

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-278/85-31

Docket No. 50-278

License No. DPR-56 Priority - Category C

Licensee: Philadelphia Electric Company
2301 Market Street
Philadelphia, Pennsylvania 19101

Facility Name: Peach Bottom Atomic Power Station, Unit 3

Inspection At: Delta, Pennsylvania

Inspection Conducted: August 6-7, 1985

Inspectors: J. J. Kottan
J. J. Kottan, Radiation Laboratory Specialist

9/16/85
date

Robert J. Beall
J. E. Beall, Project Engineer

9/16/85
date

Approved by: W. J. Pasciak
W. J. Pasciak, Chief, BWR Radiological
Protection Section

9/17/85
date

Inspection Summary:

Inspection on August 6-7, 1985 (Inspection Report No. 50-278/85-31)

Areas Inspected: Nonroutine, unannounced inspection of allegation RI-85-A-0084 involving a potential overexposure during an unplanned reactor shutdown of Unit 3 on March 1, 1985. The inspection involved 20 inspector hours on-site by two NRC regionally-based inspectors.

Results: No violations were identified. No individual appeared to have received doses in excess of regulatory limits.

DETAILS

1. Individuals Contacted

- *R. Fleischmann, Manager, Peach Bottom Atomic Power Station
- *A. Hilsmeir, Senior Health Physicist

*Denotes those present at the exit interview.

The inspector interviewed other personnel not identified in the report for reasons of confidentiality.

2. Background

On August 2, 1985, Region I received an allegation regarding a potential overexposure during an unplanned Unit 3 shutdown on March 1, 1985. A regionally-based NRC inspector was dispatched to the site on August 6 and 7, 1985, in order to review the allegation.

Two licensee and two licensee contractor personnel entered the Unit 3 recombiner offgas tunnel at approximately 1130 hours on March 1, 1985. At initial entry, the general area radiation exposure survey meter (Eberline Instrument Company Model RO-2A air ionization chamber) readings were approximately 80-100 mR/hr as expected. During the entry, the survey meter went offscale on the 0-5 R/hr scale. When switched to the 0-50 R/hr scale, the survey meter registered approximately 5 R/hr. When the beta shield of the instrument was opened, the instrument went offscale on the 0-50 R/hr scale. All four personnel evacuated the Unit 3 recombiner offgas tunnel promptly. At approximately the same time, friskers throughout the turbine building were alarming. Licensee personnel present in the turbine building were contaminated, and particulate air samples were taken throughout the turbine building. The air sample results indicated the presence of noble gas particulate daughters: Rb-88 and Cs-138. Specific areas of the Unit 3 turbine building were cleared of personnel by the licensee and posted as airborne radiation areas. Because the personnel contamination was short lived, after sufficient decay and monitoring, personnel could leave the area and the site.

The gas releases and the changes in radiation fields were caused by a Unit 3 plant transient which occurred at 11:50 a.m. on March 1, 1985 due to the failure of the 3B offgas recombiner compressor. The equipment failure, together with air leakage into the main condenser, caused a loss of condenser vacuum. Control room operators responded to the transient by attempting to reduce power and recover condenser vacuum. These efforts were unsuccessful and the unit scrambled on loss of main condenser vacuum at 12:03 p.m. A Licensee Event Report (LER) was submitted regarding this unplanned reactor shutdown (LER No. 85-007).

3. External Exposure

The personnel entering the Unit 3 recombiner offgas tunnel were wearing two TLD badges, one which is read daily by the licensee, and one read monthly by a vendor. On March 1, 1985, the daily TLD read less than 10 mR gamma for all individuals in the recombiner offgas tunnel. With the exception of one of the four persons, the daily TLD surface dose results of March 1, 1985, were also less than 10 mR. The one exception had an apparent surface dose of 12.5 mR. The vendor TLDs for three of the four individuals were sent to the vendor on March 6, 1985, and indicated 0 surface dose and 0 gamma dose. The radiation survey meter indicated an exposure of approximately 5 R/hr, and with the beta shield open, the instrument went offscale (0-50 R/hr).

Based on interviews with personnel who were in the offgas recombiner tunnel, the inspector determined that at least one person was concerned about the discrepancy between the survey meter and the TLD results, and the potential for an overexposure. The inspector reviewed a licensee discrepancy report (85-087) which was issued regarding the difference between the survey meter and the TLD results. The instrument calibration was checked on March 5, 1985, and found to be within calibration and functioning properly. The H.P. technician who used the survey meter stated that the meter responded to a radioactive source before entry into the Unit 3 offgas recombiner tunnel.

The licensee's resolution of the discrepancy report concluded that the instrument was in error as a result of moisture and high humidity which caused the instrument to temporarily malfunction. The instrument calibration performed on March 5, 1985, was acceptable because the instrument had "dried out" by that time. The inspector could find no evidence to support this conclusion, such as moisture found inside the instrument which would cause the instrument to over-respond.

