SAFETY EVALUATION REPORT FOR
DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1

Docket No. 50-346

11.0 Radioactive Waste Management

11.1 Summary Description

The radioactive waste management systems are designed to provide for the controlled handling and treatment of liquid, gaseous, and solid wastes. Since the Construction Permit was issued, the applicant has modified the radwaste system to reduce radioactive releases to levels which will meet our "as low as practicable" guidelines. These modifications include installation of an evaporator distillate polishing demineralizer in the liquid radwaste system, charcoal filters in the gaseous radwaste and containment purge systems, and a solidification system. The design criteria of the liquid, gaseous, and solid radwaste system components have also been upgraded. The liquid waste system processes liquid waste streams such as reactor coolant letdown, equipment and floor drains, leakage from equipment, condensate demineralizer backwash wastes, decontamination and laboratory waste liquids, and laundry and shower waste water. The treated liquid waste is recycled for reuse if the reactor coolant balance requires makeup and if the water quality is adequate. The liquid waste system processes waste liquid utilizing evaporation, demineralization, and filtration for removal of radioactive material, chemical impurities, and particulates.

Gaseous wastes are generated during the operation of the plant from degassing of primary coolant from displacement of liquid storage

tank cover gases, from the main steam condenser air ejector, from venting of equipment handling radioactive materials, and from leakage of systems and components containing radioactive material. The gaseous waste system removes radioactive materials from gaseous streams by filtration, and holdup for radioactivity decay. The treated gas streams are released to the environment through the station vent.

Solid wastes are generated during plant operation and consist of radioactive material from liquid waste evaporator concentrates, spent resins, spent filter cartridges, and contaminated items such as clothing, equipment, and tools. Treatment consists of solidification of wet solid wastes and compaction of dry solid wastes. Disposal consists of packaging and shipping to a licensed burial site.

The design objectives for the Davis-Besse Nuclear Power Station, Unit 1 are to meet the requirements of "as low as practicable" in 10 CFR Part 20, and 10 CFR Part 50. Based on our evaluation of the systems and its modifications, we find that the liquid, gaseous, and solid radwaste systems meet our "as low as practicable" guidelines and are acceptable.

11.2 Liquid Waste Summary

11.2.1 Description and Evaluation

The modified liquid radioactive waste systems are described in the Final Statement for the operating license stage (FES-OL). Subsequent

to the publication of the Safety Evaluation Report for the construction permit (SER-CP), the system was modified to include an evaporator condensate demineralizer in the Miscellaneous Liquid Radioactive Waste portion of the liquid radwaste system. The demineralizer will be a mixed bed resin type with a 40 gpm design flow and a 14 cu.ft. resin volume.

The design criteria of major processing equipment in the liquid radwaste system was upgraded to ASME Section III, Class III standards which more than meet the guidelines of Branch Technical Position ETSB 11-1, "Design Guidance for Radioactive Waste Management Systems Installed in Light-Water-Cooled Nuclear Power Plants".

The addition of the demineralizer was considered in the FES-OL and was included in that evaluation. We calculated that approximately 0.13 Ci/yr excluding tritium and dissolved gases will be released from the modified liquid radioactive waste systems to the environment. To compensate for anticipated operational occurrences and equipment downtime, we normalized this value to 0.3 Ci/yr. We estimate the average annual release of tritium will be 350 Ci based on data for operating pressurized water reactors. The applicant estimates that 0.45 Ci/yr excluding tritium and dissolved gases, and 346 Ci/yr of tritium will be released from the system.

Based on our evaluation of radioactive materials in liquid effluent, we calculate that the whole body and critical organ doses will be

less than 5 mrem/yr at or beyond the site boundary, and that the system will be capable of limiting the release of radioactive materials in liquid effluents to less than 5 Ci/yr/unit.

We have reviewed the effects of reactor operation with 1% of the operating fission product inventory in the core being released to the primary coolant. We have determined, under these conditions, the concentrations of radioactive materials in liquid effluents will be a small fraction of the limits in 10 CFR Part 20, Table 2, Column II.

.2 Findings

The liquid radwaste system includes the equipment and instrumentation to control the release of radioactive materials in liquid effluents. The scope of our review included the system's capability to reduce releases of radioactive materials in liquid effluents to "as low as practicable" levels in accordance with 10 CFR Parts 20 and 50.36a, considering normal operation and anticipated operational occurrences, and the design provisions incorporated to preclude uncontrolled releases of radioactive materials in liquids due to leakage or overflows in accordance with General Design Criterion 60 and the quality group classification and seismic design criteria in conformance with the guidelines of BTP ETSB 11-1.

