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W3F1-97-0122
A4.05
PR

June 27, 1997

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

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Reporting of Licensee Event Report

Gentlemen:

Attached is Licensee Event Report (LER) Number 97-018-00 for Waterford Steam Electric Station Unit 3. This report provides details of a dropped new fuel assembly. This condition is being reported as a voluntary LER.

Very truly yours,

T.R. Leonard
General Manager
Plant Operations

IE22/1

TRL/ELL/ssf
Attachment

cc: E.W. Merschhoff (NRC Region IV), C.P. Patel (NRC-NRR),
A.L. Garibaldi, J.T. Wheelock - INPO Records Center,
J. Smith, N.S. Reynolds, NRC Resident Inspectors Office,
Administrator - LRPD

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NRC FORM 366 (4-95)	U.S. NUCLEAR REGULATORY COMMISSION	APPROVED BY OMB NO. 3150-0104 EXPIRES 04/30/98 <small>ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), 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.</small>
LICENSEE EVENT REPORT (LER) (See reverse for required number of digits/characters for each block)		

FACILITY NAME (1) Waterford Steam Electric Station Unit 3	DOCKET NUMBER (2) 05000 382	PAGE (3) 1 OF 10
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TITLE (4)
Voluntary LER for Dropped New Fuel Assembly

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 NAME	DOCKET NUMBER
04	28	97	97	018	00	06	27	97	N/A	05000
									N/A	05000

OPERATING MODE (9) **6**

POWER LEVEL (10) **000**

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

<input type="checkbox"/> 20.2201(b)	<input type="checkbox"/> 20.2203(a)(2)(v)	<input type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(viii)
<input type="checkbox"/> 20.2203(a)(1)	<input type="checkbox"/> 20.2203(a)(3)(i)	<input type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(x)
<input type="checkbox"/> 20.2203(a)(2)(i)	<input type="checkbox"/> 20.2203(a)(3)(ii)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 73.71
<input type="checkbox"/> 20.2203(a)(2)(ii)	<input type="checkbox"/> 20.2203(a)(4)	<input type="checkbox"/> 50.73(a)(2)(iv)	<input checked="" type="checkbox"/> OTHER
<input type="checkbox"/> 20.2203(a)(2)(iii)	<input type="checkbox"/> 50.36(c)(1)	<input type="checkbox"/> 50.73(a)(2)(v)	Specify in Abstract below or in NRC Form 366A Voluntary
<input type="checkbox"/> 20.2203(a)(2)(iv)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(vii)	

LICENSEE CONTACT FOR THIS LER (12)

NAME T.J. Gaudet, Licensing Manager	TELEPHONE NUMBER (include Area Code) (504) 739-6666
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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)		
YES (If yes, complete EXPECTED SUBMISSION DATE).	<input checked="" type="checkbox"/>	NO			

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

On April 28, 1997, at approximately 2137, during Waterford 3 Refueling Outage 8 fuel shuffle, new fuel assembly LAR338 disengaged from the Spent Fuel Handling Tool and dropped approximately five inches. The assembly came to rest straddling spent fuel storage racks leaning at an angle of about 40 degrees, against the south side wall of the Spent Fuel Pool. Off-normal procedure OP-901-405, "Fuel Handling Accident", was entered, fuel assembly LAJ229, which was in the process of being hoisted by the Refueling Machine in Containment, was reinserted, and the Fuel Handling Building (FHB) was evacuated of non-essential personnel. Health Physics personnel took air samples of the FHB +46 elevation for particulate, iodine, and gas and checked the SFP liner leakage detection drains. All samples were normal and no liner leakage was detected. The root cause of this event has been identified as human error. The spent fuel handling tool was found approximately 75% open and locked. The locking device could not have repositioned if properly engaged and therefore it was concluded that the fuel handling tool was inadvertently mispositioned. This event did not compromise the health and safety of the public. This event is being voluntarily reported.

