Docket ~~Distrib~~

JUN 20 1975

Docket Nos. 50-508/509
MS 24-01

R. C. DeYoung, Assistant Director for Light Water Reactors, Group 1, RL

SAFETY EVALUATION REPORT FOR WASHINGTON NUCLEAR PROJECT, UNITS 3 & 5

Plant Name: Washington Nuclear Projects, Units 3 & 5
Licensing Stage: CP
Docket Numbers: 50-508/509
Responsible Branch: LWR 1-3
Project Manager: P. O'Reilly
Requested Completion Date: June 16, 1975
Description of Response: Safety Evaluation Report
Review Status: Complete

Enclosed are the Radioactive Waste Management and associated sections for the Washington Nuclear Project, Units 3 and 5.

The applicant proposes to use state-of-the-art technology for the liquid, gaseous and solid radwaste treatment systems. Based on our evaluation, the radwaste systems are capable of reducing radionuclide releases to "as low as practicable" levels and are designed to acceptable codes and standards. The determination as to whether or not the proposed liquid and gaseous radwaste systems meet the dose design objectives of Appendix I to 10 CFR Part 50 and the required cost-benefit analysis will be evaluated in a supplement to the SER.

Our analysis of radioactive releases due to liquid tank failures outside containment shows that the provisions incorporated in the applicant's design to mitigate the effects of tank failures involving contaminated liquids are not acceptable. The applicant has been advised of our findings.

Original signed by:
Robert L. Tedesco

Robert L. Tedesco, Assistant Director
for Containment Safety
Division of Technical Review

Enclosure:
As stated

cc: See next page

OFFICE ▶			8605290521 750620			
SURNAME ▶			PDR ADOCK 05000508			
DATE ▶			E PDR			

cc: S. Hanauer
F. Schroeder
A. Giambusso
W. McDonald
D. Eisenhut
J. Collins
O. Parr
M. Bell
W. Burke
P. O'Reilly
P. Stoddart
S. Varga
J. Kastner
D. Muller
W. Regan
J. Norris
J. Glynn

bcc: Docket Files
NRR Reading
CS Reading
ETSB Reading

OFFICE ▶	TR:ETSB	TR:ETSB	TR:ETSB	TR:CS		
SURNAME ▶	PStoddart:lw	WBurke	JCollins	RTedesco		
DATE ▶	6/19/75	6/19/75	6/19/75	6/19/75		

SAFETY EVALUATION REPORT
WASHINGTON NUCLEAR POWER STATION
UNITS 3 AND 5

Docket Nos. 50-508/509

11.0 Radioactive Waste Management

11.1 Summary Description

Each unit will have duplicate separate radioactive waste management systems designed to provide for controlled handling and treatment of liquid, gaseous and solid wastes. The liquid waste system will process wastes from equipment and floor drains, decontamination and laboratory wastes and laundry and shower wastes. The gaseous waste system will provide holdup capacity to decay short lived noble gases stripped from the primary coolant and treatment of ventilation exhausts through HEPA filters and charcoal adsorbers. The systems will be designed to reduce releases of radioactive materials in effluents to as low as practicable levels in accordance with 10 CFR Part 50.34a. The solid waste system will provide for the solidification, packaging and storage of radioactive wastes generated during station operation prior to shipment offsite for burial. Solid packaged wastes will be shipped to a licensed facility for burial.

In our evaluation of the liquid and gaseous radwaste systems we have considered: 1) the capability of the systems for keeping the levels of radioactivity in effluents "as low as practicable," based on expected radwaste inputs over the life of the plant, 2) the capability of the systems to maintain releases below the limits in 10 CFR Part 20, Appendix B, Table II, Columns 1 and 2, during periods of fission product leakage at design levels from the fuel, 3) the capability of the systems to meet the processing demands of the station during anticipated operational occurrences, 4) the quality group and seismic design classification applied to the system design, 5) the design features that will be incorporated to control the releases of radioactive materials in accordance with General Design Criterion 60 of Appendix A to 10 CFR Part 50, and 6) the potential for gaseous release due to hydrogen explosions in the gaseous radwaste system.

