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DUKE POWER COMPANY
POWER BUILDING
422 SOUTH CHURCH STREET, CHARLOTTE, N. C. 28201

A. C. THIES
SENIOR VICE PRESIDENT
PRODUCTION AND TRANSMISSION

P. O. BOX 2178

May 2, 1974

Mr. V. A. Moore, Assistant Director
Light Water Reactors, Group 2
Directorate of Licensing
Office of Regulation
U. S. Atomic Energy Commission
Washington, D. C. 20545

Re: Oconee Nuclear Station
Docket No. 50-269, -270, -287

Dear Mr. Moore:

In response to Mr. R. C. DeYoung's letter of December 10, 1973, please find attached a description of the interim liquid and gaseous waste disposal systems for Oconee Nuclear Station.

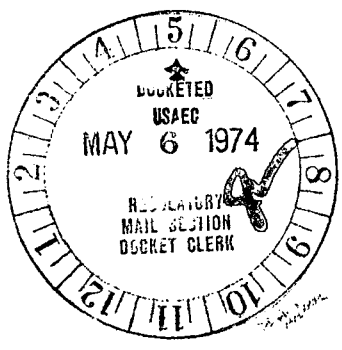
Very truly yours,

A. C. Thies

A. C. Thies

ACT:gje

Attachment



OCONEE NUCLEAR STATION

UNITS 1, 2, and 3

REPORT TO THE UNITED STATES

ATOMIC ENERGY COMMISSION

INTERIM LIQUID WASTE DISPOSAL SYSTEM

INTERIM GASEOUS WASTE DISPOSAL SYSTEM

DUKE POWER COMPANY FILE NO. OS-108

APRIL 23, 1974

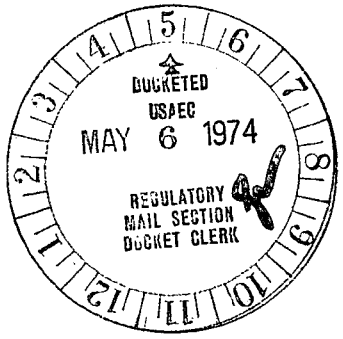


Table of Contents

1.0 SYSTEM PURPOSE

The Interim Liquid Waste Disposal System and the Interim Gaseous Waste Disposal System are provided to relieve the waste management problems at Oconee Nuclear Station. These systems and their supporting facilities are designed to serve temporarily until a larger, permanent facility can be designed, procured, and constructed. Therefore, the design and construction of the interim facilities is not in accordance with all the design criteria and code requirements of a permanent facility.

The Interim Liquid Waste Disposal System is shown on attached Duke flow diagrams PO-107H, J, K, and L. The Interim Gaseous Waste Disposal System is shown on attached Duke flow diagram PO-108C. In sections of this report the term "Interim Waste Management Systems" may be used in reference to these two systems.

2.0 SYSTEM HOUSING

A major portion of the Interim Waste Management Systems components are located in the Interim Radwaste Building as shown on Duke general arrangement drawing number 0-19. The shell of this structure is a pre-engineered metal building, anchored to a concrete slab. Radiation exposure to the public and to station personnel has been limited by surrounding all radioactive components with shield walls topped by a concrete roof slab. A $1\frac{1}{2}$ foot high curb around the perimeter of the floor slab of the building is designed to contain the spillage resulting from the simultaneous rupture of all the liquid storage tanks in the building. A floor drain system is provided to collect equipment leakage, spillage, wash-down, etc. The building is provided with a heating and ventilation system.

3.0 SYSTEM DESCRIPTION AND FUNCTIONS

3.1 GENERAL DESCRIPTION

In order to facilitate this discussion, the two functionally different areas of liquid waste and gaseous waste treatment will be discussed separately in the following sections:

3.1.1 INTERIM LIQUID WASTE DISPOSAL SYSTEM

The Auxiliary Building coolant treatment header (PO-106B, LOC G-10) has been redesigned to facilitate the processing of liquid wastes from the high activity waste tanks, low activity waste tanks, and the miscellaneous waste holdup tanks by the Interim Liquid Waste Disposal System. Liquid wastes are pumped from these tanks, through the coolant treatment header, to two 17000 gallon interim evaporator feed tanks located in the Interim Radwaste Building. To prevent solids accumulation in these tanks, an interim evaporator feed filter is located in the waste feed line upstream of the tanks.

One of these feed tanks is normally aligned for collection and storage and the other is aligned to discharge its contents for processing through the evaporator.

