HOPE CREEK GENERATING STATION
ENVIRONMENTAL REPORT-OPERATING LICENSE STAGE
AMENDMENT 2 PAGE CHANGES

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CHAPTER 3

THE STATION

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TABLE 3.3-1

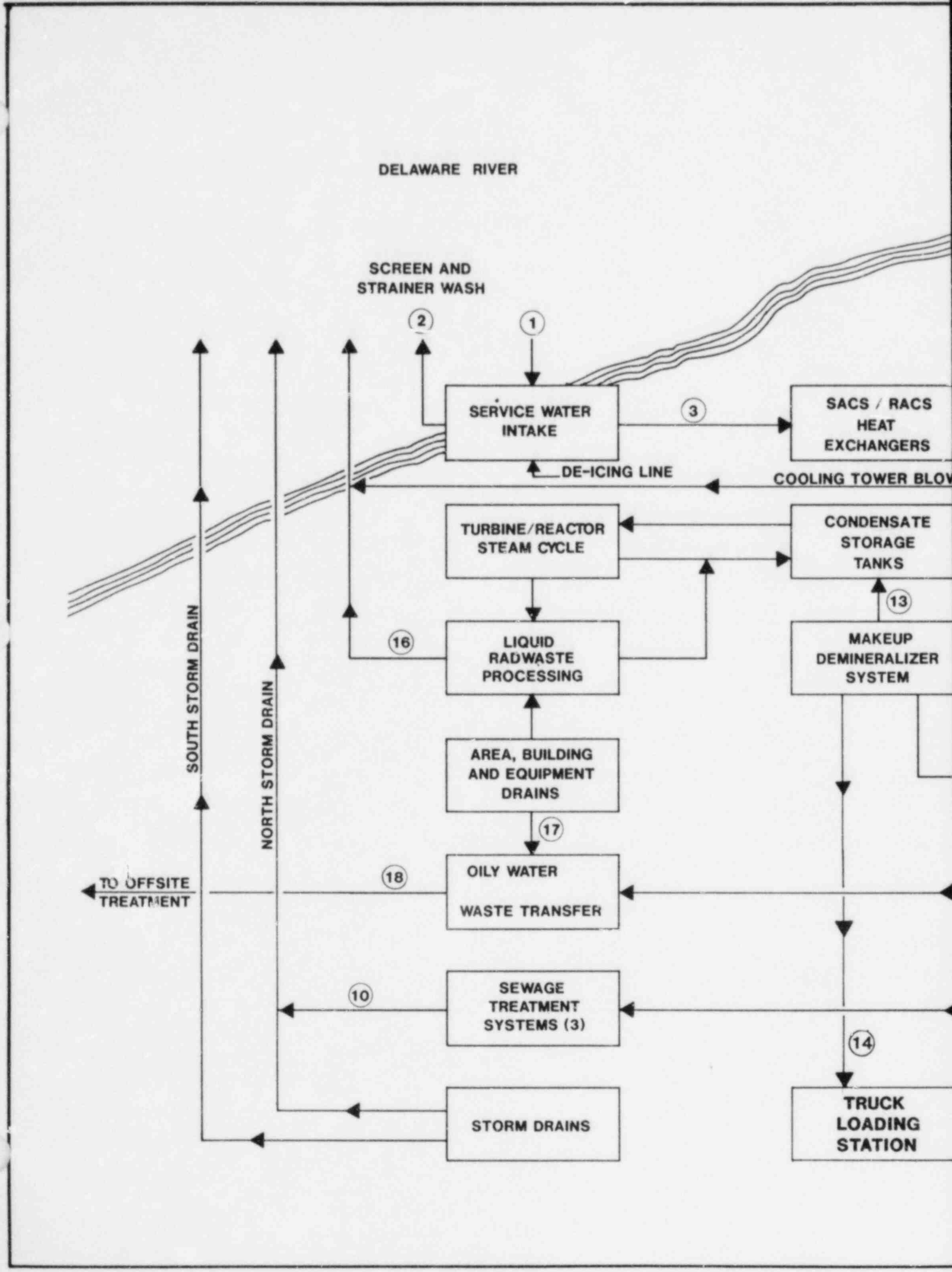
WATER USE SUMMARY

	1	2	3	4	5(1)	6	7	8	9	10	11	12(2)	13(2)	14	15	16	17	18	
Metric (liters/minute)																			
Daily Maximum @ 100%	127,000	6,700	120,300	120,300	52,200(4)	68,100	2,080,000	1,477	130	130	1,347	170	1,020	150(3)	114	28	173	287	E291.6
Monthly Average @ 100%	131,000	6,600	124,400	124,400	43,500	80,900	2,080,000	789	130	130	659	57	527	75	38	2.6	96	134	
Minimum Power Operation	131,000	6,600	124,400	124,400	30,100	94,300	1,160,000	789	130	130	659	57	527	75	38	2.6	96	134	
Following Normal Shutdown	220,000	13,500	206,500	206,500	0	206,500	0	789	130	130	659	57	527	75	38	2.6	96	134	
Following Emergency Shutdown	201,000	13,800	187,200	187,200	0	206,500	0	1,477	130	130	1,347	170	1,020	150(3)	114	28	173	287	
English (gallons/minute)																			
Daily Maximum @ 100%	33,600	1,780	31,820	31,820	13,800(4)	18,020	552,000	390	35	35	355	45	270	40(3)	30	7.6	45	75	E291.6
Monthly Average @ 100%	34,600	1,740	32,860	32,860	11,500	21,360	552,000	195	20	20	175	15	140	20	10	0.7	25	35	
Minimum Power Operation	34,600	1,740	32,860	32,860	8,000	24,860	306,000	195	20	20	175	15	140	20	10	0.7	25	35	
Following Normal Shutdown	58,000	3,560	54,440	54,440	0	54,440	0	195	20	20	175	15	140	20	10	0.7	25	35	
Following Emergency Shutdown	53,200	3,640	49,560	49,560	0	49,560	0	390	35	35	355	45	270	40(3)	30	7.6	45	75	

2

Use this table in connection with Figure 3.3-1.

(1) The only significant consumptive use. All other uses involve transfer or nonconsumptive water use.
(2) Design flow. Actual flow varies due to demand and inventory of condensate and demineralized water in storage.
(3) 380 liters per minute (100 gallons per minute) instantaneous maximum is not sustained for full day.
(4) Estimated based on 32°C (90°F) dry bulb temperature and 70% relative humidity. E291.6


DELAWARE RIVER
SCREEN AND STRAINER WASH
2
1
SERVICE WATER INTAKE
3
SACS / RACS HEAT EXCHANGERS
DE-ICING LINE
COOLING TOWER BLOW
TURBINE/REACTOR STEAM CYCLE
CONDENSATE STORAGE TANKS
13
SOUTH STORM DRAIN
NORTH STORM DRAIN
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LIQUID RADWASTE PROCESSING
MAKEUP DEMINERALIZER SYSTEM
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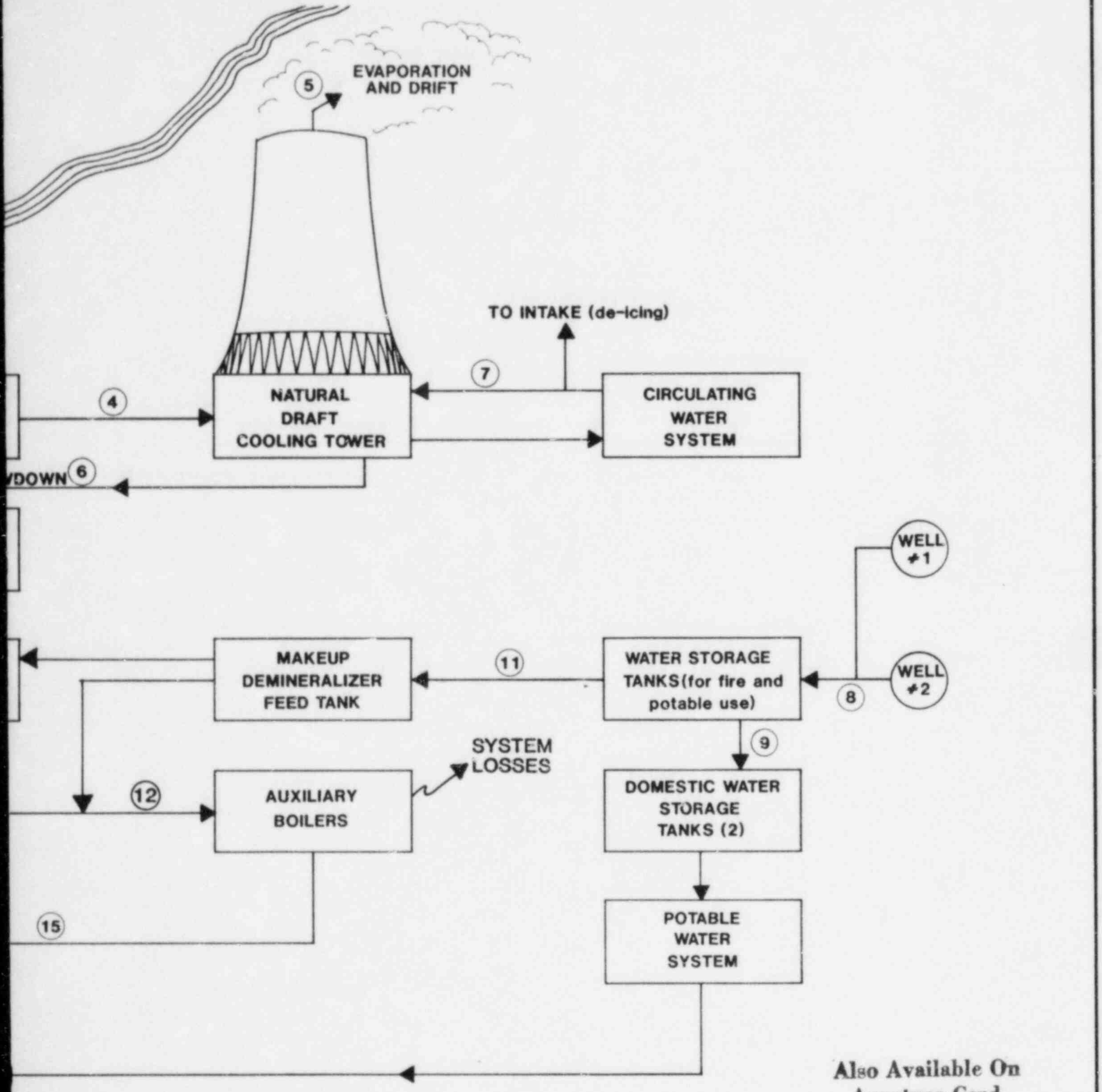

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STATION WATER USE

FIGURE 3.3 - 1 AMEND. 2

Table 3.5-7 gives the assumptions and parameters used to calculate the yearly activity releases. The yearly activity releases for each waste stream and the total appear in Table 3.5-17.

The processed liquid radwaste that is not recycled in the plant is discharged into the cooling tower blowdown line on a batch basis, at flow rates of up to 666 liters per minute (176 gallons per minute) for the low purity waste processing system, and 95 liters per minute (25 gallons per minute) for the laundry drain waste processing system. (No pump flows are given for discharges from the high purity, chemical or regenerant waste processing streams since it is not planned to actually discharge any of those streams.) Flow is controlled by a flow control valve; therefore, the actual flow could be substantially less.

The minimum monthly total cooling tower blowdown flow of 72,000 liters per minute (19,000 gallons per minute) dilutes the above discharge rates by at least a factor of 100 for the low purity waste, and by 750 for the laundry waste streams. This dilution occurs within the site boundary; the dilution is used in determining specific activity concentrations for the releases. These concentrations and a comparison to 10 CFR 20 limits appear in Table 3.5-18.

