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 FACIL:STN-50-528 Palo Verde Nuclear Station, Unit 1, Arizona Publi 05000528  
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 RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 93-008-00:on 930224,gaseous radwaste sys oxygen monitor  
 out of svc for 18 days due to random component failure.  
 Updated GRS explosive gas monitoring sys.W/930729 ltr.

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05000528

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**Arizona Public Service Company**  
PALO VERDE NUCLEAR GENERATING STATION  
P.O. BOX 52034 • PHOENIX, ARIZONA 85072-2034

JAMES M. LEVINE  
VICE PRESIDENT  
NUCLEAR PRODUCTION

192-00856-JML/TRB/KR  
July 29, 1993

U. S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Mail Station P1-37  
Washington, D.C. 20555

Dear Sirs:

**Subject: Palo Verde Nuclear Generating Station (PVNGS)**  
**Unit 1**  
**Docket No. STN 50-528 (License No. NPF-41)**  
**Licensee Event Report 93-008-00**  
**File: 93-020-404**

Attached please find Licensee Event Report (LER) 93-008-00 prepared and submitted pursuant to 10CFR50.73. This LER reports a condition prohibited by Unit 1 Technical Specifications Limiting Condition for Operation (TS LCO) 3.3.3.8 for the Gaseous Radwaste System Explosive Gas Monitoring System. The TS LCO 3.3.3.8 ACTION to perform daily grab samples, with less than the minimum number of explosive gas monitoring instrumentation channels OPERABLE, was not completed. In accordance with 10CFR50.73(d), a copy of this LER is being forwarded to the Regional Administrator, NRC Region V.

If you have any questions, please contact T. R. Bradish, Manager, Nuclear Regulatory Affairs, at (602) 393-5421.

Sincerely,



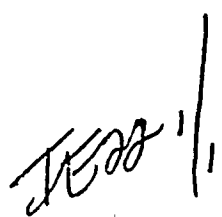
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09-128

Attachment

cc: W. F. Conway (all with attachment)  
B. H. Faulkenberry  
J. A. Sloan  
INPO Records Center

9308100004 930729  
PDR ADDCK 05000528  
S PDR



# LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) <b>Palo Verde Unit 1</b>	DOCKET NUMBER (2) <b>0   5   0   0   0   5   2   8</b>	PAGE (3) <b>1   OF   0   7</b>
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TITLE (4)  
**Gaseous Radwaste System Oxygen Monitor out of service for 18 days**

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)			
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES		DOCKET NUMBER(S)	
0	2	2	4	9	3	9	3	0	0	8	0	0
0	2	2	4	9	3	9	3	0	0	7	2	9
									N/A	0   5   0   0   0   0   0   0		
									N/A	0   5   0   0   0   0   0   0		

OPERATING MODE (9) <b>1</b>		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)									
POWER LEVEL (10) <b>1   0   0</b>	20.402(b)			20.405(c)			50.73(a)(2)(iv)			73.71(b)	
	20.405(a)(1)(i)			50.36(c)(1)			50.73(a)(2)(v)			73.71(c)	
	20.405(a)(1)(ii)			50.36(c)(2)			50.73(a)(2)(vi)			OTHER (Specify in Abstract below and in Text, NRC Form 366A)	
	20.405(a)(1)(iii)			50.73(a)(2)(i)			50.73(a)(2)(vii)(A)				
	20.405(a)(1)(iv)			50.73(a)(2)(ii)			50.73(a)(2)(vii)(B)				
	20.405(a)(1)(v)			50.73(a)(2)(iii)			50.73(a)(2)(ix)				

LICENSEE CONTACT FOR THIS LER (12)		TELEPHONE NUMBER
NAME <b>Thomas R. Bradish, Manager, Nuclear Regulatory Affairs</b>	AREA CODE <b>6   0   2</b>	<b>3   9   3   -   5   4   2   1</b>

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)									
CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC
X	W	E	M	O	N				

