BNL-NUREG-34544

CONF-840614--4

Identification of Dose-Reduction Techniques for BWR & PWR Repetitive High-Dose Jobs

BNL-NUREG--34544

DE84 010894

Bruce J. Dionne and John W. Baum

Safety & Environmental Protection Division

Brookhaven National Laboratory

Upton, N.Y. 11973

Presented at the 1984 Annual Meeting

of

The American Nuclear Society

New Orleans, LA

June 3-8, 1984

* This work was performed under the auspices of the U.S. Nuclear Regulatory Commission

Identification of Dose-Reduction Techniques for BWR & PWR Repetitive High-Dose Jobs

Bruce J. Dionne and John W. Baum
Safety & Environmental Protection Division
Brookhaven National Laboratory
Upton, N.Y. 11973

Introduction

An area of growing concern to the nuclear industry and to the Nuclear Regulatory Commission has been the apparent increase in collective radiation dose to workers at nuclear power plants. As a result, the nuclear industry is actively pursuing the development of ALARA (as low as reasonably achievable) programs. Also, the Nuclear Regulatory Commission (NRC) has contracted with Brookhaven National Laboratory to study high-dose maintenance tasks, dose reduction techniques and effectiveness of ALARA programs.

Objective

The Brookhaven National Laboratory "Occupational Dose Reduction at Nuclear Power Plant" project will provide information to industry in preplanning for radiation protection during maintenance operations. One of the objectives of this study is to identify Boiling Water Reactor (BWR) & Pressurized Water Reactor (PWR) repetitive high-dose jobs, and respective collective-dose trends and dose-reduction techniques.

DATA

A survey to collect information on high-dose jobs at 11 nuclear sites has been planned. This encompasses 18 units: six General Electric (G.E.) BWRs, six Westinghouse (W) PWRs, three Combustion Engineering (CE) PWRs and three Babcock and Wilcox (B&W) PWRs. The sites were selected based on ease of extraction of data on dose totals for high-dose jobs.

Between January and June, 1984, Brookhaven Health Physicists with past plant experience will spend three to five days at each site to collect data on the jobs listed in Table 1. Health Physics, maintenance, engineering and construction personnel will be interviewed to obtain the required information.

Following the plant information visits, dose reduction data sheets will be prepared for the major jobs. These data sheets will give a verbal description of the job tasks; the minimum, maximum and average collective dose by reactor type, e.g. G.E., B&W, W, CE.; and a list of the various dose reduction techniques. These dose reduction data sheets and the collective dose summaries will be presented, e.g. see Table 2.

USES

This information on high dose jobs will be disseminated to the participating utilities, and industrially funded organizations (INPO, AIF, EEI and EPRI) so that it can be utilized by industry in the area of occupational dose reduction.

By identifying the repetitive high-dose jobs, the NRC and industry can focus efforts on the major dose-reduction targets. Dose trends for repetitive jobs can then be examined for indication of the effectiveness of job planning and ALARA efforts. Tabulation of the collective dose ranges for repetitive

TABLE 1

Boiling Water Reactors
High Dose Jobs

Reactor Assembly and Disassembly
Fuel Shuffle/Sipping and Inspection
CRD Removal/Rebuild and Replacement
Recirculation Pump Maintenance
Main Steam Isolation Valve Repair and Inspection
Safety Valve Repair and Inspection
In Service Inspection
Insulation Removal/Replacement
Scaffold Removal/Installation
Local Leak Rate Test
Instrumentation Repair and Calb.
Jet Pump Inspection and Repair
Torus Repair Inspection and Modification
Snubber Inspection and Repair
Reactor Water Cleanup System Repair
TIP/SRM/IRM Calb. & Repair
Turbine Overhaul
Condensate Pump Maintenance
Refueling Pool Decontamination
Plant Decontamination & Shielding - Routine/Outage
Radwaste Systems Repair, Operation and Maintenance
Operations - Surveillance - Routine/Outage
Operations - Valve Lineups - Routine/Outage
Siesmic Inspection and Repair