No actual leak detection methods have been employed but
several design measures have been implemented to preclude
leakage or the consequences of any leakage. These measures
include: the use of stainless steel piping, sampling the rad-
waste tanks prior to discharge and discharging only neutral
(pH 7 to 10) liquids to minimize the internal pipe corrosion 2
process, hydrostatically testing the pipe prior to burying it,
burying the pipe in granular bedding or sandcrete, and supply-
ing the piping with impressed current cathodic protection to
preclude external galvanic type corrosion.

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3.5.2.4 Estimated Doses

To ensure compliance with Appendix I of 10 CFR Part 50, dose calculations, based on the liquid source terms described above, are performed in accordance with Regulatory Guide 1.109 by use of the USNRC computer code LADTAP II. For these pur- 1
poses doses are calculated for a maximum individual consuming aquatic biota and receiving shoreline exposure at the edge of the initial mixing zone. There is no potable water or irrigation pathway for liquid effluents from HCGS. Table 3.5-19 gives input data for these calculations. The calculated doses are 0.026 mrem per year to the total body of an adult and 1
0.372 mrem per year to the bone of a child. These doses are well within the Appendix I design guides of 3.0 and 10.0 mrem per year to the total body and any organ, respectively.

Total man-rem and man-thyroid-rem dose to the 80 kilometer (50 mile) population from liquid effluents from Hope Creek Generating Station are estimated to be 0.252 and 0.742, respectively. Using the methodology presented in Regulatory Guide 1.110, additional equipment can be justified if its total annual cost is less than one thousand 1975 dollars per man-rem or man-thyroid-rem saved. The smallest total annual cost per man-rem or man-thyroid-rem saved (even assuming that the equipment would totally eliminate all 80 kilometer (50 mile) 2
population doses) is estimated to be $14,500 (1975). Since this is greater than $1,000 (1975), it is concluded that no additional equipment can be justified. Thus the liquid waste management system is judged to be designed in accordance with the applicable position of Appendix I to CFR 50.

3.5.3 GASEOUS RADWASTE SYSTEMS

The gaseous waste management systems include all systems that process potential sources of airborne releases of radioactive material during normal operation and anticipated operational occurrences. Included are the offgas system and various ventilation systems. These systems reduce radioactive gaseous releases from the plant by filtration or delay, which allows decay of radioisotopes prior to release.

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The function of the offgas system is to collect and delay the release of noncondensable radioactive gases removed from the main condenser by the air ejectors during normal plant operation. Plant ventilation systems process airborne radioactive releases from other plant sources, such as equipment leakage, maintenance activities, the mechanical vacuum pump and the steam seal system.

3.5.3.1 Design Bases:

a. The gaseous waste management systems are designed to control and monitor the release of radioactive materials in gaseous effluents in accordance with General Design Criteria (GDC) 60 and 64 of 10 CFR 50, Appendix A.

b. The offgas system design basis source terms correspond to 500,000 microcuries per second of radioactive noble gases after 30-minute delay.

c. The gaseous waste systems are designed to limit offsite doses from routine plant releases to significantly less than the limits specified in 10 CFR 20, and to operate within the dose objectives established in 10 CFR 50, Appendix I.

d. The gaseous waste management systems are designed with sufficient capacity and redundancy to accommodate all anticipated processing requirements of the plant during normal operation, including anticipated operational occurrences.

e. Continuous monitoring is provided for all potential pathways of airborne radioactive releases, with main control room annunciation at levels higher than allowed limits.

f. Design provisions are incorporated that preclude the uncontrolled release of radioactivity to the environment as a result of any single operator error or any single active component failure.

g. The gaseous waste management systems are designed to keep the exposure to plant personnel as low as is reasonably achievable (ALARA) during normal operation and plant maintenance, in accordance with Regulatory Guide 8.8.

malfunction of moisture removal features occurs, as well as to adsorb impurities in the process gas that might adversely affect performance of the main charcoal vessels.

After passing through the guard bed, the offgas enters the main charcoal adsorption beds. The charcoal adsorption beds,maintained at 18°C (65°F) by redundant room heating and air conditioning units, selectively adsorb and delay the xenon and krypton from the bulk carrier gas. This delay permits the xenon and krypton to decay in place. The offgas stream then passes through a HEPA filter where radioactive particulate matter and any charcoal particles are retained.

The offgas stream is then directed to the north vent stack, where it is diluted with a minimum of 41,900 standard cubic feet per minute of air from the solid radwaste system exhaust and chemical lab exhaust, before being released. Table 3.5-22 shows the estimated annual release rate from the offgas system. 2

All moisture removed from the process stream is returned to the main condenser, except for the condensate from the glycolcooler condenser, which is routed to the clean radwaste drainage (CRW) system.

3.5.3.2.1.2 System Design Considerations

Charcoal Holdup Time

The charcoal adsorber bed is designed for a delay time of 35 days for xenon under the condition of a 75 standard cubic feet per minute condenser inleakage rate using manufacturer's guaranteed adsorption coefficients (733 cubic centimeters per gram for xenon and 32 cubic centimenters per gram for krypton). The required charcoal mass of 146,000 kilograms (322,000 pounds) is obtained by the following equation from References 3.5-11 and3.5-12:

$$M = \frac{TV}{0.26K}$$

where:

T = holdup time, hours
K = dynamic adsorption coefficient, cubic centimeters per gram
V = air flow rate, standard cubic feet per minute
M = mass of charcoal, 10^3 pounds

Using the adsorption coefficients for the condition of 25°C (77°F) operation, 7°C (45°F) dew point, the NUREG-0016, Revision 1 (Reference 3.5-13) methodology yields delay times of 55 days and 3.1 days for xenon and krypton, respectively, for 146,000 kilograms (322,000 pounds) of charcoal. This estimate is very conservative since the adsorption coefficients for 18°C (65°F) operation and 4°C (40°F) dew point should be significantly higher than the ones for 25°C (77°F) operation and 7°C (45°F) dew point (330 cubic centimeters per gram for xenon and 18.5 cubic centimeters per gram for krypton).

Hydrogen Detonation Resistance

The pressure boundary of the offgas system is designed to withstand the effects of a hydrogen detonation during all anticipated modes of operation. In addition, the system includes features that reduce the probability of an explosion. Such features include:

a. Maintenance of nonexplosive mixture throughout the system - loss of dilution steam in SJAE will actuate an alarm and the suction valve of SJAE will be closed to isolate the offgas system.

b. Minimization of potential ignition sources, e.g., nonsparking valves.

c. Design with dual hydrogen analyzers which isolate wher the setpoint is reached.

3.5.3.2.1.3 Component Description

Table 3.5-23 lists the materials of construction, design temperatures and pressures.

Recombiner Section:

a. Preheater - The preheater is a straight tube-and-shell heat exchanger with the process gas on the tube side and steam on the shell side. Main steam is used to heat the process gas before entering the recombiner. The process gas enters the preheater at 105°C (221°F) and is heated to 132°C (270°F). Auxiliary steam is also available for heating the process gas flow, should main steam be unavailable. Condensate from the shell side of the heat exchanger is collected in a flash pot and routed back to the main condenser.

HEPA and charcoal filters for cleanup. After reaching a steady state, approximately 7.1 cubic meters per minute (250 cubic feet per minute) of air exhausted from the FRVS recirculation system is filtered again by the FRVS ventilation system, which is equipped with HEPA and charcoal filters, and then released to the atmosphere through a vent at the top of the reactor building; this maintains the building at a negative pressure of 0.25-inch water guage.

During power operation, radioactivity released from minor system leakage inside the drywell is contained, except for minor releases necessary to control drywell pressure. Pressure is controlled by bleeding air from the drywell through five-centimeter (two-inch) lines connected to the RBVS exhaust system prior to release to the environment.

After the reactor is shut down, and before the drywell and torus are purged by the RBVS, the containment atmosphere is first recirculated through the containment prepurge cleanup system (CPCS) for up to 30 hours, to reduce the level of atmospheric iodine and particulate radioactivity. After the prepurge cleanup process, the RBVS provides the supply air to and exhausts air from the drywell and torus for purge.

Radwaste Enclosure

The radwaste area supply system delivers filtered and tempered air that is distributed throughout the enclosure in quantities sufficient to maintain required temperatures. The equipment compartment exhaust system consists of three 33-1/3 percent capacity fans and 33-1/3 percent capacity filter plenums. The service area exhaust system consists of two 50-percent capacity fans without exhaust filtration since this is a non-radioactive area. The chemical lab exhaust system consists of two 100-percent capacity fans and two 100-percent capacity filter plenums. The solid radwaste area is supplied with filtered and tempered air in order to maintain design temperatures. The solid radwaste area exhaust system consists of two 50-percent capacity fans and two 50-percent capacity filter plenums. Each filter plenum has a bank of prefilters and a bank of HEPA filters. This exhaust system is balanced to ensure that the flow of air within the enclosure is into areas with higher potential for airborne radioactive contamination. The tank ventilation filter system provides a means of filtering and venting air from tanks and equipment housed in the radwaste enclosure. Two redundant fans and filter plenums are employed for this purpose. There are HEPA filters and charcoal adsorbers in each filter plenum. Since the flow of air from tanks and equipment varies, space air is admitted as required to maintain system volume.

All the exhaust system ducts transport the filtered air to either the north or south plant vents.

Each of the above exhaust systems and the respective supply systems are interlocked so that failure of the exhaust system shuts down the supply system. This condition is alarmed in the main control room.

Turbine Enclosure

During plant start-up, air is removed from the main condenser by two mechanical vacuum pumps. Each vacuum pump discharges to the south plant vent; if excessive release of radioactivity is detected at the vent, the pump trips, automatically closing the pump suction valves, and actuating an alarm.

In the past, discharge from the steam packing exhausters has presented a source of gaseous radioactive releases in some BWR plants; at HCGS, however, clean steam (produced from demineralized condensate) from the steam seal evaporator is provided for sealing purposes. Therefore, essentially no activity is released from this system.

The exhaust air from the turbine building ventilation system is monitored for radioactivity prior to its discharge to the atmosphere.

3.5.3.3 Radioactive Releases

The assumptions used in this evaluation are summarized in Table 3.5-7. The calculated annual releases appear in Table 3.5-22. 2

It is expected that the actual releases from the plant will be lower than those referenced above, due to the more realistic parameters associated with the equipment described in this chapter. Table 3.5-28 summarizes the charcoal filtration systems that reduce the airborne radioactive releases. Table 3.5-25 presents a comparison between the concentrations at the site boundary (901 meters (2960 feet)) using the annual X/Q value of 2.47E-7 second per cubic meter with the appropriate 2
recommended concentrations presented in Table II Column 1 of 10 CFR 20.

With the exception of the FRVS ventilaton system which discharges at the top of the reactor building all potentially 2
contaminated gaseous releases are through the north and south plant vents. The north plant vent serves the off-gas system,

the solid radwaste exhaust system, and the chemistry lab exhause system. The south plant vent serves the following systems:

a. Reactor Building Ventilation System (RBVS)

b. Radwaste Area Exhaust (RWE) System

c. Service Area Exhaust (SAE) System

d. Turbine Building Exhaust (TBE) System

e. Turbine Building Compartment Exhaust (TBCE) System 2

f. Turbine Building Oil Storage Room Exhaust (TBOE) System

g. Gland Seal Exhaust

h. Mechanical Vacuum Pump Discharge

The height, effluent flow rate, average temperature, exit velocity, heat content, and dimensions of the north and south plant vent are shown on Table 3.5-27.

