an environment containing 20 and 30 percent hydrogen by volume with the balance being nitrogen. The testing results indicated that in a hydrogen environment of 30 percent by volume, the instrument inaccuracy for oxygen could be as high as two percent oxygen concentration (i.e., four percent oxygen present, but instruments indicate two percent oxygen concentration).

On October 6, 1993, the TRG concluded that although all TS surveillance requirements were met, the oxygen analyzers in a high hydrogen environment may not meet TS alarm and trip setpoint requirements. Since the hydrogen environment in the gas decay tanks often exceeded ten percent, the TRG conservatively determined that the oxygen analyzer uncertainties have exceeded setpoint requirements necessary to meet TS 3.11.2.5. Therefore, the action requirements of TS 3.3.3.10 have not been met in that, with no channels operable, grab samples have not been collected at least once per four hours and analyzed within the following four hours.

D. Inoperable Structures, Components, or Systems that Contributed to the Event:

None.

E. Dates and Approximate Times for Major Occurrences:

1. July 1979: Sensors for ANR 75 and 76 were installed.

2. September 30, 1993: ANR 75 and 76 were declared inoperable. TS 3.3.3.10 Action b requirements were met by taking grab samples on a four-hour basis.

3. October 6, 1993: Discovery date. The TRG determined that the condition was a TS violation.

F. Other Systems or Secondary Functions Affected:

None.

G. Method of Discovery:

On October 6, 1993, the TRG determined that DCPP may have operated in a condition where ANR 75 and 76 could not meet the functional requirements of TS 3.3.3.10 even though the TS surveillance requirements for operability were met.

H. Operator Actions:

ANR 75 and 76 were declared inoperable. TS 3.3.3.10 Action b requirements were met by taking grab samples on a four-hour basis and analyzing them within the following four hours.

I. Safety System Responses:

None.

III. Cause of the Event

A. Immediate Cause:

Uncertainty due to hydrogen gas interference with the oxygen sensors was substantially more than expected or allowed in setpoint determinations.

B. Root Cause:

Personnel error, cognitive, in that the purchase documents and related correspondence did not specify the sample stream mixture components or what percentage concentration these components would be present in an average sample.

IV. Analysis of the Event

Dual cell oxygen analyzers (ANR 75 and 76) are provided downstream of the waste gas compressors as a design feature to ensure that flammable mixtures do not form in the GRS during normal plant operation. ANR 75 and 76 provide indication [WE][AI], alarm [WE][ALM] and control [WE][AC] for the waste gas stream entering a GDT. The analyzers alarm setpoint is 1.2 percent oxygen by volume, which is well below the four percent oxygen limit of TS 3.11.2.5. Following this alarm, operators are required to reduce the oxygen concentration below two percent oxygen by volume within 48 hours. If the oxygen concentration in the waste gas stream reaches the 3.2 percent oxygen by volume setpoint, the waste gas compressors are tripped automatically and addition of waste gases to GRS is suspended.

Testing has been performed to determine the estimated in-service accuracy of the oxygen analyzers. The testing results indicate that for a hydrogen environment of 30 percent, the alarm function would actuate prior to

reaching 4.1 percent oxygen concentration. In addition, the automatic waste gas compressor trip function would actuate prior to reaching the explosive limit of 6.1 percent oxygen concentration. The alarm annunciator [IB][ANN] response procedure requires that the oxygen concentration be reduced to less than two percent by volume. TS 3.11.2.5 Action a allows 48 hours to reduce the oxygen below two percent concentration by volume.

The GRS is designed to avoid excess oxygen concentration accumulation during normal operation by positive pressurization with nitrogen cover gas in all vessels and the vent header, which precludes atmospheric air from entering the GRS. Thus, normal operation is not expected to result in situations exceeding four percent oxygen concentration in the GRS. However, certain plant evolutions or changes (e.g., forced oxygenation during an outage), might cause localized exceedances and would be responded to as noted above, limiting any potentially flammable mixture.

Even if a flammable mixture could have existed in a GDT, there would have been no hot spots or other internal sources to cause ignition. Furthermore, the rupture of a single GDT would be the bounding worst-case scenario if an explosive mixture existed in a GDT and if an ignition source were introduced. The worst consequence of such a postulated rupture is a radioactive release, which has been analyzed in Chapter 15 of the DCPP FSAR. Using the highest total reactor coolant system [AB] noble gas inventory historically measured at DCPP, the resultant whole body doses at the Exclusion Area Boundary and Low Population Zone are less than 1.1 percent of the rupture case analyzed in Chapter 15 and less than 0.1 percent of the 10 CFR 100 whole body limit of 25 rem.

Therefore, the inoperable oxygen analyzers did not adversely affect the public health and safety.

V. Corrective Actions

A. Immediate Corrective Actions:

1. Due to the importance of monitoring explosive mixtures within the GRS and because ANR-75 and 76 are currently inoperable, the immediate action is to continue to take and analyze grab samples in accordance with TS 3.3.3.10.

2. Implement a design change to replace the existing waste gas oxygen analyzers and associated loop instruments.

3. Verify that other Category 1B continuous monitoring instruments do not have a similar problem.

B. Corrective Actions to Prevent Recurrence:

Significantly improved engineering procedures, checklists, and guidelines (since the 1979 timeframe) should adequately preclude this event from happening again. Design changes are now prepared in accordance with Inter-Departmental Administrative Procedure (IDAP) CF3.ID9, "Design Change Package Development", which requires that design changes be prepared, checked, approved, and documented in a thorough and consistent manner.

VI. Additional Information

A. Failed Components:

None.

B. Previous LERs on Similar Problems:

None.

C. Related Information:

Manufacturer's data for the oxygen analyzers are listed below:

Component:	Oxygen Analyzer
Manufacturer:	Leeds & Northrup
Model Number:	7863
Type:	Thermomagnetic Oxygen Analyzers