UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 1 8 1983

Docket Nos. 50-400/401

MEMORANDUM FOR: Thomas M. Novak, Assistant Director
for Licensing, DL

FROM: Daniel R. Muller, Assistant Director
Radiation Protection, DSI

SUBJECT: METB INPUT FOR SAFETY EVALUATION REPORT FOR SHEARON HARRIS, UNIT NOS. 1 AND 2

PLANT NAME: Shearon Harris
LICENSING STAGE: OL
DOCKET NUMBER(S): 50-400/401
RESPONSIBLE BRANCH: LB#3; B. Buckley, LPM
REVIEW STATUS: Continuing

Enclosed for your use is the Effluent Treatment Systems Section, METB, input to the Safety Evaluation Report (SER) for Shearon Harris Nuclear Power Plant.

Since the SER is on CRESS, we have marked-up the latest draft of the SER to reflect changes in the status of open items.

Based upon our review, the confirmatory items are:
1. Description of polymer binder system (11.4).
2. Drawing(s) on seal water, BRS, etc. filter sludge handling (11.4).
3. Location of Turbine building vent monitor (10.4.2, 10.4.3 and 11.5).

The open items are:
1. Applicant possesses no method for determining releases of noble gases from the mechanical vacuum pumps during hogging operations (10.4.2 and 11.5).
2. Applicant has no means for continuously sampling for radioiodines and particulates from the mechanical vacuum pumps during hogging operations (10.4.2 and 11.5).
3. Applicant has no radioactivity monitor on the discharge from the service water system, waste processing building cooling water, and the reactor auxiliary building backwash return (11.5).
4. Applicant has not included all the appropriate systems and/or components in the leak reduction program (TMI Item III.D.1.1 and 9.3.5).

slpn

If there are any questions concerning this input, please contact J. Hayes (x27649) who is the reviewer for the Shearon Harris plant.

Original signed by
Daniel R. Muller

Daniel R. Muller, Assitant Director
for Radiation Protection
Division of Systems Integration

Enclosure:
As stated

cc: R. Mattson
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SURNAME	JJHayes:dTJ	CWillis	WPGammill	DRMuller			
DATE	11/17/83	11/17/83	11/ /83	11/17/83			

The scope of review of the main condenser included layout drawings and descriptive information in FSAR Section 10.4.1.

The basis for acceptance in the staff review was conformance of the design criteria and bases and design of the condenser to the acceptance criteria in Section II of SRP 10.4.1 and industry standards.

Based on its review, the staff concludes that the main condenser is in conformance with the above-cited criteria and design bases, can perform its designed function, and is, therefore, acceptable.

10.4.2 Main Condenser Evacuation System

10.4.2.1 Summary Description

The main condenser evacuation system (MCES) of each unit consists of two 100% capacity mechanical vacuum pumps that serve the main condenser. At startup, one or both pumps may be operated to evacuate the condenser. Once operating pressure is obtained, one pump is placed on standby. At startup and before turbine operation, the noncondensible gases will be discharged directly to the atmosphere in the turbine building area without filtration. With turbine operation, the discharge from the mechanical vaccuum pumps is directed to the turbine building vent stack without filtration.

The noncondensible gases flow to a moisture separator where most of the water vapor is condensed. The condensed water drains to the industrial waste sumps. However, the discharge from these sumps will be directed to the secondary waste system for treatment upon detection of radioactivity by monitor REM-3528. The airborne discharge from the mechanical vacuum pumps is monitored for radioactivity. Any radioactivity exceeding the monitor set point will initiate an alarm by the radiation monitors. The applicant has indicated that there is no potentially explosive gas mixture present in the MCES during normal operation or during shutdown or startup conditions. A more detailed discussion of the MCES is presented in FSAR Section 10.4.2.

10.4.2.2 Evaluation Findings

The staff's review included the system's capability to process radioactive gases and the design provisions incorporated to monitor and control releases of radioactive materials in gaseous effluents in accordance with GDC 60 and 64. The quality group classification of equipment and components used to collect gaseous radioactive effluents was reviewed relative to the guidelines of RG 1.26. The staff reviewed the applicant's system descriptions, piping and instrumentation diagrams, and design criteria for components of the MCES with respect to the acceptance criteria of SRP 10.4.2 (NUREG-0800).

The staff, in a question to the applicant, stated that the MCES contains no provisions for sampling and monitoring discharges during startup (hogging) operations as specified in Table 1 of SRP 11.5.

The applicant has responded by clarifying the description of how the hogging operation occurs. During hogging operations the vacuum pumps will discharge to the atmosphere via vent line 7AE12-19-1 through valve 7AE-B9-1. This release path s unmonitored. During hogging operations, a portion of the vacuum pump e haust will be routed through the normal vacuum pump exhaust path, line 7AE12-9- through valve 7AE-B3-1 past noble gas monitor ~~RE-1TV-3534~~. ~~The~~ ~~flow passing~~ monitor ~~REM-1TV-3534 would allow~~ action to be taken to close valves 7AE-B3 1 and 7AE-B9-1 on a high radiation signal and ~~the rerouting of~~ the offgas th ough the condenser vacuum pump effluent treatment system (CVPETS). The CVPETS cc sists of a demister, an electrical heating coil, a HEPA filter, a 4-inch cha coal adsorber, another HEPA filter, and two 100% capacity fans in parallel.

It is the st ff's position that the release of the offgas during hogging operations must b ~~monitored as noted in Table 1 of SRP 11.5~~. As long as flow is directed pas radiation monitor RE-1TV-3534, the applicant would have a measurement of he concentration of noble gases released during hogging operations. ~~For~~ ~~the applicant to have an estimate of the noble gases released~~ ~~through the~~ ~~unmonitored vent line, there must be some means of determining~~ the ~~flow rate p~~ ~~t the radiation monitor and the~~ unmonitored ~~release point~~. ~~It~~ ~~does not ap~~ ~~ar that the applicant has such capabilities~~. Because the radiation monitor doe not have the capability of continuous sampling of radioiodines and particulate there is no means available for determining their release during hogging ope ations and the requirements of Table 1 of SRP 11.5 cannot be met. It is the s aff's position that no release may occur from line 7AE12-19-1 unless Harris proc dures contain provisions for sampling and monitoring discharge during hogg g operation, as specified in Table 1 of SRP 11.5.

The applica t has indicated that the main condenser is constructed to the Heat Exchanger I stitute's "Standards for Steam Surface Condensers" and that the design capa ity of the MCES is consistent with the guidelines of this standard, as require by SRP 10.4.2.

The applic t ~~has indicated that~~ the quality group classification to which the MCES is de gned is nonnuclear safety, Category 1 for the condensate vacuum pump efflu t treatment system and nonnuclear safety, Category 2 for the mechanical vac m pumps. The applicant has indicated, in FSAR Section 3.2, that these qual y group classifications correlate with Quality Group D of RG 1.26.

At the pre ent time the design of the MCES does not conform with SRP 10.4.2; the MCES h s not met the requirements of GDC 60 and 64 with respect to the control and m nitoring of releases of radioactive materials to the environment.

10.4.3 Tu bine Gland Sealing System

10.4.3.1 Summary Description

The turbi gland sealing system provides sealing steam to the main turbine generator shaft to prevent the leakage of air into the turbine casings and the potential escape of radioactive steam into the turbine building. A portion of the main team supply is passed through the turbine gland seals and condensed in the gl nd steam condenser. The condensate is returned to the main condenser hotwell w ile noncondensible gases are discharged by two 100% capacity blowers to the en ironment. A more detailed discussion of the turbine gland sealing system is presented in FSAR Section 10.4.3.

10.4.3.2 Evaluation and Findings

The staff has reviewed the turbine gland sealing system with respect to SRP 10.4.3 (NUREG-0800). The scope of this review included the source of sealing steam and the provisions incorporated to monitor and control releases of gaseous radioactive effluents in accordance with GDC 60 and 64. The staff has reviewed the applicant's system description and design criteria for the components of the turbine gland sealing system.

The applicant has indicated that the quality group classification to which the turbine gland sealing system has been designed is nonnuclear safety, nonseismic Category I. When compared to Quality Group D of RG 1.26; this conforms to SRP 10.4.3.

The venting of the turbine gland seal condenser's noncondensible gases ~~is~~ monitored for noble gas as required by Table 1 of SRP 11.5 but not sampled continuously for radioiodines and particulates as required by ~~SRP 11.5. The staff will require sampling of the turbine gland seal condenser exhaust on a continuous basis for radioiodines and particulates.~~

~~The commitment by the applicant to meet the SRP 10.4.3 will allow~~ the staff ~~to~~ conclude that the turbine gland sealing system meets the requirements of GDC 60 and 64 with respect to the control and monitoring of releases of radioactive materials to the environment by providing a controlled and monitored turbine gland sealing system.

10.4.4 Turbine Bypass System

The turbine bypass system is an integral part of the steam dump system. the turbine bypass consists of six pneumatically operated valves connected to the main steamline downstream of the MISVs ~~and~~ discharging directly to the main condenser. The turbine bypass is capable of dumping 35% of rated steam generator flow to the condenser. The steam dump system (atmospheric and condenser) is capable of withstanding a 100% load rejection without tripping the reactor.