3.5.3.4 Estimated Doses

Table 3.5-25 also presents the whole body dose at the site boundary. To assure compliance with Appendix I of

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10 CFR Part 50, dose calculations, based on the gaseous source
term referenced above, were performed in accordance with Regu-
latory Guide 1.109 by use of the USNRC computer code GASPAR
(revised 8/19/77). Input data for these calculations are
given in Table 3.5-26. X/Q's for the nearest residence in
each of the sixteen compass directions were calculated. The
sector with the highest X/Q corresponds to that sector with
the highest calculated doses and is designated the nearest
residence - 5.2 kilometers (3.5 miles) NW. It is conserva-
tively assumed that the nearest vegetable garden, milk cow,
and meat animal are also located at that residence since it is
possible for them to be there. Maximum doses to an individual
are calculated using the values for that location. These
doses are calculated using the highest pathway doses regard-
less of age group; that is, the child thyroid dose is used for
the vegetable ingestion pathway, whereas the infant thyroid 1
dose for the cow's milk pathway is used. The calculated doses
are 0.179 mrad per year beta air dose and 0.155 mrad per year
gamma air dose for noble gases; the Appendix I design objec-
tives are 20 and 10 mrad per year, respectively. Noble gas
doses to the total body and skin are calculated as 0.103 mrem
per year and 0.279 mrem per year, respectively; the respective
limits for these pathways are 5.0 mrem per year and 15.0 mrem
per year. The Appendix I design objective for radioiodine and
particulates is 15 mrem per year to any organ. The thyroid
dose from this source is calculated as 0.981 mrem per year.
All calculated doses are within the appropriate Appendix I
design objectives.

The total man-rem and man-thyroid-rem dose to the 80 kilometer
(50 mile)population from gaseous effluents from Hope Creek
Generating Station are estimated to be 16.3 and 31.0 respec-
tively. Using the methodology presented in Regulatory Guide
1.110, additional equipment can be justified if its total
annual cost is less than one thousand 1975 dollars per man-rem 2
or man-thyroid-rem saved. The smallest total annual cost per
man-rem or man-thyroid-rem saved is estimated to be $1,775
(1975). Since this is greater than $1000 (1975), it is con-
cluded that no additional equipment can be justified. Thus
the gaseous waste management system is judged to be designed
in accordance with the applicable position of Appendix I to 10
CFR 50.

3.5.4 SOLID RADWASTE SYSTEM

3.5.4.1 Overall System Description

The solid radwaste system, as described in Section 11.4 of the HCGS FSAR, collects, reduces the volume, solidifies and packages low-level radioactive waste for its eventual shipment off site to a licensed burial site. The solid radwaste system shown in Figures 3.5-7 and 3.5-8 accepts dry solid trash, potentially radioactive lubricating oil from various pumps, processed concentrated chemical slurries, sludge and spent resins. The solid wastes are grouped for discussion purposes into four general categories. These four categories are:

a. Resin slurries
b. Concentrates from the liquid radioactive waste system
c. Compressible waste
d. Other waste

The various types of solid waste are processed differently in order to maximize the amount of volume reduction, and thus minimize the volume of waste requiring packaging and shipping off site for burial. The various treatment methods are described in the following sections.

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3.5.4.2 Treatment of Radioactive Resins

The solid radioactive waste system accepts waste sludge and resin slurries from the waste sludge phase separator, the cleanup phase separators and the spent resin tank. These resin slurries are pumped directly into a radioactive waste centrifuge feed tank on a batch basis by the pumps of the liquid radioactive waste system. A decant pump is used to remove any excess water from the feed tank after allowing sufficient time for the resin material to settle. The slurries are then recirculated and agitated and the pH is adjusted. A small side stream is then taken off the recirculation loop for control metering, and sent to the centrifuge. The centrifuge separates the carrier water from the resin/sludge mixture, and then directs this moist, aerated slurry to one of the two waste extruder/evaporators. The extruder/evaporator mixes the slurry with asphalt at a temperature of approximately 300°F (150°C). This temperature is sufficiently high to evaporate any remaining water. The asphalt and resin mixture is extruded into 55-gallon drums as a more dense and concentrated product. The filled drums are moved using a monorail transport system, which is operated by remote control. A closed-circuit television monitors the operation of the system. The monorail system uses a turntable to place empty drums beneath the filling lines of the extruder/evaporator. After the drums are filled, the turntable rotates, and the monorail system removes the filled drums and transports them to the capping and radioactive swiping station. Upon arriving at this station, the drums are capped, radiation readings are taken, and the drums are swiped a final time, and properly labeled. The drums are then conveyed to the truck bay area where they are loaded into a waiting truck or placed into the radwaste storage area for subsequent disposal. The estimated quantity and activity of resin/slurry waste to be processed is listed below:

Source of Radioactive Waste Resin

	System	Anticipated Annual Volume	Activity
a.	Waste sludge phase separator	330,950 liters (87,430 gal)	6.18×10^{-1} uCi/cc (normal) 2.03×10^{0} uCi/cc (max)
b.	Clean-up phase separator	59,280 liters (15,660 gal)	$3.8 \times 10^{+2}$ uCi/cc (normal) $4.0 \times 10^{+2}$ uCi/cc (max)
c.	Spent resin tank	38,790 liters (1370 ft^3)	3.3×10^{-1} uCi/cc (normal) $1.2 \times 10^{+1}$ uCi/cc (max)

TABLE 3.5-9 (Page 1 of 3) | 2

EXPECTED RADIONUCLIDE ACTIVITY CONCENTRATIONS IN REACTOR COOLANT AND MAIN STEAM(1) USED FOR EVALUATION OF RADIOACTIVE RELEASES (in uCi/gm)

Isotope	Reactor Coolant(2)	Reactor Steam(2)
Noble Gases		
Ar-41	-	0
Kr-83m	-	9.1E-3(3)
Kr-85m	-	1.6E-3
Kr-85	-	5.0E-6
Kr-87	-	5.5E-3
Kr-88	-	5.5E-3
Kr-89	-	3.4E-2
Xe-131m	-	3.9E-6
Xe-133m	-	7.5E-5
Xe-133	-	2.1E-3
Xe-135m	-	7.0E-3
Xe-135	-	6.0E-3
Xe-137	-	3.9E-2
Xe-138	-	2.3E-2
Halogens(4)		
Br-83	1.1E-3	1.7E-5(5)
Br-84	1.4E-3	3.0E-5
I-131	1.9E-3	3.0E-5
I-132	1.1E-2	1.7E-4
I-133	8.0E-3	1.2E-4
I-134	1.4E-2	3.0E-4
I-135	8.0E-3	1.2E-4
Cesium		
Cs-134	3E-5	3E-8
Cs-136	8E-5	8E-8
Cs-137	2E-5	2E-8
Cs-138	1E-2	1E-5
Tritium(6)		
H-3	1E-2	1E-2

See page 3 for notes. | 2

TABLE 3.5-9 (Continued) (Page 2 of 3) | 2

Isotope	Reactor Coolant[2]	Reactor Steam[2]
Other Nuclides		
Na-24	9E-3	9E-6
P-32	2E-4	2E-7
Cr-51	6E-3	6E-6
Mn-54	7E-5	7E-8
Mn-56	5E-2	5E-5
Fe-55	9E-4	9E-7
Fe-59	3E-5	3E-8
Co-58	2E-4	2E-7
Co-60	4E-4	4E-7
Ni-65	3E-4	3E-7
Cu-64	3E-2	3E-5
Zn-65	2E-4	2E-7
Zn-69m	2E-3	2E-6
Sr-89	9E-5	9E-8
Sr-90	7E-6	7E-9
Sr-91	4E-3	4E-6
Sr-92	1E-2	1E-5
Y-91	4E-5	4E-8
Y-92	6E-3	6E-6
Y-93	4E-3	4E-6
Zr-95	7E-6	7E-9
Nb-95	7E-6	7E-9
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Tc-99m	2E-2	2E-5
Tc-104	8E-2	8E-5
Ru-103	2E-5	2E-8
Ru-105	2E-3	2E-6
Ru-106	3E-6	3E-9
Ag-110m	9E-7	9E-10
Te-129m	4E-5	4E-8
Te-131m	9E-5	9E-8
Te-132	9E-6	9E-9
Ba-139	1E-2	1E-5
Ba-140	4E-4	4E-7
La-142	5E-3	5E-6

TABLE 3.5-9 (Continued) (Page 3 of 3) | 2

Ce-141	3E-5	3E-8
Ce-143	3E-5	3E-8
Ce-144	3E-6	3E-9
Pr-143	4E-5	4E-8
W-187	3E-4	3E-7
Np-239	8E-3	8E-6

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(1) The reactor coolant concentration is specified at the nozzle where reactor water leaves the reactor vessel. Similarly, the reactor steam concentration is specified at time 0 at the nozzle.

(2) Normal expected concentrations correspond to 50,000 uCi offgas release rate at 30 minutes.

(3) 1.1E-3 = 1.1×10^{-3}

(4) All halogen concentrations have been adjusted lower to account for the reduced I-131 source term which was reported in Revision 1 of NUREG0016.

(5) Halogen concentrations listed in reactor steam are based on a carryover of 0.015. For a carryover of 0.004 the halogen reactor steam concentrations would be reduced proportionately.

(6) Measured values increased to account for liquid recycle.

TABLE 3.5-18 (Continued) (Page 2 of 3)

Isotope	Concentration (uCi/ml)(1)	MPC (uCi/ml) 10CFR20 Table II, Col. 2	Fraction of MPC
Tc-99m	5E-9	6E-3	8E-7
Ru-103	7E-11	8E-5	9E-7
Rh-103m	2E-11	1E-2	2E-9
Tc-104	7E-12	3E-6	2E-6
Ru-105	2E-10	1E-4	2E-6
Rh-105m	2E-10	3E-6	7E-5
Rh-105	1E-10	1E-4	1E-6
Ru-106	8E-10	1E-5	8E-5
Rh-106m	4E-12	3E-6	1E-6
Ag-110m	1E-10	3E-5	3E-6
Te-129m	5E-11	3E-5	2E-6
Te-129	3E-11	8E-4	4E-8
Te-131m	6E-11	6E-5	1E-6
Te-131	1E-11	3E-6	3E-6
I-131	3E-8	3E-7	1E-1
Te-132	8E-12	3E-5	3E-7
I-132	2E-9	8E-6	3E-4
I-133	2E-8	1E-6	2E-2
I-134	5E-10	2E-5	3E-5
Cs-134	4E-9	9E-6	4E-4
I-135	5E-9	4E-6	1E-3
Cs-136	3E-10	9E-5	3E-6
Cs-137	8E-9	2E-5	4E-4
Ba-137m	9E-11	3E-6	3E-5
Cs-138	1E-10	3E-6	3E-5
Ba-139	2E-10	3E-6	7E-5
Ba-140	4E-10	2E-5	2E-5
La-140	2E-10	2E-5	1E-5
La-141	9E-11	3E-6	3E-5
Ce-141	4E-11	9E-5	4E-7
La-142	1E-10	3E-6	3E-5
Ce-143	2E-11	4E-5	5E-7
Pr-143	5E-11	5E-5	1E-6
Ce-144	2E-9	1E-5	2E-4
Pr-144	4E-12	3E-6	1E-6
All Others	2E-11	-	-
H3	9E-6	3E-3	3E-3
Total	1E-7	1E-1	-

2

TABLE 3.5-19 (Page 1 of 4)

INPUT DATA FOR AQUATIC DOSE CALCULATIONS

HOPE CREEK GENERATING STATION - LIQUID DOSE CALCULATIONS

1 42.3 1.0 0 | 1

5.97E06

HCGS SOURCE TERM - ONE UNIT WITH MULTIPLIER OF 1.0

H 3	26.0
NA24	0.012
P 32	0.00068
CR51	0.022
MN54	0.0013
MN56	0.0088
FE55	0.0041
FE59	0.00011
CO58	0.0048
CO60	0.01
NI65	0.000052
CU64	0.032
ZN65	0.00081
ZN69M	0.0022
ZN69	0.0024
W 187	0.00048	2
NP239	0.016
BR83	0.00059
BR84	0.000023
SR89	0.00039
SR90	0.000029
Y 90	0.000012	2
SR91	0.0033
Y 91M	0.0021
Y 91	0.0024
SR92	0.0019
Y 92	0.0046
Y 93	0.0035
ZR95	0.0014
NB95	0.002
NB98	0.000075
MO99	0.0049
TC99M	0.014
RU103	0.00022
RH103M	0.000075
TC104	0.000022
RU105	0.00074
RH105M	0.00075
RH105	0.00045
RU106	0.0024
RH106	0.000012

