

**Omaha Public Power District**

P.O. Box 399 Hwy. 75 - North of Ft. Calhoun Fort Calhoun, NE 68023-0399  
402/636-2000

March 15, 1993  
LIC-93-0054

U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Mail Station P1-137  
Washington, DC 20555

References: 1. Docket No. 50-285  
2. LER 92-029 Revision 00 from OPPD (W. G. Gates) to NRC  
(Document Control Desk) dated November 6, 1992 (LIC-92-262L)  
3. Letter from OPPD (W. G. Gates) to NRC (Document Control Desk)  
dated February 10, 1993 (LIC-93-0018)

Gentlemen:

Subject: Licensee Event Report 92-029 Revision 01 for the Fort Calhoun  
Station

Please find attached Licensee Event Report 92-029 Revision 01 dated  
March 15, 1993. This revision provides supplemental information regarding  
exposure calculations and results, root cause analyses and corrective actions.  
Revisions to the Abstract and Text are denoted by vertical lines in the right  
margin.

This report is being submitted voluntarily. Reference 3 also provides  
information regarding this event and associated corrective actions. It should  
be noted that Corrective Action 3 of the attached report provides a minor  
clarification to a Reference 3 corrective action regarding letdown filter  
assemblies. If you should have any questions, please contact me.

Sincerely,

*W. G. Gates*

W. G. Gates  
Vice President

WGG/jrg

Attachment

c: J. L. Milhoan, NRC Regional Administrator, Region IV  
S. D. Bloom, NRC Project Manager  
R. P. Mullikin, NRC Senior Resident Inspector  
INPO Records Center

*JE28*

## LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)

Fort Calhoun Station Unit No. 1

DOCKET NUMBER (2)

05000285

PAGE (3)

1 OF 7

TITLE (4)

Intake of Radioactive Material

EVENT DATE (5)			LER NUMBER (6)			REPORT NUMBER (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
04	16	92	92	-- 029 --	01	03	15	93	FACILITY NAME	DOCKET NUMBER
										05000
									FACILITY NAME	DOCKET NUMBER
										05000
OPERATING MODE (9)		5	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
POWER LEVEL (10)		000	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)(vii)		X OTHER	
			20.405(a)(1)(iii)		50.73(a)(2)(i)		50.73(a)(2)(viii)(A)		(Specify in Abstract below and in Text, NRC Form 366A)	
			20.405(a)(1)(iv)		50.73(a)(2)(ii)		50.73(a)(2)(viii)(B)			
			20.405(a)(1)(v)		50.73(a)(2)(iii)		50.73(a)(2)(x)		Voluntary Report	

## LICENSEE CONTACT FOR THIS LER (12)

NAME

Kenneth E. Steele, Acting Sup.-Rad. Health &amp; Engr.

TELEPHONE NUMBER (Include Area Code)

(402) 533-7159

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRPDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRPDS

## SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE)	X	NO	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR

## ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On April 16, 1992 a Maintenance Work Order was performed to change out the Chemical and Volume Control System Letdown Purification Filters CH-17A and B. During the course of this work a Radiation Protection Technician, responding to a heat stress situation involving two workers, received an unanticipated intake of radioactive materials.

This intake is of interest in that transuranics (i.e., elements with an atomic number greater than that of uranium), along with activation and fission products were taken into the body. A calculated exposure of 366 Maximum Permissible Concentration-Hours (MPC-Hrs) was originally determined, which is less than the 10 CFR 20 limit of 520 MPC-Hrs/Quarter. Subsequent calculations indicate that the exposure assigned should be 46 MPC-Hrs. This LER is being submitted as a voluntary report.

The root causes of the event were found to relate to the filter design not facilitating changing of the filters, deficiencies in the method used to change the filters, delays which allowed the filter media to become relatively dry, and incomplete evaluation of the radiological hazard.

Corrective actions include revisions to Maintenance and Radiation Protection procedures, and changing the filter design.

**LICENSEE EVENT REPORT (LER)**  
**TEXT CONTINUATION**

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		92	-- 029 --	01	

TEXT (If more space is required, use additional copies of NRC Form 388A) (17)

**BACKGROUND**

The Chemical and Volume Control System (CVCS) Letdown Purification Filters (CH-17A and CH-17B) are designed to filter impurities from the Reactor Coolant System. These filters perform this function by trapping and retaining particulate contaminants on the filter media. The used filters are normally replaced, during refueling outages, in a wet condition to minimize the spread of contamination.

