

NUCLEAR REGULATORY COMMISSION  
OFFICE OF INSPECTION AND ENFORCEMENT  
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RADIATION LEVELS FROM FUEL ELEMENT TRANSFER TUBES

Description of Circumstances:

On April 5, 1978, two radiation protection technicians at Portland General Electric Company's Trojan Nuclear Power Plant received whole body radiation doses of 27.3 and 17.1 rem while performing a survey adjacent to an exposed section of the fuel element transfer tube during the plant's first refueling outage. The exposures occurred in a shielded space inside the containment building which housed one of two fuel element transfer tube seismic relief bellows. The second bellows outside of containment had been provided with removable shielding and appropriate access controls. The bellows space inside containment was constructed with labyrinth-type shielding, however, access to the space was not controlled. The technicians were performing surveys in an attempt to identify a reported possible source of higher than expected radiation and had scheduled the survey to coincide with the passage of a fuel element through the fuel element transfer tube. The technicians believed that the fuel element transfer tube was buried in the concrete beyond the compartment they occupied and assumed that the structure passing through the compartment was a ventilation duct.

The licensee staff had performed surveys of all areas of the plant during the outage in an attempt to identify intermittent sources of radiation resulting from refueling activities; however, nothing significant was identified because of the transient nature of the resulting radiation fields. Subsequent to the exposures, the licensee performed surveys in numerous areas surrounding the general area of the fuel transfer tube with an irradiated fuel element stopped in the transfer tube. The surveys identified a number of areas previously unidentified where significant radiation streaming was present. The principal paths of radiation streaming were the narrow seismic relief spaces between the containment and internal and external structures.

**Action To Be Taken By Licensees:**

While the exposures above occurred at a pressurized water reactor, similar situations could occur at any reactor facility designed to transfer spent fuel between the reactor refueling canal and a spent fuel storage pool outside of containment by means of a fuel element transfer tube. Accordingly, holders of power, test and research reactor operating licenses where plant design incorporates a fuel element transfer tube, are to take the following actions:

1. Perform a thorough review of shielding design of plant areas adjacent to the fuel transfer tube to identify potential high radiation areas, both continuous and transient, as defined in 10 CFR 20.202(b).
2. Assure that positive control of access exists or is included in the facility design for entryways into potential high radiation areas where a portion of a fuel transfer tube is accessible in an unshielded condition.
3. Assure that points of access to potential high radiation areas associated with accessible unshielded portions of a fuel transfer tube are conspicuously posted in accordance with 10 CFR 20.203(c).
4. If the action from Paragraph 1 above identifies the potential for radiation streaming from shielded spaces, plan and conduct special radiation surveys during the next refueling to identify and control such areas. It is not necessary to survey in areas where the transfer tube is exposed, but if it is found desirable, extreme care should be exercised to control and limit personnel exposure. Care should also be taken in planning surveys and fuel movements such that survey requirements do not override any technical limitations on fuel movement.
5. Confirm by written reply to the NRC Regional Office within 60 days that the actions for Items 1-4 above have been or are being taken. A record, detailing findings, actions taken, and actions to be taken, should be retained for review by NRC during subsequent radiological safety inspection.

Approved by GAO, B180225 (R0072); clearance expires 7-31-80. Approval was given under a blanket clearance specifically for identified generic problems.

LISTING OF BULLETINS  
ISSUED IN 1978

| Bulletin No. | Subject   | Date Issued | Issued To  |
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| 78-01        | Flammable Contact -<br>Arm Retainers in G.E.<br>CR120A Relays   | 1/16/78     | All Power Reactor<br>Facilities with an<br>Operating License (OL)<br>or Construction Permit<br>(CP)  |
| 78-02        | Terminal Block<br>Qualification   | 1/30/78     | All Power Reactor<br>Facilities with an<br>Operating License<br>(OL) or Construction<br>Permit (CP)  |
| 78-03        | Potential Explosive<br>Gas Mixture Accumula-<br>tions Associated with<br>BWR Offgas System<br>Operations    | 2/8/78      | All BWR Power<br>Reactor Facilities<br>with an Operating<br>License (OL) or<br>Construction Permit<br>(CP)   |
| 78-04        | Environmental Quali-<br>fication of Certain<br>Stem Mounted Limit<br>Switches Inside<br>Reactor Containment | 2/21/78     | All Power Reactor<br>Facilities with an<br>Operating License<br>(OL) or Construction<br>Permit (CP)  |
| 78-05        | Malfunctioning of<br>Circuit Breaker<br>Auxiliary Contact<br>Mechanism-General<br>Electric Model CR105X     | 4/14/78     | All Power Reactor<br>Facilities with an<br>Operating License<br>(OL) or Construction<br>Permit (CP)  |
| 78-06        | Defective Cutler - Hammer<br>Type M Relays with DC<br>Coils   | 3/31/78     | All Power Reactor<br>Facilities with an<br>Operating License<br>(OL) or Construction<br>Permit (CP)  |
| 78-07        | Protection Afforded By<br>Air-Line Respirators<br>and Supplied-Air Hoods                                    | 6/12/78     | All Power Reactor<br>Facilities with an<br>Operating License<br>(OL), all Class E<br>and F Research Reactors<br>with an Operating<br>License, all Fuel<br>Cycle Facilities with<br>an Operating License,<br>and all Priority I<br>Material Licensees |