TABLE 3.5-25

EXPECTED ACTIVITY CONCENTRATIONS (uCi/ml) AT THE SITE BOUNDARY FOR EVALUATION OF GASEOUS RELEASES

Isotope	Concentration (uCi/ml)(1)	MPC (uCi/ml) 10CFR20 Table II, Column 1	Fraction of MPC	Annual External Whole Body Dose (mrem)
I131	2E-14	1E-10	2E-4	6E-5
I133	3E-13	4E-10	8E-4	1E-3
H3	4E-12	2E-7	2E-5	-
C14	7E-13	1E-7	7E-6	-
Ar41	1E-12	4E-8	3E-5	1E-2
Kr85m	2E-12	1E-7	2E-5	3E-3
Kr85	2E-11	3E-7	7E-5	3E-4
Kr87	5E-12	2E-8	3E-4	3E-2
Kr88	7E-12	2E-8	4E-4	1E-1
Kr89	5E-11	3E-6	2E-5	9E-1
Xe131m	5E-13	4E-7	1E-6	8E-5
Xe133	1E-10	3E-7	3E-4	4E-2
Xe135m	8E-11	3E-6	3E-5	3E-1
Xe135	9E-11	1E-7	9E-4	2E-1
Xe137	1E-10	3E-6	3E-5	2E-1
Xe138	8E-11	3E-6	3E-5	7E-1
Cr51	7E-17	8E-8	9E-10	2E-8
Mn54	5E-17	1E-9	5E-8	3E-7
Co58	8E-17	2E-9	4E-8	6E-7
Fe59	9E-18	2E-9	5E-9	8E-8
Co60	9E-17	3E-10	3E-7	2E-6
Zn65	5E-16	2E-9	3E-7	2E-6
Sr89	5E-16	3E-10	2E-6	3E-10
Sr90	2E-18	3E-11	7E-8	-
Nb95	9E-18	3E-9	3E-9	5E-8
Zr95	5E-18	1E-9	5E-9	3E-8
Mo99	2E-16	7E-9	3E-8	2E-7
Ru103	7E-18	3E-9	2E-9	3E-8
Ag110m	2E-21	3E-10	7E-12	4E-11
Sb124	8E-18	7E-10	1E-8	1E-7
Cs134	2E-17	4E-10	5E-8	3E-7
Cs136	9E-18	6E-9	2E-9	3E-7
Cs137	9E-17	5E-10	2E-7	2E-7
Ba140	8E-16	1E-9	8E-7	4E-7
Ce141	8E-16	5E-9	2E-7	4E-7
Total			3E-3	2E0

2

(1) Concentrations have been adjusted to reflect the fact that the releases presented in Table 3.5-22 are based on a 50,000 uCi/sec noble gas offgas rate (at 30 minute delay). The concentrations in this table are based on a 500,000 uCi/sec rate.

TABLE 3.5-26 (Continued) (Page 4 of 7)

HCGS SINGLE UNIT SOURCE TERM WITH MULTIPLIER OF 1.0

	1.0
I 131	2.4E-1
I 133	3.2E00
H 3	5.2E01
C 14	9.5E00
AR41	1.5E01
KR85M	2.9E01
KR85	2.2E02
KR87	6.3E01
KR88	9.50E1
KR89	6.1E02
XE131M	6.7E00
XE133	1.8E03
XE135M	9.9E02
XE135	1.2E03
XE137	1.3E03
XE138	1.0E03
CR51	9.2E-4
MN54	6.5E-4
CO58	1.0E-3
FE59	1.1E-4
CO60	1.1E-3
ZN65	6.1E-3
SR89	6.0E-3
SR90	2.0E-5
NB95	1.1E-4
ZR95	5.8E-5
MO99	2.7E-3
RU103	9.2E-5
AG110M	2.4E-8
SB124	1.0E-4
CS134	2.7E-4
CS136	1.1E-4
CS137	1.1E-3
BA140	1.0E-2
CE141	1.0E-2

HCGS GROUND LEVEL X/Q (NORMAL) - HOPE CREEK GROUND LEVEL RELEASE
6
N 2.369E-06 5.078E-07 2.408E-07 1.477E-07 1.046E-07 5.162E-08
1.962E-08 9.584E-09 5.971E-09 4.191E-09
NNE 2.018E-06 4.295E-07 2.032E-07 1.246E-07 8.827E-08 4.355E-08 1 2
1.656E-08 8.088E-09 5.039E-09 3.538E-09
NE 2.004E-06 4.252E-07 2.010E-07 1.235E-07 8.761E-08 4.335E-08
1.655E-08 8.107E-09 5.062E-09 3.559E-09
ENE 1.465E-06 3.123E-07 1.480E-07 9.078E-08 6.432E-08 3.175E-08
1.208E-08 5.900E-09 3.677E-09 2.581E-09
E 1.349E-06 2.890E-07 1.373E-07 8.462E-08 6.016E-08 2.990E-08
1.147E-08 5.639E-09 3.528E-09 2.484E-09

TABLE 3.5-26 (Continued) (Page 5 of 7)

ESE	1.263E-06	2.664E-07	1.275E-07	7.937E-08	5.685E-08	2.867E-08	1.121E-08	5.581E-09	3.519E-09	2.493E-09
SE	2.528E-06	5.103E-07	2.417E-07	1.514E-07	1.084E-07	5.544E-08	2.200E-08	1.108E-08	7.047E-09	5.821E-09
SSE	2.086E-06	4.332E-07	2.032E-07	1.247E-07	8.840E-08	4.374E-08	1.672E-08	8.215E-09	5.140E-09	3.620E-09
S	2.052E-06	4.339E-07	2.033E-07	1.242E-07	8.770E-08	4.305E-08	1.627E-08	7.926E-09	4.931E-09	3.458E-09
SSW	1.797E-06	3.853E-07	1.812E-07	1.107E-07	7.824E-08	3.844E-08	1.454E-08	7.078E-09	4.402E-09	3.087E-09
SW	2.033E-06	4.323E-07	2.043E-07	1.255E-07	8.905E-08	4.409E-08	1.685E-08	8.264E-09	5.164E-09	3.633E-09
WSW	1.711E-06	3.631E-07	1.709E-07	1.045E-07	7.389E-08	3.634E-08	1.377E-08	6.715E-09	4.181E-09	2.934E-09
W	1.963E-06	4.148E-07	1.936E-07	1.180E-07	8.321E-08	4.073E-08	1.535E-08	7.465E-09	4.640E-09	3.253E-09
WNW	2.272E-06	4.841E-07	2.264E-07	1.376E-07	9.682E-08	4.718E-08	1.766E-08	8.541E-09	5.289E-09	3.697E-09
NW	2.652E-06	5.725E-07	2.677E-07	1.625E-07	1.142E-07	5.556E-08	2.073E-08	1.000E-08	6.185E-09	4.318E-09
NNW	1.792E-06	3.848E-07	1.793E-07	1.087E-07	7.632E-08	3.703E-08	1.378E-08	6.639E-09	4.101E-09	2.861E-09

HCGS GROUND LEVEL X/Q (NORMAL) - IN PLACE OF DECAYED X/Q

6

N	2.369E-06	5.078E-07	2.408E-07	1.477E-07	1.046E-07	5.162E-08	1.962E-08	9.584E-09	5.971E-09	4.191E-09
NNE	2.018E-06	4.295E-07	2.032E-07	1.246E-07	8.827E-08	4.355E-08	1.656E-08	8.088E-09	5.039E-09	3.538E-09
NE	2.004E-06	4.252E-07	2.010E-07	1.235E-07	8.761E-08	4.335E-08	1.655E-08	8.107E-09	5.062E-09	3.559E-09
ENE	1.465E-06	3.123E-07	1.480E-07	9.078E-08	6.432E-08	3.175E-08	1.208E-08	5.900E-09	3.677E-09	2.581E-09
E	1.349E-06	2.890E-07	1.373E-07	8.462E-08	6.016E-08	2.990E-08	1.147E-08	5.639E-09	3.528E-09	2.484E-09
ESE	1.263E-06	2.664E-07	1.275E-07	7.937E-08	5.685E-08	2.867E-08	1.121E-08	5.581E-09	3.519E-09	2.493E-09
SE	2.528E-06	5.103E-07	2.417E-07	1.514E-07	1.084E-07	5.544E-08	2.200E-08	1.108E-08	7.047E-09	5.821E-09
SSE	2.086E-06	4.332E-07	2.032E-07	1.247E-07	8.840E-08	4.374E-08	1.672E-08	8.215E-09	5.140E-09	3.620E-09
S	2.052E-06	4.339E-07	2.033E-07	1.242E-07	8.770E-08	4.305E-08	1.627E-08	7.926E-09	4.931E-09	3.458E-09
SSW	1.797E-06	3.853E-07	1.812E-07	1.107E-07	7.824E-08	3.844E-08	1.454E-08	7.078E-09	4.402E-09	3.087E-09
SW	2.033E-06	4.323E-07	2.043E-07	1.255E-07	8.905E-08	4.409E-08	1.685E-08	8.264E-09	5.164E-09	3.633E-09
WSW	1.711E-06	3.631E-07	1.709E-07	1.045E-07	7.389E-08	3.634E-08	1.377E-08	6.715E-09	4.181E-09	2.934E-09

TABLE 3.5-26 (Continued) (Page 6 of 7)

W 1.963E-06 4.148E-07 1.936E-07 1.180E-07 8.321E-08 4.073E-08
1.535E-08 7.465E-09 4.640E-09 3.253E-09
WNW 2.272E-06 4.841E-07 2.264E-07 1.376E-07 9.682E-08 4.718E-08
1.766E-08 8.541E-09 5.289E-09 3.697E-09
NW 2.652E-06 5.725E-07 2.677E-07 1.625E-07 1.142E-07 5.556E-08
2.073E-08 1.000E-08 6.185E-09 4.318E-09
NNW 1.792E-06 3.848E-07 1.793E-07 1.087E-07 7.632E-08 3.703E-08
1.378E-08 6.639E-09 4.101E-09 2.861E-09
HCGS GROUND LEVEL X/Q (DEPLETED) - HOPE CREEK GROUND LEVEL RELEASE
6
N 2.150E-06 4.196E-07 1.893E-07 1.124E-07 7.772E-08 3.557E-08
1.150E-08 4.982E-09 2.868E-09 1.898E-09
NNE 1.829E-06 3.549E-07 1.598E-07 9.486E-08 6.558E-08 3.001E-08
9.700E-09 4.204E-09 2.421E-09 1.603E-09
NE 1.818E-06 3.513E-07 1.581E-07 9.402E-08 6.508E-08 2.986E-08
9.692E-09 4.214E-09 2.432E-09 1.612E-09
ENE 1.329E-06 2.580E-07 1.164E-07 6.910E-08 4.778E-08 2.187E-08
7.073E-09 3.067E-09 1.766E-09 1.169E-09
E 1.224E-06 2.388E-07 1.080E-07 6.441E-08 4.469E-08 2.060E-08
6.721E-09 2.931E-09 1.695E-09 1.125E-09
ESE 1.146E-06 2.202E-07 1.003E-07 6.041E-08 4.223E-08 1.975E-08 1 2
6.566E-09 2.901E-09 1.691E-09 1.129E-09
SE 2.294E-06 4.217E-07 1.901E-07 1.152E-07 8.087E-08 3.820E-08
1.289E-08 5.762E-09 3.383E-09 2.278E-09
SSE 1.892E-06 3.580E-07 1.598E-07 9.494E-08 6.567E-08 3.013E-08
9.797E-09 4.270E-09 2.469E-09 1.640E-09
S 1.862E-06 3.585E-07 1.599E-07 9.454E-08 6.515E-08 2.966E-08
9.532E-09 4.120E-09 2.369E-09 1.566E-09
SSW 1.630E-06 3.184E-07 1.425E-07 8.429E-08 5.812E-08 2.648E-08
8.515E-09 3.679E-09 2.115E-09 1.398E-09
SW 1.844E-06 3.572E-07 1.606E-07 9.555E-08 6.615E-08 3.038E-08
9.870E-09 4.296E-09 2.481E-09 1.646E-09
WSW 1.552E-06 3.000E-07 1.344E-07 7.956E-08 5.489E-08 2.304E-08
8.065E-09 3.490E-09 2.009E-09 1.329E-09
W 1.781E-06 3.427E-07 1.522E-07 8.963E-08 6.181E-08 2.806E-08
8.992E-09 3.880E-09 2.229E-09 1.473E-09
WNW 2.062E-06 4.000E-07 1.780E-07 1.048E-07 7.193E-08 3.251E-08
1.035E-08 4.439E-09 2.541E-09 1.675E-09
NW 2.406E-06 4.731E-07 2.105E-07 1.237E-07 8.487E-08 3.828E-08
1.215E-08 5.200E-09 2.971E-09 1.956E-09
NNW 1.626E-06 3.180E-07 1.410E-07 8.275E-08 5.670E-08 2.551E-08
8.074E-09 3.451E-09 1.970E-09 1.296E-09
HCGS D/Q CORRECTED FOR DEPLETION - HOPE CREEK GROUND LEVEL RELEASE
6
N 1.305E-08 2.099E-09 8.630E-10 4.807E-10 3.104E-10 1.277E-10
3.823E-11 1.560E-11 8.457E-12 5.352E-12
NNE 1.017E-08 1.636E-09 6.726E-10 3.746E-10 2.420E-10 9.950E-11
2.980E-11 1.216E-11 6.591E-12 4.172E-12