An NRC Inspection Report, (Report Nos. 50-277/85-19 and 50-278/85-15) which contained the results of performance tests of the licensee's inhouse and vendor TLDs used in their personnel dosimetry program, indicated that both the inhouse and vendor TLD systems underrespond to lower energy (Tl-204) beta radiation. Licensee personnel stated that a large part of the noble gas mixture beta energy spectrum would fall into this lower energy category. The licensee would, therefore, multiply the surface dose by a correction factor to obtain a corrected surface dose. At the time of this inspection, the licensee had yet to determine the correction factor to be used in this calculation.

The NRC inspector performed calculations based on an offgas sample taken on March 4, 1985, at 90% power. (On March 1, 1985, Unit 3 was at approximately 25% power prior to shutdown.) The calculated beta dose and the gamma dose bracket the licensee's TLD values. See Appendix A. The assumptions made by the inspector were based on the following: (1) No radioactive decay of the offgas sample, (2) dilution based on the ratio of the gamma survey meter (approximately 5 R/hr), with the beta shield closed,

to the calculated body dose of approximately 450 R/hr, and (3) dilution based on the ratio of Cs-138 concentrations in air samples taken in the turbine building to the Cs-138 concentration in the offgas sample. These ratios are approximately 100 and 100,000 respectively. Although not in equilibrium with Xe-138 (the daughter half life is greater than the parent half life), the Cs-138 air sample data was decay corrected to the counting time of the offgas vial, approximately one hour after sample time in order to approximate the dilution factor. The dilution factors give boundary conditions for the dose calculation.

4. Conclusion

Based on the results of this inspection, it appears that no licensee personnel were exposed in excess of NRC regulatory limits. The TLD gamma dose results appear to be a valid estimate of the gamma dose obtained by the individuals in the recombiner offgas tunnel. The beta doses have yet to be finalized by the licensee since the licensee has not yet decided on a final correction factor for the system underresponse. NRC calculations, based on conservative dilution factors and no radioactive decay, bracket the TLD results. The radiation survey meter appears to have been working correctly in the offgas tunnel, and the licensee's resolution of the discrepancy report appears to be incorrect. The licensee, at the time of this inspection, had no information regarding the survey instrument response in noble gas clouds including the potential for leakage into the instrument by the noble gases. The inspector stated that this issue would be an inspector follow-up item (50-278/85-31-01) until the beta dose had been finalized, the instrument response to noble gases was determined, and the release points of offgas into the offgas tunnel and the turbine building was determined.

The inspector also reviewed the results of air samples taken in the Unit 3 turbine building and noted that these values were below 10 CFR 20 MPC values. A review of the Unit 3 roof vent effluent release point for March 1, 1985, indicated an elevated release for approximately two hour period, 1230 hrs. to 1430 hrs., but within Technical Specification limits.

In addition, the inspector noted that interviewed individuals expressed concern regarding the difference between survey instrument beta results and beta results from TLDs used to measure beta dose rates for various maintenance jobs in contaminated areas. The inspector discussed the method of calibration versus the actual method of use for the survey instruments with the licensee. The inspector stated that this area would be an inspector follow-up item until the discrepancy could be resolved. (50-278/85-31-02)

5. Exit Interview

The inspector met with the licensee representatives denoted in Paragraph 1 at the conclusion of the inspection on August 7, 1985. The inspector summarized the purpose and scope of the inspection and the inspection findings.

APPENDIX A

	<u>Offgas Sample</u> <u>uCi/ml</u>		<u>pCi/m³</u>
Kr-85m	2.04E-2	=	2.04E+10
Kr-87	5.37E-2	=	5.37E+10
Kr-88	5.41E-2	=	5.41E+10
Xe-133	1.06E-2	=	1.06E+10
Xe-135	8.80E-2	=	8.80E+10
Xe-135m	1.47E-1	=	1.47E+11
Xe-138	2.51E-1	=	2.51E+11

	<u>β Skin Dose (rem/hr)</u>	<u>γ Body Dose (rem/hr)</u>
Kr-85m	3.40	2.72
Kr-87	59.57	36.24
Kr-88	14.62	90.66
Xe-133	0.37	0.36
Xe-135	18.66	18.16
Xe-135m	11.91	52.28
Xe-138	118.18	252.65
	226.64	453.08

Dose factors taken from Reg. Guide 1.109. Stay time is 1 min.

This assumes a semi-infinite cloud of offgas. This is not the case.
A dilution factor must also be considered.

Dilution factor of ~100 based on gamma survey meter readings. (See Paragraph 3)
Dilution factor of ~10⁵ based on Cs-138 air particulate values. (See Paragraph 3)

$$\text{Therefore beta skin dose} = \frac{226 \text{ Rad}}{\text{hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ min}}{1} \times \frac{1}{100} = 38 \text{ mrem}$$

$$\begin{aligned} & \text{to} \\ & = \frac{226 \text{ Rad}}{\text{hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ min}}{1} \times \frac{1}{100,000} = 0.04 \text{ mrem} \end{aligned}$$

$$\text{Gamma body dose} = \frac{453 \text{ Rem}}{\text{hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ min}}{1} \times \frac{1}{100} = 76 \text{ mrem}$$

to

$$= \frac{453 \text{ Rem}}{\text{hr}} \times \frac{1 \text{ hr}}{60 \text{ min}} \times \frac{1 \text{ min}}{1} \times \frac{1}{100,000} = 0.08 \text{ mrem}$$