In our evaluation of the solid radwaste treatment system we have considered: 1) system design objectives in terms of expected types, volumes and activities of waste processed for offsite shipment, 2) waste packaging and conformance to applicable Federal packaging regulations, and provisions for controlling potentially radioactive airborne dusts during baling operation, and 3) provisions for onsite storage prior to shipping.

In our evaluation of the process and effluent radiological monitoring and sampling systems we have considered the system's capability 1) to monitor all normal and potential pathways for release of radioactive materials to the environment, 2) to control the release of radioactive materials to the environment, and 3) to monitor the performance of process equipment and detect radioactive material leakage between systems.

In the Final Environmental Statement (FES) for the Washington Nuclear Project, Units 3 and 5, issued June 1975, we performed an evaluation to determine the quantitites and activities of materials that will be released in liquid and gaseous waste, or shipped offsite as solid waste for burial. In that evaluation, we considered waste flows, waste activities, and equipment operating performance, including anticipated operational occurrences, that are consistent with an assumed 30 years of normal station operation. The liquid and gaseous source terms listed in Tables 3.4 and 3.5 of the FES were calculated using the PWR-GALE code described in "Draft

Regulatory Guide 1.BB, Calculation of Releases of Radioactive Materials in Liquid and Gaseous Effluents from Pressurized Water Reactors (PWR's)," Docket No. RM-50-2, February 20, 1974. The principal parameters used in these calculations, along with their bases, are given in Appendix B to Draft Regulatory Guide 1.BB.

Based on our evaluation, as described below, we find the proposed liquid, gaseous and solid radwaste systems and associated process and effluent radiological monitoring and sampling systems to be acceptable. The capability of the liquid and gaseous radioactive waste treatment systems to meet the dose design objectives of Appendix I to 10 CFR Part 50 and the required cost-benefit analysis will be evaluated in a supplement to the SER.

11.2 System Description and Evaluation

11.2.1 Liquid Radwaste Treatment System

The liquid radioactive waste treatment system will consist of process equipment and instrumentation necessary to collect, process, monitor and recycle or dispose of liquid radioactive wastes. The liquid radioactive waste will be processed on a batch basis to permit optimum control of releases. Prior to being released, samples will be analyzed to determine the types and amounts of radioactivity present. Based on the results of the analysis, the waste will be retained for further processing, recycled for eventual use in the plant or released under controlled conditions. The Boron Recovery System (BRS) will process a portion of the Chemical and Volume Control System (CVCS) flow (shim bleed) for boron control along with nonaerated waste collected in the reactor coolant drain tank and equipment drain tank. The principal BRS processing will consist of evaporation and demineralization. Aerated radioactive wastes will be segregated based on their origin and processed through the Liquid Waste Processing System (LWPS). Turbine building floor drain wastes will be collected for in-plant reuse unless sampling indicates processing through the LWPS is necessary. Detergent (laundry and decontamination) wastes will be processed through a waste treatment system which includes a holdup tank, a filter and a waste monitoring tank. The principal components making up each of these systems, along with their principal design parameters, are listed in Table 11.2-1.

The design capacities of the BRS and LWPS evaporators will be 29,000 gpd each. We calculated the average expected waste flows to the BRS and LWPS to be 1900 gpd and 1300 gpd respectively. The difference between the expected flows and design capacity will provide adequate reserve for processing surge flows. We consider the system capacity and system design to be adequate for meeting the demands of the station during anticipated operational occurrences.

Blowdown from the steam generators will be cooled in a series of flash tanks. Approximately 75% of the blowdown will be returned to the secondary condensate system at he suction of the low pressure condensate pumps and upstream of the condensate demineralizers, where it will be treated as part of the condensate flow stream. Approximately 25% of the blowdown will be flashed to steam and utilized in the low pressure heaters before being vented to the condenser shell.

We calculate the average expected blowdown rate will be approximately 98,000 gpd. We consider the system design capacity to be adequate for meeting the needs of the plant.