The heart of the Interim Liquid Waste Disposal System is a 15 gpm, Westinghouse evaporator/gas stripper package. Interim evaporator feed tank contents are fed to this package by the interim evaporator feed pump. Evaporator condensate (distillate) is normally discharged directly to one of the interim evaporator condensate monitor tanks. If necessary, however, evaporator condensate may first be processed through the interim evaporator condensate demineralizer for removal of ionic contaminants. The interim evaporator condensate filter is located downstream of the demineralizer to retain resin fines.

When a batch of 500 gallons of 12 percent boric acid concentrates has collected in the evaporator, the evaporation process is shutdown. The concentrates are then pumped to the interim evaporator concentrates storage tank for storage prior to preparation for shipment.

Gases stripped from evaporator feed by the evaporator gas stripper and vent condenser are discharged to the suction of the Unit 3 waste gas compressors by way of the Unit 3 waste gas vent header.

An interim condensate monitor tank pump is provided at the discharge of each interim evaporator condensate monitor tank. The contents of these tanks are normally pumped to the plant discharge via the plant discharge radiation monitor. However, provision is made to pump condensate tank contents to the Auxiliary Building reactor coolant bleed holdup tanks for recycling if reactor grade water quality is attained. Condensate may also be pumped to the interim evaporator feed tanks or to the interim evaporator condensate demineralizer if further processing is required.

When ready for shipment, concentrates stored in the concentrates storage tank are pumped by the interim evaporator concentrates transfer pump to a drumming station located in the Unit 3 Auxiliary Building. There the concentrates are processed through the liquid waste solidification package (PO-107L) in which a polymer base chemical and catalyst are mixed with the concentrates. The waste mixture is then discharged into a large truck mounted cask liner in which it solidifies and is shipped to a licensed offsite burial ground.

Interim Radwaste Building floor and equipment drains are collected in two sumps. The floor and low activity drains sump (PO-107K, LOC D-4), as the name implies, collects floor drains and low activity degassed equipment drains. The floor and low activity drains sump pumps normally discharge sump contents to the interim evaporator feed tanks. However, the discharge of these pumps may be aligned to the Unit 3 low activity waste tank in the Auxiliary Building if necessary. The floor and low activity drains sump is vented to the Unit 3 vent stack.

High activity equipment drains containing entrained fission gasses are collected in the high activity equipment drains sump (PO-107K, LOC D-11). Two high activity equipment drains sump pumps normally discharge sump contents to the interim evaporator feed tanks. Sump pump discharge may be aligned to the Unit 3 high activity waste tank in the Auxiliary Building if necessary. The high activity equipment drains sump is vented to the suction of the Unit 3 waste gas compressors via the Unit 3 waste gas vent header.

3.1.2 INTERIM GASEOUS WASTE DISPOSAL SYSTEM

Three interim waste gas decay tanks provide 3200 cubic feet of additional radioactive gaseous waste storage at Oconee. Two of these tanks are connected to the discharge of the Units 1 and 2 waste gas compressors. The other tank is connected to the discharge of the Unit 3 waste gas compressor. Procedures for the utilization of these tanks are similar to those for the waste gas decay tanks in the Auxiliary Building.

3.2 COMPONENT DESCRIPTION

3.2.1 INTERIM EVAPORATOR FEED TANKS

Two 17,000 gallon interim evaporator feed tanks are provided in the Interim Radwaste Building to collect and store liquid wastes pumped from the low activity waste tanks, high activity waste tanks, and miscellaneous waste holdup tanks, all of which are located in the Auxiliary Building. The feed tanks are vented to the Unit 3 waste gas vent header which is aligned to the suction of the Unit 3 waste gas compressors. Overflows are provided which drain to the high activity equipment drains sump. Level instrumentation indicates liquid level in each tank, provides a low level cutoff signal to the interim evaporator feed pump, and a high level alarm. Material of construction is stainless steel.

3.2.2 INTERIM EVAPORATOR CONDENSATE MONITOR TANKS

Two 9000 gallon tanks in the Interim Radwaste Building collect and store condensate (distillate) from the interim waste evaporator package. These tanks are vented to the Unit 3 vent stack. Each tank is provided with an overflow which drains to the floor and low activity drains sump. Level instrumentation provides indication of liquid level in each tank, automatic low level cutoff for the associated interim condensate monitor tank pump, and a high level alarm. Material of construction is stainless steel.