**REQUIRED NUMBER OF DIGITS/CHARACTERS
FOR EACH BLOCK**

BLOCK NUMBER	NUMBER OF DIGITS/CHARACTERS	TITLE
1	UP TO 46	FACILITY NAME
2	8 TOTAL 3 IN ADDITION TO 05000	DOCKET NUMBER
3	VARIES	PAGE NUMBER
4	UP TO 76	TITLE
5	6 TOTAL 2 PER BLOCK	EVENT DATE
6	7 TOTAL 2 FOR YEAR 3 FOR SEQUENTIAL NUMBER 2 FOR REVISION NUMBER	LER NUMBER
7	6 TOTAL 2 PER BLOCK	REPORT DATE
8	UP TO 18 -- FACILITY NAME 8 TOTAL -- DOCKET NUMBER 3 IN ADDITION TO 05000	OTHER FACILITIES INVOLVED
9	1	OPERATING MODE
10	3	POWER LEVEL
11	1 CHECK BOX THAT APPLIES	REQUIREMENTS OF 10 CFR
12	UP TO 50 FOR NAME 14 FOR TELEPHONE	LICENSEE CONTACT
13	CAUSE VARIES 2 FOR SYSTEM 4 FOR COMPONENT 4 FOR MANUFACTURER NPRDS VARIES	EACH COMPONENT FAILURE
14	1 CHECK BOX THAT APPLIES	SUPPLEMENTAL REPORT EXPECTED
15	6 TOTAL 2 PER BLOCK	EXPECTED SUBMISSION DATE

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		97	018	00	

TEXT: more space is required, use additional copies of NRC Form 366A (17)

REPORTABLE OCCURRENCE

This event is being reported as a voluntary LER. A press release to local and national media regarding the dropped fuel assembly was made at 0840 EDT on April 29, 1997. 10CFR50.72(b)(2)(vi) requires a 4-hour call to the NRC for a news release or notification of other government agencies. This call was made at 1020 EDT on April 29, 1997. There is no corresponding 10CFR50.73 requirement. However, because of generic interest of this event to the industry, it is being reported voluntarily.

INITIAL CONDITIONS

At the time this event occurred, Waterford 3 was operating in Mode 6 for Refueling Outage 8. Fuel shuffle was in progress. At the time of this event, seventeen of twenty available lights were out and the air conditioning was not operating. There was also a ground on the 314B bus which could have further affected lighting.

EVENT DESCRIPTION

The Spent Fuel Handling Machine (SFHM) [DB] is a traveling bridge and trolley which rides on rails over the spent fuel pool, refueling canal and cask storage area. Motors on the bridge and trolley position the machine over the spent fuel assembly storage racks, new fuel elevator, and the upender.

The Fuel Handling Tool suspended from the SFHM hoist assembly, contains a grappling device which, when rotated by the operator, engages the fuel assembly to be moved. Once the fuel assembly is grappled, a cable and hoist winch raise the fuel assembly. The machine then transports the fuel assembly from the upending machine to the spent fuel storage racks or from the new fuel elevator to the upending machine. Coordinate location of the bridge and trolley is indicated at the console through the use of encoders and a mechanical pointer system.

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Positive locking is provided between the grappling device and the fuel assembly to prevent inadvertent uncoupling. The drives for both the bridge and the trolley provide close control for accurate positioning and brakes are provided to maintain that position once achieved. In addition, interlocks are installed so the movement of the SFHM is prohibited when the hoist is withdrawing or inserting a fuel assembly.

At approximately 2135, the SFHM operator proceeded to New Fuel Location DD20 to retrieve New Fuel Assembly LAR338. The hoist was lowered to 198.05 inches and the grapple was inadvertently engaged improperly. The hoist was raised and load cell monitored for proper load. The SFHM operator observed proper load cell indications all the way to the upper limit.

At approximately 2137, upon execution of the Semi-Auto move and machine movement, the New Fuel Assembly was observed by the SFHM operator to come loose and fall towards the south wall of the Spent Fuel Pool [DB]. The SFHM operator immediately stopped the machine and informed the tag board operator and Refueling Controller. The New Fuel Assembly (LAR338) came to rest at approximately a 40 degree angle with its base straddling four Spent Fuel Storage Rack [DB] cells (DD20, DD21, EE20, EE21). Locations DD21 and EE21 contained new fuel assemblies and locations DD20 and EE20 were empty.

