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Vogtle Project

April 4, 1985

Director of Nuclear Reactor Regulation
Attention: Ms. Elinor G. Adensam, Chief
Licensing Branch #4
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

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NRC DOCKET NUMBERS 50-424 AND 50-425
CONSTRUCTION PERMIT NUMBERS CPPR-108 AND CPPR-109
VOGTLE ELECTRIC GENERATING PLANT - UNITS 1 AND 2
REQUEST FOR SUPPLEMENTAL INFORMATION
DSER OPEN ITEM 89 - VOLUMN REDUCTION SYSTEM (VRS)

Dear Mr. Denton:

Attached for the review of your staff are additional items concerning the VRS. These items were asked for by your staff in a meeting on March 22, 1985 and includes the following information.

- VRS Accident Evaluation
- VRS Conformance to R.G. 1.140
- Comparison of Table 7.5.2-1 and Table 11.5.5-2
- Concerns on VRS startup and operation

If your staff requires any additional information, please do not hesitate to contact me.

Sincerely,

J. A. Bailey

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Project Licensing Manager

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7.0 ENVIRONMENTAL EFFECTS OF ACCIDENTS

7.1 STATION ACCIDENT INVOLVING RADIOACTIVITY

7.1.1 INTRODUCTION

Accidents which cause concern from the environmental protection standpoint are those which might result in an uncontrolled release of radioactive materials to the environment. Numerous barriers and features are provided which guard against accidental or uncontrolled releases of radioactive materials from the plant. These barriers are: the sealed metal cladding tubes which contain the fuel pellets; the reactor coolant system which encloses the reactor; and the containment which houses the reactor coolant system. Additional protection of the public is provided by safety features which control the release of radioactivity in the event of an accident and by the site location which further reduces the potential effects to the general public of an accidental release of radioactivity.

Various postulated incidents and all accidents except severe accidents have been analyzed and reported in detail in the Final Safety Analysis Report (FSAR) for the VEGP. These analyses demonstrate that the plant can be operated safely and that maximum radiation exposures from credible accidents would be within the guidelines of 10 CFR 100. Using very conservative calculations and assumptions, the doses calculated are in excess of what would be realistically encountered. Appendix 7A discusses the probalistic assessment of severe accidents heretofore called Class 9.0 accidents.

To facilitate the assessment of the impact of possible incidents and accidents in a realistic manner, and therefore to allow a judgment as to the potential environmental risk inherent to the operation of VEGP, further analyses have been made. Compared to the FSAR analyses, the environmental risk analyses are intended to be more realistic. For example, realistic values have been assigned to such parameters as filter efficiencies and atmospheric diffusion.

7.1.2 ANALYSIS OF ENVIRONMENTAL EFFECTS OF ACCIDENTS

A variety of accidents and incidents have been analyzed covering a wide range of severity to facilitate a realistic assessment of environmental risk. Table 7.1-1 summarizes the events which were considered. These represent a spectrum of events from relatively minor to the most severe which could credibly be postulated. The classification follows that of Regulatory Guide 4.2, Revision 2, Preparation of Environmental

Reports for Nuclear Power Plants (1976). Calculated results of these events are shown in table 7.1-2 in terms of exclusion area boundary and integrated population doses. Details of the parameters used for each accident are included in the discussion of that event.

7.1.3 DOSE CALCULATION METHODOLOGY

The radiological impacts of the postulated events are evaluated in terms of the radiation doses delivered to individuals and to the population as a whole. Whole body doses due to external exposure and thyroid doses due to inhalation are calculated for an individual at the exclusion area boundary and for the population within 50 miles of the plant site. The calculated exposures are limited to whole body and thyroid gland because these are the critical exposures for the radionuclides of potential concern.

The doses were calculated using the GASPAR computer program described in NUREG 0597, based upon the methodology of Regulatory Guide 1.109, Revision 1, for atmospheric releases. Population doses were computed based upon the projected population for the year 2007. The population projections were developed from the 1980 census and are described in FSAR subsection 2.1.3.

The dispersion factors used in the calculations were developed from 3 years of actual meteorological data for the VEGP site and are presented in FSAR subsection 2.3.5 For the purpose of this analysis, all releases are assumed to be ground level releases into the building wake.

7.1.4 TRIVIAL INCIDENTS (CLASS 1.0)

Pursuant to Nuclear Regulatory Commission (NRC) Regulatory Guide 4.2, Revision 2, Class 1.0 incidents have not been considered because of their trivial consequences.