**EVENT DESCRIPTION**

The Fort Calhoun Station (FCS) was shut down for a normal refueling and maintenance outage on February 1, 1992. Maintenance Work Order (MWO) 914222 was written to change Letdown Purification Filters CH-17A and B. These filters had not been changed for two operating cycles. Per Engineering Change Notice (ECN) 91-228, the MWO was to replace the existing 5 micron filters with 2 micron filters to reduce the radiological source term. The filters were taken out of the system lineup on April 1, 1992 and the MWO was released from Operations to work. Pre-job surveys were performed by the Radiation Protection (RP) Department and an "As Low As is Reasonably Achievable" (ALARA) planning review was completed. A Radiation Work Permit was generated to support this task and an ALARA briefing was held on April 2, 1992, just prior to the work crew beginning the task.

The task was started and the work crew discovered that they could not remove the shielding above the filter housings due to an error in the procedure. The job was delayed until a proper procedure revision could be obtained. The second attempt to complete the task was delayed when extended core inserts, which were required to hold the new filter elements in place, were not available (an ALARA briefing was conducted prior to this second attempt to do the work). These extended core inserts had to be ordered and receipt inspected in the Warehouse prior to the job proceeding.

On April 16, 1992, a third ALARA briefing was conducted and the work resumed. The used filters (which had become relatively dry since the system had been drained) were removed by the work crew and placed into drums which were sealed and then taken to a storage area. An RP Technician was assigned the responsibility of escorting the sealed drums to the storage area. Since he was located outside the room where the filter change was in progress, he was not required to wear a respirator. Only the individuals working inside the filter room and above the room removing shielding were in respiratory equipment. This included three Pressure Equipment Craftspersons, a Quality Control Inspector, a Radioactive Waste Technician and another RP Technician who was in the room performing job coverage.

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TEXT (If more space is required, use additional copies of NRC Form 305A) (17)

The RP Technician outside the room had successfully escorted the used filters to the storage area and returned to the filter room expecting to see the workers exiting the area. He approached the step off pad to the Highly Contaminated Area (HCA) and noticed two workers in obvious physical stress due to heat exhaustion. The work had been performed in a highly contaminated area and the workers had been dressed in double layers of protective clothing which included plastic suits. He assisted in the removal of the outer layer of protective clothing and the respirators and escorted the two workers out of the immediate area. He later returned to the step off pad and assisted the other RP Technician in removing bags of trash, clothing, tools, and respirators from the HCA. It is suspected that he inhaled/ingested the radioactive material while assisting in the removal of protective clothing or while assisting in the transfer of trash and protective clothing across the step off pad.

Upon exiting the Radiation Controlled Area (RCA) the RP Technician caused a portal monitor to alarm. He was attended to in the RP Count Room where positive nasal smears were detected and an initial decontamination was performed. He was then taken to the Whole Body Counter for a series of Whole Body Counts. The results of air samples taken in the filter room were completed and indicated the presence of alpha emitting nuclides. As required by Fort Calhoun Station procedures, a series of bioassay samples were collected. A total of four urine samples and one fecal sample were collected over the following five days. These samples were sent to an independent laboratory for analysis. Initial exposure calculations were performed to determine exposure in Maximum Permissible Concentration-Hours (MPC-Hrs) per 10 CFR 20 Appendix B. The ratios of alpha to gamma emitting isotopes from previously measured waste streams were used as the basis for the calculations. An initial estimate of approximately 45 MPC-Hrs was determined pending the results of the bioassay samples. This is below the 10 CFR 20 limit of 520 MPC-Hrs/Quarter.

**EVALUATION/SAFETY ASSESSMENT**

The results of the bioassay samples were received on July 16, 1992. These results showed that the RP Technician had potentially been exposed to airborne contamination levels higher than expected. The calculations, based on the results of the urine samples only, indicated that the exposure had potentially exceeded the 520 MPC-Hrs/Quarter regulatory limit. The samples indicated the presence of Americium 241, Curium 242, Curium 243/244, Plutonium 238, Plutonium 239/240, and Plutonium 242. The ratio of these transuranics was different than had been measured in smear samples taken at FCS in December 1985.



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TEXT (If more space is required, use additional copies of NRC Form 356A) (17)

An effort was then initiated to determine the exact exposure. Two experts in the field of Internal Dosimetry were retained to assist the Omaha Public Power District (OPPD) in the evaluation. The NRC was briefed on the investigation and apprised of intended actions. Contacts were made with several nuclear utilities and several Department of Energy (DOE) facilities that routinely handle transuranics. Data was input into several commercially available internal dosimetry models to obtain upper and lower bounding values for the exposure.