The review has included an evaluation effluent releases based on the modified system. Included in the review were piping and instrumentation

diagrams, schematic diagrams, and descriptive information from the FSAR.

The basis for acceptance in our review has been conformance of the applicant's design, design criteria, and design bases for the liquid radwaste system to the Commission's Regulations and to applicable Regulatory Guides, as referenced above, as well as staff technical positions and industry standards.

Based on the foregoing evaluation, we conclude that the proposed modified liquid radwaste system is acceptable.

11.3 Gaseous Waste

11.3.1 Description and Evaluation

The modified gaseous radioactive waste system and building ventilation systems are described in the FES-OL. The applicant in the FSAR issued subsequent to the SER-CP, proposed modifications to the gaseous radwaste system to include a charcoal filter downstream of the waste gas decay tanks. The charcoal filter will be of the deep bed type, with a 10-inch (24 cm) depth and a 50 cfm flow rate. The Emergency Ventilation System (EVS) was also modified to permit the flow of containment building purge system air through the EVS charcoal filters during normal plant operation.

In addition, the components in the gaseous waste system which delay or filter process gas will be designed to ASME III, Class III standards which more than meet the guidelines of Branch Technical

Position, ETSB 11-1.

The modifications to the systems were considered in the FES-OL and were included in that evaluation. In the evaluation, we calculated that approximately 3345 Ci/yr of noble gases and 0.074 Ci/yr of I-131 will be released from the modified gaseous radwaste system to the environment. The applicant estimated that 4550 Ci/yr of noble gases and 0.119 Ci/yr of I-131 will be released from the system.

Based on our evaluation of the modified gaseous waste system we calculate that the annual air dose due to gamma radiation at or beyond the site boundary should not exceed 10 mrads, the annual air dose due to beta radiation at or beyond the site boundary should not exceed 20 mrads, the annual thyroid dose to an indicidual should not exceed 15 mrems by all considered pathways, and the annual total quantity of iodine-131 released will not exceed 1 Ci.

We have revieved the effects of reactor operation with 1% of the operating fission product inventory in the core being released to the primary coolant. We have determined, under these conditions, the concentrations of radioactive materials in gaseous effluents will be a small fraction of the limits in 10 CFR Part 20, Table 2, Column II.

11.3.2 Gaseous Radwaste System Evaluation Findings

The gaseous radwaste system includes the equipment and instrumentation to control the release of radioactive materials in gaseous effluents. The scope of our review included the system's capability to reduce releases of radioactive materials in gaseous effluents to "as low as practicable" levels in accordance with 10 CFR Parts 20 and 50.36a considering normal operation and anticipated operational occurrences and the quality group and seismic design criteria. The review has included an evaluation of effluent releases based on the modified treatment processes and considering pathways due to process vents and leakage affecting building ventilation systems. Included in the review were piping and instrumentation diagrams, schematic diagrams, and descriptive information from the FSAR.

The basis for acceptance in our review has been conformance of the applicant's designs, design criteria, and design bases for the gaseous waste system to the applicable Commission Regulations and Regulatory Guides referenced above, as well as to staff technical positions and industry standards.

Based on the foregoing evaluation, we conclude that the proposed modified gaseous radwaste system is acceptable.

11.4 Solid Waste System

11.4.1 Description and Evaluation

The solid waste system is designed to collect, monitor, process, package, and provide temporary storage for radioactive solid waste

prior to offsite shipment for disposal in accordance with applicable regulations.

Radioactive solid wastes resulting from operation of the plant include concentrates from the radwaste evaporators, spent resins, spent filter cartridges, and contaminated dry waste such as disposable filters, clothing, equipment, and tools. The original solid radwaste system has been modified to use a solidification system in which the evaporator concentrates, spent resins and high activity filter cartridges will be mised with the solidifying agent, loaded in 50 ft^3 cask liners, and stored prior to shipment. Low activity filter cartridges will be loaded into 55 gal. drums. Dry wastes will be compacted into 55 gal. drums and stored for shipment. The high radioactivity level drums will be handled by use of remote handling equipment.

The equipment in the solid waste system which handle liquid wastes will be designed to ASME III, Class III standards which more than meet the guidelines of Branch Technical Position ETSB 11-1.

