

DROPPED FUEL ASSEMBLIES AT BWR FACILITIES

Description of Circumstances:

There have been several reported events involving dropped fuel assemblies at operating boiling water reactor (BWR) facilities. These events are summarized below.

1. Pilgrim - January 1974 (AO-50-293/74-3). An irradiated fuel assembly became detached from the grapple and fell in the spent fuel pool. The fuel assembly had not been completely latched in the grapple.
2. Millstone Unit No. 1 - September 1974 (AO-50-245/74-5). A fuel assembly was inadvertently released from the grapple and fell in the spent fuel pool due to the grapple J-hook not being properly engaged.
3. Humboldt Bay - June 1975 (50-133, Report dated 6-11-75). A fuel assembly was inadvertently released from the grapple and fell in the spent fuel pool due to the grapple J-hook not being properly engaged.
4. Duane Arnold - June 1975 (AO-50-331/75-31A). A fuel assembly was inadvertently released from the grapple and impacted on another fuel assembly in the core due to the grapple not being properly engaged.
5. Brunswick Unit No. 2 - March 1976 (50-324/76-11). A fuel assembly fell out of the fuel prep machine to a horizontal position across the top of the spent fuel pool storage racks. A few days prior to this event a fuel assembly was released from a grapple before being fully inserted in a spent fuel rack. The assembly tilted but did not fall out of the rack. Although there was no apparent failure of the cladding, the assembly was judged not to be re-useable.
6. Peach Bottom Unit No. 3 - January 1977 (50-278/77-5). A fuel assembly was inadvertently released from the grapple and fell across the core. The assembly drop was attributed to inadvertent

Description of Circumstances (continued)

operation of the grapple open switch (during a period when the refueling mast controls had to be rotated away from the operator) followed by a slack cable signal when the fuel assembly nose cone contacted the core as it was being lowered, thereby satisfying all the interlocks for the grapple to open.

7. Oyster Creek - May 1977 (50-219, Report dated 5-28-77). A fuel assembly and mast were inadvertently dropped while lowering the assembly into the spent fuel racks. The fuel and mast movement were arrested by the cable drum brake, without further damage, when the operator released the grapple lower lever. The drop resulted from the shearing of six bolts coupling the refueling mast speed reducer to the cable drum. Examination of the failed bolts indicated that all but two had failed at some earlier time.

The potential problem areas associated with the use of the refueling equipment at BWR facilities that have been identified as contributing to these events are summarized below.

1. If the operator does not insure that the fuel grapple hook has properly grasped the fuel element bail, the fuel element could slip out at any time.
2. If the fuel grapple open/close switch is moved to the open position while the hoist is loaded, the interlock will not allow the grapple to open. However, since the switch is a two position switch, as soon as the hoist cable is unloaded, even by inadvertent fuel assembly hangup, the grapple will open.
3. In order to rotate a fuel assembly after it is hoisted up, the entire fuel hoist (including the control console) must be rotated. This can result in the control console being rotated 135 degrees from the operator, thereby contributing to the potential for operator control manipulation errors.
4. The speed reducer to cable drum coupling bolts (on those refueling platforms utilizing a bolted connection) are susceptible to failure, possibly resulting from impact loading due to the oversized coupling bolt holes.

All holders of BWR Operating licenses or construction permits should be aware of the potential faults and malfunctions which could contribute to the dropping of a fuel assembly at their facility. Certain steps and measures can be taken to minimize the possibility of a fuel assembly dropping incident. These include steps to assure that the grapple will properly grasp the fuel assembly, measures to prevent inadvertent grapple opening, steps to reduce operator control manipulation errors, and measures to identify deterioration of or faulty components.

These steps and measures should be implemented by consideration of the following:

1. Installation of the General Electric Fuel grapple modification for positive indication of fuel assembly engagement (SIL No. 109, dated October 31, 1974). This modification provides the operator with a light, indicating that the fuel assembly bail is properly engaged in the grapple and that the grapple hook is fully closed.
2. A modification of the two position grapple open/closed switch and/or circuitry to decrease the potential for accidental opening.
3. The use of a warning light for assurance of the fuel grapple and assembly engagement could be supplemented (or replaced) with an interlock which would prevent grapple motion unless positive locking occurs. In this regard, future operating experience with the warning light installed should be evaluated to determine need for further design changes.
4. Refueling plans that minimize manipulations over the core with the console more than 45 degrees away from the platform.
5. A design review of the speed reducer to cable drum coupling bolts (where applicable) to assure adequacy and a periodic visual/non-destructive examination of the subject bolts.
6. Procedures to ensure that the refueling platform and its related equipment are thoroughly inspected prior to use (i.e. initial fuel handling and periodic refueling outages). These procedures should include but not necessarily be limited to checks for the following:

- a. Cables not worn or frayed;
 - b. Bolts, nuts and fasteners tight and secure;
 - c. All components properly lubricated;
 - e. Gears, shafts, bearings, etc. not loose or worn
 - f. Structural members and welds not deformed or cracked; and
 - b. Technical Specification required interlocks checked.
7. Procedures to conduct shift-wise and daily inspections of selected refueling equipment critical components such as cables, fasteners, hoists, and brakes when equipment is in use.

No written response to this Circular is required. If you require additional information regarding this matter, contact the Director of the appropriate NRC Regional Office.

Enclosure:
List of IE Circulars
issued in 1977

Enclosure
IE Circular 77-12
Date: 9-15-77

LISTING OF IE CIRCULARS ISSUED IN 1977

CIRCULAR NO.	SUBJECT	FIRST DATE OF ISSUE	ISSUED TO
77-01	Malfunctions of Limitorque Valve Operators	1-4-77	All holders of Operating License (OL) or Construction permit(CP)
77-02	Potential Heavy Spring Flooding	2-15-77	All affected holders of OLs
77-02A	Potential Heavy Spring Flooding	2-16-77	All affected holders of CPs
77-03	Fire Inside a Motor Control Center	2-28-77	All holders of OLs and CPs
77-04	Inadequate Lock Assemblies	3-17-77	Safeguard Group I, II, IV, V, Licensees
77-05	Liquid Entrapment in Valve Bonnets	3-24-77	All holders of OLs and CPs
77-06	Effects of Hydraulic Fluid on Electrical Cable	4-1-77	All holders of OL's and CPs
77-07	Short Period During Reactor Startup	4-12-77	Holders of BWR OLs
77-08	Failure of Feedwater Sample Probe	4-13-77	All holders of OLs
77-09	Improper Fuse Coordination In BWR Standby Liquid Control System Control Circuits	5-25-77	All holders of BWR OLs or CPs
77-10	Vacuum Conditions Resulting in Damage to Liquid Process Tanks	7-15-77	All holders of OLs

Enclosure
IE Circular 77-12
Date: 9-15-77

LISTING OF IE CIRCULARS ISSUED IN 1977 (Continued)

CIRCULAR NO.	SUBJECT	FIRST DATE OF ISSUE	ISSUED TO
77-11	Leakage of Con- tainment Isolation Valves with Resilient Seats	9-6-77	All holders of OLS and CPs

IE Circular 77-12 Dropped Fuel Assemblies at BWR Facilities - 9-15-77

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