At approximately 2138, the Refuel Operator called the Control Room to inform them of the situation and that there were no indications of rising radiation levels on the area radiation monitors. This was verified on the RM-11, radiation monitoring computer, in the Control Room. The Control Room entered OP-901-405, Fuel Handling Incident. Assembly LAJ229, which was in the process of being hoisted by the Refueling Machine

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in Containment, was reinserted. The Fuel Handling Building was evacuated of non-essential personnel. Health Physics was directed to take air samples of FHB +46 for particulate, iodine and gas. They were also directed to check the SFP liner leakage detection drains. All samples were normal and no liner leakage was found.

At approximately 2200, the NRC Senior Resident was informed of the event.

CAUSAL FACTORS

The root cause of this event is human error. To arrive at this conclusion a root cause analysis team developed a list of potential mechanical failures as well as human performance issues. By inspecting the grappling tool, taking critical measurements, and functionally testing the SFHM, the mechanical failure mechanisms were eliminated as potential causes. The most conclusive physical evidence indicating human performance error was the as-found condition of the fuel handling tool and knurled locking device. The spent fuel handling tool was found approximately 75% open and locked. The locking device could not have repositioned if properly engaged and it was therefore concluded that the fuel handling tool was inadvertently mispositioned.

A number of contributing factors were also identified:

1. Inadequate Self Checking - The inadvertent misposition of the upper grips and locking device could have been prevented through self checking at critical steps in the grappling process. Self checking, although discussed in training, was focused primarily toward the machine movement process to ensure proper location only. Self checking was not stressed during training on the grappling process.
2. Lack of Verification - No independent verification or peer check was required nor performed. Therefore, there was no opportunity for a second individual to identify

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the inadvertent misposition. Given the importance of this skill-based task, which requires heightened attention, it is prudent to employ verification.

3. Insufficient Operating Experience with Moving Fuel at Waterford 3 - There are currently no requirements for the establishment of a minimum level of operating experience for positions on the refueling crew. Although the SFHM operator had refueling experience at another Entergy Operations site and had manipulated the SFHM using the dummy assembly multiple times at Waterford 3, this was the first grappling operation on actual fuel performed at Waterford 3.

4. Poor Tool Orientation - There were no administrative controls in place to ensure optimum tool orientation (tool has 4 possible orientations). As a result, during this event, the tool was positioned such that the locking device was oriented away from the SFHM Operator. The SFHM Operator therefore did not have an unobstructed view of the knurled locking device and detent, hampering visual verification of locking device position.

5. Spent Fuel Machine Operator Visually Restricted - The glove bag at the upper grips, used to facilitate operation without protective clothing, restricted the operator's vision. Generally, the refuel operators verify the locking device position by looking through the clear plastic glove bag.

6. Inadequate Procedure - The procedure for operating the SFHM lacked detail with regard to operating the grapple. The procedure states:
 - 4.4 Lower the handling tool to the fuel assembly until the hoist stops due to slack cable at approximately 198 inches.

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4.5 Close and lock the grapple on the tool.

4.6 Raise the fuel assembly slowly and observe the free hanging weight.

The procedure should contain additional guidance with regard to orientation of the tool, positioning the grip, ensuring that the full closed position is tension free and ensuring that the knurled handle is fully engaged in the detent. The procedure should also include the requirement for peer check as previously discussed.

7. Inadequate Training - Training provided to the refuel operators did not stress the use of self checking during the critical grappling/ungrappling process. Although practice grappling and maneuvering with a dummy assembly are conducted by the SFHM operator, this was not required by the qualification card for the activity. Training also did not include discussion of tension free grappling or the specifics of the grapple design.
8. Environmental Distractions - The primary environmental distractions were inadequate lighting and improper ventilation. Seventeen of twenty available lights were out and the air conditioning was not operating. There was also a ground on the 314B bus which could have further affected lighting.
9. Mental Distractions - The refuel operator had just experienced difficulty ungrappling spent fuel assembly LAJ219. This recent difficulty combined with a lack of experience with the fuel handling machine may have significantly stressed and therefore distracted the operator. This distraction could have contributed to the initial misposition of the locking device.