During normal reactor operation, the turbine bypass system (condenser steam dump) functions to control the temperature in the reactor primary loop. During hot standby and synchronization, the system is used to maintain secondary system pressure. It is also used for decay heat removal during shutdown. The turbine bypass valves are designed to fail closed on loss of control signal and/or control air pressure. Ths sytem control signals will be blocked in the event of high main condenser pressure.

The applicant will include preoperational and startup tests of the turbine bypass system in accordance with recommendations of RG 1.68, "Initial Test Programs for Water Cooled Reactor Power Plants." the adequacy of the test program is evaluated in Section 14.1 of this report. The turbine bypass system can be tested while the unit is on line; ~~and~~ will be tested on a semi-annual basis.

The turbine bypass system meets the recommendations of BTPs ASB 3-1, "Protection Against Piping Failures in Fluid System Piping Outside Containment," and MEB 3-1, "Postulated Break and Leakage Locations in Fluid System Piping Outside

Insert A to 10.4.2

continuously sampled for radioiodines and particulates and continuously monitored for noble gases as noted in Table 1 of SRP 11.5.

Insert B to Section 10.4.2

However, in order to determine the release of noble gases through the hogging valve, the applicant must have some means of correlating the radiation monitor readings and the flow past the monitor with the flow and discharge concentration through the hogging valve. The applicant has not presented such means.

Insert C to Section 10.4.2

In addition, the failure of the monitor to have this sampling capability could lead to interference of the particulates and radioiodines with the noble gas readings.

Insert D to Section 10.4.3

The applicant has committed to routing the exhaust from the gland seal condenser exhaust to the turbine building vent stack. There continuous sampling for radioiodines and particulates will be provided. With this commitment... (continue with text).

Document Name:
S HARRIS DRAFT SER SEC 11

Requestor's ID:
STEPH 10/26/83

Author's Name:
Thomas/Kadenbi

Document Comments:
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11 RADIOACTIVE WASTE MANAGEMENT

11.1 Source Terms

11.1.1 Summary Description

The applicant calculated the liquid and gaseous effluents from Harris utilizing the PWR GALE computer program. The applicant utilized the source assumptions of RG 1.112, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Power Reactors", and NUREG-0017, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Pressurized Water Reactors (PWRs)." Gaseous effluents were calculated from such sources as offgases from the main condenser evacuation system; leakage to containment, the reactor auxiliary building, and the turbine building; noble gases stripped from the primary coolant during normal operation and at shutdown; and cover and vent gases from tanks and equipment containing radioactive material. Liquid effluents were calculated from such sources as [illegible] bleed, leakage collected in equipment, and floor drains such as those f[illegible] in the reactor auxiliary building, and fuel handling, waste processing, and turbine buildings; and contaminated liquids from anticipated plant operations such as resin sluices, filter backwash, decontamination solutions, sample station drains, and detergent wastes.

11.1.2 Evaluation and Findings

The staff has performed an independent calculation of the primary and secondary coolant concentrations and of the release rates of radioactive materials using the information supplied in the FSAR, the GALE computer program, and the methodology presented in NUREG-0017. Table 11.1 presents the principal parameters that were used in this independent calculation of the source terms. These source terms were utilized in Sections 11.2 and 11.3 to calculate individual doses in accordance with the mathematical models and guidance contained in RG 1.109, "Calculation of Annual Average Doses to Man From Routine Releases of Reactor Effluents for the purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I."

Liquid effluents occur from the waste monitoring tanks, the treated laundry and the hot shower storage tanks, and the secondary waste sample tanks. The sources of wastes to these tanks are discussed in Section 11.2 of this SER. One source of waste to the waste monitor tanks that is not discussed in Section 11.2 is the boron recycle system (BRS). Distillate from the BRS evaporators can be pumped to the waste monitor tank for discharge offsite.

The staff's estimate of the liquid effluents was based upon the information presented in Tables 11.1 and 11.2. The applicant assumed that floor drain wastes would be treated by the reverse osmosis (RO) unit of the floor drain treatment subsystem. The staff calculated liquid effluents assuming that the floor drains would be treated by the RO unit. However, the results indicated that more than 5 curies per year per unit would be released based on the staff-projected inputs to the floor drain treatment subsystem. Because this would not comply with one of the requirements of the Annex to Appendix I of 10 CFR 50, which the applicant chose to use to show compliance with Section II.D of Appendix I, the staff assumed that wastes collected by the floor drain tanks would be treated by the waste evaporator in the equipment drain treatment subsystem. The applicant had indicated in the FSAR that these evaporators would be available to treat the floor drain wastes when they contained high activity. The staff then calculated the effluents from floor drains based on the use of this evaporator. With this evaporator in use, the effluents from Harris could satisfy the criterion of Section A.2 of the Annex to Appendix I.

In ~~its evaluation~~ Additionally, the staff determined that adequate holdup and processing time were available for the treatment of both ~~the~~ floor drain wastes and ~~the~~ equipment drain wastes by this evaporator.

The applicant assumed in his analysis that the wastes collected by the secondary waste low-conductivity holding tank would be processed by an evaporator in addition to a mixed bed demineralizer. The staff's review of the applicant's description of this system indicated that these wastes would usually be treated only by a demineralizer. Therefore, the staff assumed the latter mode of treatment in its analysis.

The holdup time calculated by the staff for the treatment of the regenerative solutions from the condensate polishing system (input to secondary waste high-conductivity holding tank) was calculated to be less than 2 days. Because the secondary waste evaporator, which was intended for Units 3 and 4, is available for processing the contents of the high-conductivity holding tank if the evaporator for Units 1 and 2 becomes inoperable, no alternative treatment scheme had to be considered in lieu of the evaporator, even though less than 2 days holdup is available for the treatment of the regenerates.

¶ The staff assumed that chemical drain wastes from the chemical drain tank of Units 1 and 2 and the concentrate from the laundry and hot shower RO unit would be sent to the RO concentrates tank before discharge. The applicant did not include this source in his evaluation of effluent releases.

All detergent wastes were considered by the staff to be collected, treated by the laundry and hot shower RO unit, and then discharged.

Airborne effluents occur from the building ventilation systems, from the continuous and pre-entry containment purges, from the gaseous processing system (GWPS), the main condenser evacuation system, and the turbine gland steam condenser. All airborne effluents except those released from the turbine gland steam condenser, the main condenser vacuum pump, and the GWPS are passed through a HEPA filter and charcoal adsorber before they are discharged. The continuous containment purge is filtered ~~only~~ by a HEPA filter and charcoal adsorber in the airborne radioactivity removal system (ARRS) inside the containment.

Move to * in pg. 11-7

[Additional information utilized by the staff in its estimate of airborne and liquid releases is contained in Tables 11.1 ~~and 11.2~~ through 11.3. Additional details on the liquid and gaseous radwaste systems are in Sections 11.2 and 11.3 of this SER.

The applicant is installing a fluidized bed dryer to process evaporator concentrates (bottoms), and filter sludges to reduce the volume of solid radwaste shipped offsite. The operation of this volume reduction (VR) equipment will result in additional liquid and airborne effluents. Airborne effluents will result from the VR system's offgas and will be discharged on a continuous basis while the system is operating. There are no liquid effluents that will be discharged directly off site from the VR equipment operation. However, based upon

Table 11.1 Principal parameters and conditions used in calculating releases of radioactive material in liquid and gaseous effluents from the Shearon Harris Nuclear Power Plant

GENERAL	
Reactor power level (MWt)	2900
Plant capacity factor	0.80
Failed fuel	0.12%*
Primary system	
Mass of coolant (lb)	3.42×10^5
Letdown rate (gal/min)	60
Shim bleed rate (gal/day)	1.44×10^3
Leakage to secondary system (lb/day)	100
Leakage to containment building (lb/day)	**
Leakage to auxiliary building (lb/day)	160
Frequency of degassing for cold shutdowns (times/year)	2
Letdown cation demineralizer flow (gal/min)	6.0
Secondary system	
Steam flow rate (lb/hr)	1.2×10^7
Mass of liquid/steam generator (lb)	1.01×10^5
Mass of steam/steam generator (lb)	9.00×10^3
Secondary coolant mass (lb)	1.53×10^6
Rate of steam leakage to turbine area (lb/hr)	1.7×10^3
Containment ~~or~~ building volume (ft^3)	2.3×10^6
Frequency of containment purges (times/yr)	4
Containment low volume purge rate (ft^3/min)	1720
Containment atmosphere cleanup rate (ft^3/min)	10^4
Pre-purge cleanup time duration (hr)	16
Iodine partition factors (gas/liquid)	
Leakage to auxiliary building	0.0075
Leakage to turbine area	1.0
Main condenser/air ejector (volatile species)	0.15

*This value is constant and corresponds to 0.12% of the operating power product source term as given in NUREG-0017.