3.2.3 INTERIM EVAPORATOR CONCENTRATES STORAGE TANK

A 3000 gallon stainless steel tank is provided in the Interim Radwaste Building to collect and store interim waste evaporator concentrates. Redundant electrical heaters maintain the 12 percent boric acid concentrates above solubility temperature. The tank is vented to the Unit 3 vent stack. Level instrumentation provides indication of concentrates level, automatic low level cutoff of the interim evaporator concentrates transfer pump, and a high level alarm.

3.2.4 INTERIM EVAPORATOR CONDENSATE RETURN UNIT

The condensate return unit collects condensed steam from the interim waste evaporator package and returns the condensate to the Unit 3 condensate storage tanks. The unit consists of a 100 gallon receiver, two 25 gpm pumps, valves, piping, instrumentation and automatic controls.

3.2.5 INTERIM WASTE GAS DECAY TANKS

Three carbon steel tanks, each having a capacity of 1070 cubic feet, provide additional waste gas storage. These tanks are located in the Interim Radwaste Building. Two of the tanks are aligned to the Units 1 and 2 waste gas compressors and one is aligned to the Unit 3 waste gas compressors.

Design pressure of each tank is 100 psig. Normal operating pressure does not exceed 85 psig. Each tank is provided with a relief valve with a set pressure of 100 psig. Relief valve discharge is directed to the Unit 3 vent stack. Pressure instrumentation gives control room indication of the internal pressure of each tank.

3.2.6 INTERIM EVAPORATOR FEED FILTER

One cage assembly type interim evaporator feed filter is provided to filter particulate matter, 25 microns or larger, from the liquid waste feed to the interim evaporator feed tanks. The filter housing is constructed of stainless steel. A disposable synthetic cartridge is used. Instrumentation is provided to signal an alarm on high pressure drop across the filter.

3.2.7 INTERIM EVAPORATOR CONDENSATE FILTER

One cage assembly type interim evaporator condensate filter is provided to filter resin fines, 25 microns or larger, from the fluid discharged from the interim evaporator condensate demineralizer. Filter housing material is stainless steel. A disposalbe synthetic cartridge is used. Instrumentation is provided to signal an alarm on high pressure drop across the filter.

3.2.8 INTERIM EVAPORATOR CONDENSATE DEMINERALIZER

A 50 cubic foot non-regenerable mixed bed demineralizer is provided for removing ionic contaminants from interim waste evaporator condensate. This demineralizer is normally bypassed. However, it may be aligned to process condensate as it is being pumped from the evaporator, or it may be aligned to the discharge of an interim condensate monitor tank pump so condensate monitor tank contents may be recirculated through it. It is also possible to align the demineralizer to receive fluid directly from the interim evaporator feed tanks if the quality of evaporator feed tank contents warrants this arrangement.

A differential pressure gage indicates pressure drop through the demineralizer. Material of construction is stainless steel.

3.2.9 INTERIM EVAPORATOR FEED PUMP

One stainless steel, canned rotor, centrifugal pump provides liquid waste feed to the interim waste evaporator from the interim evaporator feed tanks. The pump may also be aligned to recirculate the contents of one of the feed tanks or to transfer the contents of one tank to the other. In addition, an evaporator bypass line allows feed tank contents to be pumped directly to the interim evaporator condensate demineralizer.

Local indication of pump suction and discharge pressure is provided. Flow instrumentation provided at the pump discharge gives indication of flow rate and total volume pumped.

3.2.10 INTERIM CONDENSATE MONITOR TANK PUMPS

A stainless steel, canned rotor, centrifugal pump is provided at the discharge of each of the interim evaporator condensate monitor tanks. The discharge of each pump may be aligned to:

A. The plant discharge header.

B. The reactor coolant bleed holdup tanks for recycle.

C. Recirculate its respective tank's contents.

D. Transfer its respective tank's contents to the other condensate monitor tank.

E. The interim evaporator condensate demineralizer.

F. The interim evaporator feed tanks.

Local indication of pump suction and discharge pressure is provided. Pump discharge flow instrumentation gives indications of flow rate and total volume pumped.

3.2.11 INTERIM EVAPORATOR CONCENTRATES TRANSFER PUMP

One stainless steel, canned rotor, centrifugal pump is provided to pump evaporator concentrates from the interim evaporator concentrates storage tank to the drumming station for solidification and shipment. The pump discharge may also be aligned to recirculate tank contents.