TABLE 3.5-26 (Continued) (Page 7 of 7)

NE	9.254E-09	1.489E-09	6.122E-10	3.409E-10	2.202E-10	9.055E-11	2.712E-11	1.107E-11	5.998E-12	3.796E-12
ENE	5.999E-09	9.649E-10	3.968E-10	2.210E-10	1.427E-10	5.870E-11	1.758E-11	7.173E-12	3.888E-12	2.461E-12
E	5.325E-09	8.566E-10	3.523E-10	1.962E-10	1.267E-10	5.211E-11	1.561E-11	6.368E-12	3.452E-12	2.185E-12
ESE	4.948E-09	7.960E-10	3.273E-10	1.823E-10	1.177E-10	4.842E-11	1.450E-11	5.917E-12	3.207E-12	2.030E-12
SE	1.610E-08	2.590E-09	1.065E-09	5.932E-10	3.831E-10	1.576E-10	4.718E-11	1.925E-11	1.044E-11	6.605E-12
SSE	1.303E-08	2.095E-09	8.617E-10	4.799E-10	3.100E-10	1.275E-10	3.817E-11	1.558E-11	8.444E-12	5.344E-12
S	1.228E-08	1.976E-09	8.125E-10	4.525E-10	2.923E-10	1.202E-10	3.599E-11	1.469E-11	7.962E-12	5.039E-12
SSW	1.111E-08	1.787E-09	7.351E-10	4.094E-10	2.644E-10	1.087E-10	3.256E-11	1.329E-11	7.203E-12	4.559E-12
SW	1.136E-08	1.828E-09	7.517E-10	4.187E-10	2.704E-10	1.112E-10	3.330E-11	1.359E-11	7.366E-12	4.662E-12
WSW	1.095E-08	1.762E-09	7.245E-10	4.035E-10	2.606E-10	1.072E-10	3.209E-11	1.310E-11	7.099E-12	4.493E-12
W	1.482E-08	2.385E-09	9.807E-10	5.462E-10	3.528E-10	1.451E-10	4.344E-11	1.773E-11	9.609E-12	6.082E-12
WNW	1.815E-08	2.919E-09	1.200E-09	6.686E-10	4.318E-10	1.776E-10	5.318E-11	2.170E-11	1.176E-11	7.445E-12
NW	2.215E-08	3.564E-09	1.466E-09	8.162E-10	5.272E-10	2.168E-10	6.492E-11	2.649E-11	1.436E-11	9.089E-12
NNW	1.218E-08	1.959E-09	8.055E-10	4.486E-10	2.898E-10	1.192E-10	3.569E-11	1.456E-11	7.893E-12	4.996E-12
1DAIRY FARM #1	13	4.9	7.389E-08	7.389E-08	5.444E-08	3.042E-10				
1SECOND SUN	8	0.5	2.086E-06	2.086E-06	1.892E-06	1.303E-08				
1VEG PLOT #1	15	3.5	1.625E-07	1.625E-07	1.237E-07	8.162E-10				
1MEAT COW #1	13	4.0	9.804E-08	9.804E-08	7.366E-08	4.330E-10				
1MEAT COW #2	14	4.0	1.142E-07	1.142E-07	8.581E-08	5.300E-10				

1 2

3.6.4 MAKEUP DEMINERALIZERS

Two trains of ion exchange demineralizers satisfy the station's high purity makeup water requirements, as was planned at the construction permit stage.

The two trains are parallel, each sized to produce 570 liters per minute (150 gallons per minute) of demineralized water. A train consists of one strong acid cation vessel, one vacuum degasifier (common to both trains), one strong base anion vessel and one mixed bed vessel. Each cation/anion train produces 820,000 liters (217,000 gallons) of demineralized water between regenerations, while each mixed bed produces 3,780,000 liters (999,000 gallons) of demineralized water between regenerations. Each demineralizer train normally requires regeneration once every three days, except for the mixed beds, which are normally regenerated once every 15 days.

At the construction permit stage it was estimated that daily regeneration of each train would require 240 kilograms (520 pounds) of 66° Baume' sulfuric acid and 140 kilograms (300 pounds) of sodium hydroxide. Cancellation of Unit 2 and the revised regeneration scheme detailed above result in the following chemical usage per regeneration:

	60° Be' H_2SO_4	NaOH
Cation/anion train	332 kg 732 lb	139 kg 307 lb
Mixed bed	65 kg 144 lb	65 kg 144 lb

Demineralizer regenerant effluent is stored in one 190,000-liter (50,000-gallon) capacity tank prior to discharge to the oily water and low volume wastewater system.

3.6.5 AUXILIARY BOILERS

The station is equipped with three auxiliary boilers to provide building heating, process testing steam and auxiliary steam to the turbine building. The boiler feedwater is treated with ammonia to maintain a pH in the range of 8.5 to 9.0. Daily ammonia consumption is anticipated to be approximately 0.5 kilogram per day (1.1 pounds per day). Hydrazine, a dissolved oxygen scavenger, is also used to treat the feedwater. A daily consumption of approximately 0.8 kilogram per day (1.8 pounds per day) is anticipated. The chemical feed systems for each solution are identical; they consist of a 190-liter (50-gallon) tank and two 14.4 liter per hour (3.8 gallon per hour) chemical feed pumps.

A single atmospheric blowdown tank is provided for the continuous blowdown of the three boilers. During normal operation, one boiler operates, while one remains in a standby mode; normal operation results in an average blowdown of 32,200 liter per day (8,500 gallons per day). An equivalent volume of cooling "quench" water is added to the auxiliary 2
boiler blowdown and is supplied by on-site production wells. During plant start-up, a maximum of two boilers operate; the resulting blowdown is expected to be 128 liters per minute (34 gallons per minute). Composition of the blowdown is expected to be as follows:

Parameter	Daily Average	Maximum Anticipated	
TSS (mg/l)	<30	100	
Oil and grease (mg/l)	<10	20	2
Copper, total (mg/l)	<0.2	0.2	
Iron, total (mg/l)	<1.0	1.0	

The auxiliary boiler blowdown discharges to the oily water treatment system.

3.6.6 OILY WATER WASTEWATER SYSTEM 2

The oily water collection system is designed to encompass the following waste streams:

a. Turbine building emergency sumps
b. Switchyard and transformer drains
c. Auxiliary boiler blowdown, blowdown quench and drains
d. Circulating water chemical storage and water 2
treatment
e. Diesel generator and control room drains

During the construction permit stage, PSE&G planned to construct and operate a treatment facility to accommodate all these wastes. Publication of revised effluent limitations (Table 5.1.2) on November 19, 1982, prompted PSE&G to reevaluate the system along with several alternatives. PSE&G selected treatment of potentially oily water in an API type 2
separator and transportation of low volume waste (demineralizer regenerant wastes) for treatment off-site. The system is described in Section 5.3.1.1.

3.6.7 METAL CLEANING WASTES

During the start-up process, various HCGS systems are flushed to insure their integrity. Well water followed by demineralized water comprise the only flushing agents. These wastes accumulate in a lined 4.9-million liter (1.3-million gallon)capacity surface impoundment to allow particulate settlement.Upon verification that the contents meet the NJPDES and the DRBC effluent limitations, the water is discharged to the Delaware River.

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2

CONTENTS (Continued)

2

1

FIGURES (Continued)

TABLE 5.2-2

ANNUAL MAXIMUM INDIVIDUAL DOSE COMMITMENTS DUE TO GASEOUS AND LIQUID EFFLUENTS (mRem unless noted)

		RADIOIODINE AND PARTICULATES IN GASEOUS EFFLUENTS			
LOCATION	PATHWAY	TOTAL BODY	HIGHEST ORGAN	THYROID	
Nearest[1] farm residence milk cow and meat animal at 3.5 miles NW	Ground deposit	1.27E-3	1.49E-3 (skin)	1.27E-3	
	Inhalation (teen-total body) (child-thyroid)	4.64E-4	7.38E-2 (thyroid)	7.38E-2	
	Milk (infant)	3.64E-2	7.69E-1 (thyroid)	7.69E-1	2 E470.4
	Vegetables (child)	2.38E-2	1.17E-1 (bone)	1.16E-1	
	Meat (child)	5.41E-3	2.63E-2 (bone)	2.10E-2	
TOTALS					

		LIQUID EFFLUENTS			
		TOTAL BODY	BONE	LIVER	
Nearest fish at outfall	Fish ingestion	1.66E-2 (adult)	2.89E-1 (child)	2.75E-2 (teen)	1

NOBLE GASES IN GASEOUS EFFLUENTS

	TOTAL BODY	SKIN	GAMMA AIR DOSE (mrads)	BETA AIR (mrads)	
Nearest residence 3.5 miles NW	1.03E-1	2.79E-1	1.55E-1	1.79E-1	1 2

(1) "Nearest" refers to the location where the highest radiation dose to an individual from all applicable pathways has been estimated.

TABLE 5.2-3

APPENDIX I ANNUAL MAXIMUM INDIVIDUAL AND POPULATION DOSE COMMITMENTS[1]

	APPENDIX I DESIGN OBJECTIVES	CALCULATED DOSES	
Liquid Effluents			
Dose to total body from all pathways	3 mrem	0.026 mrem	1
Dose to any organ from all pathways	10 mrem	0.372 mrem (bone)	
Noble Gas Effluents (at nearest actual resident)			
Gamma dose in air	10 mrad	0.155 mrad	
Beta dose in air	20 mrad	0.179 mrad	1 2
Dose to total body of an individual	5 mrem	0.103 mrem	
Dose to skin of an individual	15 mrem	0.279 mrem	1 2
Radioiodines and Particulates[2]			
Dose to any organ from all pathways	15 mrem	0.981 mrem (thyroid)	1 2

	POPULATION DOSES WITHIN 80 km (50 mi) TOTAL BODY	THYROID	
	Annual Dose		
Natural Radiation Background[3]	490000 man-rem		
Liquid Effluents	0.252 man-rem	0.742 man-rem	
Noble Gas Effluents	15.3 man-rem	15.3 man-rem	
Radioiodines and Particulates	1.04 man-rem	15.7 man-rem	1 2

(1) Appendix I Design Objectives from Sections II.A, II.B, II.C and II.D of Appendix I, 10 CFR Part 50, considers dose to maximum individual and population per reactor unit. From Federal Register, 40, p. 19442, May 5, 1975.

(2) Carbon-14 and tritium have been added to this category.

(3) "Natural Radiation Exposure in the United States," U.S. Environmental Protection Agency, ORP-SID-72-1 (June, 1972); using the average terrestrial plus cosmic background (82 mrem per year for the Hope Creek area) and year 2010 projected population of 5970000.