**1%/day of the primary coolant noble gas inventory and 0.001%/day of the primary coolant iodine inventory.

TABLE 11.1 (continued)

LIQUID RADWASTE SYSTEM DECONTAMINATION FACTORS

Material	Boron recycle system	Equipment drain treatment system	Secondary waste high conductivity subsystem	Secondary waste low conductivity subsystem	Laundry and hot shower RO concentrate subsystem
Iodine	10^5	10^3	10^4	10^2	10^3
Cesium, rubidium	2×10^3	10^4	10^5	2	10^4
Other	10^4	10^4	10^5	10^2	10^4

LIQUID WASTE INPUTS

Stream	Flow rate (gpd)	Fraction of PCA	Fraction discharged	Collection time (days)	Decay time (days)
Shimbleed rate (BRS)	1440	1.0	0.1	23.3	3.11
Equipment drains (EDTS)	250	1.0	0.1	24.4	0.46
RO concentrates wastes	838	0.002	1.0	2.23	0.17
Blowdown	119,000 ~~11,900~~	-	0.0	0	0
Floor drains (FDTS)	935	0.11	1.0	21.4	0.46
Regenerant solution (SWTS)	6000	-	1.0	0.50	0.21
Detergent wastes	450	-	1.0	-	-
Low conductivity holding tank	19,000	8.7×10^{-6}	1.0	0.47	0.13

Source of Volume Reduction System Wastes	Volume/year/unit
Evaporator bottoms	
Recycle evaporator	1025 ft^3
Waste evaporator	960 ft^3
Secondary waste evaporator	4675 ft^3
RO concentrate	876 ft^3
~~Filter sludge~~	

GASEOUS WASTE INPUTS

There is continuous low volume purge of volume control tank.

Holdup time for xenon (days)	70
Holdup time for krypton (days)	70
Fill time of decay tanks (days)	35

Table 11.2 Decontamination factors for individual equipment items

1. EVAPORATORS SYSTEM	All nuclides except iodine	Iodine
(a) Secondary waste and waste	10^4	10^3
(b) Recycle	10^3	10^2

2. DEMINERALIZERS	Anions	Cesium, Rubidium	Other nuclides
(a) Secondary waste (mixed bed)	10^2	2	10^2
(b) CVCS, laundry, RO package and waste monitor tank, cation bed	1	10	10
(c) Recycle evaporator feed, mixed bed	10	2	10
(d) Recycle evaporator condensate, anion bed	10^2	1	1

3. VOLUME REDUCTION EQUIPMENT	Iodine	Others
(a) Fluidized bed dryer and gas/solids seperator	2	100
(b) Scrubber/preconcentrator	3	100
(c) HEPA filter	1	100
(d) Charcoal adsorber	100	1

4. RO UNITS	All nuclides
Laundry and hot shower	30

e. Waste Processing Building filter exhaust system	100	100

FSAR Figure 11.4.2-2, decontamination solutions, condensate from the scrubbers and leakage from pumps, pipes, and so forth will result in additional quantities of wastes being treated by the floor drain treatment system. Ultimately, some of these wastes will be discharged off site from the waste monitor tanks and some will again be treated in the VR system.

~~11.1.2 Evaluation Findings~~

The staff has estimated the quantity of wastes to be treated by the VR system and the radioactivity associated with these wastes. The staff has estimated the additional amount of radioactivity released as airborne effluents from the VR system and as liquid effluents from the liquid radwaste system. These

Number needed

releases were included with the releases calculate using NUREG-0017, and the total quantity of effluents is presented in Section 5 of the Shearon Harris Final Environmental Statement (NUREG-0972). ~~Tables 11.1 and 11.2 of this SER present the assumptions used in the calculation of effluents resulting from operation of the Harris units.~~

→ Attached insert A

→ Insert from pg 11-3

* 11.2 Liquid Radwaste System

11.2.1 Summary Description

The liquid waste processing system (LWPS) consists of process equipment and instrumentation necessary to collect, process, monitor, and recycle and/or discharge of radioactive liquid wastes.

The LWPS is designed to collect and process wastes based on the origin of the waste in the plant and the expected levels of radioactivity. All liquid waste is processed on a batch basis to permit optimum control of releases. Before liquid waste is released, samples are analyzed to determine the types and amounts of radioactivity present. Based on the results of the analysis and the waste treatment system utilized, the waste may be recycled for eventual reuse in the plant, retained for further processing, or released to the environment under controlled conditions. A radiation monitor in the discharge line from the various discharge tanks will automatically terminate liquid waste discharges if radiation measurements exceed a predetermined level. An alarm will be simultaneously actuated in the control room for Units 1 and 2, in the waste processing building control room, and in the health physics control room.

The design parameters of the prinicpal components considered in the calculation of liquid effluents from the Harris plant are shown in Table 11.3. The LWPS is composed of the following subsystems:

(1) equipment drain treatment
(2) floor drain treatment
(3) laundry and hot shower treatment
(4) secondary waste treatment

Table 11.3 Design parameters of principal components considered in the calculation of liquid effluents from Harris Units 1 and 2

Component	Number	Capacity (each)	Safety class
Boron Recycle System			
Recycle evaporator feed demineralizer	2	30 ft^3	3
Recycle evaporator feed filter	2	150 gpm	3
Recycle holdup tank	2	84,000 gal	3
Recycle evaporator feed pump	2	30 gpm	3
Recycle package	2	15 gpm	3 & NNS
Recycle evaporator concentrate filter	2	35 gpm	NNS
Recycle evaporator condensate demineralizer	2	20 ft^3	NNS
Recycle evaporator condensate filter	2	35 gpm	NNS
Recycle monitor tank	2	10,800 gal	NNS
Recycle monitor tank pump	2	30 gpm	NNS
Equipment Drain Treatment System			
Reactor coolant drain tank	2	350 gal	NNS
Reactor coolant drain tank pump	~~4~~ ?	100 gpm	NNS
Reactor coolant drain tank pump heat exchanger	2	-	NNS
Waste holdup tank	1	25,000 gal	NNS
Waste evaporator feed pump	1	35 gpm	NNS
Waste evaporator feed filter	1	35 gpm	NNS
Waste evaporator package	2	15 gpm	NNS
Waste evaporator condensate demineralizer	1	~~35 gpm~~ 30 ft^3	NNS
Waste evaporator condensate tank filter	1	35 gpm	NNS
Waste evaporator condensate tank	2	10,000 gal	NNS
Waste evaporator condensate tank pump	2	35 gpm	NNS
Waste evaporator concentrate tank	1	5,000 gal	NNS
Waste evaporator concentrate tank pump	2	35 gpm	NNS
Floor Drain Treatment System			
Floor drain tank	4	25,000 gal	NNS
Floor drain tank pump	4	35 gpm	NNS
Floor drain tank filter	4	35 gpm	NNS
Floor drain reverse osmosis unit	2	30 gpm	NNS
Floor drain reverse osmosis feed pump	2	30 gpm	NNS
Waste monitor tanks	2	25,000 gal	NNS
Waste monitor tanks demineralizer	1	50 ft^3 (30 gpm)	NNS
Waste monitor tanks pump	2	35 gpm	NNS
Chemical drain tank	2	600 gal	NNS
Chemical drain tank pump	2	35 gpm	NNS

Table 11.3 (Continued)

Component	Number	Capacity (each)	Safety class
<u>Laundry and Hot Shower Treatment System</u>			
Laundry and hot shower tank	2	25,000 gal	NNS
Laundry and hot shower tank pump	2	35 gpm	NNS
Laundry and hot shower tank filter	2	35 gpm	NNS
Laundry and hot shower RO unit	1	30 gpm	NNS
Laundry and hot shower RO feed pump	1	30 gpm	NNS
Laundry and hot shower demineralizer	1	50 ft^3 (30 gpm)	NNS
Treated laundry and hot shower tank	2	25,000 gal	NNS
Treated laundry and hot shower tank pump	2	100 gpm	NNS
RO concentrate tank	2	5,000 gal	NNS
RO concentrate evaporator feed pump	2	35 gpm	NNS
~~RO~~ concentrate package	2	10 gpm	NNS
RO concentrate evaporator distillate pump	2	20 gpm	NNS
<u>Secondary Waste Treatment System</u>			
Low conductivity holding tank	3	15,000 gal	NNS
Low conductivity holding tank pump	2	100 gpm	NNS
Secondary waste filter	2	100 gpm	NNS
Secondary waste demineralizer	2	70 ft^3	NNS
Secondary waste sample tank	1	25,000 gal	NNS
Secondary waste sample tank pump	2	100 gpm	NNS
High conductivity holding tank	1	15,000 gal	NNS
High conductivity holding tank pump	~~2~~ 1	110 ~~35~~ gpm	NNS
Secondary waste evaporator package	2	15 gpm	NNS
Secondary waste ~~evaporator~~ concentrate tank	2	4,000 gal	NNS
Secondary waste evaporator concentrate tank pump	2	35 gpm	NNS

The LWPS has been designed so that liquid wastes from the reactor coolant and its associated subsystems are separated into three main streams: recyclable reactor grade, nonrecyclable, and secondary waste. ¶ The recyclable reactor-grade stream consists of tritiated wastes collected in the equipment drains.

This stream is treated by the equipment drain treatment subsystem. The non-recyclable equipment stream consists of nonreactor-grade water sources and is collected and processed through either the floor drain treatment subsystem or turbine building sumps

the laundry and hot shower treatment subsystem. The secondary waste stream consists of regenerant solutions from the condensate polishing system, and backflush from the electromagnetic filters of the steam generator blowdown system and is collected and processed in the secondary waste treatment subsystem.

The systems described above are shared between the two Harris reactors. ~~units. Two floor drain treatment subsystems and two secondary waste treatment subsystems are shared between the two units~~. All ~~other shared~~ systems are single subsystems.