7.1.5 SMALL RELEASES OUTSIDE CONTAINMENT (CLASS 2.0)

Pipes, valves, and flanges of systems containing fluids or gases with potentially significant radioactive concentrations are designed, fabricated, and erected to minimize leakages that may occur during normal plant operations.

Although constructed with the intention of having no leakage, wear- and use-related activities can cause small leakage source terms. These low level releases are evaluated as routine releases and are included in the plant release source terms

The possibility of a small crack or diaphragm leakage and resulting low level leak rates is given primary consideration in the design of the system and components. The recycle holdup tanks are not subject to high pressures or unusual stresses. Because of these factors, the possibility of a failure of the recycle holdup tank is considered small.

In the unlikely event that a release of liquid radioactive wastes does occur from the recycle holdup tank, the spilled liquid collects in a watertight room, and a high water level alarm will be activated in the control room.

In view of the above discussion, the possibility of an accident of this type occurring is considered small.

7.1.6.3.4 Radiological Effects

Using the assumptions stated, the following doses have been calculated:

	Whole Body	Thyroid
Exclusion area boundary (mrem)	2.59×10^{-3}	1.9
Population dose (man-rem)	8.27×10^{-5}	3.01×10^{-2}

7.1.6.4 <u>Equipment Leakage or Malfunction of the Volume Reduction System (Class 3.3)</u>

7.1.6.4.1 Description

The postulated accident is defined as a leak or malfunction that results in the release of a portion of the inventory of the volume reduction system. The release is the volume reduction system's airborne dry product.

7.1.6.4.2 Calculation Assumptions

A. The leakage is assumed to occur in the line from the fluid bed dryer to the Venturi scrubber.

B. The duration of the release is 24 h. The release rate is 100 ft^3/min, corresponding to the maximum leakage possible without automatic system shutdown.

C. A ground level release from the building is assumed.

D. The airborne radioactivity released via the cubicle heating, ventilation, and air conditioning (HVAC) is processed through a high efficiency particulate air (HEPA) filter and a charcoal filter prior to environmental release.

E. A filter efficiency of 99 percent is assumed for the charcoal filters.

F. Due to the HVAC filters and the relative radiological effects, only isotopes of iodine have been considered. Total activity released to the environment following the accident is included in table 7.1-3, part III.

7.1.6.4.3 Probability of Occurrence

The likelihood of the occurrence of this type of accident is small. The volume reduction system is equipped with an exhaust monitor to ensure that the parameters are within the prescribed limits. In addition, routine surveillance will note any upward trend and thereby limit the probability of occurrence.

7.1.6.4.4 Radiological Effects

Using the assumptions stated, the following doses have been calculated:

	Whole Body	Thyroid
Exclusion area boundary (mrem)	5.5×10^{-4}	4.1×10^{-1}
Population dose (man-rem)	1.56×10^{-5}	6.33×10^{-3}

~~7.1.6.5 Rupture of a Waste Gas Decay Tank (Class 3.4)~~

7.1.6.5.1 Description

This postulated accident is defined as an unspecified event that initiates the complete rupture of a waste gas decay tank. The airborne radioactivity released from this tank during the accident is assumed to be vented directly to the environment via the plant vent.

7.1.6.5.2 Calculation Assumptions

A. One hundred percent of the average tank inventory has been assumed to be released, as shown in table 7.1-3.

part IV. This evaluation is based on normal operating conditions.

B. The airborne radioactivity released into the auxiliary building has been assumed to be released unfiltered to the environment.

7.1.6.5.3 Probability of Occurrence

The likelihood of an inadvertent waste gas decay tank rupture is considered small. The radioactive gases stored in the decay tanks will consist of fission product gases, hydrogen, and nitrogen cover gas. The nitrogen will be added in the various collection and holdup tanks to preclude the possibility of obtaining a flammable mixture of hydrogen gas. Hence, a tank rupture resulting from ignition of hydrogen in the decay tank is considered remote. The system will also be designed to appropriate industry and Seismic Category I component standards. In addition, a waste processing system panel with associated alarms, isolation valves, and system surveillance will ensure that the possibility of this type of accident is small.

7.1.6.5.4 Radiological Effects

Using the assumptions stated, the following doses have been calculated:

	Whole Body	Thyroid
Exclusion area boundary (mrem)	2.42×10^{-3}	2.42×10^{-3}
Population dose (man-rem)	2.74×10^{-2}	2.74×10^{-2}

7.1.6.6 Rupture of a Liquid Radwaste Holdup Tank (Class 3.5)

7.1.6.6.1 Description

This postulated accident is defined as an unspecified event that initiates the complete rupture of the tank containing the largest quantity of significant isotopes in the waste management system. This tank has been identified as a recycle holdup tank located in the auxiliary building. The airborne radioactivity released from this tank during the postulated accident is then vented to the environment via the plant vent.