The liquid radwaste system will be located in a seismic Category I structure. The seismic and quality group classifications of the equipment, which are consistent with our guidelines, are listed in Table 11.2-1. The systems will also be designed to control the release of radioactive materials due to overflows from indoor and outdoor tanks by providing level instrumentation which will alarm in the control room, and by means of curbs and retention walls to collect liquid spillage and retain it for processing. We consider these provisions to be capable of preventing the uncontrolled release of radioactive materials to the environment. We find the applicant's proposed system design to be acceptable in accordance with Branch Technical Position ETSB 11-1.

We have determined that during normal operation the proposed liquid radwaste treatment systems will be capable of reducing the release of radioactive materials in liquid effluents to approximately 0.1 Ci/yr/reactor, excluding tritium and dissolved gases, and 350 Ci/yr/reactor for tritium.

11.2.2 Gaseous Radwaste Treatment System

The gaseous radwaste treatment system will be designed to process gaseous plant wastes based on the origin of the wastes in the plant and the expected activity levels. The gaseous waste treatment system will consist of a Gaseous Waste Processing System (GWPS), a main condenser effluent processing system and ventilation systems that control the release of radioactive effluents to the environment. The principal components of the system, along with their principal design parameters, are listed in Table 11.2-1.

The GWPS will collect and process gases stripped from the primary coolant along with miscellaneous tank cover gases. Operating with two 2 scfm compressors and nine 700 ft^3 gas decay tanks (each of which is capable of being isolated from all others) the GWPS will have adequate capacity to allow operation during periods of equipment downtime. We consider the system capacity and the system design to be adequate for meeting the demands of the station during normal operations and anticipated operational occurrences. The system design includes redundant hydrogen and oxygen analyzers downstream of the recombiners which will initiate an alarm if hydrogen or oxygen concentrations vary beyond the design concentration limits. The input stream to the recombiner will be diluted with nitrogen to maintain a three to six percent hydrogen mixture. The system design will limit the hydrogen concentrations downstream of the recombiner by automatically controlling the oxygen flow to produce a stoichiometric mixture of hydrogen and oxygen into the recombiner. In this manner the hydrogen/oxygen mixtures will be maintained well outside the explosive limit envelope. The system will be designed to Quality Group C and seismic Category I and will be located in a seismic Category I structure. We find the system quality group, seismic design classification, and the design provisions incorporated to reduce the potential of hydrogen explosion to be acceptable.

Gaseous wastes from the main condenser will be processed through HEPA filters and charcoal adsorbers for particulate and iodine removal, respectively. Noble gases will not be affected by the treatment provided. The system releases will be proportional to the rate of primary to secondary system leakage and the primary coolant activity. In the event of excessive primary to secondary leakage, the affected steam generator will be isolated before radioactive material concentrations in main condenser offgas exceeds the limits in 10 CFR Part 20.

Ventilation exhausts from the auxiliary building, including the radwaste and fuel handling areas, will be processed through HEPA filters and charcoal adsorbers prior to release. Ventilation exhaust from the containment building will be processed through HEPA filters and charcoal adsorbers prior to release. In addition, the containment building atmosphere will be recirculated through filters and charcoal adsorbers prior to purging to the ventilation exhaust system. The turbine building ventilation exhausts will be released to the environment without treatment. The plant ventilation systems will be designed to induce air flows from potentially less radioactive contaminated areas to areas having a greater potential for radioactive contamination.

We have determined that the proposed gaseous radwaste treatment systems and plant ventilation systems will be capable of reducing the release of radioactive materials in gaseous effluents to approximately 1500 Ci/yr/reactor of noble gases and 0.017 Ci/yr/reactor of iodine-131.

11.2.3 Solid Radwaste Treatment System

The solid radwaste treatment system will be designed to collect and process wastes based on their physical form and need for solidification prior to packaging. "Wet" solid wastes, consisting of spent demineralizer resins, evaporator bottoms, filter sludges, and chemical drain tank effluents, will be combined with a solidification agent and catalyst to form a solid matrix and sealed in the shipping containers. Dry solid wastes, consisting of ventilation air filters, contaminated clothing and paper, and miscellaneous items such as tools and glassware, will be compacted into 55-gallon steel drums. Miscellaneous solid wastes, such as irradiated primary system components will be handled on a case-by-case basis based on their size and activity. Expected solid waste volumes and activities shipped offsite for each reactor will be 4500 ft^3/yr of "wet" solid waste containing an average of 1.3 Ci/ft^3 and 450 drums/yr of "dry" solid waste containing less than 5 Ci total.