TABLE 5.2-4

ANNUAL TOTAL-BODY U.S. POPULATION DOSE COMMITMENT

CATEGORY	U.S. POPULATION-DOSE COMMITMENT (man-Rem)
Natural background radiation[(1)] (man-rem/yr)	28,400,000
General Public	
Gas and particulates	34.6
Liquid effluents	1.53
Transportation of fuel and waste	3

1 2

(1) Using the average U.S. background dose (102 mrem per year) and year 2010 projected U.S. population from "Population Estimates and Projections," Series II, U.S. Dept. of Commerce, Bureau of the Census, Series P-25, No. 541, February, 1975.

5.3 EFFECTS OF CHEMICAL OR BIOCIDE DISCHARGES

5.3.1 SURFACE WATER

HCGS uses the Delaware River to assimilate liquid discharges from the chemical and biocide systems described in Section 3.6. The DRBC and NJDEP require that specific stream quality objectives for Zone 5 of the Delaware be met within 1100 meters (3,500 feet) of the discharge (mixing zone). Table 5.1.1 provides these water quality objectives.

PSE&G controls station discharges to meet these objectives and the discharge limitations imposed by the EPA and DRBC (see Section 5.1.1). A description of chemical and biocide discharge effects on the Delaware River follows:

5.3.1.1 Oily Water 2

At the construction permit stage, PSE&G planned a chemical waste treatment system. Publication of revised effluent limitations (Table 5.1-2) on November 19, 1982, prompted PSE&G to evaluate treatment alternatives. Potentially oily water, including auxiliary boiler blowdown, is now treated at HCGS, and low volume wastewater is collected and trucked for treatment at Salem Generating Station.

Low volume waste neutralization is accomplished in the 190,000 liter (50,000 gal) waste tank, if necessary, to ensure that shipments are in the pH range of two through twelve, prior to removal from HCGS (see Figure 5.3-1).

Figure 5.3-1 also depicts the flow of potentially oily wastes which are treated and discharged at HCGS. As shown, water that may be contaminated with oil is collected from various points onsite and delivered to either of two lift stations (1B or 1C). 2

Potentially oily water collected at lift station 1B ranges in flow from 0 - 390,000 (0 - 100,000 gallons per day), depending on the presence of rainwater and/or oil spills. Pollutants encountered here can include oil and suspended solids, and iron and copper at low concentrations. Water collected at lift station 1C emanates from sources whose flows are intermittent or rare, depending on rainfall or spills. Only auxiliary boiler blowdown and blowdown quench water provide continuous flow. Both blowdown and quench water each range from 32,200 (average) to 98,400 (maximum) liters per day (8,500 (average) to 26,000 (maximum) gallons per day). Typical contaminants found in both sources include suspended solids, iron, and copper at levels acceptable for direct discharge without special treatment.

The lift stations pump the waste to a 1900 liter per minute (500 gallon per minute) American Petroleum Institute (API) type oil separator. Average flow through this system is approximately 121,000 liters per day (32,000 gallons per day).

The API separators are equipped with a surge chamber, oil
skimmer and 56,800 liter (15,000 gallon) waste oil holding
tank. Any sludges removed from the tank are stored in a
2,000 gallon oily sludge holding tank. These sludges are
disposed of in accordance with current Resource Conservation 2
and Recovery Act (RCRA) and NJDEP hazardous waste
regulations.

The API separator's treated effluent is monitored to ensure compliance with the station's NJPDES permit and current DRBC regulations. This effluent discharges into the cooling tower blowdown line and eventually to the Delaware River.

This level of treatment, although accomplished differently, is consistent with CP stage plans. Only the wastes from a single unit are now involved, however.

5.3.1.2 <u>Cooling Tower Blowdown</u>

As Section 3.4 describes, a natural draft cooling tower is the major feature of the station's heat dissipation system. The service water system obtains make-up water from the Delaware River to replace evaporative losses and cooling tower blowdown.

Make-up water requires treatment with chlorine (see Section 3.6.1) prior to its use in both service and circulating water systems in order to control biofouling. Similarly, sulfuric acid prevents deposition of calcium carbonate (scaling) when added to circulating water.

The EPA regulates the concentration of residual chlorine (biocide) in cooling tower blowdown (see Table 5.1-2). Free available chlorine (FAC) in cooling tower blowdown may not exceed 0.5 milligram per liter as a one-day maximum or 0.2 milligram per liter as a 30-day average. Additionally, daily chlorination is limited to two hours each day (see Table 5.1-2).

Cooling tower blowdown flow averages approximately 80,900 liters per minute (21,360 gallons per minute) over an average month at full power operation.

In order to meet make-up water chlorine demand and maintain an effective FAC residual in the service and circulating water systems, HCGS utilizes a maximum of 145,600 kilograms (390,000 pounds) of chlorine (as Cl_2) annually (400 kilograms (1,100 pounds) per day).

The release of FAC should not have a significant impact on Delaware River water quality. The chlorine, which is added as sodium hypochlorite, exists in the dissolved state as hypochlorous acid (HOCl) and hypochlorite ion (OCl^-). These species disperse, and are diluted, as in the near field of the thermal plume (see Section 5.1.2). Dilution alone of the chlorinated effluent assures a minimal effect on Delaware River water quality. If the station releases 0.5 milligram per liter of FAC, under conditions of least dilution (August, during ebb tide on the river bottom), the FAC concentration at the end of the 1070 meter (3,500 foot) mixing zone would be less than 0.01 milligram per liter.

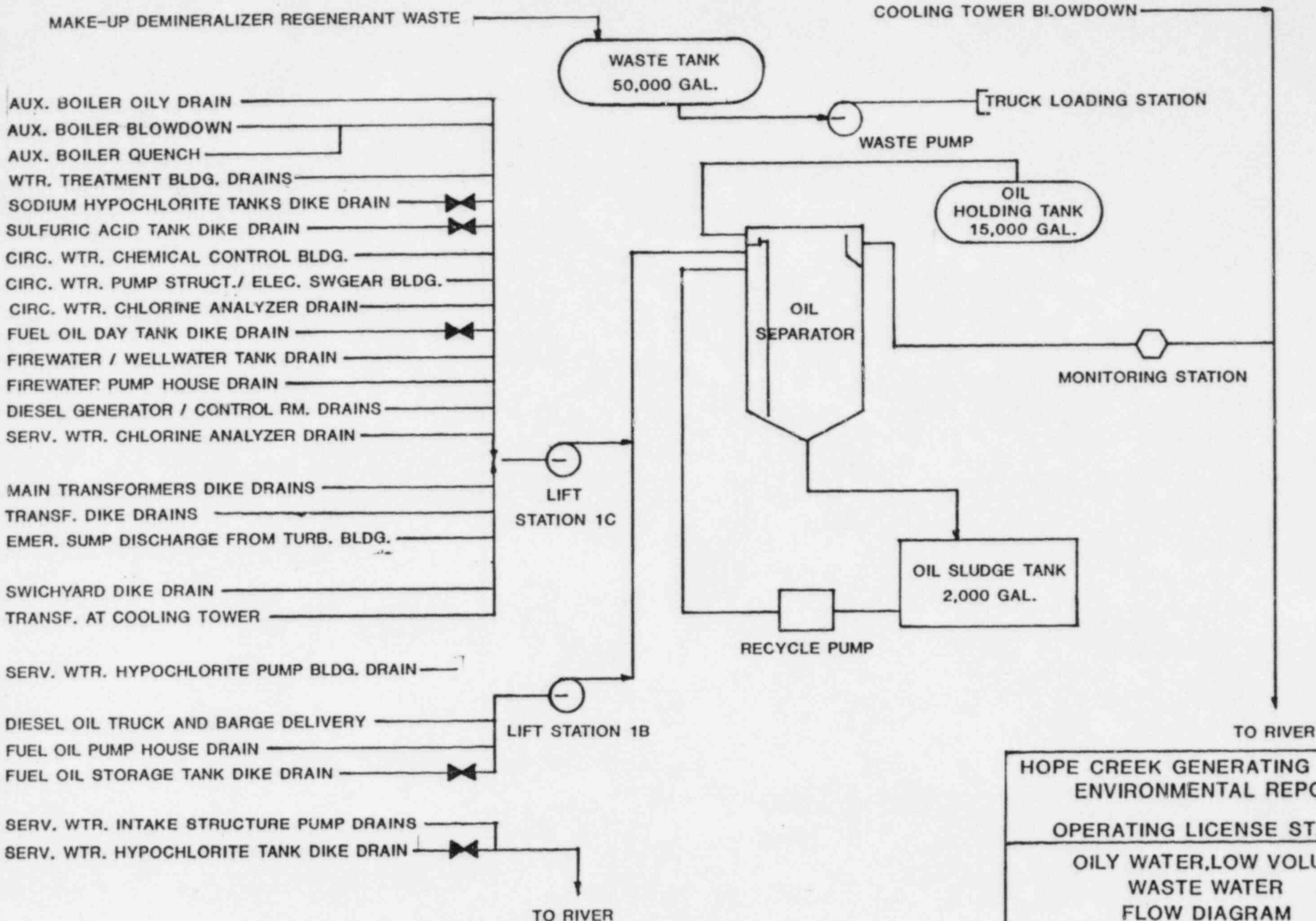
It should also be considered that the EPA limits to two hours the time during which any measurable chlorine residual is allowed. Additionally, dilution does not account for ambient river chlorine demand, which further reduces chlorine levels. It can be seen that both regulation and physical factors (dilution, chlorine demand, etc.) protect river quality.

If all chlorine is converted (reduced) to Cl^-, the river loading of 0.2 milligram per liter of the ion within the plume is negligible compared to ambient (median) river chloride levels (3,725 milligrams per liter). If it is assumed that the cooling tower creates two cycles of river water concentration, the combination of reduced chlorine and concentrated chlorides would generate a chloride concentration of only 3,982 milligrams per liter at the boundary of the plume (during the period of least dilution).

The use of sulfuric acid to control scaling should not affect river water quality. HCGS utilizes an average of 1,550 kilograms (4,150 pounds) of sulfate daily and discharges a concentration of approximately 1,029 milligrams per liter (assuming doubling of ambient river water sulfates by cooling tower).

At the boundary of the plume during the period of least dilution, the sulfate concentration would be 543 milligrams per liter (ambient river level is approximately 507 milligrams per liter).

In like fashion, the other chemical constituents of cooling tower blowdown, as Table 3.4-2 describes, disperse and are diluted within the plume to levels well within stream quality standards.



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OILY WATER, LOW VOLUME
WASTE WATER
FLOW DIAGRAM

FIGURE 5.3 - 1

AMEND. 2

10.4 CHEMICAL WASTE TREATMENT

At the construction permit stage, PSE&G reviewed four alternative chemical waste treatment systems, and selected one: pH adjustment and precipitation followed by discharge to the river via the cooling tower blowdown line. Also addressed at the construction permit stage were scale prevention and corrosion control methods.

In light of revised USEPA effluent guidelines and elimination of Unit 2, PSE&G reassessed chemical waste treatment alternatives and elect ed to treat all potentially oily wastes on-site in an API type separator, while shipping low volume wastes off-site for treatment. Section 5.3.1.1 discusses this topic. 2

13.1 CHLORINATION EFFECTS STUDY

"Prior to initiation of power operation the Applicants shall conduct a study of proposed chlorination methods to assure that the use of these methods will result in acceptable chlorine residuals in the station effluent under the full range of conditions anticipated during operation of the station. Acceptable chlorine residuals currently recommended by the EPA for warm fresh water are less than 0.2 mg/liter for intermittent discharge not to exceed 2 hours per day or less than 0.01 mg/liter for continuous discharge. The study shall include an evaluation of the effects of variable ammonia and organic nitrogen concentrations, chlorine demand, temperature and pH on the concentrations of both free and combined chlorine residuals in the treated water. Alternative methods of reducing chlorine residuals shall also be investigated and these are to include, but not be limited to, optimizing chlorine dosage and time of dosage, sequential treatment of sections of each condenser, blowdown scheduling, and adwater."