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	<input checked="" type="checkbox"/> NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On April 19, 1993, Palo Verde Unit 1 was in Mode 1 (POWER OPERATION), operating at approximately 100 percent power when a PVNGS Incident Investigation evaluation determined that one of the oxygen monitors for the gaseous radwaste system (GRS) explosive gas monitoring system had been inoperable for 18 days. The evaluation determined that one of the GRS explosive gas monitoring system oxygen monitor's microprocessor had "locked up" on February 7, 1993 and the condition had remained undetected until February 24, 1993 when a Chemistry technician performing the daily channel check noticed that the monitor was not updating the display field. Upon discovery, the Chemistry technician placed the backup oxygen monitor in service in order to comply with the appropriate Technical Specifications (TS) Limiting Condition for Operation (LCO). TS LCO 3.3.3.8 requires that at a minimum two explosive gas monitoring instrumentation channels shall be OPERABLE. A follow up review of the event determined that the TS LCO 3.3.3.8 ACTION to perform daily grab samples, with less than the minimum number of channels OPERABLE, had not been completed. Therefore, from February 7, 1993 to February 24, 1993, Unit 1 was operating in a condition prohibited by TS.

The cause of the oxygen monitor's microprocessor lock-up was determined to be a random component failure. As corrective action, the chemistry technicians were instructed to ensure that the GRS explosive gas monitoring system is updating the display field during the performance of the daily channel check. There have been no previous similar events reported pursuant to 10CFR50.73.

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TEXT

**I. DESCRIPTION OF WHAT OCCURRED:**

**A. Initial Conditions:**

On April 19, 1993, Palo Verde Unit 1 was in Mode 1 (POWER OPERATION), operating at approximately 100 percent power.

**B. Reportable Event Description (Including Dates and Approximate Times of Major Occurrences):**

Event Classification: Condition prohibited by the plant's Technical Specifications.

On April 19, 1993, a PVNGS Incident Investigation evaluation determined that one of the oxygen monitors for the gaseous radwaste system (GRS) (WE) explosive gas monitoring system had been inoperable for 18 days. The evaluation determined that one of the GRS explosive gas monitoring system oxygen monitor's microprocessor had "locked up" on February 7, 1993 and the condition had remained undetected until February 24, 1993 when a Chemistry technician (utility, nonlicensed) performing the daily channel check noticed that the monitor was not updating the display field. Upon discovery, the Chemistry technician placed the backup oxygen monitor in service in order to comply with the appropriate Technical Specifications (TS) Limiting Condition for Operation (LCO). TS LCO 3.3.3.8 requires that at a minimum two explosive gas monitoring instrumentation channels shall be OPERABLE. A follow up review of the event, performed on July 9, 1993, determined that the TS LCO 3.3.3.8 ACTION to perform daily grab samples had not been completed. TS LCO 3.3.3.8 ACTION requires that with one less than the minimum number of channels OPERABLE, operation of the GRS may continue provided grab samples are taken and analyzed daily. Therefore, from February 7, 1993 to February 24, 1993, Unit 1 was operating in a condition prohibited by TS.

The GRS collects and stores potentially radioactive gases, primarily hydrogen, generated within the plant to allow for radioactive decay prior to release to the environment. The GRS includes explosive gas monitoring instrumentation to continuously monitor for buildup of an explosive gas mixture (i.e., hydrogen and oxygen). Gas analyzers (i.e., oxygen monitors) provide direct readout of oxygen concentration in the waste gas surge tank and the waste gas surge header. In order to comply with TS LCO 3.11.2 Explosive Gas Mixture, the concentration of oxygen in the GRS shall be limited to less than equal to two percent by volume.

