



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

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MEMORANDUM FOR: Harold R. Denton, Director  
Office of Nuclear Reactor Regulation

FROM: Saul Levine, Director  
Office of Nuclear Regulatory Research

SUBJECT: RESEARCH INFORMATION LETTER # 44 RADIATION DOSE  
TO CONSTRUCTION WORKERS AT OPERATING NUCLEAR POWER  
PLANT SITES

Introduction and Summary

This memorandum transmits the results of completed research to evaluate the radiation doses received by construction workers at sites where new facilities are under construction next to operating nuclear power plants. This work was performed by the Battelle Pacific Northwest Laboratory under the direction of the Environmental Effects Research Branch of RES.

In order to comply with the National Environmental Policy Act of 1969, NRC must assess the environmental impact of the construction and operation of nuclear power plants. Because field surveys showed that exposure levels were below the point for which personnel monitoring is required, radiation doses received by most construction workers had not been routinely measured. As a consequence, an adequate environmental impact assessment could not be made for the doses to construction workers. This study was designed to provide a data base which would allow a realistic assessment of the radiological impact on construction workers of proposed multi-unit nuclear power plants and to determine whether increased control of the radiation exposure of these workers is warranted.

Methodology

Measurements of personnel exposure of construction workers were conducted at four sites where new facilities were under construction: Site A had an operating boiling water reactor; Site B, an operating pressurized water reactor; Site C, two operating boiling water reactors; and Site D, an operating boiling water reactor and an operating pressurized water reactor. Several hundred or more construction workers were employed at each site during the period of this study.

Personnel dosimeters capable of measuring beta, gamma, thermal neutron, and fast neutron radiations were worn by selected groups of workers or were placed on water phantoms at selected locations around the site. Control dosimeters were kept in a lead container at the site and additional control dosimeters were kept off-site. All thermoluminescent dosimeters were calibrated with sources traceable to the National Bureau of Standards. The dosimeters were exchanged on a two or three-month schedule at each site for a period of at least one year.

Site surveys were performed at all four sites when the operating units were at or near full power. The exposure rate was measured by a system consisting of a NaI(Tl) scintillator, a stabilized gain amplifier, and a nonlinear charge digitizer that electronically corrects for detector response. This system was calibrated to read out exposure rate directly. The photon spectra were determined with a Ge(Li) detector system and a 1024 channel analyzer.

### Results

The results of each exchange at each site are given in the enclosed report<sup>1/</sup> in terms of dose equivalent rates (mrem/mo) for each worker and worker group. Environmental measurements at each location for each cycle are tabulated in terms of exposure rate (mR/mo) and are presented graphically for each dosimeter type. Plots of the gamma spectra are reproduced with the most important peaks characterized.

Correlations between operating plant power levels and dosimeter readings were generally poor, indicating that variations in other radiation sources, such as natural background, radiographic sources and radwaste shipments, had a greater effect on the measurements. For most worker groups, such as carpenters, painters, pipefitters, etc., the average dose equivalent rates were much less than 10 mrem/mo greater than the off-site controls. Safety engineers at Site B received the consistently highest dose equivalent above background, estimated at 180 mrem/yr. No evidence of low-energy photon or beta radiation was observed; very low levels of fast neutrons were observed on some exchanges with the highest reading 10 mrem/mo.

Most of the environmental dosimeters located outside the operating units showed exposure levels at or near background levels. The highest readings were found near radwaste facilities and refueling areas at the operating units. At Site A there was evidence of exposure to high energy photons from <sup>16</sup>N.

<sup>1/</sup>

Radiation Doses to Construction Workers at Operating Nuclear Power Plant Sites, NUREG/CR-0426.

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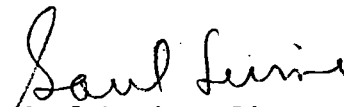
Future Work

All work in this area has been terminated.

Conclusions and Recommendations

Although Battelle concludes that there appears to be no radiation exposure problem for construction workers, such a conclusion should be reviewed by the NRC staff.

The results presented in the enclosed report can be used by your staff in preparing the environmental impact statements for construction of multi-unit power plants. For further information on this study, please contact Dr. Judith D. Foulke (427-4358).



Saul Levine, Director  
Office of Nuclear Regulatory Research

Enclosure: NUREG/CR-0426

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Original Signed by

Saul Levine  
Saul Levine, Director  
Office of Nuclear Regulatory Research

Enclosure: NUREG/CR-0426

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Saul Levine, Director

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