PSE&G has studied chlorination and related technologies including work in conjunction with the Electric Power Research Institute and the U.S. Department of Energy, with the goal of optimizing biocide use and monitoring techniques at all its generating stations, including HCGS. This work is continuing. Reports and publications resulting from efforts to date are listed as References 13.1-1 through 13.1-10. | 2

These studies were conducted at a number of locations, providing a broad base of information not necessarily limited by site-specific considerations. These studies addressed three major areas of interest:

a. Analytical Methods - References 13.1-1 through 13.1-3 are | 2
representative of efforts made to evaluate analytical methods and instrumentation for monitoring chlorine residuals in power plant effluents under actual in-plant conditions.

b. Chlorine Optimization - All the listed references include results which are related to minimizing the amount of chlorine released to the environment. Monitoring capabilities (References 13.1-1 through 13.1-3) are necessary | 2
to insure compliance with minimum effluent standards. References 13.1-4 through 13.1-10 are results of studies | 2
aimed at comparing the performance of alternative biocides to chlorine. To do such a comparison required optimizing the chlorination process to provide a baseline

for comparison of the alternatives. Conducted over periods of time and at various locations, the optimization studies included a representative range of water quality conditions. Optimization was achieved (References 13.1-6, 13.1-9 and 13.1-10) by determining the minimum chlorine dose necessary to maintain acceptable condenser performance. In addition, environmental effects were studied by exposing indigenous aquatic species to chlorinated effluents (References 13.1-7, 13.1-8 and 13.1-10). | 2 | 2

c. Alternative Methods - Several biocides, including BrCl (Reference 13.1-1) and ozone (References 13.1-6 through 13.1-10), have been studied as possible alternatives to chlorine. Studies continue on the utilization of ozone or dechlorination to minimize the impact of utility operations on the aquatic environment. | 2

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13.1-2 R. Sugam, W. Swallow and J. Trout, Field Evaluation of Chlorine Monitoring Techniques, Report EA-2070, Electric Power Research Institute, 1981.

13.1-3 R. Sugam, "Chlorine Analysis: Perspectives for Compliance Monitoring," in: Water Chlorination: Environmental Impact and Health Effects, Vol. 4, Book 1, Chemistry and Water Treatment (ed., R. L. Jolley, R. B. Cumming, J. S. Mattice) Ann Arbor Science (1982), pp. 653-666.

13.1-4 E. C. Wackenhuth and G. Levine, An Investigation of Bromine Chloride as a Biocide in Condenser Cooling Water, Paper No. IWC 74-1, presented at 35th Annual International Water Conference, Pittsburgh, PA, 1974.

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13.1-6 R. Sugam, C. R. Guerra, J. L. DelMonaco, J. H. Singletary and W. A. Sandvik, Biofouling Control with Ozone at the Bergen Generating Station, Report CS-1629, Electric Power Research Institute, 1980.

13.1-7 C. R. Guerra, R. Sugam, J. W. Meldrim, E. R. Holmstrom and G. E. Balog, Comparative Evaluation of Effects of Ozonated and Chlorinated Thermal Discharges on Estuarine and Freshwater Organisms, Final Report, U. S. Department of Energy (1980), 125 pages.

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13.1-8 J. W. Meldrim, E. R. Holmstron, G. E. Balog and R. Sugam, "A Comparative Evaluation of the Effects of Ozonated and Chlorinated Condenser Discharges on the White Perch, Morone Americana," Ozone: Science and Engineering, 3 (1981), 155-158.

13.1-9 R. Sugam, J. H. Singletary, W. A. Sandvik and C. R. Guerra, "Condenser Biofouling Control with Ozone," Ozone: Science and Engineering, 3 (1981), pp. 95-107. E291.20

13.1-10 R. Sugam and C. R. Guerra, "Comparison of Chlorine and Ozone for Power Plant Cooling Water Treatment," in: Ozone Treatment of Water for Cooling Applications, ed., R. G. Rice, International Ozone Association (1981), pp. 63-74.

allows only a small amount of fuel to come into contact with water on the drywell floor. Third, the amount of water on the drywell floor is relatively small and is limited to a depth of approximately two feet because of the location of the vent pipes. Fourth, for transient events, most of the water in the reactor vessel is boiled off to the suppression pool before core melt and this will not be deposited on the drywell floor. These considerations lead to the assignment of a negligibly small value to β for transient events (TW, TC and TQUV) and a small value, 10^{-4}, for LOCA events (AE).

3.3 HYDROGEN BURN OR EXPLOSION

As far as hydrogen burns (μ) or explosions (μ') are concerned, their probability of occurrence is limited by the availability of oxygen. The containment is normally inerted and is expected to remain so during operation for all but approximately 70 hours of the year. Hence, there is an upper limit of about 10^{-2} for this probability. Hydrogen burns or hydrogen explosions are not considered further in the present work because of this low probability relative to that of γ and γ'.

3.4 OTHER CONTAINMENT FAILURE MODES

The probability of all other potential containment failure modes (δ, containment isolation failure in the drywell; ϵ, containment isolation failure in wetwell; ζ, containment leakage greater than 2,400 volume percent per day; η, reactor building isolation failure; and θ, standby gas treatment system failure) is taken to be very small relative to overpressure. These negligibly small release probabilities are consistent with those used in WASH-1400 and in the Brown's

Ferry IREP study for the transient core melt sequences (TC, TW, TQUV) that were found to dominate risk.

4.0 SOURCE TERM MAGNITUDES

Source term magnitudes are displayed in Table C-1. Major factors controlling these source terms are as follows.

4.1 SEQUENCE TQUV-γ'

This is a sequence in which the ability to cool the core is lost and the core subsequently melts in an intact vessel and containment. The radiologically important volatile fission products I, Cs and Te are mostly released from the fuel during this phase (90%, 90% and 80%, respectively). These melt release fractions are based on NUREG-0772 (Ref. C-13) and the SASCHA experiments (Reference C-14) and are greater than those used in WASH-1400 and in the rebaselined analysis (88%, 76% and 15%, respectively), especially the Tellurium. It is assumed that these melt release fission products are blown through the main steam relief valves into the pool. The pool remains subcooled throughout this sequence: a review of experimental data on pool scrubbing shows that a decontamination factor (DF) of at least 100 can be justified in this case (References C-37 through C-40). Hence, less than 1% of the melt release will pass through the pool and be available for release to the atmosphere. E450.1

Once the core has melted, it will slump to the lower head of the vessel, which will subsequently fail. The core will fall to the concrete floor beneath and non-condensable gases will be generated by the core-concrete interactions. The buildup

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predicted to be about 42 million by the year 2010. This is the population within which most of the latent cancer fatalities would be predicted to occur. In modern industrialized societies, the individual risk of death due to cancer is about $2.5 \times 10^{-3} yr^{-1}$. This figure may be deduced by reference to the Statistical Abstract of the United States. It implies that there would be about 100,000 deaths due to cancer each year among the population in question. By contrast, even the peak event would cause only about 1,500 deaths each year for some 30 years or so, beginning a few years after the accident (1500x30=45,000 the peak of Figure C-8).

The actual fatality of $3.3 \times 10^{-5} yr^{-1}$ may be put in perspective by noting that an approximation of the population at risk is that within about 16 km (10 mi) of the plant, about 27,400 persons in the year 2010. Accidental fatalities per year for a population of this size, based upon overall averages for the United States, are approximately 8 from motor vehicle acidents, 3 from falls, 1 from burns, and one every three years from firearms (Ref. C-24).

The individual risk of early fatality as a function of distance is displayed on Figure C-10. As can be seen, these risks are all small. For comparison, the following risks of fatality per year to an indiivudal living in the United States may be noted: automobile accidents, $2.2 \times 10^{-4} yr^{-1}$ and firearms $1,2 \times 10^{-5} yr^{-1}$(Ref. C-24).

The economic risk associated with offsite property could in principle be compared with property damage costs associated with alternative energy generation technologies. The use of fossil fuels--coal or oil, for example, would emit substantial

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from Liquid Pathways After a Reactor Meltdown Accident, SAND80-1669 (NUREG/CR-1596) Sandia National Laboratories, 1981.

C-33 U.S. Nuclear Regulatory Commission, Final Environmental Statement Related to the Operation of Palo Verde Nuclear Generating Station, Units 1, 2, and 3, (NUREG-0841), 1982.

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C-35 Commonwealth Edison Company, Zion Probabilistic Safety Study, 1981.

C-36 I.B. Wall, P. E. McGrath, S. S. Yaniv, H. W. Church, R. M. Blond, and J. R. Wayland, Overview of the Reactor Safety Study Consequence Model, (NUREG-0340), U.S. Nuclear Regulatory Commission, 1977.

C-37 Marble, W. J., et. al., 1982. Retention of Fission Products by BWR Suppression Pools During Severe Accidents, General Electric Company, August 1982 (presented at the ANS Thermal Reactor Safety Meeting held from August 30 to September 2, 1982, in Chicago, Ill.).

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C-39 Devell, L., et. al., 1967. "Trapping of Iodine in Water Pools at 100 C," Containment and Siting of Nuclear Plants, Proceedings of a Symposium, I.A.C.A., 1967. CONF-67042.

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HOPE CREEK GENERATING STATION

APPLICANT'S ENVIRONMENTAL REPORT- OPERATING LICENSE STAGE

VOLUME 3

The Energy People
PSE&G

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
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QUESTION E291.17 (Section 5.3.1.1)

Update the status of the planning of the treatment system for station low volume waste water. If available, provide information on the type and degree of treatment, expected quality of the system effluent, effluent discharge rate, and location of discharge.

RESPONSE

The requested information has been incorporated into Sections 3.6, 5.3, and 10.4. 2

QUESTION E291.20 (Section 13.1)

Provide a copy of Environmental Report reference 13.1-1 entitled Chlorine Analysis Evaluation Program On-Site Comparison of Free Chlorine Analyzers for Use in Estuarine Waters, PSE&G, 1975.

RESPONSE

Due to the availability of more up-to-date information in the recent references (e.g., Sengupta *et al*, Sugam *et al*, and Sugam), PSE&G has amended the list of references for Section 13.1 by deleting reference 13.1-1.

QUESTION E291.21 (Section 5.1)

The cooling tower blowdown discharge location has been changed since the CP stage FES from 200 feet offshore to 10 feet offshore (essentially shoreline) in the river. Provide a comparative discussion of the impacts to the river biota (from thermal and chemical effluents) due to this relocation.

RESPONSE

Relocation of the cooling tower blowdown discharge and decreasing its flow (see Tables 3.4-5 and 3.4-9) changes the extent and configuration of the discharge plume from that anticipated at the CP stage to that discussed in Section 5.1.2. It is anticipated that thermal discharge related impacts on aquatic biota, as described during the CP stage, will decrease with single unit operation.

At the CP stage, the length of the two unit, buoyant thermal plume, as denoted by the 4°F (2.2°C) surface isotherm, was estimated by PSE&G to be approximately 300 feet for both summer (June) and winter (February) operating and river conditions (see Figures E291.21-1 and E291.21-2). With cancellation of Unit 2, shortening of the cooling tower blowdown discharge line and elimination of the cold water bypass, the thermal plume is a predominantly negatively buoyant bottom plume with the 4°F (2.2°F) bottom isotherm extending approximately 100 feet during the summer (August) and up to 2000 feet during the winter (February) (Section 5.1). A contributing factor is the fact that cold side blowdown is discharged at a velocity of about 3.5 feet per second (1.1 meters per second) at normal blowdown flows. Originally, the discharge velocity under similar operating conditions was estimated to be 8.5 feet per second (2.67 meters per second).

Fishes and other organisms found in the HCGS vicinity are not unique. All are found throughout the Delaware Estuary and adjacent coastal waters. The effects of thermal discharges on species found in the vicinity of Artificial Island have been presented in great detail in several reports (References 1 through 3).