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CORRECTIVE MEASURES

Immediate:

1. The SFHM grappling tool was inspected for damage or misalignment
2. Refueling procedure RF-005-002 was revised to include:
 - a. Increased detail on mechanics of operating grapple on SFHM
 - b. Requiring Peer Check of rack location and grapple positioning on SFHM
 - c. Requiring Peer Check on core location and mast rotation on Refueling Machine
 - d. Tool orientation on SFHM such that knurled lever is easily viewed by operator
 - e. Tightening of knurl without applying torque to lever
 - f. Requiring two refueling operators on the SFHM when moving fuel
3. Removed glove bag on SFHM
4. Relamped the FHB +46 elevatic. general lighting
5. Retrained all refuel operators and refuel supervisors on:
 - a. Increased self-checking
 - b. Peer Check of location and grapple operation on SFHM
 - c. Design and operation of grapple on SFHM
 - d. Visual cues of correctly positioned grapple on SFHM
 - e. Summary of Events surrounding corrective action document CR 97-1053 written as a result of this event
 - f. Video of grapple operation on SFHM

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- g. Performed actual grapple operation with dummy assembly in SFP
- h. Manual Manipulations on Refuel Machine warranting Peer Check
- i. Changes to refueling procedure as described in Corrective Measure number 2 above.

- 6. Inspected upper end fitting of dropped assembly for damage, validation of scratch marks, and measurement of strap dimensions to confirm conclusions.
- 7. Refueling Director ensured an appropriate experience mix for personnel assigned to the refueling watchbill.
- 8. Performed underwater camera inspection of Rack Location DD20 to verify no foreign object or condition which could interfere with proper grapple alignment with the fuel assembly.

Long Term:

- 1. Consider re-design of SFHM tool to prevent recurrence of dropped fuel assembly.
- 2. Generate a repetitive task to relamp FHB +46 general lighting within 30 days of refueling outages.
- 3. Revise refueling procedure RF-005-002, "Refueling Equipment Operation", to include notifying electrical maintenance regarding repetitive task to relamp FHB.

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4. Review outage positions to identify experience and training requirements for outage positions which perform critical tasks and that proper management oversight exists for personnel new to the task.

5. Review the renewal process for qualification to operate refueling equipment, including non-outage operations.

6. Revise Refueling Operator Qualification Card to require performance of manipulations of the SFHM with the dummy assembly.

7. Review the method and criteria for selecting fuel movers.

SAFETY SIGNIFICANCE

Design Basis Fuel Handling Accidents are discussed in Section 15.7.3.4 of the Waterford 3 Updated Final Safety Analysis Report (UFSAR). The design basis accident assumes the failure of fuel rod cladding of a spent fuel assembly. The failure of fuel rod cladding of a spent fuel assembly would release volatile fission products resulting in a radiation exposure concern. The fuel assembly involved in this incident was a new fuel assembly that had not been irradiated and, therefore, did not contain fission products.

Video examinations of the new fuel assembly in its resting position on top of the fuel storage racks did not disclose any physical damage to the fuel assembly. The assembly was moved to a safe location and stabilized for shipment to the vendor. The fuel assembly was examined by the vendor, remanufactured, and subsequently shipped to the site where it has been placed in the reactor core.

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The fuel assembly involved in this incident came to rest on adjacent storage rack locations which are surrounded by other rack locations (i.e. not side or corner locations). The area of the fuel storage pool in which the fuel assembly came to rest contained only new fuel assemblies. The location of the end of the fuel assembly resulted in sharing the loading from the assembly between the involved storage racks. It has been determined that the fuel assembly fell from a height of approximately five inches. Evaluation of the subject fuel storage locations did not disclose any deformation of the fuel rack.

This event did not compromise the health and safety of the public.

SIMILAR EVENTS

No previous similar reportable events involving a dropped fuel assembly were identified.

ADDITIONAL INFORMATION

Energy Industry Identification System (EIIIS) codes are identified in the text within brackets [].