Local indication of pump suction and discharge pressure is provided. Instrumentation is provided to give indication of flow rate and total volume pumped.

3.2.12 FLOOR AND LOW ACTIVITY DRAINS SUMP PUMPS

Two vertical sump pumps are provided for the floor and low activity drains sump. The pumps may be aligned to discharge to the interim evaporator feed tanks, the low activity waste tanks in the Auxiliary Building, or to recirculate the sump contents. Level instrumentation automatically starts one pump at "high" sump water level and starts the alternate pump at "high high" sump water level.

3.2.13 HIGH ACTIVITY EQUIPMENT DRAINS SUMP

Two vertical sump pumps are provided for the high activity equipment drains sump. The pumps may be aligned to discharge to the interim evaporator feed tanks, the high activity waste tanks in the Auxiliary Building, or to recirculate the sump contents. Sump level instrumentation starts one pump automatically at "high" sump water level and starts the alternate pump at "high high" sump water level.

3.2.14 INTERIM WASTE EVAPORATOR PACKAGE

A Westinghouse 15 gpm evaporator/gas stripper package is located in the Interim Radwaste Building for the purpose of processing liquid wastes collected in the interim evaporator feed tanks. The evaporator/gas stripper package consists of the following components:

A. Feed Preheater
B. Gas Stripper
C. Vent Condenser
D. Evaporator
E. Absorption Tower
F. Evaporator Condenser
G. Distillate Cooler
H. Concentrate Pump
I. Distillate Pump
J. Control Panel and Instrumentation

These components are used in one of three basic flow circuits: feed, concentrate, or distillate. These three circuits interface at the evaporator. See PO-107J.

3.2.14.1 Evaporator Feed Circuit

Liquid waste feed solution enters the system from the interim evaporator feed tanks. The feed passes immediately into the feed preheater where the temperature is raised to about 215°F. Once heated, the feed flows into the top of the gas stripping column, and cascades down through flexiring packing against counter-flowing steam. The steam strips the feed of dissolved gases and carries the gases out of the column to the vent condenser.

In the vent condenser, the steam is condensed and subcooled while the gases are channeled out the Unit 3 waste gas vent header. Vent condenser drains return to the feed line through an eductor in the piping between the preheater and the stripping column.

The degassed feed from the stripping column flows directly to the evaporator shell. In the evaporator, the hot feed solution is heated to the boiling point, driving off pure vapor and concentrating the solids remaining in the liquid. The vapor flows into the distillate flow circuit, while the remaining liquid forms the concentrate flow circuit.

3.2.14.2 Evaporator Distillate Circuit

Vapor from the evaporator boiling pool rises into the absorption tower which contains sections of wire mesh and bubblecap trays. The mesh removes entrained solids by mechanical impingement, and the bubblecap trays force the vapor to flow through a thin layer of reflux water which reabsorbs the volatile solids contained in the vapor. The pure vapor (less than 10 ppm total solids) then goes directly to the evaporator condenser where it is condensed. A distillate pump conveys the distillate (except for a small amount used as reflux water in the absorption column) through a distillate cooler and then to storage.

3.2.14.3 Evaporator Concentrate Circuit

The liquid remaining in the evaporator boiling pool is the concentrate. While feed is added and vapor is removed from the system continuously, the concentrate remains in the evaporator for the duration of a run, until its concentration has reached drumming levels. The concentrate pump constantly circulates this liquid to assure uniform chemistry throughout the boiling pool during concentration, and the same pump serves to pump the concentrates to the interim evaporator concentrates storage tank at the end of each run.

3.2.15 INTERIM LIQUID WASTE SOLIDIFICATION PACKAGE

An interim liquid waste solidification package is provided to process and solidify evaporator concentrates in preparation for shipment to an offsite burial ground (see PO-107L). Solidification of these concentrates is accomplished by mixing with a polymer base chemical (urea formaldehyde). The waste-chemical stream is then mixed with a catalyst just prior to discharge into a large truck mounted disposable cask. The addition of catalyst starts the solidification process which is completed in the disposable cask prior to shipment.

The solidification package consists of a "cold skid", a "hot skid", a polymer tank skid, and a fill nozzle assembly. The cold skid contains the polymer and catalyst feed systems. It also contains the solidification package control panel. The hot skid contains the waste (concentrates) feed system and an automatic flush system. The polymer tank skid simply consists of a 475 gallon polymer tank and tank stand. The fill nozzle assembly supplements the two main skids by providing a means of connection to the disposable cask.