Pressurized Water Reactors
High Dose Jobs

Reactor Assembly/Disassembly
Fuel Shuffle/Sipping and Inspections
Steam Generator Manway Removal
Eddy Current Testing
Steam Generator Tube Plugging
RHR Repairs
Reactor Coolant Pump Seal Replacement
Primary Valve Maintenance
In Service Inspection
Insulation Removal/Replacement
Scaffold Installation/Removal
Anchor Bolt Inspection and Repair
Snubber Inspection and Repair
Siesmic Inspection and Repair
Radwaste System Repair, Operation and Maintenance
Secondary Steam Generator Inspection and Repair
Chemical Volume and Control System Repair
Charging Pump Repair
Cavity Decontamination
Plant Decontamination and Shielding - Routine/Outage
Operations - Surveillance and Inspection - Routine/Outage
Operations - Valve Lineups - Routine/Outage
Pressurizer Valve Inspection, Testing, and Repair
Instrumentation Repair and Calibration
Desludging of Tanks, Sumps, and Drains
Cavity Filter Changeout

job will assist in preparing job dose estimates during job preplanning. Also, job dose ranges by reactor type and size will provide a gauge to compare job performance. Lastly, the listing of dose-reduction techniques observed will provide a checklist of techniques which may be evaluated for possible use during the job.

It is expected that this information will be utilized by Health Physicists and ALARA Coordinators at operating nuclear power plants to assist them in preplanning their maintenance operations.

REFERENCES

1. C.A. Pelletier et al., National environmental studies project, compilation and analysis of data on occupational radiation exposure experienced at operating plants. Prepared for Atomic Industrial Forum, Inc. (1974).

2. E.A. Warman et al, Occupational radiation exposure reduction technology planning study, EPRI NP-1862, Technical planning study TPS 7961 (1981).

3. D.C. Lattanzi, C. Papa and S. Paribelli, Operating experience at nuclear power plants and its application to occupational radiation exposure reduction, in Proceedings of the International Symposium on the Application of the Dose Limitation System in the Nuclear Fuel Cycle Facilities and other Radiation Practices, pp. 191-204, IAEA, Vienna, 1982.

TABLE 2 BOILING WATER REACTOR

AVERAGE COLLECTIVE DOSE EQUIVALENT (REM) FOR 18 ACTIVITY CATEGORIES

Activity Category	US BWR Pellitier's[c]				US & European BWR Lattanzi's[d]			
	Ave.	High	Low	(N)[a]	Ave.	High	Low	(N)[a]
1. Liquid waste treatment	14.0	27.5	4.75	(4)	11.0	35.0	0.2	(22)
2. Solid waste handling	5.75	22.5	1.75	(6)				
3. Gaseous waste systems	6.75	13.75	2.25	(3)	Not Done			
4. Head removal and installation	3.5	8.0	1.0	(12)	5.5	16.0	1.2	(36)
5. Fuel Handling	13.75	42.5	2.5	(12)	6.4	14.0	2.0	(19)
6. Instrumentation work, including calibration	7.5	27.5	1.5	(8)	7.1	24.0	0.8	(15)
7. Inservice inspection	12.25	24.0	3.5	(11)	23.0	106.8	3.3	(47)
8. Control rod drive work	8.0	23.5	1.25	(12)	7.5	32.0	6.0	(49)
9. Major equipment failures	Not included				Not included			
10. Recirculation pumps, including cleanup systems	19.5	72.5	1.5	(13)	58.0	88.0	51.0	(11)
11. Steam generator inspection and repair	Not applicable				Not applicable			
12. Reactor coolant pumps	Not applicable				Not applicable			
13. Main coolant loops[b]	Not applicable				Not applicable			

(TABLE 2 continued)

Activity Category	US BWR Pellitier's[c] Ave.	High	Low	(N)[a]	US &European BWR Lattanzi's[d] Ave.	High	Low	(N)[a]
14. Charging pumps	Not applicable				Not applicable			
15. Valves	13.0	40.0	1.25	(8)	4.1	29.0	2.0	(47)
16. Turbine and auxiliary equip.	6.75	25.0	1.5	(7)	3.3	11.0	0.6	(20)
17. Fuel pool including cleanup system	1.25	3.25	0.25	(6)	5.4	31.0	0.3	(39)
18. Condensate demineralizers	9.75	0.25	(4)		Not included			3.0
Total	122				131			

a. Number of annual fractions used to compute average.

b. Collective dose equivalents from work on valves at Plant 12 have been subtracted and are included under "valve" category.

c. Pellitier's Average Fractions of annual plant collective dose equivalent were multiplied by the average BWR annual collective dose equivalent of 250 rem to obtain the tabulated rem values, data from Pelletier, Charles A, et al., "Compilation and Analysis of Data on Occupational Radiation Exposure Experienced at Operating Nuclear Power Plants", Science Applications, Inc., 1974.

d. Lattanzi, D., et al. "Operating Experience at Nuclear Power Plants and Its Application to Occupational Radiation Exposure Reduction", in Proceedings of the International Symposium on the Application of the Dose Limitation System in Nuclear Fuel Cycle Facilities and other Radiation Practices, pp. 191-204, IAEA, Vienna, 1982.