In our evaluation, we estimated annual disposal based on the oper experience of similar plants will be 235 drums of high level waste and 600 drums of dry compacted waste. The total activity after 180 days decay was estimated to be 2500 curies per year.

Based on operating experience at otherplants and the capacity of the drumming station, the applicant estimated 500 drums of high level and

and 150 drums of low level waste (4800 ft^3) will be shipped annually to a licensed burial ground. All solid waste will be packaged and shipped in conformance with 11 applicable AEC and DOT regulations.

11.4.2 Solid Radwaste System Evaluation Findings

The solid radwaste system includes the equipment and instrumentation for solidifying and packaging radioactive wastes prior to shipment offsite for burial. The review has included an evaluation of the modified system's capability for processing the types and volumes of wastes expected during normal operation and anticipated operational occurrences in accordance with General Design Criterion 60, the quality group design criteria, and the provisions for handling wastes with regard to the requirements of 10 CFR Parts 20 and 71, and 40 CFR Parts 170-189.

Included in the review were piping and instrumentation diagrams, schematic diagrams, and descriptive information from the FSAR.

The basis for acceptance in our review is conformance of the applicant's designs, design criteria, and design bases for the solid radwaste system to the Commission's Regulations and the applicable Regulatory Guides, as referenced above, as well as staff technical positions and industry standards.

Based on the foregoing evaluation, we conclude that the proposed solid radwaste system is acceptable.

11.5 Process and Effluent Monitoring

11.5.1 Description and Evaluation

In our evaluation of the process and effluent monitoring system 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.

The process and effluents 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.

Scintillation detectors will be used for monitoring liquids and for monitoring radioactive gases and particulates in vent effluents. Gaseous iodine will be collected in replaceable, impregnated charcoal adsorbers which will be continuously monitored while in use by scintillation detectors. Systems which are not amenable to continuous monitoring or for which detailed isotopic analyses are required will be periodically sampled and analyzed in the plant laboratory.

Table 11.5-1 indicates the proposed locations and types of continuous monitors. Monitors on effluent release lines will automatically terminate discharges should radiation levels exceed a predetermined value.

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 intermittant 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.

11.5.2 Process and Effluent Radiological Monitoring Evaluation Findings

The provisions for process and effluent radiological monitoring include the instrumentation and controls for monitoring and controlling the releases of radioactive materials in plant effluents and monitoring the level of radioactivity in process streams. The scope of our review included the provisions for monitoring and controlling the release of radioactive materials in plant effluents in accordance with General Design Criteria 60 and 64 and Regulatory Guide 1.21, and for monitoring radioactivity levels within the plant in process streams in accordance with General Design Criterion 13.

The basis for acceptance in our review has been conformance of the applicant's design, design criteria, and design bases for the process and effluent monitoring systems to the Commission's Regulations

as set forth in the General Design Criteria and to applicable Regulatory Guides, as referenced above, as well as staff technical positions and industry standards.

Based on the foregoing evaluation, we conclude that the proposed provisions for monitoring process and effluent streams are acceptable.

Table 11.5-1

Process and Effluent Monitoring

Stream Monitored	Detector Type
Reactor Coolant Purification System	Scintillation
Component Cooling Water	Scintillation
Steam Headers	Scintillation
Service Water Discharge Header	Scintillation
Miscellaneous Radwaste Effluent	Scintillation
Clean Radwaste Effluent	Scintillation
Station Liquid Radwaste Effluent	Scintillation
Radioactive Waste Gas Discharge	Scintillation
Fuel Handling Area Exhaust (Particulate)	Scintillation
(Iodine)	Scintillation
(Gas)	Scintillation
Radwaste Area Exhaust (Particulate)	Scintillation
(Iodine)	Scintillation
(Gas)	Scintillation
Station Vent Stack (Particulate)	Scintillation
(Iodine)	Scintillation
(Gas)	Scintillation
Containment (Particulate)	Scintillation
(Iodine)	Scintillation
(Gas)	Scintillation
Condenser Vacuum Pump Discharge	Scintillation

BIBLIOGRAPHY

1. United States Atomic Energy Commission, "Final Environmental Statement Concerning Proposed Rule Making Action: Numerical Guides for Design Objectives and Limiting Conditions to Meet the Criterion "As Low As Practicable" for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents, WASH-1258, USAEC, Washington, D.C., July 1973.