All releases are monitored before discharge to the cooling tower blowdown. The discharge valve is interlocked with a process radiation monitor and will close automatically if the radioactivity in the liquid should exceed a predetermined limit or if the dilution flow afforded by the cooling tower blowdown falls below a preset value. Additional details on the liquid radwaste treatment system follow.

The equipment drain treatment subsystem collects reactor-grade water from equipment leaks and drains, valve leakoffs, pump seal leakoffs, tritiated water sources, and tank overflows. These wastes are collected in the waste holdup tank and then processed via filtration and evaporation. After processing, these wastes are either sent to the reactor makeup water storage tanks or to the waste monitor tank for discharge or to the waste holdup tank for additional treatment.

The floor drain treatment subsystem collects and processes water from the floor drains of the reactor auxiliary building (RAB), fuel handling building (FHB), waste processing building (WPB), and tank areas (reactor makeup water storage and condensate storage tanks). ~~and portions of the hot shop~~. The waste is collected in the floor drain tank and processed by filtration and treatment in the floor drain treatment subsystem RO unit and then collected in the waste monitor tanks. From the waste monitor tanks, the wastes may be discharged to the cooling tower blowdown line, pumped to the condensate storage tank, recycled to the waste holdup tank for treatment in the equipment drain treatment subsystem, or pumped directly to the waste processing system (WPS) waste evaporator for treatment. The last route will be utilized when radioactivity levels are such that filtration and RO are not sufficient to reduce the radioactivity to acceptable levels.

The laundry and hot shower treatment subsystem collects, in the laundry hot shower tank, detergent waste from the WPB, the FHB, and the ~~hot shop~~ RAB. The applicant expects this waste to be of such quality that treatment for removal of radioactivity will not normally be required. However, if analysis indicates that treatment is required, this waste will be routed to the laundry and hot shower RO unit. The permeate from the RO unit will be passed through a demineralizer and then routed to the treated laundry and hot shower tank. The contents of this tank can be recycled for further treatment or discharged to the condensate storage tank.

The secondary waste treatment subsystem is designed to treat wastes generated from secondary systems. This water will contain radioactivity only if primary-to-secondary leakage occurs in the steam generators. The secondary waste treatment subsystem consists of one subsystem to treat high-conductivity wastes and the other to treat low-conductivity wastes.

Low-conductivity wastes such as the backflush from the electromagnetic filters of the steam generator blowdown system, ~~and~~ the ~~low-conductivity wastes~~ backwash water from the condensate polishing system, and the industrial waste sump are collected in the low-conductivity holding tanks. These wastes are filtered and passed through a demineralizer and then collected in the secondary waste sample tanks. From the secondary waste sample tanks, the water is either recycled to the condensate storage tank, discharged to the cooling tower blowdown or to the neutralization basin, or recycled back to the low conductivity holding tanks.

The main source of high-conductivity wastes is the regenerant solutions from the condensate polishing system and turbine building acid and caustic sumps. This waste is collected in the high-conductivity holding tank, ~~and~~ processed by an evaporator if activity is detected, and the evaporator distillate discharged to the low-conductivity system upstream of the demineralizer. From the demineralizer, treatment is the same as for the low conductivity subsystem.

Drainage from the turbine building equipment drains, floor drains and curbed area oil equipment and floor drains below the operating deck is collected in the industrial waste sumps of the turbine building. Drainage from drains below ground elevation is collected in a condensate pump area sump. This sump and the industrial waste sumps discharge through a radiation monitor. The contents of these sumps will normally go to a yard oil separator and then to the cooling tower blowdown. If the monitor detects ~~high radiation~~ radioactivity in the discharge from one of these pumps, the discharge will be directed to the low-conductivity holding tank for treatment.

The secondary waste subsystem also collects (1) the wastes from the chemical drain tank that are not sent to the solid waste processing system for solidification and (2) the concentrated wastes from the waste evaporator, the RO units, and the secondary waste evaporator. These wastes are collected in the RO concentrate tank and processed in the RO concentrate evaporator. The distillate from this evaporator goes to the treated laundry and hot shower storage tank for discharge. The evaporator concentrate goes to the waste evaporator concentrate tank for solidification or for treatment in the volume reduction system. The liquid waste system consists of a number of cross-ties that allow alternative treatment schemes to those discussed above. Further detail on the liquid waste system and these treatment schemes is in FSAR Section 11.2.

11.2.2 Evaluation Findings

The LWPS system was reviewed according to SRP 11.2 (NUREG-0800). The staff's review considered the capability of the proposed LWPS to meet the anticipated demands of the plant as a result of anticipated operational occurrences.

The potential consequences resulting from reactor operation have also been considered, and the staff has determined the concentrations of radioactive materials in liquid effluents in unrestricted areas to be a small fraction of the limits in Table II, Column 2 of Appendix B to 10 CFR 20.

The staff has also considered the potential consequences resulting from reactor operation with 1% of the operating fission product inventory in the core being released to the primary coolant and has determined that the concentrations of radioactive materials in liquid effluents in unrestricted areas will be a small fraction of the limits of Table II, Column 2 of Appendix B to 10 CFR 20.

As discussed in Section 11.1 of this SER, the staff calculated liquid effluents using the GALE computer program based on the treatment systems for liquid effluents described above. These source terms are in Appendix D of the Harris Final Environmental Statement (NUREG-0972).

The staff calculated the doses to offsite individuals utilizing the methodology of RG 1.109 and the liquid dispersion parameters calculated in accordance with RG 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I." The staff has determined that the proposed liquid radwaste treatment systems are capable of maintaining releases of radioactive materials in liquid effluents so that the calculated individual doses in an unrestricted area from all pathways of exposure are less than 3 mrems to the total body and 10 mrems to any organ.

As noted in Section 11.1, the staff has calculated the release of radioactive materials in liquid effluents exclusive of tritium and noble gases and found it to be less than 5 Ci per year per reactor and the annual dose to any organ of an individual in an unrestricted area to be less than 5 millirems per year total from both reactors. Therefore, in accordance with the option to Section II.D of Appendix I as provided in the Annex to Appendix I of 10 CFR 50, the staff finds that the liquid radwaste system is capable of reducing liquid radioactive effluents to as low as is reasonably achievable (ALARA) levels in accordance with 10 CFR 50.34a, Appendix I to 10 CFR 50, and the Annex to Appendix I.

The Shearon Harris Final Environmental Statement presents a comparison of the RM 50-2 and Appendix I design objective doses with the doses with calculated for the liquid source terms and a comparison of the RM 50-2 curie limitation with the projected releases.

The design of the liquid radwaste system presented in the FSAR is different from that proposed at the construction permit (CP) stage. At the CP stage the steam generator blowdown liquid was to be discharged. Although no process treatment system was proposed, the applicant made a commitment to install equipment capable of reducing the level of activity in the blowdown stream by a factor of 3000 or greater. The applicant has since decided to install an electromagnetic filter to remove magnetite and other spinel type oxides that are magnetic and to remove a portion of the nonmagnetic particulates. The filter is flushed and the water is collected in the settling tank. The flush water is then pumped to the secondary waste low-conductivity holding tanks. The steam generator blowdown passes from the electromagnetic filter to the condenser. The condensate polishing system provides some removal capability for radionuclides.

The staff has assessed the overall capability of the radwaste systems to process waste in the event of a single major equipment failure by a comparison of the design flows to the potential process routes and equipment capacities. Based on this review, the staff has determined that the radwaste system will be adequate to process wastes.

The staff has considered the capabilities of the proposed liquid radwaste treatment system to meet the anticipated demands of the plant as a result of anticipated operational occurrences and has concluded that the system capacity and design flexibility are adequate to meet the anticipated needs of the plant.

The staff has reviewed the applicant's quality assurance provisions for the liquid radwaste systems, the quality group classifications used for system components, and the seismic design applied to structures housing these systems. The design of the systems and structures housing these systems meets the criteria set forth in RG 1.143.

The staff reviewed the provisions incorporated in the applicant's design to control the release of radioactive materials in liquids as a result of inadvertent tank overflows and concludes that the measures proposed by the applicant are consistent with the criteria set forth in RG 1.143.

11.3 Gaseous Waste Management System

11.3.1 Summary Description

The gaseous waste management systems include systems that treat the normal ventilation exhausts; the exhaust from the main condenser mechanical vacuum pumps; and the gaseous wastes associated with degassing primary coolant, purging the volume control tank, displacing cover gases, purging equipment, gas sampling and analysis operations; and boron recycle process operations.

Table 11.4 provides a listing of the various normal ventilation systems and the type of treatment associated with each system. Additional details are provided in Section 9.4 of the FSAR. If a generalization can be made regarding the normal ventilation exhaust treatment systems, it is that the exhausts usually flow through a medium efficiency filter, a HEPA filter, and a charcoal adsorber.

The RAB normal ventilation system (RABNVS) filters air from the continuous containment purge exhaust and from areas of the RAB that contain equipment essential for the safe shutdown of the reactors including the CVCS chiller area, 480-V auxiliary bus area, areas containing nonessential equipment, and so forth This system exhausts to the vent stack on the roof of the RAB.