These species are physically excluded from the warmest portions of either the original or current thermal plume due to its near-field velocities exceeding the maximum sustained swim speed of the fish present. Changes in tidal direction and velocity will effect the plume's direction and extent, further limiting the number of fish in the warmest portions of the thermal plume.

Because of the plume now having a negative buoyancy, benthic macroinvertebrates will be subjected to increased temperatures not previously discussed. Such organisms are, however, extremely dynamic and opportunistic. They survive normally large shifts in bottom material caused by the river's movable sediment load and the fact that large amounts of sediment are deposited in the vicinity of the site. The original discharge design, now replaced by the current configuration of the discharge is anticipated to scour comparable, small areas of river bottom in the vicinity of the discharge outlet.

Neither the plume as discussed at the CP stage, nor the present configuration significantly affects the spawning of fishes and other organisms in the vicinity of HCGS. Thermal shock related deaths of organisms found near the station are not expected to be significant nor different from those anticipated for the original plume configuration. It is also anticipated that the new thermal plume will not block the seasonal migrations of such fishes as American shad, which pass in the vicinity of HCGS during spring and fall.

The heated plume may possibly attract fishes during all periods of the year except during the warmest summer months. As these fish encounter the far field of the plume they will move towards their preferred temperature. During the periods of highest natural river temperatures, fish may avoid the immediate vicinity of the discharge as well as be excluded due to discharge velocity. No mortality of fishes is anticipated due to the introduction of the heated effluents described in Section 3.4 either during the summer or winter.

No winter fish kills have been observed in the vicinity of Artificial Island dur to Salem's heated effluent from its once through cooling system. Nevertheless, in the case of shutdown of HCGS in winter, the fish that may occur within the vicinity of the thermal plume could find similar preferred temperatures in the Salem thermal plume. Neither station has a discharge canal which would create a slow-moving source of warm water; the discharges are dynamically affected by currents and tides.

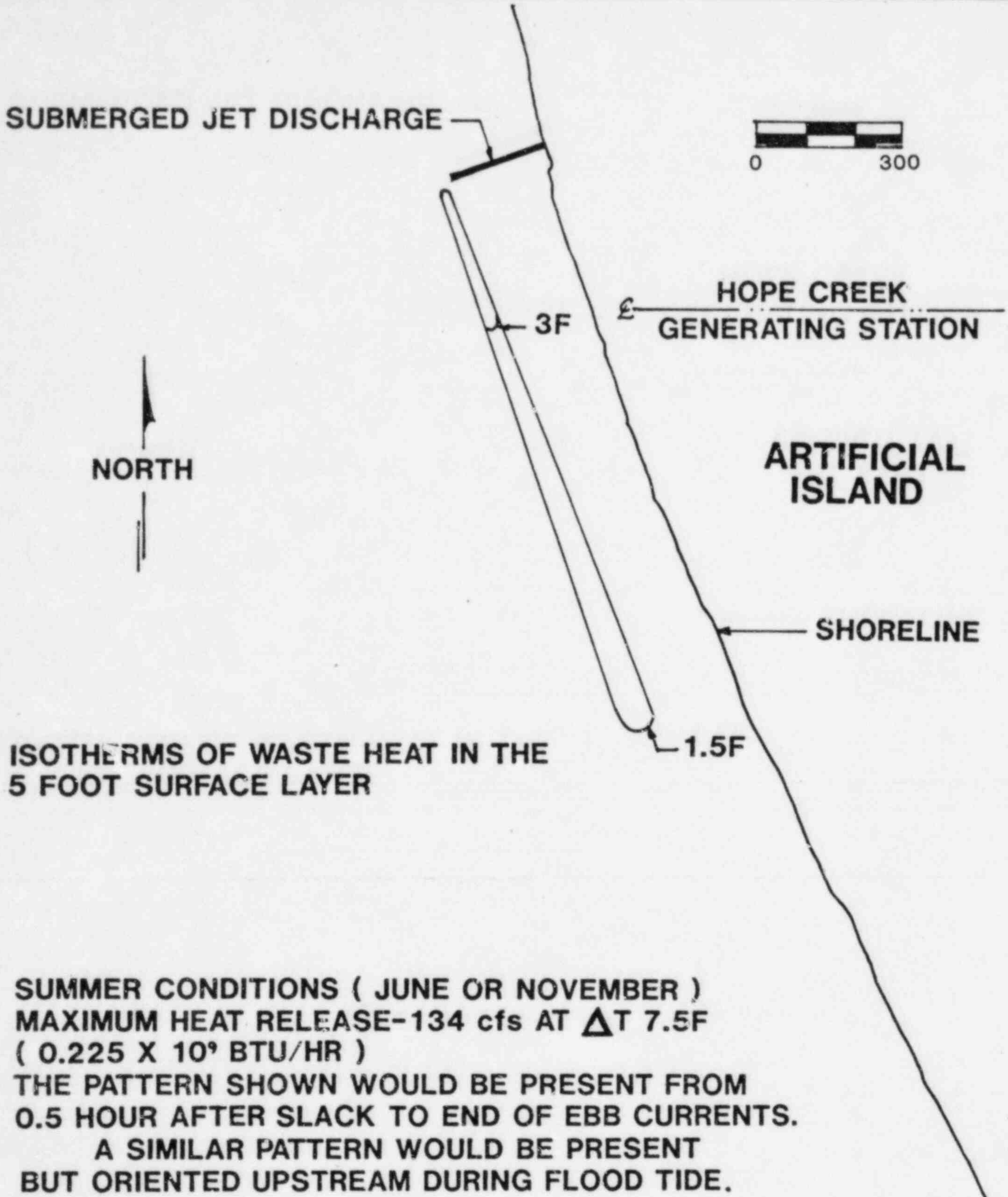
Chemical discharges associated with cooling tower operation are also present in cooling tower blowdown. Sodium hypochlorite to control biofouling and sulfuric acid to control scale buildup are among the chemicals present. The biocide methodology for HCGS at the OL stage is currently under study (see Questions E291.16 and E291.19). For now it can be said that chemical use will be reduced due to the cancellation of Unit 2. Also any biocide such as chlorine and any other chemical such as sulfuric acid which will be discharged in the cooling tower blowdown will meet applicable effluent limitations and be diluted to a low level at a short distance from the end of the pipe due to the rapid mixing of the discharge with river water. It is expected that the concentrations of all chemicals found in the blowdown will be small and will not harm any organisms that may be present.

REFERENCES

1. Public Service Electric and Gas Company 1974. Salem Nuclear Generating Station Section 316(a)Demonstration, Type 2. Newark, N.J.

2. Public Service Electric and Gas Company 1976. Salem Nuclear Generating Station Section 316(a) Demonstration, First Supplement. Newark, N.J.

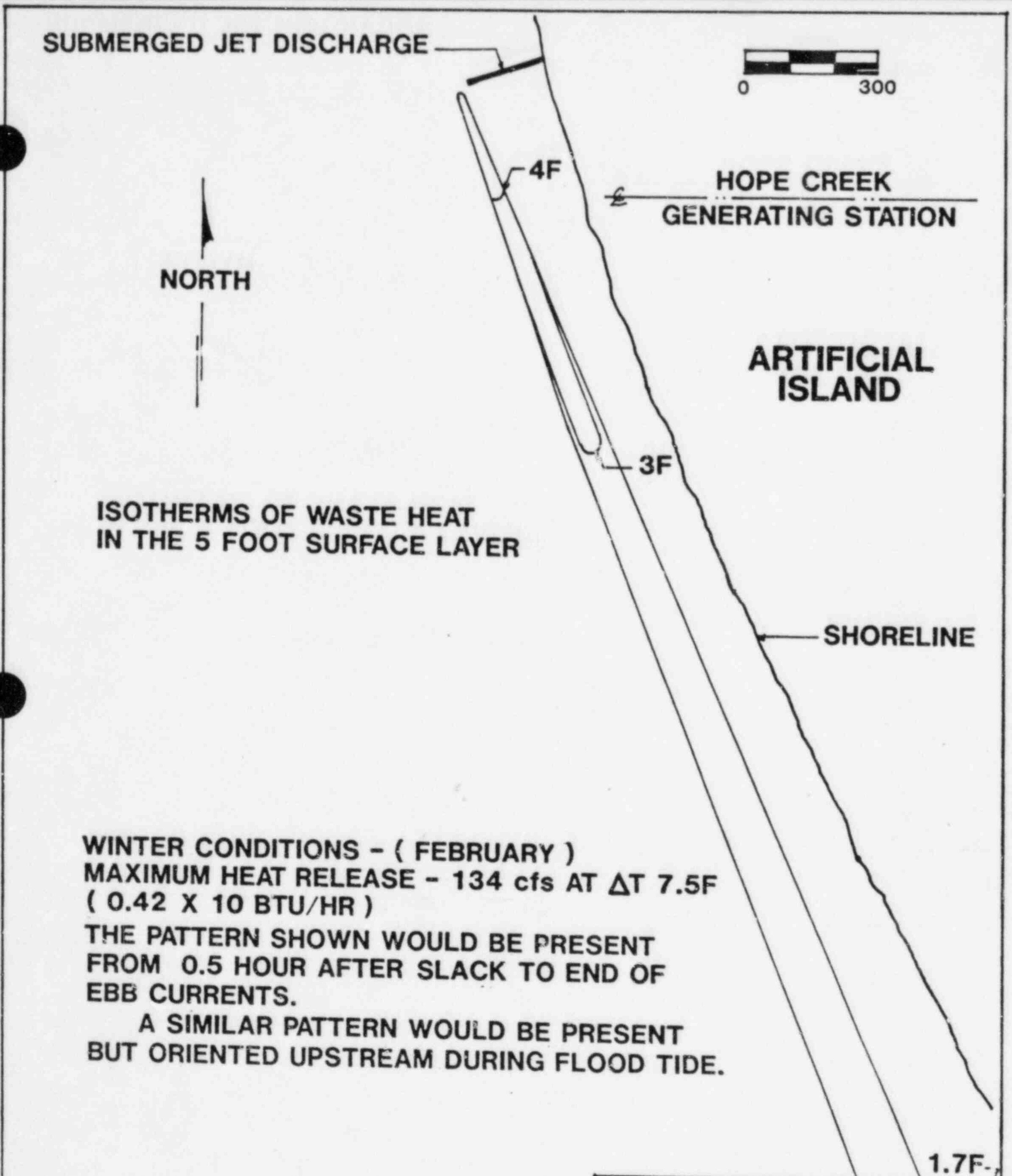
3. Public Service Electric and Gas Company 1978. Salem Nuclear Generating Station Section 316(a) Demonstration, Second Supplement.



HOPE CREEK GENERATING STATION
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

THERMAL PLUME ANTICIPATED
AT CP- STAGE, SUMMER CONDITIONS
(JUNE OR NOVEMBER)

FIGURE E291.21 - 1 AMEND. 2



HOPE CREEK GENERATING STATION
ENVIRONMENTAL REPORT
OPERATING LICENSE STAGE

THERMAL PLUME ANTICIPATED AT CP - STAGE WINTER CONDITIONS (FEBRUARY)

FIGURE E291.21 - 2 AMEND. - 2

QUESTION E291.22

Provide a copy of the NPDES permit renewal application when submitted to the state.

RESPONSE

A copy of the NPDES permit renewal application will be sent to the Nuclear Regulatory Commission when it is submitted to the state in the early part of 1984.

QUESTION E450.1 (Appendix C)

The scrubbing of fission products from gas or vapor bubbles passing through the suppression pool is discussed for several accident sequences. However, there are no references for the experimental data on pool scrubbing, even though the review of these data was mentioned (Pg.C-16). Provide references for these data, and any new relevant data on pool scrubbing.

RESPONSE

The requested references have been added to Appendix C as References C-37 through C-40. New data considered are the suppression pool decontamination factors (DF's), used in the 1983 draft report of BMI-2104 (Radionuclide Release under specific LWR Accident Conditions), which have been reviewed against those used in Appendix C and found comparable.

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