

"Closed" in 88-30 + 89-27  
(was a violation)

NRC Form 308 (9-82)										U.S. NUCLEAR REGULATORY COMMISSION									
LICENSEE EVENT REPORT (LER)										APPROVED OMB NO. 3150-0104 EXPIRES 8-31-88									
FACILITY NAME (1) Waterford Steam Electric Station Unit 3										DOCKET NUMBER (2) 05000382					PAGE 13 1 OF 47				
TITLE (4) Personnel Overexposure Due To Hot Particle Contamination																			
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)					
05	16	88	88	010	000	06	16	88	N/A					0500000					
OPERATING MODE (9) 5			THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR § (Check one or more of the following): (11)																
POWER LEVEL (10) 01010			20.402(a)			20.406(a)			50.73(a)(2)(i)			73.71(b)							
			20.406(a)(1)(i)			50.36(a)(1)			50.73(a)(2)(iv)			73.71(c)							
			20.402(a)(1)(ii)			50.36(a)(2)			50.73(a)(2)(vii)			OTHER Specific to Abstract Below and in Text NRC Form 356A							
			20.406(a)(1)(iii)			50.73(a)(2)(i)			50.73(a)(2)(viii)(A)										
			20.406(a)(1)(iv)			50.73(a)(2)(iv)			50.73(a)(2)(viii)(B)										
			20.406(a)(1)(v)			50.73(a)(2)(ii)			50.73(a)(2)(ix)										
LICENSEE CONTACT FOR THIS LER (12)										TELEPHONE NUMBER									
NAME W.T. LaBonte, Radiation Protection Superintendent										AREA CODE 5104									
										464-3149									
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									
SUPPLEMENTAL REPORT EXPECTED (14)										EXPECTED SUBMISSION DATE (15)									
YES (If yes, complete EXPECTED SUBMISSION DATE)										NO									
ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines): (16)																			
<p>Two instances of skin exposure in excess of 10CFR20 limits were discovered at 1535 hours on May 16, 1988, and 0645 hours on May 18, 1988, while Waterford Steam Electric Station Unit 3 was in cold shutdown. Both of the individuals were assisting with work performed in the reactor cavity from the +46 foot level of the Reactor Containment Building (RCB). The source of the first particle was most likely the personnel basket used for entry or exit from the cavity. The first individual had climbed on the basket to unlatch it from the crane. The source of the second particle most likely was a rope used to guide equipment being moved in the cavity. The second individual was handling the rope which probably became contaminated during prior use. Both exposures to the skin of the whole body of 22.2 and 17.6 Rem are reportable since they exceed the 7.5 Rem/Quarter limit.</p> <p>The root cause of both events was personnel error since Health Physics personnel did not establish the work areas as hot particle zones during cavity evolutions. Both individuals were decontaminated and hot particle controls in the affected areas were elevated. The particles were contained within the Radiologically Controlled Area (RCA) and exposure was limited to the two personnel. Thus, there was no health hazard to the general public.</p>																			

All

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TEXT (If more space is required, use additional NRC Form 386A's) (17)

At 1535 hours on May 16, 1988, Waterford Steam Electric Station Unit 3 was in cold shutdown when a contract worker exiting the Reactor Containment Building (RCB) (EIIS Identifier NH) alarmed the Personnel Contamination Monitor (PCM-1) (EIIS Identifier IL-MON) due to a radioactive particle on the skin of his inner left thigh. He proceeded to the -4 foot level Health Physics (HP) control point where he was successfully decontaminated. The exposed individual had been working on the +46 foot elevation of the RCB and was assisting in the movement of the personnel basket. The personnel basket was being used to lower workers to the bottom of the highly contaminated reactor cavity. Upon completion of their work, the workers returned to the basket and were raised back up to the +46 foot level where they exited via the refueling bridge. The exposed individual then followed the contaminated basket to a laydown area on the +46 foot level and unhooked it from the Bridge Crane (EIIS Identifier LR-CRN). He then left the refueling bridge area and assisted in the landing of material boxes in another area of the +46 foot level. The individual then exited containment and his contamination was promptly discovered. As a result of this incident, the Health Physics Shift Control Technician had the personnel basket and the area surrounding it roped off as a known (zone 3) hot particle area.

An initial dose assessment was based on the individual's estimated time from unhooking the basket to his time of decontamination (30 minutes) and a hand-held frisker's response to the particle (60,000 counts per minute). This resulted in an estimated dose of 810 mrem to the skin of the whole body. Although this exposure was significantly less than 7.5 Rem per quarter dose allowed by 10CFR20.101, the individual's dosimetry was pulled until a more formal dose evaluation could be performed. The individual was successfully decontaminated and exited the Radiologically Controlled Area (RCA). It was determined at this time that he had not exceeded any of the limits of 10CFR20. Other personnel working in containment had received exposures from particles which appeared to be higher (1 to 4 Rem skin dose), so their dose assessments were assigned a higher priority for detailed evaluation. This individual's dose was reassessed after the next incidence of overexposure on May 18, 1988, and was determined to be reportable on May 27, 1988.