Table 11.4 Normal ventilation system components at Harris

System	Demister	Heater	Filter Medium			
			Filter	HEPA	Charcoal	HEPA
RAB normal ventilation			X	X	X	X
WP areas filtered exhaust			X	X	X	X
WPB laboratory fume hood exhaust (except perchlorite)			X	X	X	
Condensate polishing demineralizer area filtered exhaust ~~system~~			X	X	X	X
Condenser vacuum effluent treatment*	X	X	X	X	X	X
Continuous containment purge (passes through RAB normal ventilation system and airborne radioactivity removal system)			X	X	X	X
Containment pre-entry purge			X	X	X	

*Will not be used to filter releases on a routine basis; credit was not given in the Appendix I evaluation.

The waste processing areas filtered exhaust system exhausts air from the contaminated areas of the WPB and discharges to a vent stack on the roof of the WPB. The WPB laboratory areas fume hood exhausts are filtered except for the perchloric acid exhaust. This exhaust is discharged unfiltered to the vent stack on the roof of the WPB.

The air from the contaminated spaces of the condensate polishing demineralizer area is exhausted through the condensate polishing demineralizer area filtered exhaust system. The exhaust is discharged from the vent stack located on each unit's turbine building.

The condenser vacuum pump effluent treatment system is discussed in Section 10.4.2 of ~~the~~ this SER.

The containment pre-entry purge is filtered by the containment pre-entry purge system. The purge is discharged to the RAB vent stack. Additional details of the normal ventilation systems are in Section 9.4 of the FSAR.

The gaseous waste processing system (GWPS) processes gases collected from the volume control tank and vents ~~connections~~ from the recycle evaporator gas stripper, the reactor coolant drain tank, the pressurizer relief tank, and the recycle holdup tanks. The GWPS is shared between the two units and consists of 2 waste gas compressors, 2 catalytic hydrogen recombiners, and 10 waste gas decay tanks to accumulate the fission product gases. Eight gas decay tanks are used during normal operation, and two are used for shutdown and startup.

Nitrogen with entrained fission gases will be continuously circulated around the GWPS by one of the two waste gas compressors. Fresh hydrogen gas is charged to the volume control tank where it is mixed with fission gases that have been stripped from the reactor coolant into the volume control tank gas space. The contaminated hydrogen gas is continuously vented from the volume control tank into the circulating nitrogen stream to transport the fission gases into the GWPS. The hydrogen-nitrogen mixture of fission gases is pumped by the waste gas compressor to the hydrogen recombiner where the recombiner converts the hydrogen to a water vapor by oxidation. After removal of the vapor, the resulting gas stream is circulated to a waste gas decay tank and then back to the compressor. Each gas decay tank is valved into the GWPS recirculation loop for 1 or 2 days.

Continued plant operation results in the buildup of pressure in the waste gas decay tank because of the accumlation of nonremovable fission gases. When the pressure in the gas decay tanks reaches 25 psig, the alignment of the GWPS must be changed because of the design of the recombiner. The new alignment has flow from the compressor to the gas decay tanks to the recombiner and then back to the compressor. This alignment is suitable for operation up to 100 psig.

The GWPS has analyzers to monitor oxygen concentrations between the oxygen supply and the hydrogen recombiner package and downstream of the recombiner. Hydrogen analyzers are located in the process stream entering the recombiner and in the discharge stream from the recombiner.

The applicant has indicated that the normal ventilation system complies with the criteria of RG 1.140 and that the GWPS conforms to the criteria of RG 1.143.

11.3.2 Evaluation Findings

The gaseous waste management system was reviewed according to SRP 11.3 (NUREG-0800).

At the CP stage the offgas from the condenser air ejectors was untreated and, except for the exhaust from the WPB, the ventilations systems were only filtered by HEPA filters. The WPB exhaust was also filtered by a charcoal adsorber. The staff stated in the SER-CP that treatment of the main condenser offgas would be required to reduce this potential source of iodine-131 to the atmosphere to bring the offsite doses into compliance with Appendix I. The applicant had added the condenser effluent treatment system, which can be utilized for filtration and adsorption during conditions of high radioactivity discharge from the mechanical vacuum pump, and has added charcoal adsorbers to the various ventilation systems that exhaust air from contaminated areas. These additions decrease the quantity of iodine released from Harris and are therefore acceptable when judged against the design objective doses of Appendix I to 10 CFR 50. However, it should be noted that the filtration and adsorption

staff did not credit the plant with ~~removal~~ of the condenser effluent because the condenser effluent treatment system will not be utilized on a routine basis.

The staff has calculated the doses to individuals off site utilizing the methodology of RG 1.109 and the atmospheric dispersion parameters calculated in accordance with RG 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors." The staff has determined that the proposed gaseous radwaste treatment systems are capable of maintaining releases of radioactive materials in gaseous effluents so that the calculated individual doses in an unrestricted area from all pathways of exposure are less than 5 mrems to the total body and 15 mrems to any organ from noble gases and that releases of radioiodine and radioactive material in particulate form result in doses that are less than 15 mrems to any organ.

The staff has also considered the potential effectiveness of augmenting the proposed gaseous radwaste treament systems using items of reasonably demonstrated technology. The applicant has chosen to show compliance with Section II.D of Appendix I to 10 CFR 50 by complying with the Annex to Appendix I (RM 50-2). The Harris Environmental Statement presents a comparison of the doses and releases calculated for Harris with the design objectives of Appendix I and RM 50-2. The applicant's proposed design complies with the design objectives of RM 50-2. Therefore, the staff has determined that no further effluent treatment equipment will reduce the cumulative population doses within a 50-mile radius in a cost-effective manner.

The staff has also considered the potential consequences resulting from reactor operation with 1% of the operating fission product inventory in the core being released to the primary coolant. The staff has determined that the conentrations of radioactive materials in gaseous effluents in unrestricted areas will be a small fraction of the limits of Table II, Column 1 of 10 CFR Part 20.

The capability of the proposed gaseous radwaste treatment systems to meet the anticipated demands of the plant as a result of operational occurrences was also considered, and it was concluded that the system capacity and design flexibility are adequate to meet the anticipated needs ~~of the needs~~ of the station.

The applicant's quality assurance provisions for the gaseous radwaste systems, the quality group classifications used for system components, the seismic design applied to the systems, and the structures housing the radwaste systems were also reviewed. The FSAR indicates that the design of the systems and the structures housing these systems meet the criteria set forth in RG 1.143. ~~However, the plant does not contain a gas analyzer between the compressors and the gas decay tanks. Such an analyzer is required in accordance with SRP 11.3. Dual analyzers are required.~~

→ Insert B here

The staff has reviewed the normal ventilation system design, testing, and maintenance of the HEPA filters and charcoal adsorbers against RG 1.140. The applicant has indicated in FSAR Chapter 1 that the normal ventilation system meets the criteria of this guide.

→ Insert C here

~~The above information is required, along with a commitment that the applicant with install dual analyzers, before the staff can complete its evaluation of the GWPS.~~

11.4 Solid Waste Management Systems

11.4.1 Summary Description

The solid waste processing system (SWPS) is designed to process two general types of solid wastes: wet solid wastes and dry solid wastes. Wet solid wastes consist mainly of spent filter cartridges, demineralizer resins, filter sludges, chemical drain solutions, and evaporator bottoms that contain radioactive materials removed from liquid streams during processing. Dry solid wastes consist mainly of ventilation air filtering media (HEPA, charcoal), contaminated clothing, paper, rags, laboratory glassware, and tools.

The spent filters associated with the various ventilation systems will be moved from the filter housing, wrapped, and packaged from disposal using a hydraulic compactor. The filter sluges from the liquid radwaste systems will be backwashed to a WPB filter backwash storage tank and to the WPB paticulate concentrate tank. These sludges may then be solidified or sent to the volume reduction (VR) system. Chemical drain solutions will be ~~solidified~~. sent to the solidification pretreatment tank for solidification or treatment by the VR system.

Insert D here

The dry salt generated by operation of the volume reduction system will be collected in a storage hopper. When a sufficient amount of material has been collected to require solidification, the salt is transferred to a drum for solidification by the use of a polymer.

Compressible low-activity solid waste will be compacted in 55-gallon drums. The compactor is equipped with a hood, ventilation fan, and HEPA filter. The displaced air will be vented through the HEPA filter.

The applicant has indicated that the storage capacity of the SWPS is 1020 drums. The applicant has also indicated that the SWPS meets the criteria of BTP ~~11-1~~ 11-1 ETSB, Revision 1, which is the equivalent to RG 1.143.

The applicant has committed that all radioactive waste will be packaged in accordance with appropriate Federal and state standards for burial in accordance with 49 CFR 170 to 179, 10 CFR 20, and 10 CFR 71. All drums will be shipped and buried in accordance with 49 CFR 173.

Additional information with respect to the solid radwaste system is in Section 11.4 of the FSAR.