7.1.6.6.2 Calculation Assumptions

A. One hundred percent of the average inventory of a recycle holdup tank has been assumed to be released into the auxiliary building.

B. An iodine partition factor of 0.001 for air to water has been assumed.

C. The airborne radioactivity released has been assumed to be released unfiltered to the environment (table 7.1-3, part V).

7.1.6.6.3 Probability of Occurrence

The discussion concerning the remoteness of an equipment leakage or malfunction accident of a recycle holdup tank is equally applicable to a complete release accident. The possibility of a complete rupture or complete malfunction accident is therefore considered even less than that of the partial release accident described in paragraph 7.1.6.3.

7.1.6.6.4 Radiological Effects

Using the assumptions stated, the following offsite doses have been calculated:

	Whole Body	Thyroid
Exclusion area boundary (mrem)	2.08×10^{-3}	1.54
Population dose (man-rem)	1.03×10^{-4}	3.76×10^{-2}

7.1.6.7 Rupture of the Volume Reduction System (Class 3.6)

7.1.6.7.1 Description

This postulated accident is defined as an event that causes the complete rupture of the volume reduction system. The airborne radioactivity released from the system during the accident is assumed to be vented to the environment via the radwaste building vent.

7.1.6.7.2 Calculation Assumptions

A. Isotopic source terms are assumed to be 100 percent of the iodine in suspended dust particles in the volume reduction system.

B Activity released is assumed to consist of the airborne solids in the system from the dryer bed to the Venturi scrubber.

C. The airborne radioactivity released has been assumed to have passed through a charcoal filter and the building's HEPA filter prior to being released to the environment.

D. The release is assumed to be a ground level release.

E. A filter efficiency of 99 percent for the charcoal filters has been assumed. Total activity released to the environment following the accident is included in table 7.1-3, part VI.

7.1.6.7.3 Probability of Occurrence

The likelihood of a rupture of the volume reduction system is small because a change in system pressure greater than 2 psi will cause the high/low pressure switches to shut the system down automatically. Also, the system has a maximum operating pressure of 10 psig and hydrostatic test pressures greater than 25 psig. This will further reduce the probability of this type of an accident. In addition, the Volume Reduction System instrumentation and controls maintain process parameters within limits which ensure safe system operation.

7.1.6.7.4 Radiological Effects

Using the assumptions stated, the following offsite doses have been calculated.

	Whole Body	Thyroid
Exclusion area boundary (mrem)	3.27×10^{-5}	2.42×10^{-2}
Population dose (man-rem)	9.2×10^{-7}	3.74×10^{-4}

TABLE 7.1-3 (SHEET 1 OF 8)

ACTIVITY RELEASED TO THE ENVIRONMENT

Isotope	Activity Released (Ci)
Part I - Following a Waste Gas Decay Tank Equipment Leakage or Malfunction Accident	
Kr-83m	4.0×10^{-2}
Kr-85	1.7×10^{2}
Kr-85m	6.8×10^{-1}
Kr-87	6.4×10^{-2}
Kr-88	6.9×10^{-1}
Kr-89	1.4×10^{-5}
Xe-131m	1.5
Xe-133	2.2×10^{2}
Xe-133m	2.8
Xe-135	3.5
Xe-135m	7.7×10^{-4}
Xe-137	3.7×10^{-5}
Xe-138	2.3×10^{-3}
Part II - Following a Liquid Waste Tank Leakage or Malfunction Accident	
I-130	3.3×10^{-6}
I-131	6.2×10^{-3}
I-132	3.6×10^{-5}
I-133	9.3×10^{-4}
I-134	5.3×10^{-6}
I-135	1.6×10^{-4}
Part III - Following a Volume Reduction Leakage or Malfunction Accident	
I-130	5.52×10^{-7}
I-131	1.56×10^{-3}
I-132	3.12×10^{-6}
I-133	3.29×10^{-3}
I-134	8.59×10^{-7}
I-135	1.86×10^{-4}

TABLE 7.1-3 (SHEET 2 OF 8)