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**TEXT**

The PVNGS Incident Investigation evaluation referenced above was initiated on February 10, 1993, when Unit 2 Instrumentation and Control (I&C) Maintenance personnel (utility, nonlicensed) performing the GRS explosive gas monitoring system calibration identified that oxygen monitor's microprocessor could "lock up" while in service and the condition could remain undetected until the next performance of the monthly functional test. The GRS explosive gas monitoring system oxygen monitor's microprocessor lock-ups which occur during calibration are expected and documented in the vendor technical manual. The oxygen monitor would not be returned to service in a locked up condition. However, if the microprocessor were to lock up while in service, oxygen levels in the GRS would not be monitored at the sample point (i.e., waste gas surge header or waste gas surge tank) and an explosive environment may exist that would exceed the alarm setpoints and remain undetected. The evaluation for the Unit 2 event included an equipment root cause of failure analysis, an equipment problem history search, and corrective action determination.

During the course of the Unit 2 evaluation, at approximately 1725 MST on February 24, 1993, a Unit 1 Chemistry technician performing the daily channel check noticed that the oxygen monitor located at the waste gas surge header (WGS)H was not updating the display field (NOTE: the technician was not aware of the ongoing evaluation in Unit 2). Upon discovery, the Unit 1 Chemistry technician aligned the backup GRS explosive gas monitoring system oxygen monitor to the WGS)H in order to comply with TS LCO 3.3.3.8 and notified the Unit 1 I&C Maintenance personnel to perform troubleshooting. Unit 1 Control Room personnel were notified via a Technical Specification Component Condition Record.

A review of the Unit 1 daily channel check surveillance testing data sheets revealed that the WGS)H oxygen monitor display field was locked in at 1536 parts per million (ppm) from February 7, 1993 to February 24, 1993. The GRS explosive gas monitoring system had been calibrated on February 5, 1993. The evaluation determined that the WGS)H oxygen monitor had been inoperable for the 18 days. The cause of the oxygen monitor locking up could not be readily determined and the monitor was returned to the vendor for further evaluation.

TS LCO 3.3.3.8 requires that at a minimum two explosive gas monitoring instrumentation channels shall be OPERABLE. The oxygen monitor located downstream at the waste gas surge tank was in service. A follow up review of the Unit 1 event determined that the TS LCO 3.3.3.8 ACTION to perform daily grab samples had not been completed. TS LCO 3.3.3.8 ACTION requires that with one less

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TEXT

than the minimum number of channels OPERABLE, operation of the GRS may continue provided grab samples are taken and analyzed daily. Therefore, from February 7, 1993 to February 24, 1993, Unit 1 was operating in a condition prohibited by TS.

- C. Status of structures, systems, or components that were inoperable at the start of the event that contributed to the event:

The GRS explosive gas monitoring system oxygen monitor's microprocessor was determined to be in a "locked up" condition for approximately 18 days from February 7, 1993 to February 24, 1993. During this period, oxygen levels in the waste gas surge header were not monitored. However, the oxygen monitor located downstream at the waste gas surge tank was still in service. There was no indication of an explosive environment in the GRS during this period.

- D. Cause of each component or system failure, if known:

The oxygen monitor is controlled by a microprocessor. As documented in the vendor technical manual, several external conditions can cause the microprocessor firmware (i.e., operating programs) to initiate an "endless loop." These external conditions include problems with peripheral hardware (i.e., unplugged sensor, printer off-line, or input and output ports disconnected during operation) and problems with exceeding specific numerical ranges, such as oxygen levels. In essence, the microprocessor will wait indefinitely for the peripheral hardware or for data within acceptable ranges.

- E. Failure mode, mechanism, and effect of each failed component, if known:

When the oxygen monitor's microprocessor initiates an "endless loop," it can no longer perform other functions related to oxygen monitor operation and "locks up." The monitor is incapable of sampling oxygen levels, alarming if the setpoint has been exceeded, or updating the display field.

- F. For failures of components with multiple functions, list of systems or secondary functions that were also affected:

Not applicable - no failures of components with multiple functions were involved.



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**TEXT**

- G. For a failure that rendered a train of a safety system inoperable, estimated time elapsed from the discovery of the failure until the train was returned to service:

Not applicable - no failures that rendered a train of a safety system inoperable were involved.