11.4.2 Evaluation Findings

The staff has reviewed the SWPS in accordance with the acceptance criteria of SRP 11.4 (NUREG-0800). The scope of the review included line diagrams of the system, piping and instrumentation diagrams and descriptive information for the SWPS and for those auxiliary supporting systems that are essential to the operation of the SWPS. The applicant's proposed design criteria and design bases for the SWPS, and the applicant's analysis of those criteria and bases have also been reviewed. Also reviewed were the capability of the proposed system to process the types and volumes of wastes expected during normal operation and anticipated operational occurrences in accordance with GDC 60 and provisions for the handling of wastes relative to the requirements of 10 CFR 20 and 71 and applicable Department of Transportation regulations, ~~have also been reviewed.~~

Insert E here

The staff wil. not approve the design of the SWPS until the applicant provides information detailing how various waste components are treated. Information that is missing includes

(1) ~~a description of the polymer system and its conformance to SRP 11.4~~
The applicant has provided some general information

(2) ~~details~~ on how the filter sludge ~~from the following filters~~ will be handled. ~~and associated~~ However drawings which demonstrate how the filter sludge from the following filters are handled were omitted:

- reactor coolant
- seal water injection
- seal water return
- boric acid
- BRS recycle evaporator feed
- BRS recycle evaporator concentrate
- recycle evaporator condensate

These drawings should be provided. This will be considered a confirmatory item.

(3) details showing that the vent exhaust from the spent resin storage tanks and the decanting tanks are filtered by a HEPA filter in accordance with BTP ETSB 11-3 (SRP 11.4)

The applicant ~~has~~ had indicated that portions of the RAB that have piping systems that could contain stagnant boric solutions are equipped with space heaters or are heat traced to ensure that temperatures ≥70°F are maintained during operating modes 1-5. The applicant did not specify what means ~~are~~ would be~~ing~~ utilized for the concentrates line of the recycle evaporator to the boric acid tank.

→ Insert F

It is the staff's position that boric acid solutions should be maintained at ≥70°F for all modes of operation, not just modes 1-5. Crystalization would not be a function of the operating mode. In addition, the applicant did not specify what means were utilized to ensure that the piping systems are maintained at ≥70°F for those portions of the RAB for which space heaters are utilized. Some automatic means should be available to start the heaters when the temperature approaches 70°F. Therefore, it is the staff's position that the applicant should specify what parameters are monitored to result in automatic initiation of these heaters.

Insert G

Until the above information is provided ~~the SWPS will be considered unacceptable~~.

The applicant has not provided the process control program (PCP). The PCP is not required until 6 months before the issuance of the operating license. The PCP will be judged as to its acceptability when it is submitted.

Insert H here

11.5 Process and Effluent Radiological Monitoring and Sampling Systems

11.5.1 Summary Description

The process and effluent radiological monitoring and sampling systems are designed to provide information concerning radioactivity levels in systems throughout the plant, indicate radioactive leakage between systems, monitor equipment and performance, and monitor and control radioactivity levels in plant discharges to the environs.

The Harris airborne effluent sampling and monitoring systems are located in the plant vents on the RAB and the WPB. For liquid effluents, the effluent monitor locations are downstream of the pumps of the LWPS waste monitor tanks, the treated laundry and hot shower tanks, and the secondary waste sample tanks. Effluent monitors are also located to monitor of the industrial waste sumps of the turbine buildings, the discharge from the tank area drain transfer pumps, and the service water system.

Table 11.5 contains a listing of both the process and effluent monitors for airborne and liquid sources.. For ease of reference, this table also includes the type of radioactivity monitored for airborne effluents, the type of monitor used, and the plant-specific, Tag number of the monitor. Sections 11.5 and 12.3.4 of the FSAR present a detailed discussion of the process and effluent monitoring system.

11.5.2 Evaluation Findings

The staff has reviewed the process and effluent monitoring system according to SRP 11.5 (NUREC-0800).

Acceptance Criterion II.C.1.a of SRP 11.5 states that the gaseous and liquid process streams and effluent release points should be monitored and sampled according to Tables 1 and 2 of SRP 11.5. Information provided in FSAR Section 11.5 indicated that the SHNPP did not meet these criteria in the following areas:

(1) The turbine gland seal condenser exhaust and the mechanical vacuum pump exhaust ~~are~~ during hogging operations were not monitored and sampled in accordance with Table 1.

(2) The condenser vacuum pump effluent is not sampled in accordance with Table 1. during normal operations

(3) There is no effluent monitor for the turbine building vents (release points 3A and 3B) as required by Table 1, and sampling provisions are not provided.

(4) The service water system, WPB cooling water system, and RAB waste return line are not ~~should be~~ monitored downstream of all potential radioactive inputs to the system. The liquid monitor for the emergency fan coolers is ~~are~~ not adequate for ~~this purpose~~ the service water system.

The applicant has indicated, in response to a staff question, that the process and effluent monitoring program will meet the guidelines of position C of RG 4.15. ~~with one exception~~.

The applicant has not addressed the capability of the process and effluent monitoring program to meet the guidelines of position C and Table 2 of RG 1.97. Instead, The applicant has addressed item II.F.1, Attachments 1 and 2 of NUREG-0737, which covers criteria for effluent monitors similar to those proposed by RG 1.97. Based on the staff's review of the applicant's submittal, the staff has concluded that the applicant has incorrectly located two of the accident monitoring points. The turbine building effluent release points, 3A and 3B, should be points of monitoring and not the condenser vaccum pump effluent point alone. This change would (1) result in the monitoring of a potential effluent release source (condensate polishing cubicles) that ~~which~~ is excluded by the present monitoring scheme; (2) allow isokinetic samples to be taken; (3) and minimize the potential damage of high humidity air on the sampler's charcoal adsorber. ~~The applicant has not responded to the staff's position.~~

INSERT I here

Table 11.5 Liquid and airborne process and effluent monitoring system at the Shearon Harris Nuclear Power Plant

Monitor	Monitor number	Monitoring*	Monitor type
Airborne Process			
Gas decay tank	21REM-3545	NG	β scin
FHB normal exhaust	RE-1FL-3506 RE-1FL-3507	P, I, NG	β scin, γ scin, β scin
FHB emergency exhaust	REM-1FL-3508BSB	P, I, NG	β scin, γ scin, β scin
	REM-1FL-3508ASA		β scin, γ scin, β scin
RAB normal exhaust	REM-1AV-3531	P, I, NG	β scin, γ scin, β scin
	REM-2AV-3531	P, I, NG	β scin, γ scin, β scin
RAB emergency exhaust	REM-1AV-3532A	P, I, NG	β scin, γ scin, β scin
	REM-1AV-3532B	P, I, NG	β scin, γ scin, β scin
	REM-2AV-3532A	P, I, NG	β scin, γ scin, β scin
	REM-2AV-3532B	P, I, NG	β scin, γ scin, β scin
Condenser vacuum pump effluent treatment system	REM-1TV-3534 REM-2TV-3534	NG NG	β scin β scin
Continuous containment purge	REM-1LT-3502ASA	P, I, NG	β scin, γ scin, β scin
	REM-1LT-3502BSB	P, I, NG	β scin, γ scin, β scin
	REM-2LT-3502ASA	P, I, NG	β scin, γ scin, β scin
	REM-2LT-3502BSB	P, I, NG	β scin, γ scin, β scin
Turbine gland seal/condenser exhaust	REM-1AE-3536 REM-2AE-3536	NG NG	β scin β scin
Liquid Process			
Component cooling water system	1REM-3501A SA 1REM-3501B SB 2REM-3501A SA 2REM-3501B SB	- - - -	γ scin γ scin γ scin γ scin

*P = particulate; I = radioiodine; NG = noble gases.

Table 11.5 (Continued)

Monitor	Monitor number	Monitoring*	Monitor type
Auxiliary steam condensate tank	21-REM-3525A	-	γ scin
	21REM-3525B	-	γ scin
Steam generator blowdown	1REM-3527	-	γ scin
	2REM-3527	-	γ scin
Auxiliary steam condensate waste processing system	21REM-3543	-	γ scin
WPB cooling water	1REM-3544	-	γ scin
Airborne Effluent			
Plant vent (Release Point 1)	REM-1AV-3509SA	P, I, NG	β scin, γ scin, β scin
	REM-2AV-3509SA	P, I, NG	β scin, γ scin, β scin
WPB exhaust systems			
(Release Point 5)	REM-1WV-3546	P, I, NG	β scin, γ scin, β scin
(Release Point 5A)	REM-1WV-3547	P, I, NG	β scin, γ scin, β scin
Turbine building vent stack			
(Release Point 3A)	-	-	-
(Release Point 3B)	-	-	-
Liquid Effluent			
Service water system	REM-1SW-3500ASB	-	γ scin
	REM-2SW-3500ASB	-	γ scin
	REM-1SW-3500BSA	-	γ scin
	REM-2SW-3500BSA	-	γ scin
	REM-1SW-3500CSA	-	γ scin
	REM-2SW-3500CSA	-	γ scin
	REM-1SW-3500DSB	-	γ scin
	REM-2SW-3500DSB	-	γ scin
Waste monitor tanks	REM-21WL-3541	-	γ scin
Turbine building drain	REM-1MD-3528	-	γ scin
	REM-2MD-3528	-	γ scin
Tank area drain transfer pump	REM-1MD-3530	-	γ scin
	REM-2MD-3530	-	γ scin
Treated laundry and hot shower tank pumps	REM-1WL-3540	-	γ scin
Secondary waste sample tank pumps	REM-21WS-3542	-	γ scin

The applicant has proposed a method for determining the release of radioactivity from the safety relief valves and the atmospheric steam dump valves that is similar to that proposed for the Waterford plant. The staff is assessing this method at this time. Based on the determination made in the Waterford review, the acceptability of the method proposed for Shearon Harris will be the same.