Isotope	Activity Released (Ci)
Part IV - Following a Rupture of a Waste Gas Decay Tank	
Kr-83m	1.55×10^{-1}
Kr-85	2.69×10^{-1}
Kr-85m	2.65
Kr-87	2.52×10^{-1}
Kr-88	2.7
Kr-89	5.52×10^{-5}
Xe-131m	1.2×10^{1}
Xe-133	1.58×10^{3}
Xe-133m	1.58×10^{1}
Xe-135	1.58×10^{1}
Xe-135m	3.0×10^{-3}
Xe-137	1.45×10^{-4}
Xe-138	8.82×10^{-3}
Part V - Following a Rupture of a Liquid Waste Holdup Tank	
I-130	1.3×10^{-5}
I-131	2.5×10^{-2}
I-132	1.4×10^{-4}
I-133	3.7×10^{-3}
I-134	2.1×10^{-5}
I-135	6.4×10^{-4}
Part VI - Following a Rupture of the Volume Reduction System	
I-130	3.6×10^{-8}
I-131	1.02×10^{-4}
I-132	2.03×10^{-7}
I-133	2.14×10^{-4}
I-134	5.6×10^{-9}
I-135	1.21×10^{-6}

Operation and Testing of Off-Gas System with Regulatory Guide 1.140

Regulatory Guide 1.140 requires that the HEPAs and charcoal adsorber be procured and tested prior to installation in accordance with ANSI N509. This should not be a problem since we have committed to similar ~~things~~ tests and procurement requirements in FSAR section 9.4.

Section C.5 of Regulatory Guide 1.140 requires four tests to be done upon initial installation.

a. Visual Inspection
b. Airflow distribution for HEPA filters (bypass leakage)
c. DOP tests for HEPA filters
d. Adsorber leak testing (Air-Distribution and Tracer Tests)

The ~~B and B~~ Byron filters were designed with sample and injection ports, so they have the ability to carry out the required tests. Our filters are contained in a pressure vessel with no space between the HEPAs and the charcoal. The visual inspection outlined in ANSI N510 can be accomplished during installation. An overall pressure drop test can be accomplished after installation and then compared to the design data. The design of these filters is that of a process filter. The VR off-gas system is hard piped before and after the filter vessels. The size of the piping is not amendable to accurate flow distribution readings as required for the flow distribution tests.

The installation of the filter assembly follows a specific procedure that minimizes the potential for the HEPAs and adsorber to be damaged.

The DOP and tracer tests cannot be accomplished on an individual or overall basis at this time.

Section C.5 also requires in-place HEPA DOP and adsorber leak testing at intervals of every 18 months. The expected change-out frequency of the filters is every 6 months at which time the on-line filter is valved out of service and allowed to decay. At that time the idle filter is valved into service and used. Because of the changeout frequency, the 18 month interval tests are not applicable.

FSAR questions 460.06 and 460.12 deal with the filters and compliance with Regulatory Guide 1.140.

Responses to NRC Concerns on Table 7.5.2-1 & R.G. 1.97

1. Condenser air ejector has a range of $5x10^{-7}$ to 10^5 in Table 11.5.5-2 and this range has been included in update of 7.5.2-1* in Amendment 16. Therefore both ranges are identical.

2. Plant vent - Table 7.5.2-1* inadvertently did not include the exponents for the ranges for this monitor. The Table (7.5.2-1) will be updated in a future amendment to be made consistent with Table 11.5.5-2. The range of this monitor is 10^{-6} to 10^4.

3. Steamline radiation monitor - both Tables 7.5.2-1* and 11.5.5-2 are consistent.

4. Radwaste building monitor - this monitor is not in Table 7.5.2-1 because it is Category 3, and thus is not used as a key or backup variable for accident mitigation.

5. SG liquid - this monitor does not have to be included in Table 7.5.2-1 since it is isolated on any signal that gives an auxiliary feedwater start, and therefore cannot be used for accident diagnosis.

6. Plant vent/radwaste building samplers - a range for these passive samplers is inappropriate. The samplers will be analyzed in the lab to determine activity.

*As shown in GN-548, dated 3/15/85, DSER Open Item 62 - R.G. 197, Rev. 2

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Responces to NRC Concerns on VRS System

Q. #1 Will instrumentation be calibrated prior to initial startup of VRS?

A. Yes. Instrumentation will be calibrated according to recommended manufacturer guidelines. Calibration will be performed by qualified personnel using VEGP approved instrument calibration procedures.

Q. #2 Will the feed to the VRS exceed the 0.3% sulfur and 1% halogenated plastic limits?

No, we will prevent the feed from exceeding the limits by segregating out the high sulfur and halogenated plastics and not feeding them into the VRS. In addition, the purchasing department will be prohibited from buying high sulfur and halogenated plastics.