Container filling operations will be controlled remotely from consoles located outside the container fill area. Filling operations will have interlock features to prevent opening of filling valves when a container is not properly positioned in the filling station. Baling of dry wastes will be carried out inside a closed and vented dust shroud.

The solid radwaste systems will be located in a seismic Category I structure. The seismic and quality group designations of the equipment, which are consistent with our guidelines, are listed in Table 11.2-1.

Storage facilities for up to 50-150 ft^3 liners of solid radioactive wastes will be provided at grade in the radwaste building. Based on our estimate of 4500 ft^3/yr/reactor, we find the storage capacity adequate for meeting the demands of the station. Wastes will be packaged in 100 ft^3 and 150 ft^3 containers and in 55-gallon steel drums in accordance with the requirements of 10 CFR Part 20, 10 CFR Part 71 and 49 CFR Parts 170-178, and shipped to a licensed burial site in accordance with NRC and DOT regulations.

11.3 Process and Effluent Radiological Monitoring Systems

The process and effluent radiological monitoring system will be designed to provide information concerning radioactivity levels in systems throughout the plant, indicate radioactive leakage between systems, monitor equipment performance, and monitor and control radioactivity levels in plant discharges to the environs. Liquid and gaseous streams will be monitored. Table 11.3-1 indicates the proposed locations and types of continuous monitors. Monitors on certain effluent release lines will automatically terminate discharges should radiation levels exceed a predetermined value. Systems which are not amenable to continuous monitoring or for which detailed isotopic analyses are required will be sampled and analyzed in the plant laboratory.

We have reviewed the locations and types of effluent and process monitoring provided. Based on the plant design and on the continuous monitoring locations and continuous and intermittent sampling locations, we have concluded that all normal and potential release pathways will be monitored. We have also determined that the sampling and monitoring provisions will be adequate for detecting radioactive material leakage to normally uncontaminated systems and for monitoring plant processes which affect radioactivity releases. On this basis we consider the monitoring and sampling provisions to meet the requirements of General Design Criteria 13, 60 and 64 and the guidelines of Regulatory Guide 1.21.

11.4 Evaluation Findings

Our review of the radwaste systems included system capabilities to process the types and volumes of wastes expected during normal operations and anticipated operational occurrences in accordance with General Design Criterion 60, the design provisions incorporated in accordance with General Design Criterion 60 to control releases of radioactive material due to leakage overflows or hydrogen explosion, the quality group and seismic design classification in conformance with the guidelines of Branch Technical Position ETSB 11-1, and the design provisions incorporated in conformance with the guidelines of Regulatory Guide 8.8, paragraph C.3. We have reviewed the applicant's system descriptions, process flow diagrams, piping and instrumentation diagrams, and design criteria for the components of the radwaste treatment systems and for those auxiliary supporting systems that are essential to the operation of the radwaste treatment systems. We have performed an independent calculation of the releases of radioactive materials in liquid and gaseous effluents based on the calculational methods of Draft Regulatory Guide 1.BB.

Our review of the process and effluent radiological monitoring and sampling systems included the provisions proposed for sampling and monitoring all station effluents in accordance with General Design

Criterion 64, for providing automatic termination of effluent releases and assuring control over discharges in accordance with General Design Criterion 60 and Regulatory Guide 1.21, for sampling and monitoring plant waste process streams for process control in accordance with General Design Criterion 63, for conducting sampling and analytical programs in accordance with the guidelines in Regulatory Guide 1.21, and for monitoring process and effluent streams during postulated accidents. The review included piping and instrument diagrams and process flow diagrams for the liquid, gaseous, and solid radwaste systems and ventilation systems, and the location of monitoring points relative to effluent release points on the site plot diagram.