The applicant cannot ensure representative samples from the recycle holdup tank because the capability of the recirculation pumps does not meet the criteria of II.2.a of SRP 11.5. Therefore, the applicant ~~should~~ propose an alternative means of ensuring that the contents of the various liquid waste may be sampled in a representative manner.

~~Another area of the acceptance criteria of SRP 11.5 that~~ the applicant has ~~not addressed or that deviate from the acceptance criteria is~~ the incorporation of administrative controls and procedures to minimize inadvertent or accidental releases of radioactive liquids.

The turbine building drain monitors and the tank area drain monitors do not provide a record of effluent flow. Therefore, there appears to be no means to determine the quantity of activity released nor the volume released, ~~in accordance with~~ RG 1.21. It is the staff's position that Harris possess the capability to determine the quantity of effluents released from these two sources. The applicant has agreed to divert waste from the industrial waste sump and the tank area to a radwaste treatment system upon detection of radioactivity. This satisfies the staff's concern.

As a result of ~~his~~ responses to staff questions on the FSAR, the applicant must revise Table 9.3.2-2, Figure 9.3.2-2, and Section 9.3.2.2.2 to reflect grab sampling of the service water system.

The staff's review of the process and effluent monitoring system has not addressed some items of SRP 11.5. Those items that have not been addressed will be reviewed when the Radiological Effluent Technical Specifications are reviewed. Those areas of the process and effluent monitoring system to be reviewed at that time include

(1) sampling frequencies, required analyses, instrument alarm/type setpoints, calibration, and sensitivities

(2) frequency of routine instrument calibration, maintenance, and inspections

The process and effluent monitoring systems cannot be judged as acceptable to their ~~adequacy~~ until the above items, excluding technical specification items, are addressed to the satisfaction of the staff.

11.1.2 Harris Insert A pg 11-7

While the applicant assumed that the VR system would be treating filter sludges, the staff could not accept this. The fluidized bed dryer of the VR system was not intended to treat filter sludges. There would not be much, if any, VR associated with this form of treatment of the sludge. In addition, with the typical radioactivity associated with filter sludges, the potential exists that Appendix I doses could be exceeded. Additional details concerning this are addressed in Section 11.4 of this SER.

Insert B pg 11-19

The applicant did not have an O_2 monitor on the discharge from the GWPS compressors. This did not conform to the acceptance criteria of SRP 11.3. In addition, the applicant did not have a system designed to preclude the buildup of explosive H_2 and O_2 mixtures through automatic isolation of the O_2 source. Ideallly, system design should ensure that (1) the valve in the line from the O_2 supply fails closed automatically on a high-high alarm; (2) that if the downstream O_2 concentration exceeds 4%, flow is automatically switched to the alternate recombiner; and (3) if the O_2 concentration exceeds 4% in the part of the GWPS between the compressor and the gas decay tanks, automatic control features exist to reduce the O_2 concentration by the injection of diluents.

The applicant has added an O_2 monitor between the compressors and the gas decay tanks.

(Insert B pg 11-19 continued)

At the Harris plant, the only automatic function the GWPS has is to isolate the O_2 supply to the recombiners when a high O_2 concentration is detected in the recombiner exhaust. If this occurs, an alarm will sound at the waste process control board, which is manned continuously.

The applicant has committed to establishing the set point for the O_2 monitor on the compressor to alarm at 2% O_2. This alarm will occur at the waste processing control board and, when such an alarm occurs, personnel will verify the alarm and that the component, which is the source of the inleakage, will be removed from service.

The staff finds this approach acceptable in lieu of having automatic control features since the actions will be precipitated at 2% O_2 rather than at 4%. The action items of the technical specifications covering these monitors will be written to show automatic isolation of the O_2 source on a signal of 2% O_2 in the recombiner exhaust and that a signal of 2% O_2 from the O_2 monitor on the GWPS compressor, the affected component will be removed from service. These measures are adequate to prevent the occurrence of an explosion.

Insert C pg 11-19

Based upon the foregoing evaluation, the staff concludes that the proposed gaseous radwaste treatment system is acceptable. The bases for the acceptance has been the conformance of the applicant's design, design criteria, and design bases for the gaseous radwaste treatment system to the applicanble rregulations and Regulatory Guides referenced above.

Insert D pg 11-20

The VR system consists of a fluidized bed dryer which is utilized to calcine evaporator bottoms (concentrates) and chemical drain solutions. The liquid to be calcined is collected in the waste feed solidification pre-treatment tank where the pH is adjusted. The contents of this tank is pumped to the venturi scrubber of the VR system where it is utilized to scrub the offgas from the gas/solids separator of the VR system. The scrub solution is concentrated in the scrubber pre-concentrator and recycled to the venturi. A portion of the concentrates from the pre-concentrator is used as feed to the fludize bed dryer. In the fludize bed dryer, most of the liquid is calcined as salts on the bed material. This bed material is discharged from the dryer and conveyed to the solidification system for drumming. The offgas from the fluid bed dryer is discharged to a gas/solids separator where the large particulates are removed. The solids collected from the gas/solids separator are collected in a hopper and conveyed to the drumming station. The offgas from the gas/solids separator proceeds through the venturi scrubber, the scrubber pre-concentrator, a condenser, to a gas heater and finally through a filter assembly consisting of a HEPA filter, charcoal adsorber, and another HEPA filter.

Insert E pg 11-21

The appl cant has recently purchased the polymer binder system for solidification c the dry salt material. A description of the polymer binder system has not een provided. However, the applicant has committed to providing details n the system as they become available. Information on this system will be onsidered a confirmatory item. The applicant has indicated that the poly er binder system will conform to SRP 11.4. (continue on pg 11-21)

Insert F pg 11-21

The applicant has committed to heat tracing with temperature monitoring the concentrates line from the recycle evaporator to the boric acid tank. The temperature will be maintained to a low setpoint of 70°F and high setpoint of 90°F with redundant thermocouples and panels for all operating modes (1-6).

A combination of space heaters and heat tracing will be used for other lines carrying 4% wt. boric acid. The temperature monitoring for the lines with dedicated heat tracing will be the same type as stated above for the concentrates line. For the areas in which space heaters will be used, automatic temperature monitoring (area thermocouples) will be used to insure that the space heaters are started at a low setpoint temperature of 70°F. This will be for modes 1-6. This satisfies a previous staff concern.

Insert G pg 11-22

The applicant has indicated that they intend to process filter sludges in the VR system. This is unacceptable to the staff. The VR system design, which was approved by the NRC (December 1, 1975 AECC-1), was not based upon processing filter sludge. The topical report on the VR system did not provide any test data on the processing of this waste. In addition, the VR system was never intended for such processing. These would be little, if any, VR associated with such processing and with the activities typically associated with such sludge the releases could be at a level such that Appendix I dose limitation may be exceeded. Therefore, approval of the VR system is contingent pon the applicant agreeing not to process filter sludge in it.

Insert H pg 11-22 Do not Type

6. ETSB compares the quality group classifications of the solid waste system to the guidelines of Regulatory Guide 1.143 (Ref. 2).

7. ETSB compares the seismic design of the structures housing the SWS to the guidelines of Regulatory Guide 1.143 (Ref. 2). Exceptions are transmitted to MEB, which has primary responsibility under SRP Section 3.2.1.

8. ETSB compares equipment layout, design features, and mode of operation of the solid waste system to the guidelines of Regulatory Guide 1.143 (Ref. 2) and (BTP) ETSB 11-3 (Ref. 1).

9. At the OL stage ETSB reviews the technical specifications proposed by the applicant for process and effluent control for input to the review of SRP Section 16.0. The reviewer will determine that the content and intent of the technical specifications prepared by the applicant are in agreement with the requirement developed as a result of the staff's review. The review will include the evaluation or development of appropriate limiting conditions for operation and their bases consistent with the plant design. The technical specifications are reviewed per the requirements of 10 CFR Part 50, §50.36a (Ref. 4).

IV. EVALUATION FINDINGS

ETSB verifies that sufficient information has been provided and that the review is adequate to support conclusions of the following type, to be included in the staff's safety evaluation report:

~~The staff concludes~~ that the design of the solid waste management systems is acceptable and meets the requirements of 10 CFR Part 20, §20.106; 10 CFR Part 50, §50.34a; General Design Criterion 60, 63, and 64; and 10 CFR Part 71. This conclusion is based on the applicant demonstrating that the solid waste system (SWS) includes the equipment and instrumentation used for the processing, packaging, and storage of radioactive wastes prior to shipment offsite for burial. The scope of the review of the SWS includes line diagrams of the system, piping and instrumentation diagrams (P&IDs), and descriptive information for the SWS and for those auxiliary supporting systems that are essential to the operation of the SWS. The applicant's proposed design criteria and design bases for the SWS, and the applicant's analysis of those criteria and bases have been reviewed. The capability of the proposed system to process the types and volumes of wastes expected during normal operation and anticipated operational occurrences in accordance with General Design Criterion 60, provisions for the handling of wastes relative to the requirements of 10 CFR Parts 20 and 71 and of applicable DOT regulations, and the applicant's quality group classification and seismic design relative to Regulatory Guide 1.143, have also been reviewed. T~~he applicant's proposed methods of assuring complete solidification and/or dewatering have been reviewed and the processing, design features and waste storage meet Branch Technical Position ETSB 11-3 and SRP Section 11.4 - Appendix A (applicable to plants with temporary onsite storage of low level radioactive waste~~). The basis for acceptance ~~in our review~~ has been conformance of the applicant's designs, design criteria, and design bases for the solid radwaste system to the regulations and the guides referenced above, as well as to staff technical positions and industry standards. ~~Based on the foregoing evaluation, we conclude that the proposed solid radwaste system is acceptable~~.