- H. Method of discovery of each component or system failure or procedural error:

As discussed in Section I.B, the inoperable oxygen monitor was found during the performance of the surveillance requirement for a daily channel check. There were no procedural errors which contributed to this event.

- I. Cause of Event:

An evaluation was initiated in accordance with the PVNGS Incident Investigation Program to determine the cause of the event. As discussed in Sections I.D and I.E, the vendor technical manual documents several external conditions that can cause the microprocessor firmware (i.e., operating programs) to initiate an "endless loop." When the oxygen monitor's microprocessor initiates an "endless loop," it can no longer perform other functions related to oxygen monitor operation and "locks up." The monitor is incapable of sampling oxygen levels, alarming if the setpoint has been exceeded, or updating the display field.

The evaluation determined that the problem of the oxygen monitor locking up while in service was not common to the three units; The Chemistry technicians in Units 2 or 3 had no known occurrences of the oxygen monitor locking up while in service. The specific cause of the lock-up was not determined. The most likely cause was some type of problem with the peripheral hardware. The vendor stated that Palo Verde was their only customer experiencing the unexplained lock-ups. The monitor was returned to the vendor for further evaluation. The oxygen monitor failure was determined to be a random component failure (SALP Cause Code E: Component Failure). If information is developed which would affect the readers understanding or perception of this event, a supplement will be submitted to describe the final root cause of failure.

No unusual characteristics of the work location (e.g., noise, heat, poor lighting) directly contributed to this event. There were no procedural or personnel errors which contributed to this event.



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TEXT

**J. Safety System Response:**

Not applicable - there were no safety system responses and none were necessary.

**K. Failed Component Information:**

The gas analyzers (i.e., oxygen monitors) are manufactured by Orbisphere Labs. The model number is 2641.

**II. ASSESSMENT OF THE SAFETY CONSEQUENCES AND IMPLICATIONS OF THIS EVENT:**

Following the discovery that the oxygen monitor located at the waste gas surge header (WGSB) was not updating the display field, the Chemistry technician placed the backup WGSB oxygen monitor in service and verified that the concentration of oxygen did not exceed the TS limits. The GRS explosive gas monitoring system oxygen monitor's microprocessor was determined to be in a "locked up" condition for approximately 18 days from February 7, 1993 to February 24, 1993. Although the oxygen levels in the waste gas surge header were not monitored during this period, the oxygen monitor at the waste gas surge tank was still in service and there was no indication of an explosive environment in the GRS during this period. The event did not result in any challenges to the fission product barriers or result in any releases of radioactive materials. Therefore, there were no other adverse safety consequences or implications as a result of this event. This event did not adversely affect the safe operation of the plant or the health and safety of the public.

