

BNL ALARA Center Data Base

GERMANY

R-427

DOSE RATE TRENDS IN SIEMENS-DESIGNED BWRs

Keywords: CONTAMINATION PREVENTION; COMPONENT RELIABILITY; COBALT; COBALT REPLACEMENT; COBALT-60; DOSE; DOSE RATE; WATER CHEMISTRY; BWR

Principal Investigator:

T. Marchl
Siemens AG/KWU
P. O. Box 32 20
D-91050, ERLANGEN
GERMANY
Phone: 49 9131 182010

Project Manager:

Rolf Riess
Siemens AG/KWU
P. O. Box 32 20
D-91050, ERLANGEN
GERMANY
Phone: 49 9131 182010

Objectives: To investigate the reasons for significantly lower personnel radiation exposures in the newer Siemens-designed BWR plants.

Although the older Siemens designed BWRs show similar trends in radiation exposure as are typical for BWRs, the newer BWRs show reduced radiation exposure, typically annual exposures of about 100 person-Sv per reactor. The Siemens BWR plants may be divided into three main groups: (1) Those with external, (2) Those with internal and (3) Those with internal recirculation, cobalt replacement materials in the reactor pressure vessel and improved shielding. The highest annual plant dose (400 to 600 person-rem) characterizes the first group, intermediate dose (200 to 380 person-rem) the second group and low doses (80 to 180 person-rem) the third group.

Comments: The Co-60 activity concentrations differ successively for the three groups. Whereas the difference between the first and second group is typically by a factor of 5, the difference between the first and the third group is about two orders of magnitude. The differences are still significant but less for Co-58 activity concentrations.

There are also some important structural differences between the units which have an affect on radiation exposures:

One unit has 2 external recirculation pumps and 16 internal jet pumps. Its condensate cleanup as well as reactor water purification is carried out by means of a precoat filter. The heater drains are cascaded. Four other units have multiple internal recirculation pumps, condensate cleanup and reactor water purification is carried out by precoat filters. Two of these units have cascaded and the other two forward pumped heater drains. The last two units have internal pumps but use electromagnetic plus mixed bed filter for condensate cleanup, precoat filters for reactor water purification and forward pumped heater drains.

Remarks: Refueling outage and plant exposures were compared for plants with different design features. The plants differed significantly in collective outage exposure, similarly but much less in operational dose. Diminishing radiation exposures successively resulted for plants with the following features:

- (a) plant with external recirculation line.
- (b) plant with cascaded heater drains.
- (c) plant with forward pumped heater drains.

BNL ALARA Center Data Base

GERMANY

R-427

- (d) plant with non-stellite rollers and improved shielding.
- (e) plant with non-stellite rollers and further improved shielding.

The newer BWRs had radiation exposures comparable to those with low radiation exposures of a different design.

References: Riess, R. and T. Marchl, "Dose Rate Trends in Siemens-Designed Units," Proceedings, EPRI Radiation Field Control and Chemical Decontamination Seminar, Tampa, Florida, November 1995, available from EPRI Distribution Center, P.O. Box 23205, Pleasant Hill, CA 94523, Phone: (501)934-4212.

Duration: from: 1990 to: 1995

Funding: N/A

Status: In progress

Last Update: May 7, 1996