[When the above confirmatory items are satisfied, the staff will be able to conclude

Insert I pg 11-23

The applicant has committed to installing a wide range noble gas monitor for withdrawing samples from the turbine building vent stack during normal operations and accidents. This monitor will also be provided with continuous sampling capability for radioactive particulates and iodine. The monitor sampling line will be heat traced to prevent moisture accumulation in the particulate and iodine filters. This commitment satisfies the NRC concern identified as Item 3 above.

The applicant has committed to routing the turbine gland seal condenser exhaust to the turbine building vent. This eliminates one part of Item (1) above of noncompliance. With the installation of the continuously sampling system on the turbine building vent, the effluent from the condenser vacuum pump is sampled continuously. This eliminates Item 2 above.

As discussed in Section 10.4.2 of this SER, the applicant still does not have any means for continuously sampling for particulates and radioiodines during hogging operations nor is the applicant capable of determining noble gas releases from this source. This item is open.

The applicant has not addressed Item 4 above to the satisfaction of the staff so that it too is an open item.

Insert J pg 11-26

The applicant has proposed that a representative sample of the recycle hold-up tank can be accomplished by recirculating the tank, taking samples from the tank, and trending the sample results. Since the purpose of sampling the tank is to determine whether the fluid is suitable for recycling, this determination can be made without absolute knowledge of the boron recycle tank's contents. Therefore, a "leveling off" of sample results is not required. Since the contents of this tank cannot be released directly to the environment, the staff finds this acceptable.

III.D.1.1 Integrity of Systems Outside Containment Likely to Contain Radioactive Material

Summary Description

The applicant has provided a description of the program designed to reduce leakage from systems ~~outside containment~~ that would or could contain primary coolant or highly radioactive fluids during a serious transient or accident. ~~The applicant noted the systems which would be included in the leak reduction program and those which would be excluded. The applicant briefly described the program to reduce leakage to as-low-as practical levels prior to commercial operation and the program to follow once commercial operation begins.~~

Insert K

Evaluation and Findings

The staff reviewed the applicant's proposed program to reduce leakage from systems containing primary coolant or highly radioactive fluids outside containment in accordance with Item [illegible].1.1 of NUREG-0737. Based upon this review, the staff has concluded that the applicant's program does not meet the requirements of NUREG-0737. ~~because~~

(1) The gaseous waste processing system (GWPS) was excluded from the program. This system should not be excluded from the program. Sources to this system include venting operations from the recycle holdup tank, reactor coolant drain tank, pressurizer relief tank, volume control tank purge, and the recycle evaporator stripper.

(2) The process sampling system should not be excluded from the program since it is designed to collect fluid and gaseous samples contained in the reactor coolant system and the safety injection system.

Insert L

(3) The demineralizers of the CVCS should be included in the program since they may be utilized during RHR operation.

(4) The boron recycle components, which should be included in the program, are the recycle evaporator feed pumps, recycle evaporator feed filters, and demineralizers. Since letdown to the boron recycle system would pass through the filters and the demineralizers and since the feed pumps would have to be utilized to pump the contents from the recycle holdup tank, all three components should be included in the program.

(5) The seal water return system should not be excluded from the program, since it is desirable to have the reactor coolant pumps operating during a steam generator tube rupture accident and the seal water return system would be operating during such an event.

(6) The applicant has not provided the justification for excluding those systems which could contain radioactive materials.

The applicant should modify their proposed leak reduction program to include the above systems or components in the leak reduction program~~, and should provide the justification for excluding other systems listed in their FSAR section addressing this TMI item.~~

The applicant shall also provide the initial leak-test results at least four months prior to issuance of a fuel loading license.

Insert K III.D.1.1

The applicant's program will be initiated during the preoperational test phase and will be performed in accordance with the applicable provisions of ASME Section XI. The program is designed to detect leakage to RAB atmosphere from systems which would be used to bring the plant to a safe shutdown following a serious transient or accident. The following systems are included in the leak reduction program.

a) Residual Heat Removal System;

b) Safety Injection System, except boron injection recirculation subsystem;

c) Containment Spray System, except spray additive subsystem and RWST;

d) Chemical & Volume Control System;
   1) Letdown Subsystem Except Demineralizers
   2) Boron Recycle Hold-Up Tanks
   3) Charging Pumps

e) Post-Accident Sample System;

f) Post-Accident RAB Ventilation System; and

g) Valve Leakoff Equipment Drain System.

The following systems have been excluded by the applicant from the leak reduction program because they will not be used to mitigate the consequences of an accident:

a) Chemical and Volume Control;
   1) Demineralizers
   2) Boron Thermal Regeneration System
   3) Seal Water Return
   4) Boric Acid Transfer System
   5) Boron Recycle System Except Recycle Holdup Tanks

b) Safety Injection;
   1) Boron Injection Recirculation Subsystem

c) Filter Backwash System;

d) Fuel Pool Cooling and Cleanup System;

e) Radioactive Waste Disposal Systems; and

f) Process Sampling System.

The applicant's leak reduction program will employ visual inspections of the mechanical joints and seals of the system to detect leakage and measurement of observed leakage. These inspections will be conducted with the system pressurized to normal operating pressure using the system fluid or demineralized water as a test medium. The applicant will document the observed leakage and will compare it against the acceptance criteria. Corrective action will be taken as appropriate, but, in all cases, the action will be to reduce leakage to as-low-as-practical levels. Testing of gaseous systems will include helium leak detection or equivalent testing methods.

The applicant will initiate a program of preventative maintenance to reduce leakage to as-low-as-practical levels after commercial operation. This program will include periodic leak tests at each refueling.

The applicant has evaluated potential leak paths as discussed in NRC letter regarding the North Anna incident dated October 17, 1979, and has committed to implementing design changes, if the need is identified prior to fuel load to eliminate the open paths to the atmosphere as discussed in the letter.

Insert L III.D.1.1

The applicant has restricted the program to only those systems in the RAB and only those systems which are used to bring the plant to a safe shutdown following a transient or an accident. The systems which are to be included are systems outside containment that would or could contain primary coolant or other highly radioactive fluids or gases during or following a serious transient or accident. Therefore, limiting this program to systems utilized to bring the plant to a safe shutdown following an accident or a transient is an incorrect interpretation of this item, and in the case of Harris systems should not be limited to those in the RAB.

The applicant has excluded the gaseous waste processing system (GWPS). The applicant's basis for excluding this system is that since the system operates continuously the integrity of the system is continuously verified through the use of airborne radiation detectors. An alarm from one of these monitors would require prompt isolation and repair of that portion of the system that is leaking.

The staff does not agree with the applicant's position. If the fuel failure level is low, then a leak from the GWPS would never result in an alarm from this airborne radiation monitor. The leak reduction program would see this sooner than the monitor in this case. In addition, from the Harris FSAR, there are no airborne radiation monitors in the areas of the GWPS. Thus, this GWPS should be included in the leak reduction program.

The boron recycle system (BRS), except for the recycle holdup tanks, has been excluded from the leak reduction program because the applicant considered this tank to be the only component of the system that would be required and this system performs no safety-related functions following an accident. The applicant stated that if the feed pumps and feed filters were required post-accident then the system could be leak-tested before its use and repairs made. This basis is unacceptable to the staff.

First, the requirements of III.D.1.1 are not limited to safety-related systems. Second, the time to leak test the feed pumps and feed filters is not after an accident has occurred, but rather before. The recycle evaporator feed pumps are utilized to transfer the contents of one recycle holdup tank to another and should be included in the program. The recycle evaporator demineralizer and the feed filter should be included in the program since the normal flowpath is through these components.

The filter backwash system was excluded by the applicant because they indicated that the filters would be bypassed during letdown to the recycle holdup tank. That possibility does exist but there are a number of other filters which must be considered. They include seal water injection and return filters and reactor coolant filters. The filter backwash system should be included in the leak reduction program.

The applicant has excluded the seal water return because this system is not used post accident and because it discharges its contents to the pressurized surge tanks on a Phase A containment isolation signal (T signal). The staff agrees with this. However, if the accident which occurs is a steam generator tube rupture with a coincident iodine spike, then it is desirable to have the reactor coolant pumps operating and the seal water return would also be operating. No Phase A signal would result. Therefore, the seal water return should be included in the leak reduction program.

The applicant has also excluded the fuel pool cooling cleanup system. This system is utilized to maintain fuel pool temperature and to remove particulate material from leaking or defective fuel assemblies. This system would be operating during a fuel handling accident. In addition, the purification system will be started on a high radiation alarm in the fuel handling building. Therefore, this system should be included in the leak reduction program.

The applicant has also deleted the CVCS demineralizers from the leak reduction program: However, these demineralizers are used during cold shutdown and RHR operation. Bypass flow from the RHR system is admitted into the letdown line upstream of the letdown heat exchanger, flows through a mixed bed demineralizer and the reactor coolant filter to the volume control tank. Again, these demineralizers should be included in the program.