4.0 SYSTEM COMPONENT DESIGN PARAMETERS

4.1 INTERIM EVAPORATOR FEED TANKS

Quantity	2
Volume, gal.	17000
Design pressure	Static head plus 5 psig
Design temperature, °F	200
Material	304 stainless steel

4.2 INTERIM EVAPORATOR CONDENSATE MONITOR TANKS

Quantity	2
Volume, gal	9000
Design pressure	Static head plus 5 psig
Design temperature, °F	200
Material	304 stainless steel

4.3 INTERIM EVAPORATOR CONCENTRATES STORAGE TANK

Quantity	1
Volume, gal.	3000
Design pressure	Static head plus 5 psig
Design temperature, °F	200
Material	304 stainless steel

4.4 INTERIM EVAPORATOR CONDENSATE RETURN UNIT

Quantity	1
Receiver volume, gal.	100
Design pressure	Atmospheric
Design temperature, °F	212
No. of pumps	2
Design flow, gpm	25
Design head, ft.	65

4.5 INTERIM WASTE GAS DECAY TANKS

Quantity	3
Volume, ft^3	1070
Design pressure, psig	100
Design temperature, °F	200
Material	Carbon steel

4.6 INTERIM EVAPORATOR FEED FILTER

Quantity	1
Type	Cage Assembly (disposable synthetic cartridge)
Design pressure, psig	200
Design temperature, °F	250
Design flow rate, gpm	35
Pressure drop at design	Clean - 5
Flow, psi	Fouled - 20
Retention of 25 microns particles, %	98
Material	Stainless steel

4.7 INTERIM EVAPORATOR CONDENSATE FILTER

Quantity	1
Type	Cage Assembly (disposable synthetic cartridge)
Design pressure, psig	300
Design temperature, °F	250
Design flow rate, gpm	150
Pressure drop at design	Clean - 5
Flow, psi	Fouled - 20
Retention of 25 micron particles, %	98
Material	Stainless steel

4.8 INTERIM EVAPORATOR CONDENSATE DEMINERALIZER

Quantity	1
Type	Non-regenerable
Design temperature, °F	200
Design pressure, psig	150
Vessel volume, ft^3	55
Resin volume, ft^3	50
Design flow, gpm	310
Material	Stainless steel
Resin type	Mixed bed

4.9 INTERIM EVAPORATOR FEED PUMP

Quantity	1
Type	Canned centrifugal
Design flow, gpm	35
Design head, ft	250
Design pressure, psig	150
Design temperature, °F	200
Operating temperature, °F	120
Material	Stainless steel

4.10 INTERIM CONDENSATE MONITOR TANK PUMPS

Quantity	2
Type	Canned centrifugal
Design flow, gpm	100
Design head, ft	250
Design pressure, psig	150
Design temperature, °F	200
Operating temperature, °F	120
Material	Stainless steel

4.11 INTERIM EVAPORATOR CONCENTRATES TRANSFER PUMP

Quantity	1
Type	Canned centrifugal
Design flow, gpm	35
Design head, ft	250
Design pressure, psig	150
Design temperature, °F	200
Operating temperature, °F	120
Material	Stainless steel

4.12 FLOOR AND LOW ACTIVITY DRAINS SUMP PUMPS

Quantity	2
Type	Vertical
Design flow, gpm	50
Design head, ft	100
Material	Stainless steel

4.13 HIGH ACTIVITY EQUIPMENT DRAINS SUMP PUMPS

Quantity	2
Type	Vertical
Design flow, gpm	50
Design head, ft	100
Material	Stainless steel

4.14 INTERIM WASTE EVAPORATOR PACKAGE

Quantity	1
Nominal capacity, gpm	15
Steam supply pressure, psig	50
Steam flow, lb/hr	10500
Cooling water flow, gpm	780
Concentrates batch volume, gal	500
Max. boron concentration, ppm	21000
Liquid DF*	10^6
Gaseous DF**	10^5

*DF for liquid = $\frac{\text{activity in concentrates}}{\text{activity in distillate}}$

**DF for gas = $\frac{\text{activity in feed}}{\text{activity in distillate}}$

4.15 INTERIM LIQUID WASTE SOLIDIFICATION PACKAGE

Quantity	1
Liquid waste feed rate, gpm	10
Polymer feed rate, gpm	5
Catalyst feed rate, gph	50
Polymer tank capacity, gal	475
Catalyst tank capacity, gal	100