**III. CORRECTIVE ACTION:**

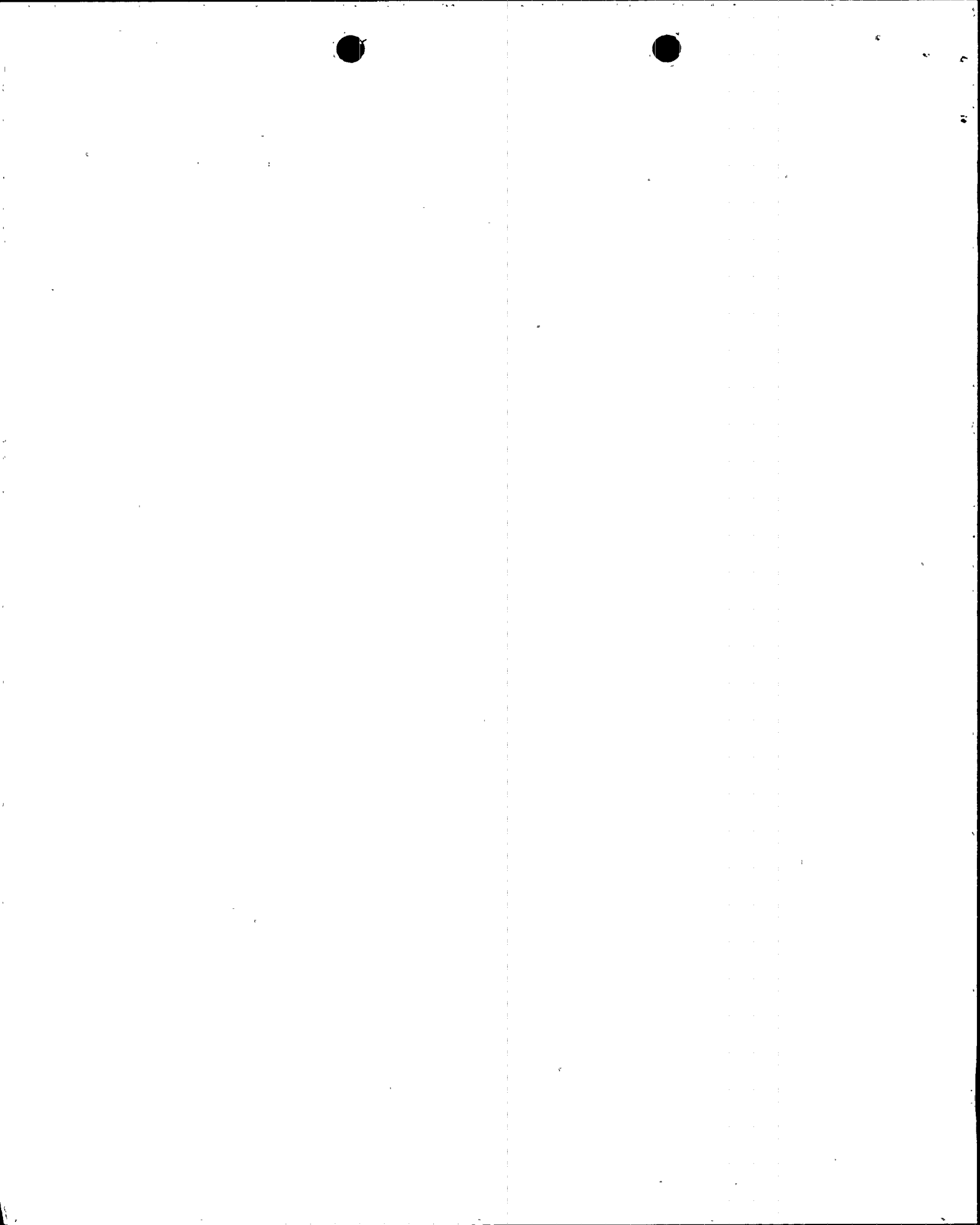
**A. Immediate:**

The chemistry technicians were instructed to ensure that the GRS explosive gas monitoring system is updating the display field during the performance of the daily channel check surveillance testing.

**B. Action to Prevent Recurrence:**

The oxygen monitor was returned to the vendor for further evaluation.

The GRS explosive gas monitoring system channel check testing procedure has been revised to include the verification of the system operability by ensuring that the display field is updating.



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**IV. PREVIOUS SIMILAR EVENTS:**

No other previous events have been reported pursuant to 10CFR50.73.

**V. ADDITIONAL INFORMATION:**

When the evaluation was completed on April 19, 1993, an action to perform a follow up review of the event for reportability was assigned to the Nuclear Regulatory Affairs department. Because the unit was placed in compliance with TS LCO 3.3.3.8 upon discovery of the inoperable oxygen monitor by placing the backup oxygen monitor in service, there were no immediate operability concerns and a ninety day review period was given to perform a reportability determination. The personnel involved with the assignment of the ninety day review period did not recognize that the oxygen monitor had been inoperable for 18 days prior to placing the backup monitor in service and therefore did not recognize that a condition prohibited by the plant's TS had occurred. The personnel involved have been counseled on their responsibility for timely reportability reviews. On July 9, 1993, the follow up review was performed and the event was determined to be reportable.