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TEXT (If more space is required, use additional NRC Form 302A's) (17)

At 0645 hours on May 18, 1988, Waterford Steam Electric Station Unit 3 was in cold shutdown when a second contractor exiting the RCB alarmed the PCM-1 due to a radioactive particle on the skin of his upper left abdomen. The individual proceeded to the -4 foot level HP control point where he was successfully decontaminated at 0705 hours. This technician had been working on the south end of the +46 foot level of the reactor cavity assisting with the movement of the In-Core Instrumentation (ICI) Shroud Housing (EIIIS Identifier IG-SPT). His job was to steady the movement of the ICI Shroud and guide the shroud by use of a "tag" rope as it was lifted. The actual performance of this task took only a few minutes. The "tag" rope could have become contaminated during prior use in the reactor cavity and is the most likely source of this particle.

An initial dose estimate based on a duration of 3 hours and a hand-held frisker probe response of 100,000 counts per minute resulted in an estimated skin exposure of 8.1 Rem. This exposure exceeded the allowable quarterly skin dose limit of 7.5 Rem stated in 10CFR20.101. The individual was decontaminated, exited the RCA, and his dosimetry was pulled until a more complete evaluation was performed. Following this occurrence, contamination controls on the +46 foot level of the RCB and inside the reactor cavity were evaluated and upgraded.

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U.S. NUCLEAR REGULATORY COMMISSION

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TEXT (If more space is required, use additional NRC Form 365A's) (17)

During the formal evaluation of both exposures, all available sources of documentation were used to pinpoint possible exposure duration. Since neither individual actually entered the reactor cavity, their names would not appear on the hot particle log for the cavity. The crews who they worked with entered the reactor cavity, and documentation of their entry was used to conservatively estimate particle exposure times. Exposure times of two and two-and-one-half hours respectively were determined for the individuals. In addition, it was conservatively assumed that the particles immediately migrated through the exposed individual's protective clothing and were deposited on the skin. Gamma isotopic analysis of the particles from each event was performed by using an intrinsic germanium detector linked to a multichannel analyzer. Total particle activities were determined to be 2.12 and 1.32 microcuries, respectively. As a result of this formal dose assessment, required by procedure HP-2-101, "Dosimetry Problem Reports", the doses were set at 22.2 and 17.6 rem, respectively, to a one square centimeter area of the skin at a depth of seven milligrams per square centimeter. This exposure was determined using the VARSKIN code for skin dose estimation from hot particles. Both events are reportable since both individuals received exposures to the skin of the whole body in excess of the 10CFR20 limit. Information required by 10CFR20.405(b) is contained on Attachment (1) to this report.

Following the discovery of the source of the second individual's contamination, work was curtailed in the area surrounding the reactor cavity until extensive hot particle surveys could be completed. The entire +46 foot level of the RCB and the top portion of the reactor cavity were surveyed. As a result of the surveys, nine hot particles were found. Most of these particles were found in the cavity and the remainder were on the Refueling Bridge (EIIIS Identifier DF). During the refueling outage, this area was separated from the rest of the +46 foot RCB by temporary herculite barriers erected for hot particle control. The area had alternated between zone 2 and zone 3 hot particle control requirements during the outage according to survey results and work performed in the area. Zone 2 areas are "buffer" zones and are maintained free of hot particles. As "buffer" zones, they have the potential of becoming contaminated. Zone 3 areas are known or suspected to be contaminated with hot particles.

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

Hot particle surveys are performed twice per shift in zones 2 and 3 during maintenance or operational activities. In addition, personnel working in zone 3 areas are periodically monitored for hot particles and are logged into and out of the zone 3 areas. In both events, the contaminated individuals were working in areas demonstrated to be free of hot particles during prior surveys. These work areas were adjacent to zone 3 areas and were set up as zone 2 areas.

The root cause of this event has been attributed to a failure by shift Health Physics personnel to establish the areas as zone 3 in accordance with procedure HP-01-241, "Hot Particle Contamination Control", prior to commencement of these evolutions. Had this area been designated as zone 3 prior to these events, hot particle monitoring of personnel could have detected the particles prior to the personnel exceeding the allowed exposure.

As a result of these events, the entire +46 foot level of the RCB was designated as a zone 2 hot particle area, and the area adjacent to the reactor cavity was designated as a zone 3 hot particle area. Throughout the remainder of the refueling outage, no additional personnel overexposures due to hot particles have occurred. Work in the RCB associated with the refueling outage has been completed, and equipment and temporary barriers used during the outage have been removed.

Due to the relatively small skin area for assessing dose from a particle assumed by presently approved methods of dose calculation, these calculations overestimate the dose of these small particle exposures. Proposed changes to methods used for dose assessment in the Federal Register, Volume 50 Number 245, would reduce both exposures by a factor of ten, resulting in exposures below the limit for both individuals. Additionally, the actual length of exposure is most likely shorter than the time periods used for formal dose assessment. Since the particles were contained in the Radiologically Controlled Area and exposure was limited to the two personnel, there was never any health hazard to the general public.



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TEXT (If more space is required, use additional NRC Form 386A's) (17)

## SIMILAR EVENTS

None

## PLANT CONTACT

W.T. LaBonte, Radiation Protection Superintendent, 504/464-3149

Page seven of this LER contains personal information on the two individuals referenced in the report. Since this information is not necessary to understand the contents of the report, it has not been included in this copy.

Should you have a need to know the above information, please call the Event Analysis, Reporting & Response Department at (504)-464-3229.