The most appropriate calculation of the exposure was obtained using a combination of urine, fecal and whole body count data. Based on the guidance of NUREG/CR4884, an exposure of 366 MPC-Hrs was calculated. This was determined to be the best estimate with respect to regulatory models using the data available at the time, and this exposure was preliminarily assigned to the individual. Seven other individuals involved in the job were assigned calculated exposures ranging from 3.854 to 11.552 MPC-Hrs. Additional assessments were completed, taking into account the respirable/non-respirable fraction of the intake. As a result of those assessments, the 366 MPC-Hrs preliminarily assigned to the RP Technician was revised, and 46 MPC-Hrs were assigned for the exposure.

This LER is being submitted as a voluntary report. The intake reported in this LER is of interest in that transuranics (i.e., elements with an atomic number greater than that of uranium), along with activation and fission products were taken into the body. The calculated exposure value of 46 MPC-Hrs is less than the regulatory limit of 520 MPC-Hrs/Quarter, but exceeded a FCS administrative limit of 40 MPC-Hrs/Week. It should be noted that several internal dosimetry experts were in agreement that the actual exposure was much less than the preliminary value of 366 MPC-Hrs initially assigned to the individual and concur with assigning 46 MPC-Hrs as the best estimate of the true exposure.

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**CONCLUSIONS**

Two Root Cause Analyses, the first focusing on the intake event itself and the second focusing on the radiological work practices and the job coverage provided by RP personnel, were performed as a result of the event. The first Root Cause Analysis identified three root causes:

The filter design does not facilitate easily changing the filters,

The method used to change the filters promotes the spread of contamination and physical stress of the workers, and

The CVCS system was drained for maintenance and then the filter maintenance was delayed. This allowed the filter media to become relatively dry, allowing the contaminants to become re-suspended.

Failure to have all of the parts available to perform the job led to delays in completing the task. The accompanying procedures were not correct and required procedure changes, which added to delays. The ALARA planning work package was not evaluated for changing radiological conditions or the consequences of the filters drying as the work was delayed.

This event could have been prevented if the job had been completed without delays experienced in performing the task or if procedures had been written to accommodate potential delays in performing the task.

The second Root Cause Analysis determined the root cause of the event to be an incomplete evaluation of the radiological hazard associated with the CH-17A and B filter change out for the given conditions.

**CORRECTIVE ACTIONS**

The following corrective actions have been or will be completed:

1. Procedure RP-301, "ALARA Job Reviews" was revised to include guidance for reviewing the work plan when work is delayed. Procedure RP-201, "Radiation Work Permits" was also revised to provide guidance for reviewing the Radiation Work Permit when work is delayed.

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2. Procedure PE-RR-CH-0200, "Removal and Disposal of CH-17A and CH-17B Filter Cartridges," has been revised to ensure that the CH-17A and CH-17B filters are kept wet until change-out. This will reduce the potential for airborne radioactivity.
3. As a result of an evaluation, Engineering has recommended changing CH-17A and CH-17B to a single or dual filter cartridge assembly in each filter housing. An Engineering Change Notice has been initiated to accomplish this task. This will simplify filter changes and limit the potential for airborne radioactivity and the spread of contamination. This will be completed during the 1993 Refueling Outage.
4. A procedure review program (92-002-RP) has been established for the Radiation Protection Department. This on-going required reading program will ensure timely review of pertinent RP procedures by personnel in the department. This program is intended to keep the RP Technicians familiar with the numerous RP procedures. This action should result in increased attention to detail by RP personnel.
5. Procedure RP-AD-200, "Radiation Protection Surveillance Program Administrative Procedure," has been revised to include specific "Stop Work Authority" for the RP Technicians. Additionally, RP Technicians have been trained on this "Stop Work Authority."
6. RP management will establish written guidance for RP involvement on infrequently performed activities in high radiation areas/very high radiation areas. This will be completed by May 1, 1993. This action should result in increased attention to detail by RP personnel.
7. The training for new RP Technicians will be evaluated for its content and effectiveness as it applies to this event to determine if additional training is warranted. This will be completed by June 1, 1993.
8. A communications/interface team assessment for all Radiation Protection exempt personnel has been completed. The recommendations from this assessment will be presented to OPPD management and implemented by September 1, 1993.
9. An RP procedure will be written for change-out of primary system filters by September 1, 1993. This new procedure will address RP requirements when changing various primary system filters.

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**PREVIOUS SIMILAR EVENTS**

No previous events involving intake of transuranics have been identified.