Based on the foregoing evaluation, we conclude that the above aspects of the proposed radwaste treatment and monitoring systems are acceptable. The basis for acceptance has been conformance of the applicant's designs, design criteria, and design bases for the radioactive waste treatment and monitoring system to the applicable regulations and guides referenced above, as well as to staff technical positions and industry standards.

The capability of the liquid and gaseous radioactive waste treatment systems to meet the dose design objectives of Appendix I to 10 CFR Part 50 and the required cost-benefit analysis will be evaluated in a supplement to the SER.

TABLE 11.2-1

DESIGN PARAMETERS OF PRINCIPAL COMPONENTS CONSIDERED IN RADWASTE SYSTEM EVALUATION

Components	No.	Capacity Each	Quality Group (1)
Gaseous Waste Processing System			
Gas Holdup Tanks	9	700 cuft	C
Compressors, Waste Gas	2	2 scfm	C
Surge Tank, Gas	1	20 cuft	C
Nitrogen Recycle Tank	1	700 cuft	C
Gas Recombiner	1	2 scfm	C
Liquid Waste Processing System			
Laundry & Hot Shower Tanks	2	7,500 gal.	D
Floor Drain Tanks	2	30,000 gal.	D (Augmented)
Secondary Waste Tanks	4	30,000 gal.	D (Augmented)
Waste Monitor Tanks	6	15,000 gal.	D
Chemical Waste Tanks	2	30,000 gal.	D (Augmented)
Floor Drain Evaporator	1	20 gpm	D (Augmented)
ICW Evaporators	2	30 gpm	D (Augmented)
Mixed Bed Demineralizers	3	50 gpm	D (Augmented)
Solid Waste Processing System			
Solidification Feed Tanks	2	5,000 gal.	D (Augmented)
Evaporator Bottoms Tank	1	3,000 gal.	D (Augmented)
Spent Resin Storage Tank	1	3,000 gal.	D (Augmented)

(1) Quality Group C components will be of seismic Category I design and Quality Group D components will be of non-seismic design.

TABLE 11.3-1

PROCESS AND EFFLUENT RADIOLOGICAL MONITORING

Stream Monitored

Liquid*

- Component Cooling Water Loops
- Steam Generator - Secondary Side
- Steam Generator - Blowdown
- Service Water Return Line
- Liquid Radwaste Release
- CVCS Letdown Line
- CVCS Preholdup Line

Gas**

- Plant Vents (2), including Containment Purge Exhaust
- Condenser Air Discharge
- Fuel Pool Ventilation Exhaust
- Gas Decay Tank Discharge

* All liquid streams will be monitored for gross gamma activity.

** All gas streams will be monitored for noble gas (beta or gamma); other forms of radioactivity are sampled for laboratory analysis.

15.7.3 Postulated Radioactive Released Due to Liquid Tank Failures

The consequences of component failures which could result in contaminated liquid releases to the environs were evaluated for components containing liquid radioactive materials located outside reactor containment. The scope of the review included the calculation of radionuclide inventories in station components at design basis fission product levels, the mitigating effects of the plant design, and the effect of site geology and hydrology.

The radwaste tank that will contain the highest total quantity of activity is the auxiliary building floor drain holdup tank. This tank will have a volume of 30,000 gal. and will contain liquid with a primary coolant activity concentration of approximately 10 μCi/ml.

Liquid spills will enter the groundwater control system and will be diverted to Workman Creek. We evaluated the liquid transit time for radwaste leakage to Workman Creek to be approximately one hour. We estimate a water dilution factor of two. At the point of mixing with the creek water a negligible dilution factor will be effected after mixing.

Considering dilution and radioactive decay over the one hour transit time, a rupture of the waste discharge tank will give a concentration of 5.3 μCi/cc in Workman Creek. This value is in excess of the limits of 10 CFR Part 20, Appendix B, Table II, Column 2 for unrestricted areas.

Based on the foregoing evaluation, we conclude that the provisions incorporated in the applicant's design to mitigate the effects of component failures involving contaminated liquids are not acceptable.